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The Use of Behaviour Change Techniques in Interventions for German-speaking Children with Speech Sound Disorders: Identification and Training

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Abstract

Background

Speech sound disorders (SSDs) are some of the most common communication difficulties among preschoolers. Yet, little is known about the key ingredients of SSD interventions. Behaviour change techniques (BCTs) are the smallest components that can bring change in an intervention. Currently no coherent terminology is used to describe techniques in interventions. Identifying BCTs may support Speech and Language Therapists (SLTs) and Speech and Language Therapy (SLT) students in implementing, reporting and replicating SSD interventions explicitly and coherently.

Aim/Objectives

This three-stage study explores the specific framework Behaviour Change Technique Taxonomy Version 1 (BCTTv1). Stage one aims to identify BCTs in SSD interventions. Stages two and three aim to investigate whether bespoke BCT training for SLTs and SLT students is effective.

Method

BCTs were identified from SSD intervention literature and training manuals, plus an intervention session video. A BCT training was then developed. Eleven SLTs and ten SLT students were trained to identify BCTs using video analysis in Stage 2. The BCT training was revised on the basis of this and repeated in Stage 3 with eight students. All participants were asked about their response to using BCTs.

Results

Seventeen BCT types were identified in German-speaking SSD interventions, and fourteen of these seventeen BCT types were identified in the SSD intervention video. These BCT types were included in the BCT training. BCT coding results of SLTs and SLT students were low in Stage 2, whereas results in Stage 3 showed a significant increase in coding accuracy. All participants (N=29) agreed that BCTs help to label SLTs' actions more explicitly.

Conclusion

The application of BCTs is a theoretically sound, acceptable and practical way of identifying key ingredients of SSD interventions. The SLT student BCT training was effective in Stage 3. Participants find that the BCTTv1 is useful and beneficial for SSD interventions.

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Covid-19 Impact Statement

At the end of September 2019, I started my PhD programme and have been to Newcastle to discuss the procedure and project plan with James Law, my supervisor at this time. We decided that I would come to Newcastle every 8-12th week to be there in presence and have access to University activities, the library and have personal meetings. I have then visited Newcastle again in November 2019 and February 2020, before the pandemic hit. All follow-up meetings have been held online since February 2020 until November 2021 when I returned to the university the first time personal again. However, due to the collective shock, my well-being and the management of the clinic “Logopädie Dornstauder” in Austria, I was not able to work on my PhD in March and April 2020. James Law has been really supportive during this time and we started a rapid review on tele-practice for SLT as I needed to adapt the clinic system and I reviewed all the literature on this. Finally, the publication “Tele-practice for children and young people with communication disabilities: Employing the COM-B model to review the intervention literature and inform guidance for practitioners” has been published later (2021). This work helped to stay connected with the University, my PhD work (as it has been related including models from behavioural science) and supported me to go back to my PhD in May 2020.

The research project of my PhD has then been adapted. Previously, it has been planned that Behaviour Change Techniques (BCTs) are identified from literature and a Speech Sound Disorder (SSD) Intervention video in Stage 1 (took place), and then introduced to Speech and Language Therapists (SLTs) and SLT students in Stage 2 in a BCT training which aimed at identifying these BCTs in a SSD intervention video (took place). The BCT training has been moved to online mode and not taken place face-to-face as previously planned. For Stage 3, the effectiveness of single BCTs should have been tested in therapy intervention sessions. Therefore, students would have delivered SSD interventions in the clinic “Logopädie Dornstauder”. However, at this time it was not possible that students attend the clinic due to the COVID-19 regulations in Austria. In addition, the low BCT coding results of students Stage 2 did not yet allow that students use and apply BCTs in therapy sessions. Thus, Stage 3 has mainly been adapted because of results from Stage 2 but would have also been adapted because of the COVID-19 regulations in Austria. Stage 3 then included a revised BCT training workshop for students, aiming at simplifying the BCT training and improve BCT coding results of students. The revised BCT training workshop has also been held online, due to the pandemic.

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List of Abbreviations

APEASE	Acceptability, Practicability, Effectiveness, Affordability, Side-effects, and Equity
AUT	Austria
AHP	Allied Health Professionals
BCT	Behaviour Change Technique
BCTTv1	Behaviour Change Technique Taxonomy version 1
BCW	Behaviour Change Wheel
COM-B	Capability, Opportunity, Motivation - Behaviour
CONSORT	Consolidated Standards of Reporting Trials
COST	European Cooperation in Science and Technology
DLD	Developmental Language Disorder
EBP	Evidence Based Practice
ECTS	European Credit Transfer and Accumulation System
e.g.	for example
FHCW	Fachhochschule Campus Wien
GER	Germany
ICF	International Classification of Functionality
ICF-CY	International Classification of Functionality for Children and Youth
MRC	Medical Research Council
SLCN	Speech, Language and Communication Needs
SLT	Speech and Language Therapy/Speech and Language Therapist
SSD	Speech Sound Disorder
SR	Systematic Review
TDF	Theoretical Domains Framework
TIDieR	Template for Intervention Description and Replication
UCL	University College London
UK	United Kingdom
VEO	Video Enhanced Observation

Publications arising from this thesis

Charlton, J., Dornstauder, M., Charlton, J., Gréaux, M., Kulkarni, A. & Law, J. (2022). Paediatric speech & language therapists' perceptions on the use of telehealth in current and future clinical practice: an application of the APEASE criteria [Manuscript submitted for publication]. Newcastle University.

Law, J., Dornstauder, M., Charlton, J., Gréaux, M. (2021). Tele-practice for children and young people with communication disabilities: Employing the COM-B model to review the intervention literature and inform guidance for practitioners. International Journal of Language & Communication Disorders. 56 (2), 415-434. doi: 10.1111/1460-6984.12592.

Dornstauder, M. (2020). Behaviour Change Techniques und Logopädie. Eine neue Methode im Fokus. logoThema, 17 (1), 12-14.

Dornstauder, M., Pfaller-Frank, K., Frank, W. & Maasz, M. (2020). Interventionen bei Kindern mit Sprachentwicklungsstörungen in Österreich, Deutschland und der Schweiz – Ergebnisse der europaweiten COST Action IS1406 1 Umfrage. logoThema, 17 (2), 12-19.

Presentations

Dornstauder, M., Law., J., Moxam, C., Smith, F. & Letts, C. (2022). The effectiveness of a Behaviour Change Technique Training for Speech and Language Therapy students - The use of Behaviour Change Techniques in interventions for children with Speech Sound Disorders. Poster presentation on the 11th ESLA congress, 26th-28th May 2022, Salzburg, Austria.

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Dornstauder, M. (2021). Behaviour Change Techniques (BCTs) und Logopädie. Oral presentation at the online congress from LogopädieAustria on the 6th March 2021.

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Dornstauder, M. (2019). Speech and Language Therapy in Austria – main aspects of training, services and the practice Logopädie Dornstauder. Vortrag an der Széchenyi István Egyetem University of Gyór. November, 2019.

Introduction

Speech sound disorders (SSDs) are the most common communication difficulties among preschool children (McLeod & Harrison, 2009). Interventions, many of which have been shown to have positive results, are widely used yet little is known about the key ingredients and components of these interventions. SSD interventions consist of more than one key component and levels of complexity and are therefore considered as complex interventions (Craig et al., 2008). Key components comprise therapy elements which interact with and build on each other. Such components can frequently be linked to a therapy effect and finally to the therapy outcome — for example, a therapist's choice of intervention, the individuality of the child/parent/therapist dynamic, the severity of the SSD, the therapy setting, funding (Beresford et al., 2018). Thus, key components are also considered as active ingredients, as these are the ones responsible for behaviour change (McCleary et al., 2013). Due to the many interacting components of complex interventions, it is often hard to identify active ingredients such as the techniques used to change behaviour in children. In addition, currently there is no consistent terminology and classification to draw from when identifying techniques used in SSD interventions. This presents a problem in terms of consistent and transparent reporting, describing, evaluating, designing, implementing and teaching SSD interventions, as there is a lack of consistent terminology and therefore a lack of information reported (Glasziou et al., 2008). Moreover, testing the effectiveness and efficacy of SSD interventions is essential if we are to know whether and how SSD interventions work. It is assumed that the active ingredients — in terms of techniques used to change behaviour in the child — are known; but, unless these techniques are explicitly identified, they cannot be tested.

Thus, identifying the smallest components that can bring about change in interventions — namely, Behaviour Change Techniques (BCTs) — has three positive implications for clinical practice, research and teaching across all Speech and Language Therapy (SLT) areas. First, clinical practice can benefit from identifying techniques used to change behaviour in SSD interventions, as more detailed descriptions of intervention components can support the implementation of interventions (Beresford et al., 2018; Craig et al., 2008; Michie et al., 2013b; Skivington et al., 2021). Second, identifying BCTs in SSD interventions impacts research in that it provides more informed and nuanced details relating to included components and active ingredients of interventions used in studies. This facilitates the inclusion of more behaviour change intervention studies in systematic reviews as the level of detail is more precise and consistent which then supports comparability (Law et al., 2017; Scott et al., 2020). Third, detailed descriptions of techniques used in SSD intervention sessions may support students in implementing therapy techniques in clinical practice (Horton et al., 2004).

This project aimed at identifying BCTs from the Behaviour Change Technique Taxonomy Version 1 (BCTTv1) (Michie et al., 2013b) in SSD interventions for German-speaking children. Michie et al. (2013) developed the BCTTv1, which includes 93 BCTs. The current project makes use of this taxonomy and applies it to SSD interventions to see which BCTs occur and whether the use of the taxonomy supports SLTs and SLT students.

Due to the many interacting components (Craig et al., 2008), all SLT interventions are considered as complex interventions. However, this project focuses on SSD for a number of reasons. SSD interventions provide a more structured terminology and are described in a more coherent manner compared to, for example, Developmental Language Disorder (DLD) interventions in German-speaking countries. In addition, only evidence-based interventions available for German-speaking children with SSD are included in this project. Evidence for the effectiveness of a DLD intervention approach in German-speaking countries has only been provided for one approach targeting semantic-lexical difficulties — the 'lexical pirate' from Motsch and Marks (2015). BCTs have been researched in SLT interventions in the English-speaking context (Atkinson & Stringer, 2016; Barnett, 2022; Spalding & Stringer, 2016; Stringer & Toft, 2016a, 2016b; Toft & Stringer, 2017), whereas no such research has yet been carried out for German-speaking countries. Given the gaps in the literature, the current project deals with SSD interventions for German-speaking children in the context of the BCTTv1.

The first aim of this thesis is to investigate which BCTs occur in SSD interventions for German-speaking children. The second aim is to investigate whether SLTs and SLT students can be trained to identify BCTs from SSD interventions. This is important, as it is suggested that professionals need training in the BCTTv1 in order to use and apply the taxonomy properly. The BCT training helps develop an understanding of what a BCT is, why the taxonomy has been developed and how to identify BCTs in interventions. Research suggests that Allied Health Professionals (AHPs) need to be able to identify BCTs in interventions before using these actively. Therefore, the BCT training aims to teach SLTs and SLT students how to identify BCTs correctly in a SSD intervention. Third, as the use and application of the BCTTv1 is new in Austria, SLTs and SLT students' opinions on how useful the taxonomy is for SSD intervention and SLT student training was investigated by using a survey.

In sum, this project first aims to identify BCTs (by which is meant the smallest components that can bring about change in behaviour change interventions) in SSD interventions for German-speaking children (stage 1) by exploring the BCTTv1 (Michie et al., 2013b). Five research questions have been investigated in this thesis:

1) Which BCT types can be identified from SSD intervention manuals and studies and from a German-speaking, representative real-world SSD therapy video?
2) Can SLTs and SLT students be trained to identify BCTs in SSD interventions and are there any differences between the BCT coding accuracy of SLTs and SLT students (stage 2)?
3) Do SLTs and SLT students think that the application of BCTs in SSD interventions with children is useful, and if so why, and do they think that the BCT training workshop should be included in the training curriculum of students?
4) Does simplifying the BCT training workshop and reducing the number of BCT types included increase the BCT coding accuracy of SLT students from before to after workshop training?
5) Do SLT students doing the revised BCT training workshop think that the application of BCTs is SSD intervention with children is useful and if so why and do they think that the simplified BCT training workshop should be included in the training curriculum of SLT students?

The main difference between Stage 2 (**RQ 2** and **RQ 3**) and Stage 3 (**RQ 4** and **RQ 5**) is the revised BCT training taking place in Stage 3. The BCT training was significantly simplified and streamlined in an effort to make it more effective than the Stage 2 training. In addition, participants between Stage 2 and Stage 3 differed, as only SLT students were included in Stage 3 compared to Stage 2 in which both SLTs and SLT students participated.

Chapter 1: Literature Review

This chapter outlines the link between speech sound disorder (SSD) interventions and Behaviour Change Theory. It will introduce the prevalence rate, types and difficulties associated with SSD. An outline of why speech and language therapy (SLT) interventions have to be considered as complex interventions (Law, 2019) using the United Kingdom's Medical research council's framework (UK's MRC) (Craig et al., 2008) is given. The importance and relevance of SSD as a complex intervention are discussed. Furthermore, the necessity of using all aspects of evidence-based practice (EBP) when treating children with SSD is stressed. Next, the need to identify active ingredients in SSD interventions is highlighted and the importance of using coherent and consistent terminology around SSD interventions is outlined.

The complexity of many interacting components in SSD interventions (e.g., child, parent, therapist, child's difficulty) requires a theoretical framework taking all aspects relevant for complex interventions into account to analyse how these interventions work. Therefore, the theory of behaviour change which has been developed in the context of complex interventions is explained using theoretical frameworks such as the behaviour change wheel and the theoretical domain framework. These theoretical frameworks have been developed to consider many aspects of complex interventions and therefore allow for a more detailed analysis and identification of active components. In addition, other available taxonomies used to date for describing complex interventions in the field of SLT are discussed in terms of their benefits and disadvantages. Overall, the focus of this thesis is concerned with Behaviour Change Technique Taxonomy Version 1 (BCTTv1) (Michie et al., 2013b), a specific taxonomy designed for behaviour change interventions such as SSD interventions. The benefits of using the BCTTv1 in applied health professions (AHPs) and SLT are outlined. The focus is then set on the BCTTv1 in the context of SSD interventions and, furthermore, the training of SLT students, including the BCTTv1 for SSD interventions. The possible benefits for using the BCTTv1 in SSD interventions and the training of SLT students are discussed, before introducing the research objectives and hypotheses for all stages of this thesis.

1.1 Speech and Language Therapy (SLT) Interventions: Complex Interventions

Complex interventions comprise more than one component or element in an intervention, which interact and influence each other (Craig et al., 2008). Thus, SLT interventions — for example, those for Developmental Language Disorder (DLD) and Speech Sound Disorder (SSD) — are considered as complex interventions when using the framework of the United Kingdom Medical Research Council (UK MRC) from Craig et al. (2008), as these interventions incorporate several interacting components. Due to the complex nature of speech and language, SLT interventions are always going to be complex interventions.

DLDs are some of the most prevalent developmental conditions in young children and often have long-term consequences for those concerned. The prevalence rate for 4-5-year old children with DLD is reported to be 7.6% in the United Kingdom (Norbury et al., 2016), varying in the area of language difficulties (e.g., phonology, semantics, word-finding, syntax, morphology, pragmatics, verbal memory and learning) as well as severity (van Weerdenburg et al., 2006). However, SSDs in children are also found to be one of the most common communication disorders (Broomfield & Dodd, 2004; Eadie et al., 2015; Law et al., 2000; McLeod & Harrison, 2009; Stackhouse & Wells, 1997) and comprise between 40% to 70% of paediatric SLTs caseloads (Furlong et al., 2021; Mcleod & Baker, 2014; Williams et al., 2021). SSDs comprise deficits in articulation — which relate to difficulties in motor-based production and phonological deficits, including the ability to use speech sounds and speech sound patterns correctly (Eadie et al., 2015) — and also phonological awareness skills, which refer to the child's awareness of sounds and phonological structures of a spoken word (Gillon, 2018). SSD is therefore a term that includes all kinds of difficulties relating to speech production (Williams et al., 2021). Compared with the diagnosis of DLD, which can include more than one area of impairment and difficulties (e.g., lexicon/semantics, word-finding, syntax/morphology, phonology and/or pragmatics), SSD is a narrower diagnosis and comprises mainly phonology and articulation. However, the domain phonology is overlapping, as it counts to DLD and SSD (Bishop et al., 2017). Thus, if a child has phonological difficulties but no other language domain is impaired, the diagnosis is most likely SSD. If there are combined difficulties in, for example, semantics/lexicon, morphology/syntax and phonology, the diagnosis will most likely be DLD.

Many different interventions for children with DLD and SSD are in use, but the key components of these interventions are not yet coherently identified and described (Law et al., 2008; Roulstone, 2015). It is often difficult to identify the incorporating components and elements of the intervention precisely as they are strongly linked to each other and clear boundaries are lacking (Craig et al., 2008). In addition, complex interventions can have different levels of complexity — for example, referring to different target groups, or to various outcome possibilities dependent on external factors or have different groups of professionals involved in the complex intervention (Beresford et al., 2018; Craig et al., 2008, 2013). Characteristics of the therapist (intervention provider) and the patient/child (intervention recipient) as well as the context and setting of intervention delivery may also influence the intervention outcome (Beresford et al., 2018; Campbell et al., 2000; Craig et al., 2008; Craig & Petticrew, 2013; Skivington et al., 2021). Intervention components and elements are also referred to as active ingredients (Beresford et al., 2018), meaning that the expertise of the therapist and the techniques used also count as active ingredients of a complex intervention (Beresford et al., 2018; Boutron et al., 2008; Boutron & Ravaud, 2012; McCleary et al., 2013). The next paragraphs give detailed insight into why SLT interventions have to be considered as complex interventions, whereas subsequent sections discuss the challenges of identifying active ingredients such as techniques used to change behaviour in complex interventions.

SLT interventions such as DLD and SSD interventions meet the criteria for complex interventions, as they appear to include multiple components and mechanisms of change and therefore present elaborate characteristics. Their outcomes are impacted by the context the therapy takes place in and is implemented within (Skivington et al., 2021). In contrast, an intervention would be described as “simple” if a clear link between the intervention and the outcome exists (Petticrew, 2011). For example, evaluating the efficacy of a new medical drug is straightforward compared to evaluating the efficacy of a complex intervention. In contrast to simple interventions, the outcomes of SLT interventions are dependent on many exogenous factors, such as the variation in child’s/patient’s difficulties (as well as the child’s/patient’s needs), differences in the desires, expectations and needs of the parents/caregivers, the delivery mode (e.g., professional therapists, their expertise, knowledge, experience), the delivery context (e.g., in a clinic, at home, at school), dosage (e.g., once or twice a week for an hour) and techniques used by the therapist to deliver and implement the intervention (Law et al., 2017). In addition, the outcome measurement of speech and language interventions is not straightforward, as some individual disabilities and disorders of the children involved may limit the use of standardised assessments and/or tests (Law et al., 2017).

The level of complexity of an intervention increases in line with the number of interacting components, behaviours, expertise and skills included in an intervention (Craig et al., 2008). Expertise and skills comprise techniques used by the therapist for delivering an intervention. In addition, more complexity gets added by heterogenous groups who deliver or receive the intervention or the different settings an intervention takes place in (Craig et al., 2008), as complex interventions often aim at several levels within an organisation (Beresford et al., 2018). Therefore, the therapeutic process in DLD and SSD intervention includes many factors which impact the outcome and need to be flexible and adapted to the context and/or setting (McCleary et al., 2013).

SLTs use techniques to successfully deliver these interventions and are also required to constantly adapt their behaviour to the current situation and context. Thus, as DLD and SSD interventions aim at changing the behaviour of the child/patient, they are not only considered as complex interventions but also as behaviour change interventions (Law, 2019). As pointed out by Craig et al. (2008), the identification and precise description of components and active ingredients in complex interventions is often difficult, as so many elements interact with each other. For both DLD and SSD interventions, there is a great need of identifying, reporting and describing SLT interventions and their active ingredients transparently and precisely to inform research and clinical practice (Beresford et al., 2018; Craig et al., 2008; Scott et al., 2020; Skivington et al., 2021).

1.1.1 COST Action IS1406 and an Example of a Complex SLT Intervention

An initial approach considered for this thesis was to use an existing international and large dataset from the *"European Cooperation in Science and Technology*" (COST), to see how complex SLT interventions are described. It was found that there were challenges in mapping the existing terminology and language used to describe interventions onto BCT frameworks and the BCTTv1. However, this section gives a summary and brief insight into the preliminary work undertaken at the start of this research, because it provides an important context for the rationale and aims of the current project and therefore the relevant literature base.

The pan-European research project "*Enhancing children's oral language skills across Europe and beyond - a collaboration focusing on interventions for children with difficulties learning their first language*" (COST Action IS1406) (Law, Tulip, et al., 2019), funded by the COST, looked at interventions for children with DLD. As part of the COST Action, a survey including information on intervention techniques, strategies and methods was carried out with practitioners working with children with DLD.

A preliminary study within this project was carried out to look at a complex intervention — in this case a DLD intervention — from the standpoint of behaviour change, and to see whether survey responses from the COST Action IS1406 about intervention methods, techniques and strategies would supply the right sort of information for this.

The COST Action IS 1406 has been the most recent (2015-2019) and largest study (survey respondent N=5024 from 36 countries) in the field of SLT to date (Law, 2019), collecting data on methods, strategies and techniques used in SLT interventions (Dornstauder, 2020; Law, 2019). Therefore, data from this survey was analysed in the context of techniques used in complex SLT interventions, to identify which strategies, methods and/or techniques are currently used the most by SLTs. All professional groups working with children with DLD, could participate in the survey (e.g., teachers, psychologists). Thus, N=5024 practitioners responded to the survey, excluding missing data from the total responses (N=979 participants did not complete the survey, hence initially there were N=6003 participants in the survey).

The practitioner survey included 48 questions, split into four parts: i) practitioners' background, ii) service delivery, iii) theoretical considerations and iv) the social and cultural context of DLD intervention for children (Law, Tulip, et al., 2019). The entire practitioner survey of the COST Action and secondary data can be accessed from Newcastle University (Law et al., 2020). The third part of the COST Action survey is named "*theoretical considerations*" (Appendix A) and investigated the most used methods, strategies and techniques for complex interventions by SLTs across Europe (Law, 2019; Saldaña & Murphy, 2019). The survey included a list of 27 methods, strategies and techniques which was presented to survey participants, who had to answer which of these methods, strategies and techniques they use in DLD interventions. This list was created by members of working group 2 from the COST Action IS 1406, and identified through discussions and presentations during the Action as well as based on professional experience of working group members (Saldaña & Murphy, 2019). In addition, Saldaña and Murphy (2019) state that the chosen methods, strategies and techniques have been mentioned in the general DLD literature (e.g., Paul et al., 2018). They also report that the used techniques and strategies are wide-ranging and include a number of different approaches along the DLD therapy continuum (Saldaña & Murphy, 2019). Hence, the approaches included in the practitioner survey vary in their nature and range from implicit to explicit and child-centred to parent-led approaches, and some may even overlap. In addition, discussions within the working group of the COST Action showed that some countries may have different views on speech compared to language, so methods, strategies and/or techniques used may reflect intervention for both difficulties. Also, children may show difficulty in both language and speech (Law et al., 2022).

Practitioners working with children with DLD were asked to think of one specific child with DLD they had worked with recently and answer the questions addressing techniques and strategies they had been using in the DLD intervention with this child in the practitioner survey. The answer options were "Never", "Occasionally", "Often", "Always" and "Don't know" on a five-point Likert-Scale. The latter was included to take account of the diversity of participants, in terms of professional groups and among countries, where for some the listed method, strategy or technique was not known, common or participants would not be familiar with it. Table 1 shows the list of strategies, techniques and/or methods 1:1 as used in the COST Action survey (not in hierarchical order as used identical as in COST Action survey).

Table 1: Techniques and strategies listed in the COST Action IS1406 practitioner survey

(a) Behaviour modification approaches	(o) Embedding of intervention and changes in the environment in an ecological approach
(b) Sensori-motor approaches	(p) Development of conversational skills
(c) Linguistic modelling/facilitation to support implicit learning of language	(q) Development of meta-pragmatic awareness
(d) Explicit teaching	(r) Phonological contrast approaches
(e) Strategies to develop understanding of social situations	(s) Training of parent-child interaction
(f) Milieu teaching approaches	(t) Interaction based therapy (i.e., not involving parent training in parent child intervention)
(g) Comprehension monitoring	(u) Metalinguistic approaches
(h) Scaffolding in intervention	(v) Working memory intervention
(i) Enhancement of frequency and quality of content in the input to the child	(w) Specific illustrative materials to teach language rules (e.g., pictures, movies)
(j) Cueing hierarchies	(x) Drilling
(k) Strengthening of phonological/semantic/syntactic/ morphological/pragmatic representations	(y) Reinforcement schedules
(l) Development of social skills	(z) Focused stimulation
(m) Teaching the child to use compensatory strategies	(aa) Conversational recast intervention
(n) Oro-motor approaches	(ab) Other (please specify)

Researchers identified six strategies (Milieu teaching, Comprehension monitoring, Scaffolding, Cueing hierarchies, Focused stimulation and Conversational recast), methods/techniques that required additional descriptions as they felt practitioners might be unsure of these given the diversity of said practitioners (Law, Tulip, et al., 2019). For all other methods, strategies and techniques, no descriptions were included, as it was thought that practitioners across countries would be familiar with these terms. The entire survey had been translated and reverse translated (e.g., the survey had been translated from English to German, and back translated from German to English) in the 34 languages from participating countries by the national COST members, including practitioners, to ensure reliable and correct translations (Law, Tulip, et al., 2019). Newcastle University granted ethical approval for the survey (Ref. 11532/2016). After completion, the survey was entered into Survey Monkey and then disseminated via national professional bodies such as the Royal College of Speech and Language Therapy (RCSLT) and logopaedieAustria. For data analysis, the team from Newcastle University provided a coding manual online to ensure correct data analysis procedure. This manual and the COST Action data can be found on the Newcastle University website (Law et al., 2020). Further detailed information on the development of the practitioner survey can be found in Chapter 2 by Law and colleagues in "*Managing Children with Developmental Language Disorder – Theory and Practice Across Europe and Beyond*" (Law, Tulip, et al., 2019).

The researcher MD has been actively involved in developing the practitioner survey, as member of the COST Action IS1406 team and as a representative for Austria. Hence, there has been active involvement in the described parameters and processes (e.g., survey development, translation, distribution) (Dornstauder et al., 2020; Law, Tulip, et al., 2019). Within this project, data from speech and language therapists (SLTs) from Austria, Germany and the United Kingdom has been selected for analysis for the following reasons. First, the research project of this thesis targets only SLTs and SLT students, so data from other professional groups (e.g., teachers, psychologists) were excluded from the analysis. In addition, SLTs are the main profession working with children with DLD in all three included countries (Buchmann & Kauschke, 2019; Dornstauder et al., 2019; Law, Roulstone, et al., 2019). Thus, data from participants indicating that they are "Speech and Language Therapists" or "LogopädInnen" has been analysed. Second, the three countries have been chosen to gain an international perspective on the most frequently used methods, strategies and techniques for DLD interventions in German- and English-speaking countries. By analysing this data about the methods and techniques used, a perspective on an international level can be determined. Austria and Germany share the same language (German) and therefore therapy approaches, which was another reason why Germany was included. In addition, there is much more research focused on English-speaking contexts (Fox-Boyer, 2014a; Fox-Boyer & Siegmüller, 2014; Mayer & Ulrich, 2017), which is why this study extended to German-speaking countries. Lastly, this study has been conducted by MD doing her PhD in a United Kingdom-research-context (Newcastle University) while based in Austria, as participants and clinics involved are from Vienna. Thus, analysing results from the three countries was seen to add meaningful value for the further progress of this study, as results gave an insight into both the researcher's (MD) environments and provided a stable basis on which to make decisions about how to proceed with the research.

The most used techniques and strategies in DLD interventions by SLTs across Austria (N=158), Germany (N=176) and the United Kingdom (N=134) have been investigated by using Microsoft Excel, Statistical Package for the Social Sciences (SPSS) and the coding manual developed by the team from Newcastle University to analyse the data descriptively (Robson & McCartan, 2016). Summarising the results from the COST Action IS1406 survey, it can be said that four strategies/techniques — *linguistic modelling*, *enhancement of frequency and quality of content on the input to the child*, *strengthening of phonological/ semantic/ syntactic/ morphological/ pragmatic representations,* and *conversational recast intervention* — are used frequently (meaning that the technique has been rated to be used "often and always" by at least 50% or more of participants in every single country) for DLD intervention in all three countries. According to participating SLTs, these are the most used techniques/strategies for DLD intervention.

Although there was a degree of consistency around the frequent use of the four key techniques and strategies, there was very little consistency in the terminology and language used to describe DLD techniques and strategies in the survey, making it impossible to map the current techniques and strategies of the COST Action survey onto BCTs. This finding implies that the SLT field in general does not use descriptors that map well onto the framework of the BCTTv1. Rectifying this would address the issue of using consistent terminology for techniques used in SLT interventions.

1.1.2 Conclusion and Rationale for Direction of Current Study

The analysis of the COST Action IS 1406 data showed that techniques and strategies used in DLD interventions could not be consistently mapped onto the BCTTv1 as language and terminology used to describe these techniques and strategies showed great variability. In other words, a lack of coherent terminology to describe techniques used in DLD interventions exists. Overall, as the researchers Saldaña and Murphy (2019) state in "*Managing children with developmental language disorders*", great variation between the *types* of approaches, techniques, strategies and methods included in the survey exists. However, some of the terms address "therapy approaches" (e.g., metalinguistic approach) or "content of interventions" (e.g., strengthening of phonological/ semantic/ syntactic/ morphological/ pragmatic representations) or “methods” (e.g., focused stimulation). Therapy content and techniques were mixed together with no concise terminology used to describe therapy techniques explicitly. Therefore, great variability has been used to describe techniques and strategies in DLD interventions which shows that the field of SLT in general does not use descriptors that map well onto the BCTTv1 for describing techniques in DLD interventions. Barnett (2022) looked at applying behaviour change techniques (BCTs) to a particular DLD approach with very young children (parent-child interaction), whereas there has been no attempt to apply BCTs to the full range of DLD interventions. As discussed earlier, precise description of intervention components is important, so that they can be identified and their success assessed. Rees et al. (2016) also agree that the term “intervention” often refers to “approaches, packages and schemes” (Rees et al., 2016, p. 16), with little distinction between these terms being made — rather, they are used and merged together without being distinguished and explained precisely at all. However, for a variety of reasons, precise reporting and description of active ingredients, such as BCTs in complex SLT interventions, are vital for SLT practice, research and training of SLTs.

The COST Action survey has shown that there is currently no common terminology used in SLT to describe techniques and strategies in complex SLT interventions. The current observation of the COST Action survey and literature (e.g., Rees et al., 2016) suggests that intervention content is often mixed with techniques used to change behaviour in children/patients, and techniques to change behaviour are not reported concisely. Thus, identifying active ingredients such as BCTs from the terms used for DLD intervention methods, techniques, approaches and/or strategies in the COST Action IS 1406 survey has not been possible due to the lack of discrete terminology and the mix of intervention content, therapy and/or therapy aims. Previously, this project aimed at identifying BCTs used in DLD interventions, using the COST Action IS 1406 data. However, the discovery of the incoherent use of terminology and the fact that the evidence-base in German-speaking DLD interventions is less well developed than for English-speaking DLD interventions, meant a move away from DLD as the focus for the current thesis. SSD interventions for German-speaking children are more evidence-based than DLD interventions. In addition, the terminology around SSD interventions is more coherent. For example, evaluated classification systems on SSD exist (Waring & Knight, 2013), compared to DLD interventions. For these reasons, moving forward with DLD as the focus was not deemed suited for this thesis, so the current study focuses on SSD interventions for German-speaking children, which are also complex SLT interventions.

Thus, to investigate the use of BCTs from the Behaviour Change Techniques Taxonomy Version 1 (BCTTv1; Michie et al., 2013b) in complex SLT interventions, the current study investigates which BCTs are used in German-speaking SSD interventions. Furthermore, as BCT experts have suggested that BCT training is essential before using BCTs (Wood et al., 2016), BCT training for SLTs and SLT students has been developed. In addition, the opinion of both groups on the use of the BCTTv1 for SLT interventions and the training of SLT students has been investigated. The next sections introduce the complex SSD intervention and explain in more detail the importance of using the concept of EBP (section 1.2.1), of identifying active ingredients of complex interventions (section 1.2.2), of using a coherent terminology (section 1.2.3) and of reporting complex interventions consistently (section 1.2.4).

1.2 Speech Sound Disorder (SSD) Interventions

As previously mentioned, SSDs in children are a common communication disorder (Broomfield & Dodd, 2004; Eadie et al., 2015; Law et al., 2000; McLeod & Harrison, 2009; Stackhouse & Wells, 1997) and describe difficulty in producing speech sounds which leads to unintelligibility or difficulty in verbal communication (American Psychiatric Association, 2013). The prevalence rate for SSDs in preschool children is estimated around 3.6% among 4-8 year-old children (Broomfield & Dodd, 2004; Eadie et al., 2015; Shriberg et al., 1999; Wren et al., 2016).

Most SSDs are of unknown origin (Harding et al., 2023). Only a minority of SSD cases can be linked to a known cause such as organic factors influencing the child's speech — for example, cerebral palsy or cleft palate (Broomfield & Dodd, 2004). However, all SSDs can present in high variation in severity and type and therefore show different characteristics (Bowen, 2009; Williams et al., 2021; Wren et al., 2018). A number of classification approaches have been developed, each one considering different aspects of SSD (Waring & Knight, 2013). For example, Shriberg's Speech Disorder Classification System (Shriberg et al., 2010) focuses on the aetiology of SSDs; Stackhouse and Wells' (1997) psycholinguistic framework looks at speech processing; and Dodd's differential diagnosis system looks at speech error patterns to classify SSDs (Dodd, 2005).

Due to the high variability among SSDs, also with unknown cause, Dodd (1995, 2005) developed a precise classification system considering the descriptive-linguistic and psycholinguistic approach for the English language. SSDs with unknown origin have therefore initially been classified into four groups (Dodd, 1995). According to Dodd (1995) children's SSD can be classified by error patterns occurring at surface level, which nevertheless indicate the type of processing difficulties common for a specific subgroup. The first group comprises children with *articulation disorders* also referred to as phonetic disorders — for example, a sound is substituted or distorted by the same sound isolated and in all contexts (e.g., lateral lisp) (Dodd, 2014). The second subgroup is called *phonological delay*, which includes speech error patterns which are typical in a child's development but occur later than normative data suggests (e.g., stopping of fricatives in English) (Dodd, 2014). The third group, *consistent atypical phonological disorder,* indicates that the child uses at least one error pattern which is pathological and therefore does not occur in normal development (Dodd, 2014). The fourth group is called *inconsistent phonological disorder*, which includes children who do not show difficulties in their oromotor system, however when naming the same item three times, multiple phonemic error forms occur in terms of inconsequent production for at least 40% of 25 items (words) (Dodd, 2014).

These four subcategories of Dodd's classification system have been investigated and confirmed for the German language by (Fox, 2003). In 2005, Dodd added a fifth category — *childhood apraxia of speech (CAS)* — which includes, for example, characteristics of inconsistent speech, oromotor difficulties such as sequencing articulatory patterns, and reduced speech rate or utterance length. Even though Fox-Boyer and Schulte-Mäter (2020) stress the difference between the two categories *inconsistent phonological disorder* and *childhood apraxia of speech (CAS),* it has to be acknowledged that CAS has not been added as a fifth category to the classification system of SSD for German-speaking children (Fox-Boyer & Schulte-Mäter, 2020). Overall, McLeod and Baker (2017) reviewed the classification of SSD in the international literature and found two categories: *phonology*, which includes phonological impairment and inconsistent speech disorder, and *motor speech*, which comprises articulation impairment, childhood apraxia of speech and childhood dysarthria. This thesis includes children with SSD difficulties in phonology, including all four categories initially developed by Dodd (1995) and established for German-speaking children with SSDs by (Fox, 2003).

Children who do not resolve their SSD until their school entry are at risk of developing literacy difficulties (Leitão & Fletcher, 2004; McCormack et al., 2009; Stackhouse et al., 2006), as spoken language builds the fundament for written language (Stackhouse & Wells, 1997). In addition, it is known that children with SSD may also experience socioemotional difficulties which impact relationships with others and their behaviour (Clegg et al., 2015; Law, Rush, et al., 2015; Law & Stringer, 2014). In response to the high occurrence and difficulties associated with SSD in children, several interventions have been developed to support children's speech sound difficulties (Baker & McLeod, 2011).

SSD interventions are, according to the United Kingdom Medical Research Council (UK MRC), considered to be complex interventions as they comprise several interacting components (Craig et al., 2008). Interacting components in SSD interventions can be the severity of the SSD, the individuality of the child and therapist, the therapists' choice of intervention, other professionals included in the child's treatment, or how the therapy is being funded (Craig et al., 2013; Dodd, 2007). Thus, a large number of components and levels of complexity influence each other and finally the therapy outcome (Craig et al., 2008). Therefore, identifying the active ingredients of complex interventions is often hard, as the single elements and components are strongly connected (Craig et al., 2008). Components of SSD interventions are also frequently labelled as active ingredients, and these include the techniques used by the therapist (Beresford et al., 2018; Boutron et al., 2008; Boutron & Ravaud, 2012; McCleary et al., 2013). As therapists aim to change behaviour in SSD interventions, these are also referred to as behaviour change interventions (Law, 2019). Due to the difficulty of precisely identifying the active ingredients of SSD interventions, it is hard to measure which components of a complex intervention are the ones responsible for being effective in bringing about change in the child/patient.

As stated in the Cochrane Review by Law et al. (2017), the number of components included in a SSD intervention may vary, depending on the theoretical background of an intervention and the child's needs. However, to evaluate the effectiveness of SSD interventions, it is necessary to identify the interacting components and active ingredients of the intervention. Without being explicit about the components and active ingredients included in a SSD intervention, we cannot test their efficacy and effectiveness. It is for this reason that there is a great need of transparency and clarity on included components and active ingredients in implementing complex and behaviour change interventions. The concept of evidence-based practice (EBP) can help to inform both the decision-making and problem-solving process, which is why it is introduced in the following section.

1.2.1 Evidence-based Practice

Evidence-based practice (EBP) entails the integration of the therapist's expertise (knowledge, skills, experience), scientific evidence, the patient's/carer's perspective and contextual factors such as funding the treatment into the therapeutic decision-making process. The profession of SLTs has enthusiastically incorporated the four EBP principles into their clinical actions over the past 20 years (Law, 2019). The EBP components "best available external clinical evidence" (e.g., scientific studies), "best available internal evidence" (e.g., therapist experience) and "best available patient-preference evidence” (e.g., a patient’s perspective) and so-called “other drivers” (contextual factors, e.g., funding of SLT) were described, discussed and outlined as detailed in literature (Dollaghan, 2007; Ebbels et al., 2019; Gladfelter et al., 2011; Klee et al., 2009; Law, 2019; Law, Roulstone, et al., 2015; Zipoli & Kennedy, 2005). Considering the concept of EBP in clinicians’ actions and the decision-making process is vital for deciding on the best currently available treatment in terms of effectiveness and efficacy for children with SSD, as all important factors for the therapy process are included in the EBP concept (Beushausen, 2014).

Overall, children with SSD present a very heterogenous group (Dodd & McCormack, 1995) and every child may respond differently to an intervention in different contexts (Dodd & Bradford, 2000). These facts emphasise again that SSD interventions are complex interventions in which many factors need to be considered. However, even though the group of children with SSD is heterogenous and SSD interventions are considered as complex interventions, the report from Law et al. (2004) showed that SSD interventions, especially those involving phonological therapy, were effective (further information on the effectiveness and efficacy of SSD interventions for German-speaking children is given in the section 2.1.1).

Contrary to some misguided assumptions, EBP is not “only research evidence” (Dollaghan, 2007, p. 2), but includes far more components than this. Obviously, the pillar “external evidence” refers to scientific research, such as SRs/meta-analyses. Nevertheless, the external evidence needs to be linked to the practitioner’s expertise and the therapy context (Law, Roulstone, et al., 2015; Marshall et al., 2011; The Royal Children’s Hospital Melbourne, 2011). Thus, scientific evidence and results are included into the decision-making process but are just one part of the whole picture. Therefore, when applying the concept of EBP for planning therapy of an individual child with SSD, the steps may involve (1) reading a systematic review on the effectiveness and efficacy of SSD interventions (e.g., Baker & McLeod, 2011; Wren et al., 2018) (external evidence), (2) thinking of how intervention worked best for children with similar difficulties (internal evidence) and (3) taking the child’s and parents’ needs and preferences into account (preference of a fully informed patient).

It is true that the practitioner’s perspective (internal evidence pillar) and the patient’s perspective has not received as much attention as the scientific evidence pillar. Therefore, more research on shared-decision making is necessary to understand how, for example, practitioners integrate their clinical expertise into the decision-making process (Law, Roulstone, et al., 2015). Thus, one key issue is to understand how practitioners perceive that an intervention is working or not (Law, 2019). To achieve this, the active ingredients of an intervention and the techniques used to bring change are important key issues which need to be teased out of interventions, investigated in detail and tested to understand how single elements included in an intervention work (Law, 2019). Currently, most intervention studies look at the "what" in terms of content of a therapy intervention, whereas the "how" and "why" have not been investigated in such detail (Furlong et al., 2021; Michie et al., 2008; Turkstra et al., 2016). Hereafter, the active ingredients of SSD interventions are identified in order to then discuss the terminology SLTs use to communicate about active ingredients of SSD interventions and methods, strategies, approaches and techniques.

1.2.2 Active Ingredients

The term "active ingredients" has first been used to investigate the effectiveness of an element of a pharmacologic intervention which is responsible for the therapeutic effect (i.e., the intervention is effective if a certain element is present and ineffective if this element is missing). It has then been adapted to the field of complex intervention research, which comprises interventions from AHPs, such as SLT interventions (McCleary et al., 2013). Active ingredients of therapeutic interventions are less often described than in other interventions, such as biomedical treatment (Beresford et al., 2018; McCleary et al., 2013). However, the detailed reporting of active ingredients in SLT interventions, which are complex interventions, is crucial for understanding how these interventions work.

Even though Petticrew (2011) argues there are hardly any 'simple' interventions, he acknowledges that definitions such as 'complex' and 'simple' interventions are important, as they indicate the type of research we conduct — for example, a randomised controlled trial will more likely be conducted if the intervention is labelled as simple intervention compared to a complex intervention. Depending on the question in mind, interventions can be described as 'simple' interventions (e.g., medical interventions) to answer a simple research question associated with a linear pathway with a clear link between the intervention and the outcome (Petticrew, 2011). However, when analysing these interventions more closely, they usually also turn out to be complex interventions, as additional factors are identified. Nevertheless, sometimes contrary to pharmacological interventions, several components which are responsible for an intervention to be effective are included in behaviour change interventions (Craig et al., 2008). The components which can be linked directly to an effect, and eventually to a therapy outcome, are the ones that bring about behaviour change and are seen as active ingredients in complex interventions (McCleary et al., 2013). In reverse, according to McCleary et al. (2013), not including such a component would lead to an ineffective intervention. As complex interventions show a high level of complexity in terms of the interacting components included (Craig et al., 2008), adapting the term from pharmacological interventions is not quite straightforward (Beresford et al., 2018; McCleary et al., 2013). Thus, possibilities for what an active ingredient is in, for example, a SSD intervention could refer to several components of complex interventions rather than a single element responsible for the therapeutic action. However, the first step towards testing the effectiveness of components included in complex interventions is reporting content and outcomes. For SLT interventions, reporting components is not yet coherent, nor is there a consensus on active ingredients in terms of effective components. Without reporting the components of interventions more explicitly, the investigation of theoretical underpinnings and the effectiveness of mechanisms of change used in these interventions is not possible (Beresford et al., 2018; Furlong et al., 2021; Law et al., 2017; Turkstra et al., 2016).

In SSD interventions, all incorporating components contributing to the therapy process, as discussed earlier in the EBP section, have to be considered in the decision-making process for the best possible outcome. Beresford et al. (2018) conducted a study using individual interviews and focus groups with 70 practitioners (clinical academics and researchers including physiotherapists, occupational therapists and SLTs) to investigate the professionals' views on the active ingredients of neurodisability therapy interventions for children. All participating practitioners agreed that different levels of complexity exist for complex interventions, such as SLT interventions, which need to be considered when looking at their active ingredients. According to participants of the study (Beresford et al., 2018), the levels of complexity comprise: (1) parents/school staff; (2) the child's impairment in terms of its nature and the type/number of interventions delivered by a single therapist; (3) the care management plan in terms of additional therapeutic, medial and/or surgical interventions; and (4) an increase or decrease of the child's difficulty which again depends on the nature of the impairment. Thus, a therapist's decision-making process is based on the level of complexity including these four points. In short, the active ingredients of therapies seem to depend on the level of complexity of the child's impairment and all accompanying factors. In the following section, the role of the therapist will be investigated within the context of active ingredients of complex interventions. The contributing components to the therapy process within complex interventions include the role of the therapist, who has to consider and evaluate many individual factors in the decision-making process for the best possible outcome for the child/patient.

An additional layer to the level of complexity for speech and language interventions is added by "the therapist" himself/herself/themselves as participants of the study, Beresford et al. (2018) argue that the component "therapist" influences the intervention outcome by the use of techniques, individual experience, the procedures and material used and/or the overall therapeutic context. Therefore, the therapist is a key factor in delivering the intervention and the elements which should bring change in the client (Law, 2019). However, the study compares influential factors from "the therapy" versus "the therapist" and "the therapeutic context", as all of these components contribute to the therapy outcome. The different influential factors contributing to the outcome of complex interventions coming from "the therapy", "the therapist" and/or "therapeutic context" have been shown comprehensively in a Table in Beresford et al.'s (2018) report. For the better understanding of active ingredients in complex interventions, the Table has been reproduced and is shown in Table 2 (read each column separately from top to bottom).

Table 2: Participants' views on the active ingredients of therapy interventions replicated from Beresford et al. (2018)

The therapy	**The therapist**	**The therapeutic context**
The overall approach	What the therapist brings:	The capacity of the wider "therapeutic team"
The schools of thought	Knowledge	Setting
Techniques, procedures, and/or equipment provided	skills	Access to equipment
---	What the therapist does:	Space to use equipment
---	Clinical decision-making	Access to clinical expertise
---	Ongoing assessment and review	---
---	Physical contact	---
---	Creating a therapeutic team and therapeutic environment	---
---	The work with the family: psychosocial support, "activating" the family in the intervention	---

When considering Table 2, a clear and straightforward distinction between “the therapy” and “the therapist” seems not to be possible, as there is an overlap of content in the two categories. In addition, Beresford et al. (2018) confirm that the components may impact each other and are therefore not seen as separate, individual components but, rather, show intersections and overlaps. The section “skills” in the “therapist” column refers to all skills of a therapist which determine how a therapist is working — this includes a range of skills such as “being sensible, having the ability to empathise (…) [or] being able to train others in techniques, procedures and/or use of equipment” (Beresford et al., 2018, p. 47). In addition, “techniques, procedures, and/or equipment provided” are also covered in the column “therapy”. Thus, both refer to techniques used by the therapist in the therapy. Therefore, the categories “skills” and “techniques, procedures, and/or equipment” from the columns “therapy” and “therapist” cover, for example, the behavioural techniques a therapist uses in an intervention to support change in patients/children. All descriptions of these categories are noted to be examples rather than complete lists, which also demonstrates much room for interpretation and indicates the absence of a consistent terminology for describing methods and techniques used by therapists.

More explicit components of complex interventions have been defined by Law et al. (2017, p. 4): “the delivery agent, the context of delivery, the intervention technique, the dosage, the outcome and adverse effects”. The “delivery agent” comprises parents, teachers, and SLTs, whereas “the context of the delivery” mainly means settings such as at a clinic, at school or at home, and the type of delivery such as a face-to-face or tele-practice therapy setting. The intervention techniques are the strategies, methods and techniques used by a therapist to bring about behaviour change in the client/child, as SLTs “commonly use a range of behavioural techniques” (Law et al., 2017, p. 4). Clearly, “dosage” refers to the frequency, intensity and duration of the intervention, and the “outcome” stands for the effects the intervention has/had on the child’s speech and language abilities. Lastly, “adverse effects” refers to, for example, a parent’s anxiety when noticing that their child is struggling, although Law et al. (2017) acknowledge that currently there are no known adverse effects in the interventions included in their systematic review. All of the above explicit elements contribute to the mechanisms of change and “are likely to identify the active ingredients of any intervention both in terms of immediate and longer-terms benefits” (Law et al., 2017, p. 3). This list of components included in SLT interventions (“the delivery agent, the context of delivery, the intervention technique, the dosage, the outcome and adverse effects”) also shows that active ingredients cannot be identified straightforwardly in complex interventions, as many interacting elements are included (Beresford et al., 2018; McCleary et al., 2013). The following paragraphs look in more detail at the component “intervention technique”, as this component relates directly to behaviour change in SSD interventions and it is of interest in this thesis in terms of how techniques used in SSD interventions are described and which ones are used.

The active ingredient “intervention technique” is a key feature of a complex intervention, which is currently mostly referred to as the content of an intervention (Furlong et al., 2021; Turkstra et al., 2016). However, the intervention technique does not only include the content of an intervention, but also the techniques used by a therapist to bring about change through an intervention (Law, 2019). As we still strive to understand how SLT interventions work and what impact the individual active ingredients have on the therapy process and outcome, the smallest component of an intervention which is responsible for bringing about change in the child’s behaviour needs to be identified and tested in its effectiveness to understand the impact of these elements. Most interventions include the “what” in terms of therapy content, whereas the “how” in terms of which techniques to use to bring about behaviour change in the child has not yet received much attention in SLT interventions (Furlong et al., 2021; Turkstra et al., 2016). The active ingredient “intervention technique” also shows that a term used to describe an active ingredient of an intervention can include more than one element, such as the therapy content and the technique used to change the behaviour in the child. Besides the need of a coherent terminology to report active ingredients and therapy components which is discussed in the next section (section 1.1.3), it is also important to identify and report techniques used in complex interventions in detail to later test their effectiveness.

To clearly report the active ingredients of complex interventions, the content of an intervention needs to be separated from the techniques used to deliver it, as they both target different levels of actions. The content of an intervention describes “what” is done in a therapy session (for example, exercises for phonological awareness), whereas the technique used to change behaviour in the child describes “how” this is being done (for example, by giving feedback, practice and revision). An example for summarising active ingredients/elements of a phonological therapy is the “Phonological intervention taxonomy” developed by Baker et al. (2018), which gets discussed in more detail in section 1.3.1. The taxonomy provides a comprehensive and important list of active ingredients included in SSD interventions. However, a separation between the content of the intervention and the techniques used to deliver the content and change the child’s behaviour has not been done — although these techniques need to be identified to test their effectiveness in order to know what it is in SSD interventions that works.

Overall, the terminology around identifying active ingredients in SLT interventions is not consistent which complicates the comparability and the testing of the effectiveness of the single components. Looking at the two above-mentioned examples from Beresford et al. (2018), who label and identify active ingredients for complex interventions in general, and Law et al. (2017), establishing these elements for SLT interventions, it can be noticed that the terminology for active ingredients is inconsistent throughout AHP as well as among single professional groups (e.g., SLT). For example, within SLT, active ingredients are also referred to as “influencing factors” (Beier & Siegmüller, 2017; Beushausen & Grötzbach, 2018). Nevertheless, all of the descriptions of active ingredients and therapy components influence the therapy outcome and are therefore important for the therapy process. However, to identify active ingredients of complex interventions and test the impact of the single components, a coherent and straightforward description of active ingredients is essential. Currently, descriptions of active ingredients in SLT interventions are mostly vague, incoherent and inconsistent as no unique terminology is being used to describe active ingredients in general, as well as techniques used to bring about change in behaviour.

We need to know exactly what professionals do in terms of active ingredients included in SSD interventions in order to be able to evaluate and test these active ingredients. Before doing so, an explicit description of active ingredients in SSD interventions using unique terminology is essential. Thus, a coherent terminology to draw from when describing active ingredients such as techniques used in SSD interventions is much needed. As most complex interventions have been described in terms of the “content” of an intervention (what is being done in an intervention) and the “how” of SSD interventions (how to implement the content of an intervention) has not been investigated to the same extent (Furlong et al., 2021; Law et al., 2017; Lorencatto et al., 2013; Turkstra et al., 2016), the next section looks at the current state of describing techniques in complex, especially SSD, interventions.

1.2.3 Lack of Agreement on Terminology

An agreed terminology ensures that professionals from one or more areas have the same understanding for a term (Denman et al., 2021; Michie et al., 2013b). If professionals do not use the same expert-specific terminology, many difficulties can occur, as different terms for the same techniques/phenomena could be used and cause confusion. For some areas in SLT, agreed terminology has already been reached — for example, in the case of addressing the diagnosis of DLD (Bishop et al., 2017). Other areas, such as reporting SLT interventions, show a lack of agreement on a coherent terminology, which means that a high variation in intervention descriptions and level of detail exists. Often, therapy interventions in SLT are described poorly, which has negative consequences for SLT and science. Thus, clear and transparent intervention descriptions would: (a) enable researchers to replicate studies using the intervention (and therefore generate more evidence for the efficacy and effectiveness of SLT interventions) (Michie et al., 2013b); (b) allow practitioners to implement interventions correctly (Baker et al., 2018); (c) allow research and practice to link techniques used in interventions to theoretical frameworks and therefore underpin the mechanism of change by appropriate theory (Michie et al., 2013b; Saldaña & Murphy, 2019); and (d) enable researchers to evaluate interventions coherently and summarize research results in, for example, meta-analyses (Michie et al., 2013b); and (e) positively support the process of developing a new intervention as researchers could use an agreed terminology (Michie et al., 2013b).

However, currently, as previously discussed, no coherent terminology to describe, deliver, report, and evaluate SSD interventions is being used. In addition, as is the nature of complex interventions, many interacting components exist in SSD interventions and describing all components coherently is a major undertaking. Nevertheless, we need to start to identify components included in SSD interventions in order to better test their efficacy and effectiveness and investigate which components are responsible for changing the child's behaviour and having the best impact on the speech sound difficulty. Currently, we do not exactly know how therapists deliver SSD intervention in terms of the techniques used to bring about behaviour change in the client/child (Denman et al., 2021; Furlong et al., 2021; Law et al., 2017; Lorencatto et al., 2013; Turkstra et al., 2016). It is essential to investigate the techniques used by therapists in SSD interventions (how is content being implemented) as these have, compared to the content of an intervention (what is being done), not yet been explored in detail. Once techniques used by the therapist in SSD interventions have been identified, their efficacy and effectiveness can be tested (Law, 2019). To know what works in SSD interventions, we first need to know exactly what is being done.

It is not enough to report the content of an intervention coherently, as the same therapy content can be administered by a variety of techniques by different therapists. For example, therapy content can be described as "working on producing a certain sound". However, this task can be administered in various ways: by demonstrating the difference between one sound and another, visually or verbally; by contrasting the incorrect sound the child says with the correct sound; or by explaining where to move the tongue to articulate the sound correctly. Due to the difference between therapy content and techniques used to convey the therapy content, therapy techniques also need to be reported and described consistently with one terminology. Research may also benefit from reporting therapy techniques in SSD interventions coherently (Michie et al., 2013b), as describing techniques explicitly supports investigating what works. In the context of clinical practice, reporting techniques in detail may ease the adequate implementation of interventions (Baker et al., 2018). In addition, as currently no consistent terminology is being used, the training of SLT students may also benefit from a coherent and explicit terminology of the techniques used to change behaviour (Rees et al., 2016) and implement content in SSD interventions.

As SSD interventions can be considered as complex behaviour change interventions (Law, 2019), it is important to discuss the theoretical framework of complex interventions in the context of describing, reporting, evaluating and teaching these. Consistently identifying techniques used to bring about behaviour change in SSD interventions by using a coherent behaviour change taxonomy to describe these techniques has many benefits: techniques can be described consistently in manuals, studies and the training of SLT students and, in the long run, be tested in terms of efficacy and effectiveness.

1.2.4 Describing and Reporting Complex Interventions

The basis for developing, designing, implementing, evaluating and teaching complex interventions is always rooted in describing and reporting complex interventions precisely (in terms of content and techniques used) and consistently (in terms of language use). Consistency in describing and reporting complex interventions reduces room for misinterpretation, which often leads to differences in how the interventions are implemented and the techniques are used. Thus, coherent descriptions/reports of complex interventions, including agreed terminology, is key to supporting the development, implementation, evaluation and dissemination of interventions.

The framework of the Medical Research Council (MRC) and National Institute for Health Research (NIHR) gives guidance on how to develop and evaluate complex interventions and has been improved greatly over the last two decades (Campbell et al., 2000; Craig et al., 2008; Skivington et al., 2021). The first version of the MRCs framework "*A Framework for the Development and Evaluation of RCTs for complex interventions to Improve Health*" was published in 2000 and focused on conducting randomised controlled trials (RCTs) with complex interventions. There followed, in 2008, the report "Developing and evaluating complex interventions" by Craig et al. (2008) which included guidance and information on how to conduct non-experimental methods as well as including non-health service complex interventions. Since then, there has been considerable development in the field of complex intervention research — for example, in terms of guidance on how to conduct and report studies. Thus, an updated version of the MRC report was published in 2021 (Skivington et al., 2021), funded by the MRC and NIHR.

In this context, there has been a great debate on how to design, implement and evaluate complex interventions over the last fifteen years (e.g., Craig et al., 2008; Shahsavari et al., 2020; Skivington et al., 2021; Voigt-Radloff et al., 2016). In comparison to the study of biomedical interventions such as drug trials, the evaluation of complex interventions involves significant challenges due to the many interacting components (section 1.1.1) (Campbell et al., 2000; Craig et al., 2008). Shifts and progress towards more transparency and greater consensus on how complex interventions should be designed, implemented and evaluated professionally have been made. The latest update from the MRC and NIHR report (Skivington et al., 2021) suggests that research addressing complex interventions may be structured into four phases: "development or identification of the intervention, feasibility, evaluation and implementation" (Skivington et al., 2021, p. 3). In addition to these four phases, a core set of six elements should be considered and answered in each phase. These elements address the context, programme theory, stakeholders, key uncertainties, intervention refinement and economic consideration for each intervention (Skivington et al., 2021). However, this only partly guides researchers and practitioners, as no agreed terminology on components and active ingredients of the therapy process has been included or suggested. Thus, the difficulty of having an incoherent and inconsistent terminology addressing the components and active ingredients of complex interventions remains, even though the framework gives helpful guidance to design, implement and evaluate complex interventions.

Teaching how to implement and deal with complex interventions to SLT students is also a challenging undertaking as so many components need to be considered in complex interventions (Rees et al., 2016). As reported earlier, a main difficulty in evaluating complex interventions is that intervention descriptions lack important information and describe intervention elements insufficiently (McCleary et al., 2013; Scott et al., 2020). This also impacts the teaching of complex interventions. If intervention descriptions are not described in detail and/or do not use coherent terminology, teaching the techniques to implement the content of an intervention cannot be done consistently and coherently throughout SLT training institutions, i.e. universities (Horton et al., 2004). Thus, we need explicitness not only for designing, implementing and evaluating complex interventions, but also for describing what we do (content of an intervention) and how we deliver content (techniques we use to implement the content) in order to teach these components consistently, transparently and coherently to SLT students. In addition, the level of complexity varies between patients/children as these may present a heterogenous group which often makes it difficult for SLT students to decide on therapy approaches, the implementation of the approaches, the techniques used to implement the content, the therapy setting, the dosage and more. As components may have different names and be labelled incoherently among therapy interventions and approaches, or even in clinical placements, students may be confused and struggle with labels, names and terms used in the context of complex interventions (Horton et al., 2004; Rees et al., 2016). This then may impact the quality of implementing the therapy content, the therapy outcome and, more importantly, the patient's/child's therapy progress. In some clinical workplaces, agreement on terminology is available for some components of a complex intervention (e.g., using the International Classification of Functioning, Disability and Health for Children and Youth (ICF-CY) and its codes as framework), whereas in other settings (e.g., self-employed practices) every SLT uses his/her/their own terminology. This also applies for other components of complex interventions, such as techniques used to convey content of an intervention. Additionally, practitioners mainly have their own style, a therapeutic relationship with their patients and use what they think works (Law, 2019).

The lack of a precise and consistent terminology for reporting components of SSD interventions including techniques is evident, even though awareness of the need to report complex interventions more clearly is also strongly felt. Besides the guidance on how to develop and evaluate complex interventions from the NIHR and MRC (Craig et al., 2008; Skivington et al., 2021), the guidelines "Consolidated Standards of Reporting Trials" (CONSORT) (Moher et al., 2009; Schulz et al., 2010) and the "Template for Intervention Description and Replication" (TIDieR) (Hoffmann et al., 2014; Voigt-Radloff et al., 2016) are two suitable tools for describing therapy interventions in detail. While these two frameworks help and support researchers and practitioners in describing interventions more coherently, there is still much room for interpretation of content and techniques used to deliver the content, as there is still no common terminology to describe content and therapy techniques to deliver the content of complex interventions and draw from it. And so, as previously stated, intervention descriptions remain unclear due to the lack of common terminology, even if the correct questions have been asked using the guidelines for reporting and describing complex interventions.

In sum, making use of the concept of EBP (section 1.1.1), identifying active ingredients (section 1.1.2), agreeing on a coherent terminology for complex and behaviour change interventions (section 1.1.3) such as SSD intervention are vital for reporting and describing complex interventions. Using a consistent terminology would have a positive impact on developing, designing, evaluating, implementing and teaching complex interventions and would contribute positively to effectiveness and efficacy studies in the field of complex intervention, as a coherent terminology supports replication and comparison.

SSD interventions can be considered as complex interventions as previously discussed (section 1.1) as well as behaviour change interventions (section 1.1) (Law, 2019). Thus, as the characteristics of complex interventions have been outlined and linked to SSD interventions in this chapter, we need to investigate behaviour change theory to understand how complex interventions (SLT interventions, especially SSD interventions) work — and how they can benefit from applying behaviour change theory. Therefore, the following section introduces the theoretical frameworks of complex, behaviour change interventions to understand how these interventions work.

The Behaviour Change Wheel (BCW) (Michie, Atkins, et al., 2014), the Capability, Opportunity, Motivation -Behaviour model (COM-B model) (Michie, Atkins, et al., 2014), the theoretical domain framework (TDF) (Michie, Atkins, et al., 2014) and the so-called APEASE criteria, which stands for Acceptability, Practicability, Effectiveness, Affordability, Side-Effects and Equity (Michie, Atkins, et al., 2014), all contribute to the theoretical underpinning and understanding of complex interventions and therefore SSD interventions. Finally, to address the issue around the lack of a concise and consistent terminology, especially for the techniques used to bring about behaviour change in SSD interventions, taxonomies used to describe SLT interventions coherently are introduced. Furthermore, the Behaviour Change Theory Taxonomy Version 1 (BCTTv1) (Michie et al., 2013b) is suggested for SSD interventions, as this taxonomy is an efficient and explicit taxonomy for describing and reporting techniques used by the therapist to change behaviour. Making use of this taxonomy to describe and report techniques used in SSD interventions would support practice, research and the teaching of SLT students in terms of designing, implementing, evaluating and SSD interventions. However, first we need to investigate how complex interventions, including SSD interventions, work.

1.3 Theoretical Frameworks: How do Complex Interventions work?

Theoretical underpinnings and logical models of interventions are fundamental to an understanding of how complex interventions work (Craig et al., 2008; Law, 2019). Teasing out individual active ingredients of interventions helps to investigate their effectiveness on the desired change. It is important to know how complex interventions work, which factors are involved and, finally, which components and ingredients are active in the intervention in order to be able to report and evaluate it clearly. The most used and traditional example of demonstrating how complex interventions work comes from the public health “use of apples” logic model, which can, as Law (2019) indicates, also be used for interventions in SLT. For this reason, the logical model addressing “the use of apples” is used here first to demonstrate an early attempt at showing how therapy works by identifying the broad links between the input and output/outcome of a complex intervention. Second, the same model was adapted for SSD interventions, to demonstrate the input and output/outcome for SSD interventions in a logic model. Therefore, Figure 1 is reproduced from the example used by Law (2019), whereas the same logic model has been adapted and transposed to the example of a SSD intervention, shown in Figure 2.

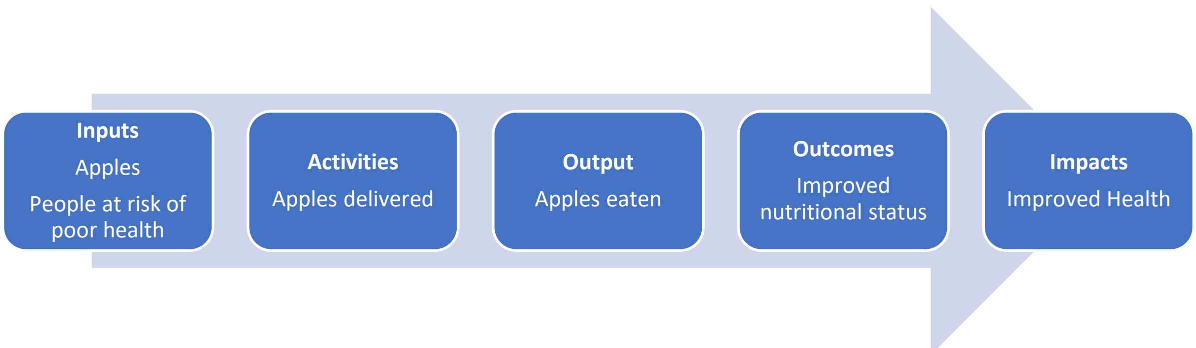


Figure 1: A common example of a logic model, reproduced from Law (2019, p.10)

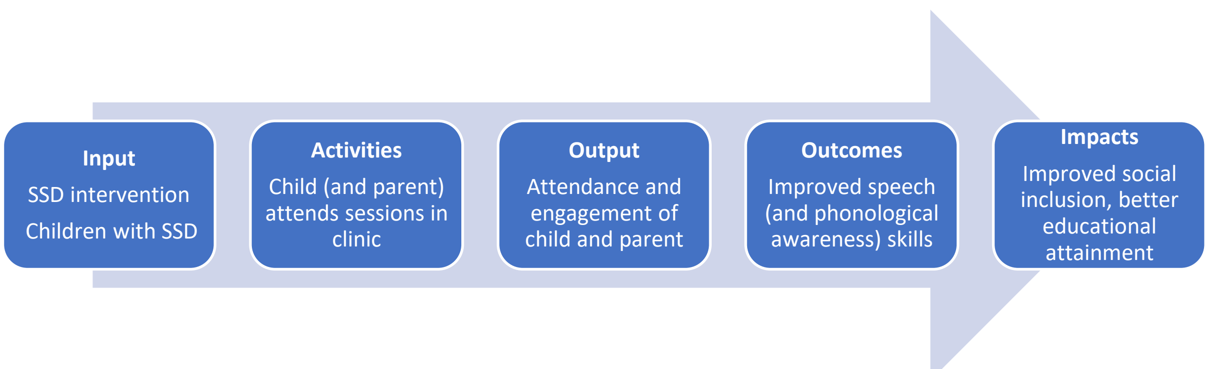


Figure 2: Logic model for how SSD interventions work adapted from Law (2019, p.10)

Logic models help to visualise the broad relationships between the input and output or outcome of an intervention and may help to clarify the impact of such interventions on individuals. The purpose of a logic model is to give an overview of how the intervention works to achieve behaviour change, rather than giving detailed information on all factors and components included in the intervention (Office for Health Improvement and Disparities, 2018). Even though the purpose of a logic model is rather simple, it has been critiqued for not sufficiently considering contextual factors (Ebenso et al., 2019; Mills et al., 2022). This is also true in the context of SSD interventions. The logic model provides a superficial overview of how therapy works and provides an example of how complex interventions can be illustrated simplistically but lacks sufficient detail of the components included in the therapy process. In addition, the model does not differ between content and techniques used in an intervention. Using the logic model to present a superficial, shorthand summary of how change takes places in an intervention seems reasonable, as it presents a comprehensive overview (Office for Health Improvement and Disparities, 2018). However, to identify active ingredients and mechanisms of behaviour change and to see how these interact, behaviour change interventions in SLT need to be analysed in much more detail, including identifying key elements of an intervention — such as the delivery agent, the dosage of an intervention or the behavioural techniques used by the delivery agent (Law et al., 2017) — which are all neglected in the logic model. The following section introduces models from behaviour change science to investigate how SSD interventions work in detail, considering all relevant components.

1.3.1 Behaviour Change Interventions

Behaviour change theories aim to explain conditions and components under which humans can change and have been applied to behaviour change interventions broadly and successfully in the public health context — for example, smoking cessation (Michie et al., 2014) and interventions against Covid-19 (Michie, West, et al., 2014; West et al., 2020). Because behaviour change is a major undertaking with many different levels of complexity, factors and techniques involved, frameworks underpinned by sufficient theory are needed to implement such interventions effectively (Michie, Atkins, et al., 2014; Michie et al., 2008). Theories aspire to give information on why a behaviour occurs (reason), when a behaviour occurs (timing), and the kind of behaviour that occurs (type). Theories "provide a systematic view of events or situations by specifying relations among variables, in order to explain or predict the events or situations" (Glanz et al., 2015, p. 26). In fact, theories should provide information on what to do and in which way to change the targeted behaviour (Michie et al., 2008). It is especially essential for complex interventions as we have them in health professions like SLT (Law, 2019) to make use of frameworks to either plan and design, implement or evaluate complex interventions, to provide the best available up to date therapy possible. As a high number of components and factors are included in SLT interventions and influence each other (section 1.1), it is important to consider all of them individually and acknowledge their possible impact. As far as the number of interacting components in complex interventions is concerned, a complex intervention always includes more than only a single key component, which is discussed in the previous section (1.1.2). Nevertheless, awareness of all involved components and factors is important to consider the "whole picture" of an intervention and identify mechanisms of action and their efficacy. Frameworks to do this for behaviour change interventions have been developed by behavioural psychologists in the past twenty years to provide a convenient and logical way to describe how behaviour change might work.

Four major tools (TDF, BCW, COM-B, BCTTv1) for implementing, designing, evaluating and reporting behaviour change interventions have been developed within the last two decades. Each of the four instruments has a different purpose. In addition, each one has been developed and built on the previous one. Thus, starting in chronological order of the behaviour change tools, the TDF was developed first (Atkins et al., 2017; Michie et al., 2005). As incorporating EBP relies on improving and implementing behaviour change interventions, a method suitable to characterise behaviour change interventions and enable researchers and practitioners to analyse the desired behaviour was needed (Michie, Stralen, et al., 2011). Originally, with the rise and advocated need of using the EBP model in clinical practice, the TDF was developed by Michie et al. in 2005 to identify how behaviour change can be supported for health professionals to implement EBP effectively and easily in their clinical actions (Michie, Atkins, et al., 2014). A revision and update of the TDF took place in 2012 and a more comprehensive and compact version was developed (Cane et al., 2012; Michie, Atkins, et al., 2014), which is currently the most up to date version. The integrative TDF supports the identification of barriers and facilitators (e.g., funding of therapy as barrier) which may influence certain behaviours (e.g., attending therapy) and therefore allows for the analysis of components responsible for behaviour change (e.g., funding is needed for the family to be able to attend therapy) (Law, 2019). Thus, Michie et al. (2014) report that the TDF has been used in many studies to assess problems in terms of implementing evidence-based strategies into clinical settings and is currently still used for this purpose (e.g., De Leo et al., 2021). Fourteen domains are included in the TDF, supporting the analysis of components relevant for behaviour change; these are "knowledge, skills, memory, attention and decision process, behavioural regulation, social/professional role and identity, beliefs about capabilities, optimism, beliefs about consequences, intentions, goals, reinforcement" (Michie, Atkins, et al., 2014, p. 87). Thus, the TDF supports the planning, designing and evaluating of complex interventions, behaviour change interventions and, therefore, also SSD interventions.

Subsequently, the COM-B model, which stands for **C**apability, **O**pportunity, **M**otivation, all referring to **B**ehaviour (COM-B model) (Michie, Stralen, et al., 2011), was developed from the TDF to categorise and analyse behaviours linked to interventions in terms of the Capability, Opportunity and Motivation of involved people as well as the mechanisms of change coming from the intervention. Each element relates to the nature of the behaviour to be changed. Capability refers to physical and psychological capability, Opportunity to physical and social opportunity and Motivation to automatic and reflective motivation of people involved in an intervention (e.g., a child, parent/carer and therapist in a SSD intervention) (Law et al., 2021). Thus, the COM-B domains help us to understand "the nature of the behaviour to be changed, and [serve as] an appropriate system for characterising interventions and their components that can make use of this understanding" (Michie, Stralen, et al., 2011, p. 2). The COM-B model summarizes the 14 TDF domains into three interacting domains. Every single domain of the TDF relates to a component of the COM-B — for example, the TDF domains reinforcement and emotion are linked to the COM-B modality automatic motivation. Thus, using the TDF allows for the analysis of the behaviour in more detail in terms of additional elements which influence a behaviour, such as emotions or reinforcement. Thus, the COM-B model can be used as a starting point to understand which components/active ingredients are included and interact in an intervention, and in which circumstances these may be a barrier of facilitator of an intervention's effectiveness, whereas the TDF can then be used as extension to the COM-B model to investigate these behaviours in more detail (Atkins et al., 2017; Michie, Atkins, et al., 2014). Figure 3 shows the COM-B model and its domains.

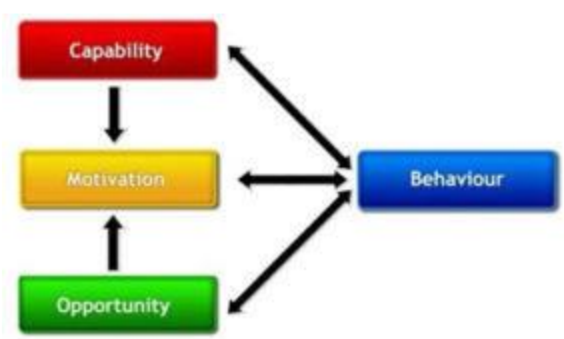


Figure 3: The COM-B model (Michie et al., 2011)

The COM-B model can be used as a bottom-up framework when designing new therapy interventions as the domains are considered and carefully thought-through in the context of the intervention. It can also be applied as a top-down process, where the framework helps to critically identify and evaluate these domains in interventions or even in existing literature, as Law et al. (2021) did in their rapid review. Looking at all domains (physical and psychological capability, physical and social opportunity, reflective and automatic motivation) in relation to SSD intervention, overall examples for how these interacting domains relate to the context of SSD interventions are given in Appendix B. Law et al. (2021) showed examples of the COM-B domains related to tele-practice for children with communication disabilities and also stressed, as discussed previously, that the COM-B elements relate to the behaviour of every involved person — usually the therapist, child and parent. Thus, the COM-B modalities need to be considered for each participating person in the therapy process. Based on the results of the rapid review (Law et al., 2021), Appendix B gives different examples, which may apply to one or more people involved in the therapeutic process. Using the COM-B model in the context of SSD intervention shows explicitly how many elements, people and levels are involved in a complex intervention such as a SSD intervention.

Changing the behaviour of a person includes change in one of the COM-B domains (Michie, Atkins, et al., 2014). Therefore, when a new intervention is designed, the COM-B model components need to be considered when planning the intervention and examined in terms of their presence (e.g., psychological capability: Does the intervention include information for parents/carers on why it is important or does the intervention need to include more information for parents/carers to cover physical capability?). Thus, by using the COM-B model as starting point to plan and design an intervention, one would determine the behavioural target and then discover which behaviour components need to be changed to achieve the desired behavioural target (Michie et al., 2011). In hindsight, if an existing intervention is being evaluated, the components can be examined with the available information of the intervention. Thus, looking at the included components and checking whether they are working well can also be applied, as done in Law et al.'s (2019) rapid review. In sum, the COM-B model supports the identification of those components in an intervention which bring or do not bring the desired change (Michie, Atkins, et al., 2014).

According to Michie et al. (2011), available behaviour change frameworks up to 2011 have not been comprehensive and easily applicable for designing and evaluating an intervention, as they did not include all existing intervention options — for example, Mindspace by the Institute for Government (Michie, Atkins, et al., 2014). This led the research team to develop the Behaviour Change Wheel (BCW), which has the COM-B model at its core and includes a broader range of intervention options which may be responsible for whether an intervention works or not (Michie et al., 2011; Michie et al., 2014). Thus, the BCW enables professionals and researchers to design, but also to evaluate, existing interventions by including a broader range of possible components influencing the success and effectiveness of a behaviour change intervention, such as the function(s) of an intervention (e.g., training, education) and policy options (e.g., guidelines, service provision). Therefore, the BCW is a broad model, including wide-spread areas relevant for an intervention and comprises three layers: (1) the hub of the wheel, which is the COM-B model; (2) nine intervention functions forming the second layer; and (3) the rim of the wheel, which includes seven policy categories that could be used to deliver intervention functions of the second layer (Michie et al., 2014). To consider more factors that might be responsible for the success of an intervention, the first step for developing the BCW included conducting a literature review to examine and investigate existing frameworks of behaviour change interventions from psychology, health promotion, epidemiology, public health, and anthropology. Michie et al. (2011) assumed that many frameworks describing behaviour change interventions exist, so they aimed at collecting a representative set rather than a complete set of behaviour change intervention frameworks. To be included in the literature review, frameworks needed to provide enough detail on their key features and had to be written in English, so that researchers could investigate these frameworks in detail. Nineteen behaviour change frameworks from 19 articles were found and analysed (Michie, Abraham, et al., 2011). Components which were identified in the included behaviour change intervention frameworks were then linked to the layers of the BCW, which aimed at including a broad range of factors responsible for the effectiveness of an intervention in a coherent and sufficient manner, as well as being useful for all behaviours in any settings (Michie et al., 2014). All components found in any of the 19 behaviour change frameworks have been included and summarised in one framework, the BCW (Michie et al., 2014). The BCW is illustrated in Figure 4.

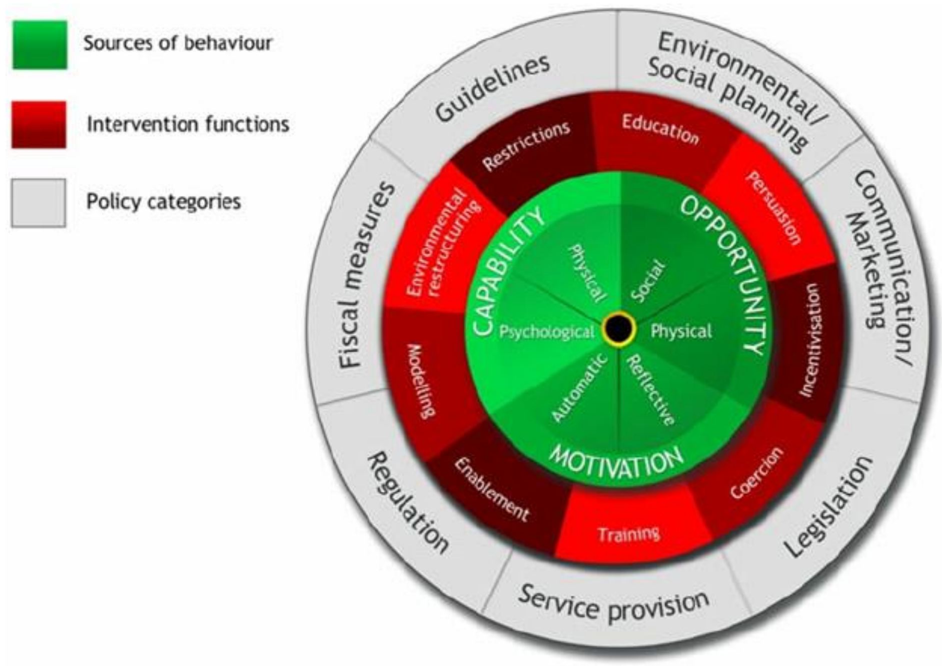


Figure 4: The Behaviour Change Wheel (BCW) (Michie et al., 2014)

Finally, by using the BCW, all COM-B domains (Figure 4) (inner rim, green), intervention functions (middle circle, red) and policy options (outer circle, grey) which possibly influence the outcome in an intervention (Law et al., 2021; Michie, Atkins, et al., 2014; Michie, Stralen, et al., 2011), can be considered and reviewed systematically. However, to figure out which techniques are used to deliver intervention content (how is the content being implemented) and report these techniques transparently, it is now important to focus on the smallest component of an intervention that brings about change (Michie et al., 2015). These components of an intervention are named Behaviour Change Techniques (BCTs), which determine mechanisms of actions and are applied directly in an intervention. BCTs can be linked to intervention functions, as different functions of an intervention may need different BCTs to deliver the intervention (e.g., intervention function teaching may require different BCTs than the intervention function persuasion). Although they are not shown as explicit 'sections' in the BCW (Figure 4), when analysing more detailed intervention functions, BCTs are needed to consider how the intervention is being delivered (Michie, Atkins, et al., 2014). BCTs might be used by the therapist (delivers the intervention) delivering intervention content to the child (receives the intervention) in any complex and behaviour intervention, likewise in SSD interventions. To address techniques used in behaviour change interventions, Michie et al. (2013b) developed the BCTTv1 (Michie et al., 2013b). Subsequent sections explain the BCTTv1 and its link to AHPs, especially SLT. In addition, the benefits of using the BCTTv1 for SSD interventions is outlined in detail.

1.3.2 Behaviour Change Technique Taxonomy Version 1 (BCTTv1)

The BCTTv1 was developed by Michie et al. (2013b) in Delphi-exercises with international behaviour change experts to provide a taxonomy with techniques used to change the behaviour of patients/clients and/or children in behaviour change interventions. In addition, the BCTTv1 supports, due to its coherent terminology, research and practice of professions working with behaviour change interventions in terms of reporting, describing, evaluating, designing, implementing and teaching complex, behaviour change interventions. The BCTTv1 includes 93 BCTs, which are structured in 16 groups. For each group a heading appropriate to its purpose has been used which should support users in the application, in both research and practice. Due to its length, the entire BCTTv1 is not included in this dissertation but can be found online (https://www.bct-taxonomy.com/pdf/BCTTv1_PDF_version.pdf) (Michie et al., 2013a). A BCT is defined as "(…) an observable, replicable, and irreducible component of an intervention designed to alter or redirect causal processes that regulate behaviour; that is, a technique is proposed to be an 'active ingredient' (e.g., feedback, self-monitoring, and reinforcement)" (Michie et al., 2013b, p.82). Thus, by using BCTs from the BCTTv1, it is possible to identify active ingredients of interventions and label exactly how an intervention content is being delivered in terms of the techniques used (how to implement the content of an intervention).

However, the mere availability of the BCTTv1 is not sufficient, as one needs to be able to apply and use it correctly (Marks et al., 2018). Therefore, a BCT training programme for anyone interested in or working with behaviour change interventions was developed (Michie et al., 2013b). A study by Wood et al. (2015) investigated the effectiveness of the BCT training programme and observed the improvement — in reliability, validity, and confidence — of participants in coding BCTs in intervention descriptions (Wood et al., 2015). Three additional studies, summarised and published in one article (Wood et al., 2016), assessed whether BCT training improved the quality of the behaviour change intervention compared with before the training (Wood et al., 2016). The two studies are reported on in more detail in section 3.1.1, as these studies substantially impacted the development of the BCT training in the current study. However, as this section introduces the BCTTv1 — including its possible benefits, limitations and critique — a short insight into the responses of participants addressing their opinions on the use of the BCTTv1 for complex interventions is given in the next paragraph.

Overall response to the BCTTv1 has been positive, as study participants, healthcare professionals, behaviour change researchers and practitioners either familiar or unfamiliar with the BCTTv1 and unspecified “trainees unfamiliar with the BCTTv1” described the taxonomy as “good, useful and desirable” (Wood et al., 2016, p. 1). However, they also stated that clarity could still be improved to ensure the best replicability possible for interventions or intervention manuals (Marks et al., 2018; Wood et al., 2016). Furthermore, additional critique addressing the BCTTv1 exists, as some researchers claim that the taxonomy provides a list of techniques like ingredients of a cooking recipe: you have ingredients, and still need to know how to cook the meal, to get the desired outcome (Marks et al., 2018). As outlined above, practitioners indeed need more than just a list of BCTs to apply an intervention effectively.

However, having a taxonomy is a positive first step into more transparent behaviour change interventions on all levels e.g., reporting, describing, evaluating and teaching these interventions. To date, most intervention manuals describe the content in detail, give advice on the dosage of an intervention, the setting and the context, whereas the techniques used to deliver interventions are neglected and not described (Michie et al., 2013b). One might argue that AHPs are well-educated and, to repeat the “cooking” analogy, SLTs would be in the position of master chefs — meaning that the decision-making about which particular BCTs to use for a specific child/patient could probably be left to the therapists. However, in an ideal world we would have certain BCTs and combinations of BCTs identified which come together with an effective, evaluated and specified intervention package. The combination of certain BCTs and their impact on behaviour change interventions has recently been investigated (e.g., Bohlen et al., 2020). Academic psychologists, practising clinicians and social scientists, experts in the BCTTv1, were included as expert participants to investigate which BCT combinations may be effective in behaviour change interventions (Bohlen et al., 2020; Connell et al., 2019; Michie et al., 2018). According to Bohlen et al. (2020) the study applies to all fields using behaviour change intervention, which would also include SLT. In addition to the ongoing studies which aim to identify the effectiveness of certain BCTs or combinations and sets of BCTs, an update for the BCTTv1 is still in progress according to Michie (2015 and see Appendix C: Email correspondence with Prof Michie in April, 2020), which aims to add, expand and clarify some elements with the help of cross-disciplinary professionals working with behaviour change interventions.

Stakeholders, policy-makers and researchers all call for precise and transparent description of complex interventions, for slightly different reasons (e.g., cost-effectiveness, providing the best available evidence from the scientific EBP pillar) (Michie et al., 2013b). Thus, the application of

BCTs to complex, behaviour change interventions such as SSD intervention is a logical step for AHPs such as SLT. This suggestion is in line with literature, as an increased use of the BCTTv1 and BCTs in health professions such as physiotherapy (Bourke et al., 2022; Keogh et al., 2018) or SLT (Stringer & Toft, 2016a, 2016b) has been determined. The identification of BCTs in complex interventions such as SSD interventions helps to identify techniques used to bring about behaviour change and therefore identifies active ingredients which are responsible for bringing about change but have not yet been investigated in detail. When BCTs used in SSD interventions are identified, it would be possible to test their effectiveness and contribute to the greater picture of what it is that works in SSD intervention. In addition, using BCTs to teach SLT students how to implement the content of an intervention also contributes to more transparency of techniques used in SSD interventions. However, as discussed above (in the cooking example), the use and application of the BCTTv1 requires practitioners who have been trained to apply and identify BCTs reliably and accurately (Marks et al., 2018). Overall, using the BCTTv1 has the following benefits: (a) assured teaching quality as everyone refers to the same terminology in SSD interventions; (b) transparent and detailed description of techniques used in SSD interventions; (c) testing of active ingredients of SSD interventions. In addition, the use of BCTs can be applied prospectively when designing and planning a new SSD intervention, as well as retrospectively, when coding, describing or evaluating a SSD intervention approach currently in use (Michie, Atkins, et al., 2014). Therefore, further detail on how the BCTTv1 has been applied in AHPs, especially speech and language science and therapy and SSD interventions, are outlined in the next section.

1.4 The BCTTv1 in Allied Health Professions and SLT

The BCTTv1 (Michie et al., 2013b) has mainly been used in the context of public health and psychology (Jongstra et al., 2017; Michie, Atkins, et al., 2014; Prestwich et al., 2016), before gaining the attention of AHPs (National Institute for Health and Care Excellence, 2014). AHPs can benefit in two ways from using the BCTTv1 and its included BCTs. On the one hand, the use of the BCTTv1 can support the implementation of behaviour change within the profession and on the other hand BCTs can be used in the intervention with the child/patient. Thus, BCTs from the BCTTv1 can not only be used to design, plan, evaluate and implement interventions for clients in AHPs, but in reverse for supporting behaviour change within several professions and disciplines. Addressing the latter — for example, the digitalisation of the health care system — demands different actions from AHPs than before (e.g., analogue documentation works differently than digital documentation). A great deal of research has already been conducted with regard to the behaviour change competency of AHPs. This began by addressing the ability to implement the

EBP model into clinical practice (Kolehmainen et al., 2012; Michie, Atkins, et al., 2014), enabling and supporting AHPs to have healthy and behaviour change conversations with patients (e.g., Bright et al., 2021) and then moved onto the e-health competency in the light of the pandemic (e.g., Virtanen et al., 2021). Focusing on patient interventions, the BCTTv1 has been used in diverse ways: (a) researchers and practitioners have used BCTs to code already developed interventions retrospectively in terms of techniques included (e.g., Heine et al., 2012; Rogers et al., 2009; Thomas & Mackintosh, 2014); (b) to plan and design prospective interventions using the BCW framework and BCTs (Dugdale et al., 2016; Thomsen et al., 2017); (c) to evaluate and improve interventions retrospectively (Michie, Atkins, et al., 2014); (d) to test single BCTs or BCT combinations in interventions (e.g., Bohlen et al., 2020; Patey et al., 2021); or (e) to investigate the overall effectiveness of BCTs in health-related behaviour and therefore improve interventions (and hopefully their outcome) for clients (Michie et al., 2018). The frameworks around behaviour change interventions (BCW, COM-B model and BCTs from the BCTTv1) have even been used to report findings of systematic and rapid reviews more coherently as using a unique terminology supports explicit reporting (e.g., Law et al., 2021; Richardson et al., 2019; Wood et al., 2015).

Using the BCTTv1 in SLT and science makes it possible to identify active ingredients in terms of BCTs (Law, 2019; Michie, Abraham, et al., 2011; Wood et al., 2016) in, for example, SSD interventions. In the long run, the efficacy of these BCTs can be tested to see which BCTs or combinations of BCTs promote the desired change in patients/children (Bohlen et al., 2020; Lewis et al., 2021; Michie et al., 2018; Patey et al., 2021). SLT researchers started to link the BCTTv1 to SLT and sciences in 2016 (Atkinson & Stringer, 2016; Dornstauder, 2020; Govender et al., 2015; Johnson et al., 2017; Law, 2019; McKean et al., 2022; Rees et al., 2016; Spalding & Stringer, 2016; Stringer & Toft, 2016a, 2016b; Toft & Stringer, 2017). Different areas such as childhood speech and language disorders (Atkinson & Stringer, 2016; Spalding & Stringer, 2016), inducible laryngeal obstruction (Asbridge et al., 2019) and neurological disorders (Toft & Stringer, 2017) have been investigated using the BCTTv1. Thus, Toft & Stringer (2017) used the BCTTv1 to precisely describe the delivery of head and neck cancer intervention and describe the use of BCTs with a comprehensive example for dysphagia intervention:

> If specific dysphagia therapeutic strategies, such as exercises or diet modification, can be classed as theoretical ‘bricks’ of our intervention, then the BCTs are the behavioural ‘mortar’ that allow them to be cohesively delivered and for the SLT and patient to work together to achieve their goals. (Toft & Stringer, 2017, p. 184)

First results provide an insight into how the BCTTv1 can contribute positively to the precise and detailed description of SLT interventions (Atkinson & Stringer, 2016; Rees et al., 2016; Toft &

Stringer, 2017). This then leads to various beneficial outcomes on many levels for the SLT profession for research and clinical practice: (a) replicability of studies; (b) inclusion of studies into meta-analyses; (c) a universal language to speak about the same techniques or content within the profession and in an interdisciplinary team; (d) helping students understand how we deliver intervention content and what we do exactly to enable behaviour change. Some of the contribution that the use of BCTs in SLT brings has already been evaluated. For example, Barnett (2022) found that using the BCTTv1 for parent-led language interventions had benefits for parents and a positive impact on the effectiveness of the intervention. However, more research is needed to further evaluate the exact impact of the deliberate use of BCTs in child-language interventions further.

Even though other taxonomies have been used in the broad field of SLT, the BCTTv1 is the only taxonomy which enables researchers and practitioners to describe the techniques used (e.g., by the therapist) in SLT sessions which bring about change in the child/patient. Even though there is potential to develop the BCTTv1 and include some BCTs currently missing for the profession of SLT (Barnett, 2022), it is a taxonomy which provides a good starting point for describing techniques used in SLT sessions. In addition, another strength of the BCTTv1 is that content is not mixed with BCTs, compared to other taxonomies (e.g., the voice taxonomy by Van Stan et al., 2015). Some taxonomies have been invented for the area of rehabilitation (e.g., the brain management injury case management taxonomy 'BICM-T' by Lukersmith et al., 2016), including acquired speech and language difficulties, which get treated by SLTs (Dijkers et al., 2014; Hatfield et al., 2005; Lamb et al., 2011; Natale et al., 2009; Ozelie et al., 2009; Whiteneck et al., 2009; Whyte et al., 2014). Within a 'Scientific Rehab Series' published over several years in the 'Journal of Spinal Cord Medicine', a special 'Specific Speech and Language Therapy Taxonomy' also related to acquired speech and language disorders has been introduced by Gordan et al. (2009). In addition, Van Stan and colleagues (2015) developed a taxonomy for voice therapy, also arguing that precise description of what occurs in therapy sessions is lacking in current interventions. This taxonomy also makes a good start in describing techniques used in therapy interventions and divides the section 'intervention delivery methods' further into 'extrinsic and intrinsic'. Looking at the 'extrinsic' section, terms such as 'exploration', 'hierarchy', 'modelling', 'psychotherapeutic' and 'teaching' can be found. However, none of these terms give an insight or description of how to deliver this intervention by using specific techniques in a certain way to change the behaviour of the patient and implement intervention content. Two further taxonomies linked to speech and language disorders in children have been published: the "Phonological Intervention Taxonomy" by Baker et al. (2018) and the "Taxonomy for child language intervention" by Denman et al. (2021).

These two taxonomies are highly related to the current project as they target phonological intervention and child language intervention and are therefore outlined and discussed in more detail in the next chapter (Chapter 2). Unfortunately, these two taxonomies also do not offer a clear distinction between content and techniques for SLT. However, the BCTTv1 has been created to specifically target techniques used in interventions to promote behaviour change in our client/child and to describe the active elements/ingredients of an intervention (Stringer & Toft, 2016a). For this reason, the BCTTv1 seems to be a strong and very appropriate taxonomy for the use in SLT interventions. The next section links the BCTTv1 to SSD interventions, considering the "Phonological Intervention Taxonomy" by Baker et al. (2018) and the "Taxonomy for child language intervention" by Denman et al. (2021).

1.4.1 The BCTTv1 and SSD Interventions

In contrast to the BCTTv1 (Michie et al., 2013b), most taxonomies developed for SLT (e.g., rehabilitation taxonomies) mix the content of an intervention with the techniques used in the intervention. Therefore, these taxonomies do not provide clear guidance on how to label techniques or which techniques to use in interventions to promote behaviour change in children/patients. Compared to other taxonomies, the BCTTv1 offers a clear and constant terminology on techniques used in SSD interventions. Two further taxonomies ("Phonological Intervention Taxonomy" by Baker et al., 2018; "Taxonomy with terminology for describing language interventions" by Denman et al., 2021) are relevant for SSD interventions and are outlined below to discuss and show why these taxonomies are currently not explicit enough in terms of techniques, content and, moreover, in terminology used in SSD interventions.

The "Phonological Intervention Taxonomy" (Baker et al., 2018) was developed by four researchers specialised in SSD in children. Two phases were conducted: Phase 1 to identify intervention elements in current SSD approaches by using thematic analysis; Phase 2 used the Phonological Intervention Taxonomy created from Phase 1 to code and identify these intervention elements in SSD interventions (Baker et al., 2018). Overall, the taxonomy provides a list of elements which may be present in SSD interventions, rather than a comprehensive collection of techniques used to deliver SSD interventions. This is helpful for identifying active ingredients in SSD interventions. However, a list of elements does not solve the issue around having a coherent terminology on techniques used in SSD interventions and testing which techniques used to bring about behaviour change are effective. As outlined before (section 1.1.2), even though Baker et al. (2018) used four categories ('goal', 'teaching moment', 'context' and 'procedural issues'), a clear distinction between service delivery and techniques is not provided in this taxonomy. The category ‘teaching moment’ for example, comprises three further subcategories: ‘*antecedent event’* (including ‘content of model or instruction’ and ‘modality of model or instruction’), ‘*response’* (including ‘imitation and spontaneous’) and ‘*consequent event’* (including ‘evaluative, reflective and responsive feedback’). This example highlights two issues: First, it makes the mixing between content and techniques clear, as the interventions’ content is summarised in the section ‘teaching moment’. Second, feedback is seen as a separate category, whereas feedback also serves as response, and can indeed, for example, also be a demonstration of the target behaviour. Thus, this taxonomy shows a summary of elements of a SSD intervention which can be beneficial in identifying overall active ingredients of SSD interventions rather than specific techniques to deliver SSD intervention. In addition, no coherent terminology is being suggested for consistent use.

The “Taxonomy for child language intervention” by Denman and colleagues (2021) had as its objective: “to develop consensus from speech-language pathologists (SLPs) in Australia on a taxonomy with terminology for describing language interventions for school-aged children and investigate SLPs’ application of taxonomy terminology when describing child language intervention” (Denman et al., 2021, p. 3504). The researchers acknowledged the need for a coherent terminology for describing complex interventions, as currently many terms are used and may be interpreted individually so that not everyone understands the same meaning under the same term (Denman et al., 2021). All Australian researchers, clinicians and academics working in the field of child language were invited to participate in a Delphi-study to develop a taxonomy which describes categories for language interventions. The five overall categories to describe child language interventions resulting from the study were ‘modality and domains’ (e.g., spoken and written), ‘purpose’ (e.g., skill development or strategy use), ‘delivery’ (e.g., conducted by SLP, others), ‘form’ (e.g., contextualised or activity-focused) and ‘teaching techniques’. The category ‘teaching techniques’ was split in three further domains — ‘prompting techniques’, ‘linguistic techniques’ and ‘regulatory techniques’. Denman et al. (2021, p. 3511) described ‘teaching techniques’ as “observable actions that aim to change performance either immediately or over time”. Overall, these techniques seem to target what therapists are doing to enhance behaviour change in their child/patient and give detailed insight into certain techniques. Nevertheless, a more general level of description — such as feedback, instruction or demonstration — might be helpful for building a more explicit and comprehensive hierarchy of levels, as these included techniques seem to be more content-related than technique-related (e.g., linguistic techniques relate more to content than to implementing techniques). One also has to keep in mind that this taxonomy has been developed for child communication disorder in general, rather than specifically for SSD.

However, the developed categories seem similar to these developed in the previously mentioned "Phonological Intervention Taxonomy" by Baker et al. (2018).

Overall, compared to other taxonomies, the BCTTv1 offers a comprehensive, explicit and coherent terminology in the form of a taxonomy which includes BCTs aiming at changing the behaviour in children/patients. The BCTTv1 does not mix content and techniques, which enables everyone working with this taxonomy to be explicit about how to implement content by using particular kinds of techniques. It provides the possibility of breaking content and delivery of content via techniques into small and transparent pieces. In the long run, this may also enable researchers to test these active ingredients - BCTs. In addition to all the benefits already mentioned when using the BCTTv1 for SSD interventions, one more advantage results from the application of the BCTTv1. As the concept of BCTs allows practitioners to be explicit about techniques used in SSD intervention to bring about behaviour change, the taxonomy also supports lecturers and students to be explicit in theoretical and practical SLT training. Thus, incorporating BCTs in SLT student training has the potential of positively supporting SLT student training, which is the topic for the next section.

1.4.2 Behaviour Change Techniques (BCTs) and SLT Student Training

SLT students often struggle to report the techniques used in speech and language interventions to promote change as there is no coherent and common terminology used in the field (Rees et al., 2016). The issue around terminology used for SSD interventions starts with the term 'intervention' itself. The term 'intervention' used in the context of SSD often refers to different "approaches, programmes, packages and schemes" (Rees et al., 2016, p. 16), as with many interventions in the field of SLT. One would even add the terms 'methods' and 'strategies', as they additionally occur often in the context of SSD interventions and seem to be used interchangeably with the other four terms (Dornstauder, 2020). No satisfactory distinction between terms such as method, package, approach, programme, scheme, strategy and/or technique is made — they are used and merged together without being distinguished and explained precisely. Considering that SLT students (at the start of their training) will only recently have begun to become familiar with professional terms used, it is understandable that they struggle when asked to report techniques included in certain interventions (Rees et al., 2016). As outlined earlier (section 1.2.3), a precise and coherent description of SSD interventions, content, and techniques used to bring about change in the child's behaviour is currently not possible. The inconsistent application of terminology also impacts SLT students in terms of their theoretical and clinical training (section 1.4.2).

SLT students need to learn techniques used and explicitly applied in therapy interventions if they are to advance and implement their knowledge correctly (Law et al., 2008; Roulstone, 2015). "SLPs learn terms for describing language intervention via multiple avenues including university training, textbooks, professional literature, continuing professional development opportunities, workplaces, and discussions with peers" (Denman et al., 2021, p. 3504). By using an agreed and coherent terminology across institutions, universities and literature, SLT students can be supported in learning which techniques are used how and when in SSD interventions, as variability is replaced by clarity (Roulstone, 2015). This may also counteract the fact that newly qualified SLTs often feel as if they have not learned "how to do therapy" (Horton et al., 2004, p.382) (Ensslen, 2013). Thus, using BCTs from the BCTTv1 (Michie et al., 2013b) can support SLT student learning in the theoretical and clinical context. In the following chapter, all the research objectives and research questions are presented together with an overview of the further structure of this thesis.

1.5 Rationale for the current Study and Research Objectives

Overall, using a precise taxonomy such as the Behaviour Change Technique Taxonomy version 1 (BCTTv1; Michie et al., 2013b) for describing techniques used in SSD interventions has a beneficial impact on research and clinical practice (sections 1.1, 1.2 and 1.3). This is true for everyone working in the context of SSD interventions such as researchers, SLTs and SLT students. As shown by the example of the COST Action IS1406, there is currently no common terminology to draw from when reporting and describing techniques used in SLT interventions to change behaviour in children/patients. Therefore, the current study comprises three stages which contribute to the use of the BCTTv1 in SSD interventions.

The objective of Stage 1 is to use the BCTTv1 to identify Behaviour Change Techniques (BCTs) in evidence-based, effective SSD interventions for German-speaking children with SSD, to then create a list of BCTs used in SSD intervention. The investigation of the use of BCTs in SLT interventions is novel in German-speaking countries, which makes this project the first in this context. This list is then developed based on the theoretical underpinning of evidence-based SSD interventions for German-speaking children.

Stage 2 aims to develop an effective BCT training for student SLTs and SLTs and investigates student SLTs and qualified SLTs' perception of a BCT training for SSD interventions. In order to apply the BCTTv1 correctly in the theoretical or practical context of SSD, users need to complete a BCT training. Stage 2 also aims at investigating the opinions of these two groups with regard to the use of BCTs for SSD interventions and SLT students training. Furthermore, building on the results of Stage 2, which showed lower than expected BCT coding accuracy of participants, the objective of Stage 3 was to revise the BCT training and investigate the effectiveness in terms of coding accuracy. As no considerable differences between SLTs and SLT students' BCT coding accuracy could be observed in Stage 2, only SLT students participated in Stage 3.

1.5.1 Identifying BCTs in SSD Interventions (Stage 1)

In Stage 1, the BCTTv1 (Michie et al., 2013b) was used to identify present BCT types from SSD intervention manuals and studies addressing German-speaking children and an example of a representative real-world SSD intervention video, to see which BCT types are present in SSD interventions in theory and research (intervention manuals and studies) as well as in a real-world example (SSD intervention video). The video was recorded with a child with SSD in the Logopädie Dornstauder clinic so that BCTs could be identified in both the literature and a real-world video example. The following research question has been investigated:

RQ 1. *Which BCT types can be identified from SSD intervention manuals and studies and from a German-speaking, representative real-world SSD intervention video?*

1.5.2 BCT Training for SLTs and SLT Students (Stage 2)

An online BCT training unit for student SLTs and SLTs (online due to the pandemic) was developed and conducted in Stage 2 to see whether it is possible to train the two groups to identify 17 BCTs of the BCTTv1 (Michie et al., 2013b). At the end of the BCT training workshop, the coding accuracy and reliability of participants was assessed to see whether the training worked. Differences between BCT coding accuracy of student SLTs and SLTs are also explored. The following research question has been investigated:

RQ 2. *Can SLTs and SLT students be trained to identify BCTs in SSD interventions and are there any differences between the BCT coding accuracy of SLTs and SLT students?*

SLTs and SLT students were asked for their opinion on the use and application of the BCTTv1 for SSD interventions and the training of SLT students. The use and application of the BCTTv1 for

AHPs has been developed over the last decade. Therefore, it was of interest whether SLTs and SLT students think that the explicit use of BCTs is beneficial in informing others about what is being done in SSD interventions. A survey was used to gather data on this issue. The following research question has been investigated:

RQ 3. *Do SLTs and SLT students think that the application of BCTs in SSD interventions with children is useful, and if so why, and do they think that the BCT training workshop should be included in the training curriculum of students?*

1.5.3 Revised BCT Training for SLT Students (Stage 3)

As the coding results of participants in Stage 2 had been lower than expected, a revised BCT training workshop was conducted in Stage 3. This time only SLT students participated, as previous results showed no notable difference in coding results among the two groups (SLTs and SLT students). Thus, on the basis of the results from Stage 2, a revised BCT training for SLT students was carried out in Stage 3. One aim of the revised BCT training was to simplify it by reducing the number of included BCTs. Only the most used and most common BCTs, identified in Stage 2, have been included in Stage 3. The second objective of Stage 3 was to achieve higher BCT coding accuracy results of participants, as coding accuracy results of participants in Stage 2 had been lower than expected. The following research question was investigated:

RQ 4. *Does simplifying the BCT training workshop and reducing the number of BCT types included increase the BCT coding accuracy of SLT students from before to after workshop training?*

The same BCT survey which was used in the initial BCT training workshop to investigate participants' views on whether they think that the application of BCTs in SSD interventions with children is useful has been amended in terms of number of BCT types included and then also been used in the revised and simplified BCT training in Stage 3. This is because participants receiving the revised BCT training which includes fewer BCT types may have different responses on the use and applicability of the BCTTv1 (Michie et al., 2013b) in the context of SSD interventions compared to participants of Stage 2 who were trained in more BCT types. The following research question has been of interest:

RQ 5. *Do SLT students doing the revised BCT training workshop think that the application of BCTs in SSD intervention with children is useful and if so why, and do they think that the simplified BCT training workshop should be included in the training curriculum of SLT students?*

Chapter 2: Identifying Behaviour Change Techniques (BCTs) in Speech Sound Disorder (SSD) Interventions (Stage 1)

The overall aim of this chapter is to investigate whether BCTs can be reliably identified in existing SSD interventions. The focus will be on three interventions that have the strongest evidence-base for Speech Sound Disorder (SSD) interventions for German-speaking children. First, BCTs will be identified and coded within the relevant SSD therapy approach manuals and intervention descriptions. Then, second, the BCTs extracted will be compared with a video of a representative real-world SSD intervention session to establish whether BCTs suggested in intervention instructions align with those demonstrated in practice.

2.1 Introduction

This section gives insight into evidence-based SSD interventions for German-speaking children, discussing the extent to which strategies and techniques used by Speech and Language Therapists (SLTs) to bring about behaviour change in children with SSD are included in published descriptions of these SSD interventions. The findings of the appraised literature served as the basis for creating a list of Behaviour Change Techniques (BCTs) which occur in effective SSD interventions, taken from the Behaviour Change Technique Taxonomy version 1 (BCTTv1) (Michie et al., 2013b) . The identified evidence-based SSD interventions were then coded by a BCT-trained SLT and two SLT students to see whether — and, if so, which — BCT types occur in these interventions.

Among all childhood speech and language difficulties, the greatest body of evidence on the effectiveness of interventions can be found for the treatment of children with SSDs for the English language. SSD is one of the most common communication disorders in preschool children (section 1.1) which can result in literacy difficulties. Unintelligible speech impacts children not only in terms of their educational path but also in their social interaction with others, which may also impact a child's behaviour and emotional state (Bowen, 2009; McLeod & Baker, 2017; Williams et al., 2021; Wren et al., 2018). Thus, the treatment of SSD in childhood is fundamental for a child's social, emotional, and educational development and their future path.

Even though there is evidence on the effectiveness of SSD interventions, Law et al. (2017) report a lack of randomised controlled trials testing the effectiveness of SSD interventions in their updated Cochrane review (Law et al., 2017). Most intervention studies for SSD therapy approaches vary in study design — such as quasi-experimental or non-experimental case (Law et al., 2017; Wren et al., 2018). As a lack of randomised controlled trials (RCTs) within the field of SSD interventions also exists for German-speaking countries, the narrative approach to investigate evidence-based SSD interventions for German-speaking children has been chosen to ensure that all available studies and literature can be included. Thus, the scope of inclusion criteria was left open to identify all relevant studies. In addition, even though RCTs are still sometimes seen as 'gold-standard' by many researchers for testing the effectiveness of interventions (e.g., Carding & Hillman, 2001), other study designs, such as quasi-experimental studies or single-case study designs, have been acknowledged to be very informative and important, particularly for some research questions (e.g., Best et al., 2019; Vance & Clegg, 2012). Study types included in this literature review all investigated the effectiveness of the included SSD interventions in different research designs. The following section introduces evidence-based SSD interventions for German-speaking children, identified by using a narrative approach.

2.1.1 SSD Intervention Approaches used in German-speaking Countries

Even if language specific differences exist, some SSD therapy approaches used for the treatment of German-speaking countries have their origin in English-speaking countries (e.g., Metaphon, Minimal Pair) (Fox, 2003). Some of these approaches have been adapted and tested for their use in German, such as the commonly used phonologically-oriented SSD intervention therapy approaches "*Minimalpaartherapie*" ("Minimal Pair Therapy", Weiner, 1981) and "*Metaphon*" by Dean & Howell (1986) (transferred into German by Jahn in 2000). As reported in Forsythe et al. (2021), analysing results from the COST Action IS1406, the main therapy approach used for SSD in German-speaking countries is the "*Psycholinguitisch-orientierte Phonologie Therapy*" (P.O.P.T.; "Psycholinguistically Oriented Phonology Therapy"). The SSD approach P.O.P.T. has been developed specifically for German-speaking children with SSD by the German SLT Fox (2003). Other approaches comprise the "*Zyklische Therapie*" — the "cycles approach or cycles remediation approach" (Hodson, 2006; Hodson & Paden, 1983, 1991) and the "whole language approach". As the name of the latter implies, this approach targets more language levels than "only" the phonological one and is sometimes also used for children with phonological difficulties (Tyler et al., 1987). In addition, the "psycholinguistic framework" by Stackhouse and Wells (1997) is also often used to identify children's speech processing difficulties, which then allows the creation of a specific treatment plan for the therapy of children with SSD (Stackhouse et al., 2002, 2006). From the above-mentioned SSD interventions, the Minimal Pair approach (Weiner, 1981), Metaphon (Dean & Howell, 1986; Jahn, 2000, 2007) and P.O.P.T. (Fox, 2003; Fox-Boyer, 2016) are introduced in more detail in the following subsections. These three approaches have been found to be evidence-based, and studies targeting their efficacy and effectiveness have been conducted. As previously stated, RCTs for German SSD interventions are not available. Thus, quasi-experimental studies are also included in the review. The three therapy approaches are presented based on their publication and development date.

2.1.1.1 Minimal Pair

First developed by Weiner in 1981, the "Minimal Pair" approach is the oldest therapy intervention of the three. The original version by Weiner (1981) has been used as theoretical underpinning and foundation for the development of further variations of this approach (e.g., Minimal Pair approach 'maximal oppositions' by Gierut, 1989; Minimal Pair approach 'empty set' by Gierut, 1992; Minimal Pair approach 'multiple oppositions' by Williams, 2006). According to Fey (1992, p.230), three principles can be applied to most phonology-based approaches, especially all forms of Minimal Pair approaches: "First, all such programs focus on the modification of groups of sounds that seem to be treated by the child in a similar fashion […]. Second, emphasis frequently is taken off of correct sound production and is placed on the establishment of previously neutralized phonological contrasts. […] Third, there is much greater emphasis on the use of speech sounds for communicative purposes, rather than on the correct production of sounds as a goal in itself." (Fey, 1992, pp. 230–231). Overall, therapy activities using the Minimal Pair approach consist of making use of mis-productions produced by the child and later by the therapist by using minimal pairs. For example, if the child names a picture of the 'sea' /siː/ by saying 'tea' /tiː/, the therapist may hand over the card showing the 'tea'. Thus, confusion and/or a challenge has been created in the therapy session, which confronts the child to think about what he/she/they just said. The child is forced to focus on changing how they say the word in order to communicate it effectively. Hence, this task is conducted to show that language carries meaning and to support the process of reflecting on this (Bowen, 2009; Fox, 2003; Keul et al., 2018).

Effectiveness of the Minimal Pair approach for English-speaking children with SSD has been investigated in several studies (Gierut, 1998; Saben & Ingham, 1991; Tyler et al., 1987; Weiner, 1981). In addition, Baker and McLeod (2011) found 42 studies for their systematic review which confirmed the effectiveness of the Minimal Pair approach for English-speaking children. However, as this approach has been developed in English-speaking countries and therefore uses English as foundation to conduct the Minimal Pair therapy approach, the transfer to other languages such as German has been criticised (Fox, 2009). One main reason is the fact that German does not include many monosyllabic words, which are the basis for carrying out this approach (Fox, 2009). Fox (2009) reports that a number of minimal pairs can easily be found for the English language compared to the German language which does not provide a great number of minimal pairs for most words. In addition, it is argued that if minimal pairs for German words are found, it is often hard to show these on pictures to work with children with SSD in therapy interventions due to their meaning (Fox, 2009). However, materials for working with minimal pairs in SSD interventions for German speaking children have been collected and used throughout (e.g., Babbe, 2018). Recently Kauschke et al. (2021) published material to work with children with SSD in German, which indicates that this approach is, despite the critique from Fox (2003), also used and applied for German-speaking children. Nevertheless, even Kauschke et al. (2021) report that minimal pairs are used in combination with other tasks. Rather than presenting as a single therapy approach which only contains minimal pairs, it is seen as an element of the SSD intervention. Even though the application of the Minimal Pair approach is limited due to the language characteristics of German, the approach has been used and investigated with German-speaking children (Fox, 2009). Hacker (1996, 1999) and Hacker and Wilgermein (2001) presented single case descriptions, which reported a positive impact of the Minimal Pair approach in German-speaking children with SSD. Large-scale studies proving the effectiveness for the use of this approach with German-speaking children with SSD are still not available (Fox-Boyer, 2016).

2.1.1.2 Metaphon

The therapy approach "Metaphon" was developed by Dean and Howell in the 1980s (1986) and transferred to German by Jahn (1998, 2000, 2007). Dean and colleagues describe the approach as "a remediation procedure designed to facilitate change in phonological processing by developing and utilizing metalinguistic awareness" (Dean et al., 1995, p. 1). The concept refers to the assumption that restricting intervention to confronting the child only with minimal pairs does not sustainably impact their speech (Bowen, 2009). Thus, Howell and Dean (1991) developed an approach which combines the development of (meta)phonological skills with the Minimal Pair approach. The therapy concept comprises two phases which are presented briefly here: Phase 1 is concerned with teaching the child that language conveys meaning, is used to express feelings, wishes and conditions, and can be made transparent (Bowen, 2009). In addition, 'labels' to communicate about specific phonological characteristics are introduced to develop a shared terminology to use in Phase 2 (e.g., long and short for fricatives vs. plosives) (Bowen, 2009; Keul et al., 2018; Mayer & Ulrich, 2017). Phase 1 only targets the receptive level, whereas Phase 2 then includes expressive tasks. The child's awareness towards correctly and incorrectly realised speech and target words gets supported by the therapist as feedback about success or failure is provided (Bowen, 2009; Keul et al., 2018). Here, minimal pairs are incorporated into the tasks and terms and vocabulary for speech characteristics taught previously (e.g., long and short) are used to demonstrate, in a transparent and tangible way for the child, differences between words and their meanings. The second phase of Metaphon also includes minimal pair sentences, including instructions for the child and the therapist in turn (e.g., "Draw a pin/fin on the fish", Bowen, 2009, p.120).

As Metaphon therapy approach for children with SSD originated in the United Kingdom, studies to investigate the effectiveness of this intervention have been conducted first in English (Bowen, 2009; Keul et al., 2018). Results of various studies show that Metaphon has had a positive impact on SSD, improved children's speech and has therefore been an effective intervention for treating SSD in children (Dean et al., 1995, 1996; Harbers et al., 1999; Howell & Dean, 1991; Jarvis, 1989; Waters et al., 1995). However, to determine the effectiveness of Metaphon for German-speaking children with SSD, only one single-case study with twins (two children) was conducted by Jahn (2000). Jahn (2007) also reports that these results show a positive trend, but large-scale studies would be desirable to confirm these findings. Nevertheless, these results are important and a first step towards transparency of SSD intervention evidence. The next SSD intervention approach introduced for German-speaking children, widely used in Austria, Germany and Switzerland (Forsythe et al., 2021) is P.O.P.T. (Fox-Boyer, 2016).

2.1.1.3 Psycholinguistically Oriented Phonological Therapy

The '*Psycholinguistisch-orientierte Phonologie Therapy*' (P.O.P.T.; 'Psycholinguistically Oriented Phonology Therapy') was developed by Fox (2003) and is, to date, the only therapy approach specifically developed for German-speaking children with SSD (Keul et al., 2018; Mayer & Ulrich, 2017). The intervention is based on the previously mentioned 'psycholinguistic framework' developed by Stackhouse and Wells (1997) and incorporates their principles and assumptions on phonology acquisition and SSD (Fox-Boyer, 2016). The intervention can be used with children from the age of three, showing phonological delay, consistent phonological disorders and inconsistent phonological disorders (Fox-Boyer, 2016). Overall, this approach consists of four phases. In the pre-phase, the therapist provides and uses phonologically incorrect words which children should recognise as being wrong — this requires the child to engage with phonological structures of words, regardless of their semantic meaning (Fox-Boyer, 2016; Keul et al., 2018).

Once the child is able to detect correct from incorrect offered forms, the therapy moves on to Phase 1. The focus of Phase 1 lies in differentiating between phonological contrasts of isolated sounds, syllables, pseudo words and real words at both receptive and expressive level. Phase 2 mainly aims at the productive level in terms of repeating words correctly that were first established receptively in Phase 1. The third phase comprises both the receptive and productive level to detect the correct sound of a word and realise it correctly (Fox-Boyer, 2016).

The effectiveness of P.O.P.T. has been investigated in several single-case studies and quasi-experimental study designs. First, Fox (2000) investigated the effectiveness of phonological therapy compared with articulation therapy for a child (monolingual German-speaking child, 4:7-year-old) with a consistent phonological disorder in a single-case study. The child received articulation therapy as a first step for 53 sessions (one session 40 minutes). Progress was found for oro-motor tasks, for detecting speech sounds in other speakers and for isolated phoneme production as well as syllable level (with the exception of fricatives). However, as there was no progress on word level and in spontaneous speech, the child remained unintelligible and progress in the phonetic and phonemic system was low. In contrast, after receiving only eight sessions of the phonological approach (each session 45 minutes, twice a week over a period of four weeks), the child showed a number of intelligible and correctly realised phonemes which impacted the overall intelligibility substantially. Therefore, production abilities of the child have been increased significantly after the delivery of the phonological approach.

Second, Teutsch and Fox (2004) conducted a study also comparing the effectiveness of articulation therapy compared to phonological therapy using P.O.P.T (Fox, 2003). Four monolingual German-speaking children, all with consistent phonological disorders, participated and were between 3:10 and 4:5 years old. Two of the four children received articulation therapy over eight weeks, whereas the two other children received phonological therapy over eight weeks. Results of the two groups and treatment approaches were compared and indicated that children who received the phonological therapy approach showed greater progress in terms of correctly realised consonants and resolved atypical phonological processes better than children receiving articulation therapy.

Third, Bräger et al. (2007) conducted a study with ten monolingual German-speaking children between 3:9 and 5:8 years old. Seven children showed a phonological delay and three children showed consistent phonological disorder. To compare the treatments, children's speech sound status was tested before and after (Fox, 2003). The treatment phase lasted for 12 sessions —

twice a week with 45-minutes sessions. Pre-and post-assessments of all children showed significant improvement in terms of number of phonological processes and occurring processes. Some phonological processes had been resolved, and a decrease of frequency of remaining processes could be observed. The study by Bräger et al. (2007) was the first study to be conducted without the participation of Fox, who designed and invented P.O.P.T. (Fox, 2003). Thus, this study is an important independent study, which suggests that the phonological approach P.O.P.T. improves phonological delay and phonological disorder.

Forsythe et al. (2021, p. 1) recently analysed data on "why clinicians choose their language intervention approach" and published results from the COST Action IS1406. The term 'language' has been used in a broad sense in the COST Action survey, as speech interventions have also been included and reported. Thus, results showed that the P.O.P.T. therapy intervention (Fox-Boyer, 2016) is widely known, used and implemented in German-speaking countries. Both the intervention name "Psycholinguistically Oriented Phonological Therapy (P.O.P.T)" and the name of the researcher and SLT "Anette Fox" are highly associated with the treatment of SSD in children (Forsythe et al., 2021) in German-speaking countries, whereas the previously introduced therapy intervention "Metaphon" has been mentioned by German participants, but not by Austrian participants. However, the "Minimal Pair" approach has not been found to be used for SSD at all, across all participating European countries (Forsythe et al., 2021).

Considering the need for integrating the evidence-based practice (EBP) principles into the clinical decision-making process, the results from the data reported by Forsythe et al. (2021) are welcomed in terms of EBP for the following reason. The intervention P.O.P.T. (Fox-Boyer, 2016) is the only SSD treatment approach for German-speaking children which has been shown to be effective in several studies (Bräger et al., 2007; Fox, 2000; Teutsch & Fox, 2004). Nevertheless, the conducted studies were single-case study and quasi-experimental study designs, rather than RCTs. As mentioned before, this does not mean that study designs such as single-case studies or quasi-experimental studies do not reveal important information on interventions (Best et al., 2019), albeit that RCTs are often seen as the 'gold-standard' for evidencing the effectiveness of interventions (Carding & Hillman, 2001). The previous mentioned studies comprise the strongest evidence currently available for SSD interventions using P.O.P.T. among German-speaking children. However, the need for further studies investigating the effectiveness of phonological approaches remains.

Regardless of the therapy approach and/or intervention chosen for treating children with SSD, each SSD session follows a certain structure, which is investigated in the following section, as the structure of the SSD intervention session is linked to techniques used in certain parts of the session.

2.1.2 Structure of SSD Intervention Sessions

Furlong et al. (2021) explored the process of SSD intervention by conducting in-depth interviews with eleven Australian SLTs. One issue addressed was the "structural and procedural aspects of therapy sessions" (Furlong et al., 2021, p. 581), with emphasis on the overall structure of SSD sessions. According to the majority of participants (unfortunately no exact number is mentioned in the study), SSD sessions mainly followed a homogenous pattern, including (1) "warm-up", (2) a "therapy segment", and (3) the "cool down". All of these phases are described in more detail and are reproduced in Figure 5 from Furlong et al. (2021) to show what they comprise.

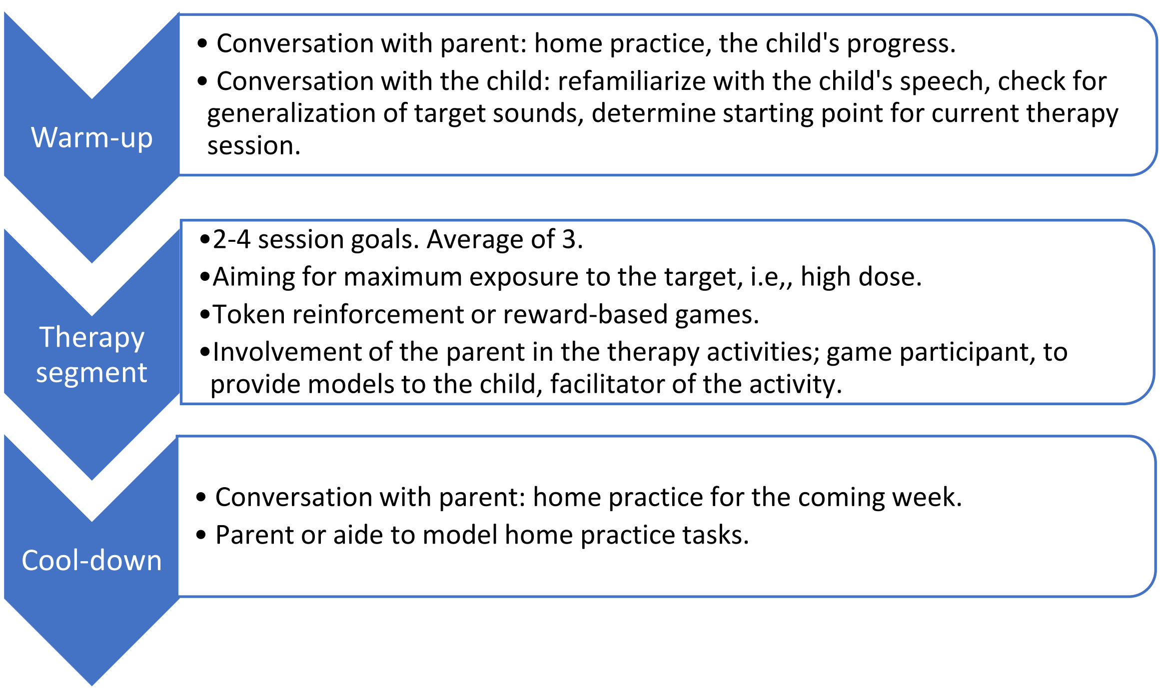


Figure 5: SSD session structure, replicated from Furlong et al. (2021)

The overall structure as set out by Furlong et al. (2021) matches the SSD intervention process suggested by Fox-Boyer (2016) and the intervention content and process introduced by Horton et al. (2004) in an education context. Horton et al. (2004) investigated how clinical processes can be demonstrated and presented more explicitly, as SLT students seem to struggle to transfer theoretical knowledge and skills learnt during SLT training into clinical practice. Therefore, Horton et al. (2004) introduced “domains and constituents” of “doing therapy” to shed light on the therapy session process. Similarly to Furlong et al. (2021), Horton et al. describe the structure of a therapy session with (1) an “opening” task which includes open and natural talk, (2) “introducing the task with clear reference to: plan, materials and strategies”, (3) “doing the task (What is the task, what is off-task”)”, (4) “Summary (being specific about what has just happened”, (5) “closing (specific recap”, and the (6) “off-task (recognising need and allocating space appropriately)” (Horton et al., 2004, p.376). The different phases are comparable to those later identified by Furlong et al. (2021), even though Horton et al. (2004) structured them into more steps. Structuring the SSD intervention session supports practitioners in implementing and meeting therapy goals and in following an overall path. The child is given the opportunity to engage in the session and stay motivated by knowing what to expect when the main structure is given (Furlong et al., 2021). In addition, techniques, strategies and methods used by the therapist to deliver intervention content depends on the phase of the session — whether it is the beginning, middle or the end of a session (Furlong et al., 2021). However, as discussed previously, the reporting of methods, strategies and techniques used in SSD interventions is currently not being done coherently. Therefore, the identification of BCTs for reporting techniques used in SSD interventions may offer the possibility of designing, reporting, implementing and evaluating SSD intervention more explicitly.

2.1.3 BCTs for SSD Interventions

Most SSD interventions report a structured procedure — such as phases to apply the specific approach, as reported earlier for “Minimal Pair” (Weiner, 1981), “Metaphon” (Dean & Howell, 1986; Jahn, 2000) and “P.O.P.T.” (Fox, 2003). In comparison, fewer approaches include an explicit set of techniques, methods and/or strategies to use for the delivery of SSD interventions aimed at changing the behaviour of the child. As described earlier (section 1.3.1), complex behavioural interventions are lacking in description of the explicit techniques which bring about positive change for the client/child (Rees et al., 2016). For the three SSD intervention approaches mentioned above, an explicit set of techniques is also not available, even though the phases of the intervention are well-described, comprehensive and sound.

Since P.O.P.T. (Fox, 2003) is the most frequently used therapy approach for German-speaking children with SSD (Forsythe et al., 2021) and shows the most evidence in terms of effectiveness (Bräger et al., 2007; Teutsch & Fox, 2004), this intervention is described in more detail to see which factors and active components of complex interventions are indicated, and to what degree of preciseness. In 2014, Fox-Boyer published a therapy manual on P.O.P.T. to facilitate its practical implementation, offer practical guidance and give tangible examples from clinical settings. Explicit techniques used to deliver the intervention are not included, but examples give information on how to put the intervention content from theory into practice. Fox-Boyer (2009, 2014b) also considered many of the explicit components impacting the intervention outcome, also suggested by Law et al. (2017) (e.g., dosage in terms of temporal therapy sequences, frequency, intensity and duration of single sessions and therapy blocks, structure of therapy sessions and structure of therapy content). Additionally, recommendations based on the international classification of functionality (ICF) and related questions are included (Fox-Boyer, 2014b) to consider the greater picture of the child's SSD. Other components, such as the delivery agent, the context of delivery (e.g., setting – face-to-face or tele-practice which has recently gained attention due to the pandemic), were mentioned less, even though main components responsible for rating SSD interventions as complex interventions (Law et al., 2017) were presented. Law and colleagues (2017) stated that SLTs use various behavioural techniques to bring about change in patients/children. For these techniques, no transparent terminology has been used to date (Denman et al., 2021; Law et al., 2008; Roulstone, 2015), as indicated by the variety of terms used to describe "what" and "how" therapists "are doing therapy" (Furlong et al., 2021; Law et al., 2017; Turkstra et al., 2016).

The transparent and explicit description of techniques used by therapists to bring about change in children/patients in SSD interventions — namely, behaviour change techniques (BCTs) — has several benefits for research, clinical practice and student training (section 1.4). A logical next step to support these long-term intentions, such as investigating the impact of BCTs used in SSD interventions on therapy outcomes, is to identify BCTs in current interventions (Denman et al., 2021; Michie, Atkins, et al., 2014). Researchers agree that components responsible for change are currently not explicitly or sufficiently described, which impedes the identification of relevant components (Denman et al., 2021; Roulstone, 2015; Smith-Lock et al., 2015). Thus, to contribute to this issue, the following section describes the research objectives and hypothesis for Stage 1, which aims at identifying BCTs in SSD intervention manuals, studies and other descriptions for German-speaking children.

2.1.4 Research Objectives Stage 1

Researchers stress that the type and number of techniques used within an intervention need to be identified for ideal intervention delivery, and for judging effectiveness as measured by intervention outcomes (Denman et al., 2021; Furlong et al., 2021; Law et al., 2017; Turkstra et al., 2016). Therefore, Stage 1 of this project aims to identify BCTs from the BCTTv1 (Michie et al., 2013b) in SSD interventions for German-speaking children. First, BCTs were identified in SSD intervention literature such as studies and therapy manuals (from the SSD approaches Minimal Pair, Metaphon and P.O.P.T.) to see which BCT types are included in the three therapy approaches. Second, a representative SSD intervention session video has been recorded and used to see whether the BCTs identified in literature also occur in a real-world SSD session. It is important to also look at a real-world session of a SSD intervention to confirm that those BCTs stated in manuals and instructions do indeed translate into practice. Therefore, the first research question of this study is as follows:

RQ 1. *Which BCT types can be identified from SSD intervention manuals and studies and from a German-speaking, representative real-world SSD intervention video?*

As BCTs have been found to be present in SLT interventions — for example, Toft & Stringer, (2017) — it is hypothesised that BCTs can be identified from SSD intervention manuals and studies, although the BCTs occurring may not be explicitly referred to or labelled as BCTs. Second, it is hypothesised, that only a small number of BCTs (10-15 BCT types) from the BCTTv1 occur within SSD interventions because the BCTTv1 has been developed for public health interventions rather than SLT interventions (Michie et al., 2013b). Thus, it is expected that some BCT types of the BCTTv1 can be found in SSD interventions whereas others are not used. Third, it is presumed that most of the BCT types identified from manuals and instructions can also be found in the representative SSD intervention session video. However, it may occur that some BCT types cannot be identified in the real-world SSD session as the use of BCT types is linked to the stage of the therapy session, the child's attention, or the type of therapy task.

Thus, the following section outlines the methods used to identify and analyse BCTs within evidence-based SSD interventions for German-speaking children and a real-world SSD intervention session with a German-speaking child.

2.2 Methods

This section explains the methods of Stage 1, which aims to answer **RQ 1:** *Which BCT types can be identified from SSD intervention manuals and studies and from a German-speaking, representative real-world SSD intervention video?* Identified BCTs then serve as basis for developing a set of SSD BCTs for a BCT workshop training, in which SLTs and SLT students participate to learn code techniques, as well as how to use and apply the BCTTv1 (Michie et al., 2013b) in SSD interventions. Hence, a set of SSD BCTs was developed in this chapter by reviewing and identifying BCTs within current SSD intervention literature and confirming these in a real-world SSD intervention video. The methods chapter comprises three main parts: First, the BCT identification from SSD literature including information on coders, material, procedure and data preparation as well as the identified BCTs from the SSD interventions. Second, the development of the real-world SSD intervention videos — which have been recorded to identify BCTs from German-speaking, real-world SSD intervention sessions — is explained. Children with SSD participating in the videos and the recording process are described. Overall, 19 videos were recorded and used for different purposes. One video was chosen to be '*the most representative real-world SSD intervention video*', which was used to identify BCTs in the current stage. In addition, this video has been used for the final coding task of the BCT training workshop which follows in Stage 2 and has therefore been labelled as '*assessment video*' in the current and all following stages. The other 18 videos have been used and labelled as '*training videos'* for the BCT training workshop in Stages 2 and 3. Information on the process for choosing the assessment video and its characteristics as well as information on the training videos is provided in section 2.2.3.3. Third, BCTs were identified from the assessment video chosen to be the most representative real-world SSD intervention session. In the long run, it is important to examine current SSD interventions Minimal Pair (Weiner, 1981), Metaphon (Dean & Howell, 1986; Jahn, 2000) and P.O.P.T. (Fox, 2003) for German-speaking children in both theory (e.g., literature, manuals) and practice (SSD intervention video) and tease out BCTs from the BCTTv1 framework used in the interventions to know which BCTs are relevant for and key factors in SSD intervention. To date, BCTs in these interventions have not been identified nor mentioned in the three SSD interventions for German-speaking children with SSD.

2.2.1 Overall Study Design

As for the nature of this study, a mixed-method research approach has been used. The study takes a qualitative approach, as identifying BCT types in SSD intervention literature and a SSD video has been carried out through a qualitative coding process to examine which BCT types are included in these interventions. Comparably, a quantitative approach has been used to assess the frequency of BCT types in the SSD intervention video. Ethical approval for all stages (Stage 1, Stage 2 and Stage 3) of the current project was obtained by Newcastle University (Ref. 18360/2019; updated Ref. 18225/2021). In addition, information from the Ethics Committee of

Vienna was obtained (Appendix D). Further appendices provide copies of a parent leaflet with information (Appendix E), an information sheet for children (Appendix G), and consent forms for parents as well as children (Appendix G and Appendix H).

BCT types have been identified in manuals and studies of evidence-based SSD interventions for German-speaking children using the BCTTv1 (Michie et al., 2013b). Second, the identified BCTs from literature were used to develop the SSD BCT list, comprising 17 BCTs. The assessment video was then coded for the occurrence and frequency of these BCT types.

SSD intervention literature has been identified in terms of *which* BCT types occur (qualitative analysis), whereas the analysis of the assessment video also focused on the *frequency* of BCT type occurrences (quantitative analysis). A quantitative analysis looking at how many times each BCT type occurred in the SSD intervention literature manuals/studies has not been conducted for three reasons: (1) the research questions aimed at analysing the BCT types in SSD interventions rather than their number of occurrence; (2) it had been decided that the number of times BCTs are mentioned in therapy manuals or studies is not meaningful in terms of how many times this certain BCT is being used in a therapy process (for the reasons given below); (3) manuals and studies differ greatly in their level of detail and description. An intervention manual which reports a therapy procedure and very detailed intervention steps will probably mention BCTs more often than manuals which do not have a detailed description. Thus, if a BCT has been mentioned once within a SSD intervention manual/study, it has been included in the list of BCT types obtained from the literature. However, the frequency of the use of BCT types in the SSD session (assessment video) has also been analysed as this *may* allow an insight into importance of particular BCT types. Figure 6 gives an overview of the research procedure used in Stage 1 to identify BCTs in SSD intervention literature and the assessment video.

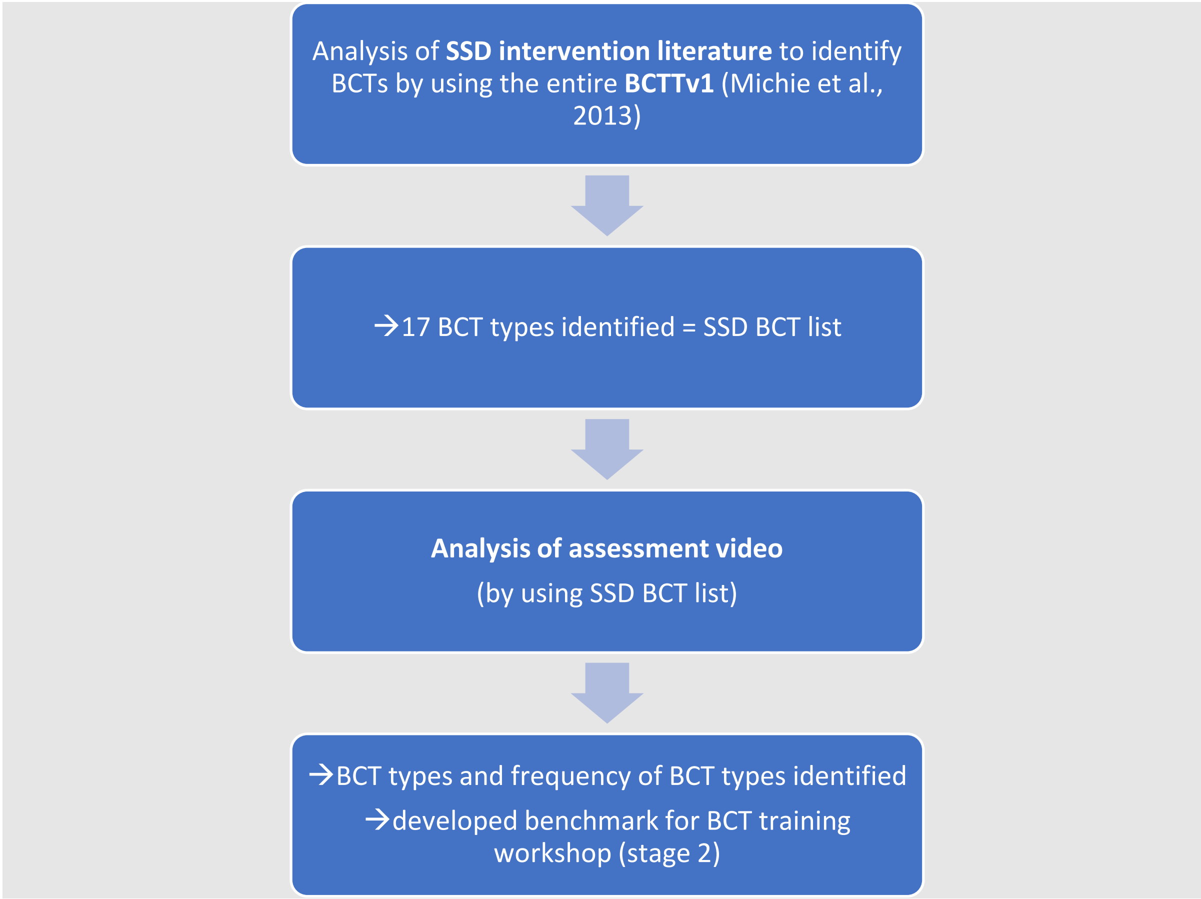


Figure 6: Overall research procedure of Stage 1

The following sections present the methods of the BCT coding of SSD intervention literature, the development of the SSD intervention videos and the method of the BCT coding of the assessment video.

2.2.2 BCT Coding of SSD Intervention Literature

To identify BCTs in SSD intervention literature, evidence-based SSD interventions for German-speaking children were determined in the literature review by using a structured search strategy. SSD therapy approaches for German-speaking children, which underpin their effectiveness with single-case and quasi-experimental studies, were identified by means of a literature search using databases such as the Cochrane Controlled Trials Register (CCTR), “MEDLINE”, Cumulative Index of Nursing and Allied Health (CINAHL), “EMBASE”, “ERIC”, “psychINFO”, “LILACS”, “SpeechBITE”, Cochrane Database of SRs, ClinicalTrials.gov, World Health Organization International Clinical Trials and “What Works”, using keywords in English and German such as speech sound disorder (“Aussprachestörung”), articulation disorder (“Artikulationsstörung”), therapy (“Therapie”), therapy approaches (“Therapieansätze”), therapy intervention (“Therapieinterventionen”), individually and combined. The three SSD therapy approaches identified from the evidence-base and previous conducted studies were: (1) “*Psycholinguistisch-orientierte Phonologie Therapy*” (P.O.P.T.; “Psycholinguistically-Oriented Phonology Therapy”) by Fox (2003); (2) “*Metaphon*” by Jahn (2000); and (3) “*Minimalpaartherapie*” (“Minimal Pair Therapy”) (Weiner, 1981). These three interventions were identified to be evidence-based for treatment of German-speaking children with SSD.

The BCT coding of evidence-based SSD intervention studies and therapy manuals included three coders and the BCTTv1 (Michie et al., 2013b). The following sections present information on coders, materials, and the procedure from the coder training, intercoder agreement and intercoder reliability of coded BCTs. In addition, data preparation and analysis are explained and results from the BCT identification in the three SSD interventions are presented, as these are used for the further procedure to code the real-world SSD intervention video.

2.2.2.1 Coders and Coder Training

Two students of the 2021 SLT class of the University of Applied Sciences in Vienna (“Fachhochschule Campus Wien”) were recruited to contribute to this part of the study. Due to restrictions on face-to-face working during the pandemic, student projects like this have been welcomed as providing other opportunities for students to gain knowledge and skills related to clinical practice and placement. As this project includes videos from children with SSD at a later phase, the direct link to clinical practice has been provided.

The project started in September 2020, when the two participating SLT students were in their last year and conducting their bachelor thesis project, which was linked to the current study. First, both students completed the online BCT Training by the University College of London (UCL) (Michie et al., 2013a). The online BCT training programme (Michie et al., 2013b) includes five ‘coding rules’, which need to be considered when identifying BCTs in interventions (Wood et al., 2015). In summary, these coding rules were defined by Wood et al. (2015) as follows: First, “only code BCTs that are directly applied to the target behaviour(s) and population(s)”; second, “do not infer the presence of a BCT”; third, “take care distinguishing between BCTs that differ in terms of their behaviour change type (i.e. behaviour versus outcome)”; fourth, “code technical terms and packages of BCTs that map onto BCTs in the taxonomy” (Wood et al., 2015, p. 140). A fifth hint has been mentioned in the UCL online BCT training, which indicates that BCTs are sometimes represented including an action verb (Michie et al., 2013a). Thus, action verbs can often indicate the presence of a BCT in interventions (Michie et al., 2013a).

The two students were regularly in touch with the author MD. Zoom meetings were held each week to discuss questions, ideas and the further procedure. Overall, all 93 BCTs included in the BCTTv1 (Michie et al., 2013b) and their potential meaning (or not meaning) for SLT had been discussed as one group. Second, after completion of the online BCT training in October 2020, students received therapy manuals for Developmental Language Disorder (DLD) interventions, such as lexical pirate (Motsch & Marks, 2015) and context-optimization (Motsch & Riehemann, 2008) to practise the coding process some more with studies addressing DLD. Students and MD used digital versions of both studies and used the comment function of the pdf file to identify BCTs and make notes. Coding results were compared and discussed in a further zoom meeting.

Thus, both students were trained to use BCTs and therefore participated in the final BCT coding process of SSD literature to ensure coding reliability. All three coders (2 SLT students and MD) have been involved in the BCT coding process of all three SSD intervention-types.

2.2.2.2 Materials

The entire BCTTv1 (Michie et al., 2013b), including all 93 BCTs, served as the framework and basis for analysing BCTs in SSD therapy manuals and intervention studies. In addition, the content of the BCT online training by UCL has been included in the coding process as it provided important ‘coding rules’ which need to be considered to identify and code BCTs correctly (see 2.2.2.1). Therapy manuals of the P.O.P.T (Fox-Boyer, 2014b) and Metaphon (Jahn, 2000, 2007) SSD approaches, as well as studies explaining the Minimal Pair SSD intervention (and looking at its effectiveness) (Weiner, 1981) were included. Hard copies of the therapy manuals, digital versions (pdf) of the intervention studies, and a structured Microsoft Excel template were used to record and document the BCT identification. The outcomes were then discussed in the intercoder agreement process, which is described in the next section.

A translation of the BCTTv1 has already been conducted by a German research group (Göhner et al., 2016) in the context of a movement research project conducted in Germany. The translation was double-checked by MD, DH and the two students participating in the project and was found to be correct and reasonable. Hence, no translation issues were found for translating the BCTTv1 from English to German and the translated version has been used additionally to check on the English ones in case a BCT name was unclear for all stages and participants of the current study.

However, all participants spoke English very well and were familiar with the terms and names used in the original BCTTv1 by Michie et al. (2013b).

2.2.2.3 Literature Coding and Agreement Procedure

Following coder training (section 2.2.2.1), the BCT coding process was carried out using the therapy manual of P.O.P.T. (Fox-Boyer, 2014b), manual-like literature on Metaphon (Jahn, 2000, 2007) and a published article addressing the intervention Minimal Pairs (Weiner, 1981). However, descriptions of the therapy approaches were enclosed in the chosen literature/studies. Coders used the entire BCTTv1 (Michie et al., 2013b), as the coding process's objective was to investigate which of the 93 BCTs from the BCTTv1 occur within the manuals and studies. The circulated SSD literature was read independently by each of the three researchers. To get an insight into how manuals and studies have been coded using BCTs, some concrete examples identifying BCTs in therapy manuals and studies by using the BCTTv1 are given across the three SSD interventions in Table 3.

Table 3: Examples of identified BCTs in SSD intervention manuals and studies by using the BCTTv1

#	BCT	BCTTv1 Definition	Example of SSD intervention literature and source
1.1.	**Goal setting (behaviour)**	Set or agree on a goal defined in terms of the behaviour to be achieved	'Objective of the game is to get me to pick up all 5 pictures of the boat. **Everytime you say boat**, I will pick one up. When I have all 5, you may paste a star on your paper.' (Weiner, 1981, p.98; *Minimal Pair*)
1.3.	**Goal setting (outcome)**	Set or agree on a goal defined in terms of a positive outcome of wanted behaviour	'Wenn das Kind die angebotenen Laute zu ca. 80% korrekt auditiv differenzieren und bestenfalls auch produzieren kann, wird zur nächsten Ebene übergegangen.' (Jahn, 2007, p.58; *Metaphon*) translation: '*When the child is able to correctly auditory differentiate the sounds offered to approx. 80% and at best also produce them, we move on to the next level.'* (translated from Jahn, 2007, p.58; *Metaphon*)
1.4.	**Action planning**	Prompt detailed planning of performance of the	'We are going to play a game. The objective of the game is to get me to pick up all 5 pictures of the boat. Every time

		behaviour (must include at least one of context, frequency, duration and intensity). Context may be environmental (physical or social) or internal (physical, emotional or cognitive) (includes 'Implementation Intentions')	you say boat, I will pick one up. When I have all 5, you may paste a star on your paper.' (Weiner, 1981, p.98; *Minimal* Pair)
2.2.	**Feedback on behaviour**	Monitor and provide informative or evaluative feedback on performance of the behaviour (e.g., form, frequency, duration, intensity)	'You keep saying bow. If you want me to pick up the boat pictures you must say the /t/ sound at the end. Listen, boat, boat, boat. You try it. Okay, let's begin again.' (Weiner, 1981, p.98; *Minimal Pair*)
8.1.	**Behavioural practice/ rehearsal**	Prompt practice or rehearsal of the performance of the behaviour one or more times in a context or at a time when the performance may or may not be necessary, in order to increase habit and skill.	'In allen Phasen ist es besonders wichtig, dass die Spiele einen hochfrequenten Input oder ein hochfrequentes Üben zulassen.' (Fox-Boyer, 2014b, p.28; *P.O.P.T.*) translation: *'At all stages, it is particularly important that the games allow for high-frequency input or practice.'* (translated from Fox-Boyer, 2014b, p.28; *P.O.P.T.*)
10.3.	**Non-specific reward**	Arrange delivery of a reward if and only if there has been effort and/or progress in performing the behaviour (includes 'Positive reinforcement')	‚Bei dieser Methode ist entscheidend, dass dem Kind ein Anreiz gegeben wird, das Wort mit dem Ziellaut, im Beispiel das Wort ‚Fee', möglichst oft zu produzieren. Dies gelingt z.B. dadurch, dass eine bestimmte Anzahl von ‚Zaubersteinen' (Murmeln) in den Beutel gelegt werden darf, sobald das Kind ‚Fee' sagt. Als Motivation kann anschließend Murmelbahn gespielt werden. (Jahn, 2007, p.50; *Metaphon*) translation: *In this method, it is crucial that the child is given an incentive to produce the word with the target sound, in the example the word 'fairy', as often as possible. This is achieved, for example, by allowing a certain number of 'magic stones' (marbles) to be placed in the bag as soon as the child says 'fairy'. As a motivation, a marble run can be played afterwards.'* (translated from Jahn, 2007, p.50; *Metaphon)*

Coders had to document the BCT type found in any of the SSD intervention literature. As previously explained, if a coder found a BCT type within the literature of a SSD intervention, it counted as 'identified BCT type'. Identified BCT types were then first noted directly in the therapy manuals/articles and then recorded in a structured Microsoft Excel template (noting the sentence of the manual/article where the BCT occurred, and the BCT type). Thus, regardless of the number of times this BCT type has been mentioned in SSD intervention literature, it has been identified if it occurred at least once.

The coding procedure and reporting of results was conducted in accordance with the "Guidelines for Reporting Reliability and Agreement Studies (GRRAS)" by Kottner et al. (2011) (e.g., documenting the procedure, using the intercoder agreement in a qualitative study design) and the recommendations for reliability and reaching consensus of the Cochrane Handbook for Systematic Intervention (Higgins et al., 2019). To ensure intercoder agreement and reliability, several tasks such as the BCT coder training (including the online training from UCL and practising coding by using DLD intervention studies) were completed by all coders in advance of the final coding task. Therapy manuals and articles were coded individually by all three coders, who all had his/her own spreadsheet and saved it separately. Hence, during this process, BCT coders were blinded as BCT coding was conducted independently by each participant. The coding process was completed in a month. The two students returned the coding outcomes noted in the Excel spreadsheets to MD and the reliability check between coders began, as MD started to compare coding outcomes systematically in Microsoft Excel spreadsheets.

First, to determine the level of intercoder agreement on the presence and absence of identified BCTs from the BCTTv1 (Michie et al., 2013b) in therapy manuals/studies, percentage agreement (Gisev et al., 2013; Hartmann, 1977) was calculated before discussion. Coders used the entire BCTTv1 including 93 BCT types and identified BCT types in the SSD intervention literature. Thus, BCT types identified or not identified by coders were compared to see whether all, two, one or no coder identified a particular BCT type — such as 6.1. *Demonstration of the behaviour* — in one of the three SSD interventions. As mentioned previously, it was not relevant whether the BCT type has been identified once or more often in the SSD intervention literature. If all coders identified a particular BCT type, the percentage agreement reached 100%, whereas if only two coders identified this BCT type, the percentage agreement reached 66.6%. In turn, if all coders agreed that a BCT type of the 93 BCTs did not occur at all in a SSD intervention, the percentage agreement is also 100%. This calculation was considered for all 93 BCTs and added up and further converted into one percentage agreement value considering all available BCT types identified from the BCTTv1 in the SSD intervention literature/manuals. This value then gave an insight into the intercoder agreement among all coders.

In addition, Fleiss Kappa statistics was used to investigate reliability of the presence and absence of BCTs between more than two coders and calculate the level of intercoder consistency (Landis & Koch, 1977; Sang-Yeon, 2017). To investigate the consistency of coding between the three raters, the Kappa Fleiss formula, which includes the value of the previously calculated percentage agreement, has been used to determine whether coding has been consistent and can therefore be taken as reliable (Landis & Koch, 1977). According to Landis and Koch (1977) kappa values <0.60 are seen as poor to moderate agreement. Kappa values >0.60 are considered as substantial agreement, and >0.80 as almost perfect agreement. Thus, based on previous studies on BCTs using intercoder agreement for agreeing on present and absent BCTs in interventions (Michie et al., 2013b), coding has been seen as reliable if coders achieved a kappa score >0.60. The objective of this task was to establish an acceptable reliability on agreement between coders on the identified BCT types from the BCTTv1 in SSD interventions, to then use the list with the most common BCTs occurring within SSD intervention in the next stages of this study.

Two in-person meetings took place at the ‘Logopädie Dornstauder’ clinic to discuss the BCT coding outcomes and achieve an agreement on present and absent BCT types, as literature reports that reliability of intercoder agreement in general is higher after discussing the coding outcomes (Michie et al., 2013b; Wood et al., 2016). A final step to ensure intercoder agreement and intercoder reliability was established by comparing, discussing and adapting BCT coding decisions in the second meeting. When there was agreement on the presence of a BCT type in the therapy manual or study, the passage of the manual/study was documented in a Microsoft Excel spreadsheet. All BCT types which were not mentioned as present, were documented as absent BCT types. After the discussion process, the intercoder agreement was recalculated by using percentage agreement (Gisev et al., 2013) and Fleiss Kappa statistics (Landis & Koch, 1977) to compare pre- and post-discussion values, using the same threshold of a kappa value (>0.60).

2.2.2.4 Coding Results: SSD Intervention Literature

This section outlines the results of identifying BCTs from BCTTv1 by Michie et al. (2013b) in the SSD literature (manuals and studies) from the three SSD approaches — Minimal Pair (Weiner, 1981), Metaphon (Jahn, 2000, 2007) and P.O.P.T. (Fox-Boyer, 2014b) — for German-speaking children. Developing the SSD BCT list, including all BCT types identified in SSD intervention literature (SSD BCT list), has been essential, as this list was used as the basis for identifying BCTs in the assessment video. In addition, these BCT types have then been included in the BCT training workshop in Stage 2. Thus, the SSD BCT list built the foundation for the further process of this study and has been crucial for its procedure. The research question investigated in this chapter is correctly *'Which BCTs can be identified from SSD intervention manuals and studies and from a representative real-world SSD therapy video?'*.

Coders of SSD literature (two SLT students and MD) transferred paragraphs/sentences from SSD intervention manuals/studies and the identified BCT type from the BCTTv1 into a structured Microsoft Excel spreadsheet. Results were then compared by MD, and differences highlighted to discuss in the intercoder agreement meeting. Each BCT identified by a single coder was discussed (section 2.2.2.3). Table 4 gives an overview of the BCTTv1 and its 93 BCTs (see entire original BCTTv1 online https://www.bct-taxonomy.com/pdf/BCTTv1_PDF_version.pdf). Thus, all 93 BCTs were available and had equal chance of being identified and coded in one of the three therapy approaches. Therefore, the BCTTv1 served as foundation and framework for coding the manuals. BCT types which achieved 100% intercoder agreement (in terms of being present in the intervention literature) and showed an intercoder reliability Kappa value >0.60 (Landis & Koch, 1977) *after* the discussion, were included in the further process of the study (BCT coding process of the assessment video and in the BCT training workshop of Stage 2). These BCTs (17 in total) are highlighted yellow in Table 4, whereas BCTs which were identified by one or two coders only and agreed on to be excluded after discussion are highlighted grey. All other BCT types were not identified by any coder, indicating all coders agreed that these BCT types were not present in the intervention literature. This led to an exclusion, of all BCT types not highlighted in Table 4, for the further study.

Table 4: BCTTv1 from Michie et. al. (2013)

Grouping and BCTs	Grouping and BCTs	Grouping and BCTs
1. Goals and planning	**6. Comparison of behaviour**	**12. Antecedents**
1.1 Goal setting (behaviour) 1.2 Problem solving 1.3 Goal setting (outcome) 1.4 Action planning 1.5 Review behaviour goal(s) 1.6 Discrepancy between current behaviour and goal	6.1 Demonstration of the behaviour 6.2 Social comparison 6.3 Information about others' approval **7. Associations** 7.1 Prompts/cues	12.1. Restructuring the physical environment 12.2. Restructuring the social environment 12.3. Avoidance/reducing exposure to cues for the behaviour 12.4. Distraction

1.7 Review outcome goal(s) 1.8 Behavioural contract 1.9 Commitment **2. Feedback and monitoring** 2.1 Monitoring of behaviour by others without feedback 2.2 Feedback on behaviour 2.3 Self-monitoring of behaviour 2.4 Self-monitoring of outcome(s) of behaviour 2.5 Monitoring of outcome(s) of behaviour without feedback 2.6 Biofeedback 2.7 Feedback on outcome(s) of behaviour **3. Social support** 3.1 Social support (unspecified) 3.2 Social support (practical) 3.3 Social support (emotional) **4. Shaping knowledge** 4.1 Instruction on how to perform the behaviour 4.2 Information about Antecedents 4.3 Re-attribution 4.4 Behavioural experiments **5. Natural consequences** 5.1 Information about health consequences 5.2 Salience of consequences 5.3 Information about social and environmental consequences 5.4 Monitoring of emotional consequences 5.5 Anticipated regret 5.6 Information about emotional Consequences	7.2 Cue signalling reward 7.3 Reduce prompts/cues 7.4 Remove access to the reward 7.5 Remove aversive stimulus 7.6 Satiation 7.7 Exposure 7.8 Associative learning **8. Repetition and substitution** 8.1 Behavioural practice/rehearsal 8.2 Behaviour substitution 8.3 Habit formation 8.4 Habit reversal 8.5 Overcorrection 8.6 Generalisation of target behaviour 8.7 Graded tasks **9. Comparison of outcomes** 9.1 Credible source 9.2 Pros and cons 9.3 Comparative imagining of future outcomes **10. Reward and threat** 10.1. Material incentive (behaviour) 10.2. Material reward (behaviour) 10.3. Non-specific reward 10.4. Social reward 10.5. Social incentive 10.6. Non-specific incentive 10.7. Self-incentive 10.8. Incentive (outcome) 10.9. Self-reward 10.10. Reward (outcome) 10.11. Future punishment **11. Regulation** 11.1. Pharmacological support 11.2. Reduce negative emotions 11.3. Conserving mental resources 11.4. Paradoxical instructions	12.5. Adding objects to the environment 12.6. Body changes **13. Identity** 13.1. Identification of self as role model 13.2. Framing/reframing 13.3. Incompatible beliefs 13.4. Valued self-identify 13.5. Identity associated with changed behaviour **14. Scheduled consequences** 14.1. Behaviour cost 14.2. Punishment 14.3. Remove reward 14.4. Reward approximation 14.5. Rewarding completion 14.6. Situation-specific reward 14.7. Reward incompatible behaviour 14.8. Reward alternative behaviour 14.9. Reduce reward frequency 14.10. Remove punishment **15. Self-belief** 15.1. Verbal persuasion about capability 15.2. Mental rehearsal of successful performance 15.3. Focus on past success 15.4. Self-talk **16. Covert learning** 16.1. Imaginary punishment 16.2. Imaginary reward 16.3. Vicarious consequences

Only one BCT (8.7. *Graded tasks,* highlighted grey in Table 4) was identified by just one coder and agreed on to be excluded *after* the discussion, whereas all other suggested BCTs have been accepted to be present in the SSD intervention literature. The BCT 8.7. *Graded tasks* first seemed to be present in one of the SSD interventions, but after discussing the passage where this appeared and the BCT was believed to be present, it was decided that this BCT has not been identified as the passage described an overall procedure rather than a specific example for graded task techniques in the SSD intervention. The example for using easy to harder tasks has been mentioned in Metaphon (Jahn, 2000, 2007), but this referred to action planning rather than to graded tasks, as only the procedure has been explained but no graded tasks have been mentioned. Thus, all the other 17 BCTs highlighted yellow achieved an intercoder agreement of 100% on the presence of BCTs in at least one of the SSD interventions and showed high intercoder reliability after the discussion.

Table 5 shows the 17 BCT types identified in at least one of the three SSD interventions *P.O.P.T.* (Fox-Boyer, 2014b), *Metaphon* (Jahn, 2000, 2007) or *Minimalpaartherapie* (Minimal Pair Therapy) (Weiner, 1981), using the 93 BCTs from the BCTTv1. Seventeen BCTs out of 93 BCTs equals 18% of BCTs from the BCTTv1. Appendix I shows each of the 17 identified BCT types accompanied by an example from the SSD intervention literature from one of the three SSD intervention approaches.

Table 5: SSD BCT list: BCTs identified in SSD intervention literature (Minimal Pair, Metaphon and P.O.P.T.)

BCT type
1.1. Goal setting (behaviour)
1.3. Goal setting (outcome)
1.4. Action planning
1.6. Discrepancy between current behaviour and goal
2.2. Feedback on behaviour
2.6. Biofeedback
3.1. Social support (unspecified)
4.1. Instruction on how to perform the behaviour
6.1. Demonstration of the behaviour
7.1. Prompts/cues
8.1. Behavioural practice/rehearsal
8.6. Generalisation of target behaviour
10.2. Material reward (behaviour)
10.3. Non-specific reward
10.4. Social reward
12.5. Adding objects to the environment
14.8. Reward alternative behaviour

As described previously, intercoder agreement was calculated using percentage agreement to see how high the agreement between coders was, and intercoder reliability among the three coders has been calculated using Fleiss Kappa statistics to investigate how consistent coders were in their BCT coding. Even though all 93 BCTs of the BCTTv1 have been included in the percentage agreement and Fleiss Kappa statistics, for clarity and better oversight only BCTs suggested by the coders to be present in the SSD interventions are listed in Table 6. Thus, BCTs in the left-hand column of Table 6 were identified by one or more coders in one or more SSD interventions *before* discussion and BCTs in the right-hand column to be present or absent *after* discussion in the SSD interventions. All other BCTs of the BCTTv1 not listed in Table 6, have automatically been agreed on not to be present in the three SSD interventions. Table 6 shows intercoder agreement results using percentage agreement and intercoder reliability using Fleiss Kappa for each SSD intervention approach before and after discussing the coding results for all 93 BCTs (the entire BCTTv1) as this was the foundation to code the SSD interventions.

Table 6: Results of intercoder agreement reliability check from two SLT students and one SLT using percentage agreement and Fleiss Kappa statistics

P.O.P.T. **(Fox-Boyer, 2014b)**					
Before discussion			**After discussion**		
LKo	**LKÜ**	**MD**	**LKo**	**LKü**	**MD**
• 1.3. Goal setting (outcome) • 1.4. Action planning • 4.1. Instruction on how to perform the behaviour • 6.1. Demonstration of the behaviour • 7.1. Prompts/cues • 8.1. Behavioural practice/rehearsal • 10.4. Social reward	• 1.3. Goal setting (outcome) • 1.4. Action planning • 4.1. Instruction on how to perform the behaviour • 6.1. Demonstration of the behaviour • 7.1. Prompts/cues • 10.4. Social reward	• 1.1. Goal setting (behaviour) • 1.3. Goal setting (outcome) • 1.4. Action planning • 2.2. Feedback on behaviour • 2.6. Biofeedback • 3.1. Social support (unspecified) • 4.1. Instruction on how to perform the behaviour • 6.1. Demonstration of the behaviour • 7.1. Prompts/cues • 8.1. Behavioural practice/rehearsal • 10.4. Social reward • 12.5. Adding objects to the environment	• 1.1. Goal setting (behaviour) • 1.3. Goal setting (outcome) • 1.4. Action planning • 2.2. Feedback on behaviour • 2.6. Biofeedback • 3.1. Social support (unspecified) • 4.1. Instruction on how to perform the behaviour • 6.1. Demonstration of the behaviour • 7.1. Prompts/cues • 8.1. Behavioural practice/rehearsal • 10.4. Social reward • 12.5. Adding objects to the environment	• 1.1. Goal setting (behaviour) • 1.3. Goal setting (outcome) • 1.4. Action planning • 2.2. Feedback on behaviour • 2.6. Biofeedback • 3.1. Social support (unspecified) • 4.1. Instruction on how to perform the behaviour • 6.1. Demonstration of the behaviour • 7.1. Prompts/cues • 8.1. Behavioural practice/rehearsal • 10.4. Social reward • 12.5. Adding objects to the environment	• 1.1. Goal setting (behaviour) • 1.3. Goal setting (outcome) • 1.4. Action planning • 2.2. Feedback on behaviour • 2.6. Biofeedback • 3.1. Social support (unspecified) • 4.1. Instruction on how to perform the behaviour • 6.1. Demonstration of the behaviour • 7.1. Prompts/cues • 8.1. Behavioural practice/rehearsal • 10.4. Social reward • 12.5. Adding objects to the environment
Percentage agreement rate before discussion: 95.72%			**Percentage agreement rate after discussion: 100%**		
Fleiss Kappa statistics before discussion: **κ = 0.74 (95% CI [0.08-0.91])**			**Fleiss Kappa statistics after discussion:** **κ = 1.00 (95% CI [0.13-0.87])**		

Metaphon (Jahn, 2000,2007)					
Before discussion			**After discussion**		
LKo	**LKü**	**MD**	**LKo**	**LKü**	**MD**
• 1.1. Goal setting (behaviour) • 1.4. Action planning • 4.1. Instruction on how to perform the behaviour • 6.1. Demonstration of the behaviour • 7.1. Prompts/cues • 8.1. Behavioural practice/rehearsal • 10.2. Material reward • 12.5. Adding objects to the environment	• 1.1. Goal setting (behaviour) • 4.1. Instruction on how to perform the behaviour • 7.1. Prompts/cues • 8.1. Behavioural practice/rehearsal • 10.2. Material reward • 12.5. Adding objects to the environment	• 1.1. Goal setting (behaviour) • 1.3. Goal setting (outcome) • 1.4. Action planning • 1.6. Discrepancy between current behaviour and goal • 2.6. Biofeedback • 3.1. Social support (unspecified) • 4.1. Instruction on how to perform the behaviour • 6.1. Demonstration of the behaviour • 7.1. Prompts/cues • 8.1. Behavioural practice/rehearsal • 8.6. Generalisation of target behaviour • 8.7. Graded tasks • 10.2. Material reward • 10.3. Non-specific reward • 12.5. Adding objects to the environment	• 1.1. Goal setting (behaviour) • 1.3. Goal setting (outcome) • 1.4. Action planning • 1.6. Discrepancy between current behaviour and goal • 2.6. Biofeedback • 3.1. Social support (unspecified) • 4.1. Instruction on how to perform the behaviour • 6.1. Demonstration of the behaviour • 7.1. Prompts/cues • 8.1. Behavioural practice/rehearsal • 8.6. Generalisation of target behaviour • 10.2. Material reward • 10.3. Non-specific reward • 12.5. Adding objects to the environment	• 1.1. Goal setting (behaviour) • 1.3. Goal setting (outcome) • 1.4. Action planning • 1.6. Discrepancy between current behaviour and goal • 2.6. Biofeedback • 3.1. Social support (unspecified) • 4.1. Instruction on how to perform the behaviour • 6.1. Demonstration of the behaviour • 7.1. Prompts/cues • 8.1. Behavioural practice/rehearsal • 8.6. Generalisation of target behaviour • 10.2. Material reward • 10.3. Non-specific reward • 12.5. Adding objects to the environment	• 1.1. Goal setting (behaviour) • 1.3. Goal setting (outcome) • 1.4. Action planning • 1.6. Discrepancy between current behaviour and goal • 2.6. Biofeedback • 3.1. Social support (unspecified) • 4.1. Instruction on how to perform the behaviour • 6.1. Demonstration of the behaviour • 7.1. Prompts/cues • 8.1. Behavioural practice/rehearsal • 8.6. Generalisation of target behaviour • 10.2. Material reward • 10.3. Non-specific reward • 12.5. Adding objects to the environment
Percentage agreement rate before discussion: 93.55%			**Percentage agreement rate after discussion: 100%**		
Fleiss Kappa statistics before discussion: κ = 0.65 (95% CI [0.10-0.90])			**Fleiss Kappa statistics after discussion: κ = 1.00 (95% CI [0.15-0.85])**		

***Minimalpaartherapie* ('Minimal Pair Therapy') (Weiner, 1981)**					
Before discussion			**After discussion**		
LKo	**LKü**	**MD**	**LKo**	**LKü**	**MD**
• 1.1. Goal setting (behaviour) • 1.6. Discrepancy between current behaviour and goal • 4.1. Instruction on how to perform the behaviour • 7.1. Prompts/cues • 8.1. Behavioural practice/rehearsal • 8.6. Generalisation of target behaviour • 10.2. Material reward • 10.3. Non-specific reward • 10.4. Social reward • 12.5. Adding objects to the environment	• 1.3. Goal setting (outcome) • 2.2. Feedback on behaviour • 4.1. Instruction on how to perform the behaviour • 7.1. Prompts/cues • 8.6. Generalisation of target behaviour • 10.3. Non-specific reward • 10.4. Social reward	• 1.1. Goal setting (behaviour) • 1.3. Goal setting (outcome) • 1.4. Action planning • 3.1. Social support (unspecified) • 4.1. Instruction on how to perform the behaviour • 6.1. Demonstration of the behaviour • 7.1. Prompts/cues • 8.1. Behavioural practice/rehearsal • 10.3. Non-specific reward • 14.8. Reward alternative behaviour	• 1.1. Goal setting (behaviour) • 1.4. Action planning • 1.6. Discrepancy between current behaviour and goal • 2.2. Feedback on behaviour • 4.1 Instruction on how to perform the behaviour • 6.1 Demonstration of the behaviour • 7.1. Prompts/cues • 8.1 Behavioural practice/rehearsal • 8.6 Generalisation of target behaviour • 10.2. Material reward • 10.3 Non-specific reward • 14.8. Reward alternative behaviour	• 1.1. Goal setting (behaviour) • 1.4. Action planning • 1.6. Discrepancy between current behaviour and goal • 2.2. Feedback on behaviour • 4.1 Instruction on how to perform the behaviour • 6.1 Demonstration of the behaviour • 7.1. Prompts/cues • 8.1 Behavioural practice/rehearsal • 8.6 Generalisation of target behaviour • 10.2. Material reward • 10.3 Non-specific reward • 14.8. Reward alternative behaviour	• 1.1. Goal setting (behaviour) • 1.4. Action planning • 1.6. Discrepancy between current behaviour and goal • 2.2. Feedback on behaviour • 4.1 Instruction on how to perform the behaviour • 6.1 Demonstration of the behaviour • 7.1. Prompts/cues • 8.1 Behavioural practice/rehearsal • 8.6 Generalisation of target behaviour • 10.2. Material reward • 10.3 Non-specific reward • 14.8. Reward alternative behaviour
Percentage agreement rate before discussion: 90.68%			**Percentage agreement rate after discussion: 100%**		
Fleiss Kappa statistics before discussion: κ = 0.46 (95% CI [0.09-0.90])			**Fleiss Kappa statistics after discussion: κ = 1.00 (95% CI [0.18-0.82])**		

Table 6 shows that the percentage agreement among the three coders is high for all three SSD interventions in the first coding attempt (without discussion). Fleiss Kappa showed poor to substantial agreement among coders before discussion. After discussion, percentage agreement achieved 100% and Fleiss Kappa statistics κ=1.00 for all SSD interventions. Thus, these results show high and substantial agreement on the BCTs occurring in the three SSD interventions as well as perfect reliability after discussion.

In sum, considering the manuals and literature of all three SSD interventions, seventeen BCTs have been agreed to occur in the intervention literature by all coders and are presented in the SSD BCT list in Table 5 (section 2.2.2.4). Thus, these 17 BCTs are the ones which are subsequently used to analyse the real-world SSD intervention video (assessment video). First, however, the development of the SSD intervention videos and the methods of the assessment video coding are described.

2.2.3 Development of SSD Intervention Videos

The following section gives information on children whose SSD sessions were recorded (video recording participants) and the procedure of the video recording. As one of the recorded videos was chosen as the assessment video, the decision-making process and characteristics of this video are explained. Overall, the videos were recorded with children who have a diagnosis of SSD and who received regular SLT intervention in the "Logopädie Dornstauder" SLT clinic in Vienna. The recordings were important to first identify BCTs used in a real-world SSD session video (assessment video) and, second, to compile useful material for the BCT training workshop (training videos). Overall, 19 sequences of usual SSD intervention sessions with four children were recorded. One video has been used for the SSD intervention video analysis and the final coding task of the BCT training workshop in Stage 2, and this was named 'assessment video'. Eighteen videos were used as training videos for the BCT training workshop in Stage 2.

All 19 videos have been informally analysed in terms of their quality, tasks, variation and focus. In addition, the selection process was discussed with my supervisors. These parameters served as the basis for deciding which videos were to be used as training videos for the BCT workshop, and which one served as an assessment video.

2.2.3.1 Video Recording Participants

The regular SLT sessions of four children with SSD were recorded to identify and determine BCTs present in a real-world SSD session (assessment video) and to compile training material for the BCT training workshop in Stage 2. Parents of children who met the inclusion criteria to participate in the SSD video recordings were introduced to the project by information leaflets (Appendix E and Appendix F). Parents and children who were willing to participate were asked for their consent (Appendix G and Appendix H). After recording the videos, parents received a thank you letter when recording sessions were completed (Appendix J). The children attended regular SLT at the "Logopädie Dornstauder" clinic, meaning that SSD interventions took place in the usual way. To avoid as much variance between therapy sessions as possible, children with a homogenous profile were selected from the clinic's caseload.

Therefore, the following inclusion criteria were set:

- Monolingual German speaking children
- Aged 4:6 to 6:0 years old
- SSD with similar SSD profile to other participating children
- No sensory impairments and not diagnosed special educational needs

The medical background and SLT history of children was known as they were already enrolled for SLT. Therefore, MD spoke to selected parents and children and already knew that children met the inclusion criteria. As explained previously, the selection criteria were chosen to assure a homogenous profile. Monolingual German-speaking children can be compared better within a group than bilingual children, as language differences may cause atypical processes in one language which may be typical in another language. Overall, data for phonological development of multilingual children is rare (Fox-Boyer, 2016). The age range of children was chosen as most German phonemes should be present by the age of 4:6 years (Fox, 2003) and children are mostly able to focus on phonological tasks at this age. All children had a similar SSD profile which included difficulty in phonological awareness (PA) tasks and the phonological processes such as stopping (which is an atypical process when it occurs a 100% at the age of 4:6 years, whereas if stopping occurs below 100% it is a 'delayed' (typical) process), reduction of consonant clusters (delayed 'typical' processes at the age of 4:6 years) and/or contact assimilations, which are always seen as atypical processes (Fox-Boyer, 2016).

2.2.3.2 Procedure

All 19 videos from the SSD intervention sessions were recorded from October to December 2020. SSD sessions were recorded using a smartphone used only for the research project, to ensure highest data protection. The application/program *Video Enhanced Observation (VEO)* is video tagging software that enables users to use customised tags within a video to e.g., support a student's learning or highlight situations within real-world situations such as SLT sessions or classroom teaching. In this research, the VEO app was used to record the SSD session videos. Therapy material in the sessions was no different from material routinely used in SLT sessions in the "Logopädie Dornstauder" clinic.

Four parents and children agreed to be recorded in the SSD therapy sessions. Video recordings lasted between 03:00 and 12:00 minutes. The mean length of the videos was 07:40 minutes. Children were introduced to the smartphone and the tasks before starting the session. Depending on the concentration of the child, single tasks or entire sessions were recorded to focus on therapy exercises rather than the recording. All sessions included at least one task for phonological awareness (e.g., syllable segmentation, identification of sounds, differentiating between one or more sounds, localising sounds), differing in the degree of severity depending on the child's level of development — this was because participating children showed difficulty in phonological awareness tasks, as is expected for children with atypical speech sound errors (Smith et al., 1998).

Tasks in the videos targeted mostly the receptive level of children (e.g., child listens and points to the word with the correct consonant cluster); a few, short expressive tasks (e.g., child attempts to say the word correctly) were included if production was already the focus of the presenting individual's therapy process. In addition, tasks from different SSD approaches have been used intentionally to capture a variety of BCTs used within SSD approaches, rather than identifying BCTs for only a single SSD intervention approach. Thus, SSD therapy approaches such as Metaphon, Minimal Pair or P.O.P.T. were not used exclusively, but therapy exercises were taken from the three interventions. As this stage first investigates which BCTs occur within a real-world SSD intervention session, this procedure suited the objective to capture BCTs in recent SSD approaches and domains (receptive/expressive). If the effectiveness of therapy approaches was to be tested, a mix of tasks would not have been reliable. However, for the aim of this study, BCTs may differ across SSD interventions and used domains (receptive/expressive). After recording the videos, session recordings were watched, shortened and edited to the appropriate tasks needed for the workshop by using the Windows programs Video-Editor and Media Player.

Eighteen videos were used as training videos for the BCT training workshop, with one video chosen as assessment video, on the basis that it: represented a SSD session which showed good quality; included a sufficient number of tasks and lasted long enough (duration); included a suitable type of SSD task; and included variation in terms of therapy approaches and a good focus on the child. These parameters, the decision-making process and rationale for choosing the assessment video are outlined in more detail in the next section, which also provides details of all 19 videos. First, the assessment video was used for determining which BCTs occur in a real-world SSD session. Second, this video was used for the final coding task within the workshop. The characteristics of the assessment video, which was chosen to represent a real-world example of a SSD session, are given in the next section.

2.2.3.3 Assessment Video: Decision-making Process and Characteristics

The assessment video was used for two central tasks: determining and identifying which BCTs occur within a real-world SSD session and assessing the coding accuracy of student SLTs and SLTs after completing the workshop. The following paragraphs explain the informed decision-making process for choosing the assessment video and describe its main characteristics.

Nineteen SSD intervention sessions with four children were recorded. Children had a similar SSD profile and, as explained previously, therapy tasks of SSD interventions were used during the session (more detail in Table 7). Different parameters were evaluated informally to underpin the decision-making process of choosing one assessment video out of the 19 recordings. The assessment video needed to capture a good range of activities across the three SSD interventions to see which BCT types are represented in terms of their frequency of occurrence. In addition, its second purpose in Stage 2 is to test whether workshop participants are able to identify the most relevant BCTs as a key outcome of training. Thus, the five parameters considered in the decision-making process on which video was chosen as assessment video are explained in Table 7.

Table 7: Parameters for decision-making process of assessment video

Parameter for decision-making process	Definition	Description of parameters in assessment video
Quality	This parameter refers to the sound and visual quality of the video.	The audio and visual quality of the video (sound and picture) was very good. The therapist and child were recorded well and no distraction in terms of quality was present.
Duration (and number of tasks)	This parameter makes sure that the assessment video represents at least half of a SSD session in terms of minutes[1]. In addition, it is important that more than one task occurs within the video to assure variation (see more detailed explanation in sections task and variation).	The video lasted 10:43 minutes. This duration represents half of the average time SLTs have to introduce new tasks in SSD sessions. In addition, the video included two SSD tasks.
Task	This parameter refers to the therapy task conducted in the SSD session. The task used in the video should represent a usual task of a real-world SSD intervention example and include receptive (e.g., child is listening and pointing to the correct word) and expressive (e.g., child attempts to articulate/say the word	The task in the therapy sequence represented a common intervention task in SSD interventions. Both tasks from the video refer to phonological awareness exercises: (1) Differ between the consonant cluster /tr/ and /kr/ (primary receptive task combined with expressive task to produce the words) (2) Identifying the location of the consonant cluster (beginning or middle of the word; the

[1] In Austria, insurance companies offer three different SLT time rates set by Austrian insurance companies: Tariff 1 (T1): 30 minutes, Tariff 2 (T2): 45 minutes, Tariff 3 (T3): 60 minutes. Thus, the minimum of time to introduce a new SSD task within a SLT session is 15 minutes (within tariff 1), whereas the longest is 25-30 minutes (within tariff 3). Hence, the average of T1 and T3 to introduce new tasks (15 min + 27:30 min/2) = 21:25 minutes, half of this time = 11:02 minutes.

	correctly) tasks. This parameter is used to capture as much diversity as possible among SSD intervention tasks to enable the identification of different BCTs (in case different BCTs target different levels such as receptive or expressive tasks).	consonant cluster /tr/ does not occur final in German words) (primary receptive task combined with expressive task to produce the words)
Variation	This parameter looks at which components from the three therapy approaches (Metaphon, Minimal Pair, P.O.P.T.) are represented in the video. The video which includes parts of all three interventions is chosen.	Components of the three therapy approaches were found in the video: PA task including components of P.O.P.T. and Metaphon (e.g., differing between sounds, locating sounds within a word) and using minimal pairs in the task (Minimal Pair Approach)
Focus	This parameter looked at whether the child was able to concentrate on the primary task without distraction of other environmental factors.	The child's attention was directed at the phonological awareness tasks with only two minor distractions (change of topic by the child) within the 10:43 minutes video.

All parameters in Table 7 were considered when deciding on the assessment video. The rationale for choosing the assessment video has therefore been based on the five decision-making parameters (Table 7). If any one of the parameters was not met, the video was not nominated as assessment video. For example, as videos were recorded during Covid-19 times, face shields/masks were sometimes used at the beginning of the session by the therapist. All such videos were eliminated from consideration as the assessment video to assure that BCT coding was not impacted by these factors. However, as some environmental factors (e.g., masks, only child has been recorded and therapist was not in the picture) occurred mostly at the beginnings of the video rather than during the whole session, such videos *were* used as training videos. In other words, training videos are still of good quality but may not fully fulfil all the parameters at all times. Table 8 shows the 19 videos and their evaluation on the five parameters.

Table 8: 19 videos of SSD interventions used in the BCT training workshop for SLT students and SLTs in Stage 2

19 videos from SSD intervention sessions							
Code	**Use**	**Gender and age of child**	**Video Quality**	**Duration of video (and number of tasks)**	**Content of Task(s)**	**Variation (therapy approaches)**	**Focus (good/ moderate/ poor)**
1_0_C_B	training video	male, 6:1 years-old	slightly pixelated, child in motion and therefore shortly out of the picture but overall good vision, sound good, therapy material not fully in the picture	09:55 min. 3 tasks	auditory discrimination task from adult production on word level mixed position (with the use of sound symbols, use of minimal pairs)	P.O.P.T., Minimal Pair, Metaphon	good
2_0_C_S	training video	male, 4:11 years-old	slightly pixelated, phone has been moved as the child has not been seen for the first minutes, sound good, therapy material not fully in the picture	11:59 min. 1 task	auditory discrimination task from adult production on word level mixed position (with the use of sound symbols, mouth picture cards as prompts), contrasting speech sounds at sound level from adult production	P.O.P.T., Minimal Pair, Metaphon	moderate
3_0_C_R	**assessment video**	**female, 4:8 years-old**	**vision good, sound good, therapy material not fully in the picture**	**10:43 min. 1 task**	**consonant cluster sound production at increasing level of complexity** (sound, syllable and word level in all positions) (with use of sound symbols, gesture prompts/cues), **identification of speech sounds from adult production on word level and mixed position, auditory discrimination task from adult production on word level mixed position**	**P.O.P.T., Minimal Pair, Metaphon**	**good**

4_1_B_1	training video	male, 6:1 years-old	slightly pixelated, sound good, therapy material not fully in the picture	05:17 min. 2 tasks	rhyming (identification and production), auditory discrimination task from adult production on word level mixed position	P.O.P.T., Minimal Pair	good
5_2_B_2	training video	male, 6:1 years-old	slightly pixelated, therapist and child can fully be seen but phone is further away, so details cannot be seen, sound good, therapy material not fully in the picture, therapist wears mask from time to time	04:56 min. 1 task	syllable segmentation (identification and production), auditory discrimination task from adult production on word level mixed position, identification of speech sounds from adult production on word level and mixed position	P.O.P.T., Minimal Pair	moderate
6_3_B_3	training video	male, 6:1 years-old	vision good, sound good, therapy material not fully in the picture	04:22 min. 1 task	rhyming (identification and production)	P.O.P.T., Minimal Pair, Metaphon	moderate
7_4_B_4	training video	male, 6:1 years-old	slightly pixelated, therapist and child not fully in the picture, sound good, therapy material not fully in the picture, therapist wears mask from time to time	04:28 min. 1 task	syllable segmentation (identification and production), categorising sounds (long vs. short sounds) from adult and child production combined with pictures representing long vs. short	P.O.P.T., Metaphon	moderate
8_5_B_5	training video	male, 6:1 years-old	vision good, sound good, therapy material not fully in the picture	06:42 min. 1 task	speech sound identification from adult production on world level all positions, identification of speech sounds from adult production on word level and mixed position	Metaphon, P.O.P.T.	moderate
9_6_G_1	training video	male, 5:11 years-old	slightly pixelated, sound good, therapy material not fully in the picture	11:54 min. 1 task	auditory discrimination task from adult production on word level mixed position,	P.O.P.T., Minimal Pair, Metaphon	good

					rhyming (identification and production)		
10_7_G_2	training video	male, 5:11 years-old	child is fully in the picture, therapist is not, sound good, therapy material not fully in the picture	08:07 min. 1 task	syllable segmentation (identification and production), auditory discrimination task from adult production on word level mixed position (use of sound symbols, mouth pictures as prompts)	P.O.P.T., Minimal Pair, Metaphon	good
11_8_G_3	training video	male, 5:11 years-old	slightly pixelated, therapist and child not fully in the picture, sound good, therapy material not fully in the picture	07:35 min. 1 task	auditory discrimination task from adult production on word level mixed position	P.O.P.T., Minimal Pair, Metaphon	good
12_9_G_4	training video	male, 5:11 years-old	slightly pixelated, therapist and child not fully in the picture, sound good, therapy material not fully in the picture	07:25 min. 1 task	auditory discrimination task from adult production on word level mixed position (use of sound symbols, mouth pictures as prompts)	Metaphon	moderate
13_10_R_1	training video	female, 4:8 years-old	vision good, sound good, therapy material not fully in the picture, therapist wears mask from time to time	11:20 min. 2 tasks	speech sound alliteration from adult production with use of visual cues/prompts, speech sound identification	P.O.P.T.	good
14_11_R_2	training video	female, 4;8 years-old	vision good, sound good, therapy material not fully in the picture	08:41 min. 2 tasks	syllable segmentation (identification and production)	P.O.P.T.	good
15_12_S_1	training video	male, 4:11 years-old	vision good, sound good, therapy material not fully in the picture	03:26 min. 1 task	syllable segmentation (identification and production)	P.O.P.T	good
16_13_S_2	training video	male, 4:11 years-old	vision good, sound good, therapy material	08:36 min.	auditory discrimination task from adult production on word	Metaphon	moderate

			not fully in the picture, therapist wears mask from time to time	2 tasks	level mixed position, speech sound alliteration from adult production with use of visual cues/prompts		
17_14_S_3	training video	male, 4:11 years-old	vision good, sound good, therapy material not fully in the picture	04:11 min. 1 task	auditory discrimination task from adult production on word level mixed position	P.O.P.T	moderate
18_15_S_4	training video	male, 4:11 years-old	vision good, sound good, therapy material not fully in the picture	06:10 min. 2 tasks	auditory discrimination task from adult production on word level mixed position, speech sound alliteration from adult production with use of visual cues/prompts	Metaphon	good
19_16_S_5	training video	male, 4:11 years-old	vision good, sound good, therapy material not fully in the picture	09:59 min. 1 task	auditory discrimination task from adult production on word level mixed position	P.O.P.T.	good

As seen in Table 8, the video with a girl aged 4:7 years was chosen to be used as assessment video. It was recorded from November-December 2020. She started SLT in May 2020 (six months before the recording) and showed difficulty in phonological awareness tasks (e.g., rhyming, syllable segmentation, identifying sounds) and had the following SSD processes: weak syllable deletion, initial consonant deletion, velar fronting and contact assimilation. In the first ten sessions, she had been working on phonological awareness, and managed to resolve all processes except for the atypical assimilation process. After that ten-session block, a break was scheduled. The recording took place when she came back from the SLT break. Thus, the 12th - 14th SSD sessions were recorded. For the assessment video, a sequence of the 14th session was used. During these sessions she had been working on the contact assimilation (see phonological awareness task of the assessment video in Appendix K).

2.2.4 BCT Coding of Assessment Video

The BCT coding of the assessment video was undertaken by two coders using the list of the 17 BCTs which had been identified in SSD intervention literature to determine the presence and frequency of any of these 17 BCT types. The next sections present information on coders, materials, the video coding procedure, and data preparation and analysis.

2.2.4.1 Coders

One SLT (DH) from the 'Fachhochschule Campus Wien' (FHCW, University of Applied Sciences), having 15 years of clinical experience and working as SLT lecturer for nearly thirty years, and MD (working as SLT for 12 years, with a Master's degree and 7 years lecturing experience) coded the assessment video to investigate the presence of BCT types. Both SLTs completed the BCT online training from UCL before coding (Michie et al., 2013a). In addition, the two SLTs also coded the same DLD intervention studies which students did previously, to practise the coding process (section 2.2.2.3).

2.2.4.2 Materials

The 17 BCTs which emerged from the literature analysis were used to code the assessment video (section 2.2.1 and section 2.3.1). Thus, in contrast to the literature coding process (section 2.2.2.3), in which the entire BCTTv1 (Michie et al., 2013b) including all 93 BCTs was used for coding, just the list of the 17 BCTs identified in SSD intervention literature was used for the assessment coding. The rationale for this decision was based on the number of BCTs, which had been drastically reduced by using the SSD BCT list provided after coding the SSD intervention literature. The duration of the assessment video was 10:43 minutes. Both coders received the taxonomy in digital and hard-copy formats and had a VEO account to access the platform on which the assessment video was saved.

In addition, a Microsoft Excel template which included the 10:43 minutes of the assessment video in 10-second time stamps, was used by both coders. This Excel template was used to analyse and identify the presence of BCTs. The plan was to use VEO to identify BCTs within the assessment video, as this program has been used widely and successfully in teaching (Seedhouse, 2022) and in earlier SLT projects linked to BCTs (Barnett, 2022). Overall, VEO is a powerful tool for teaching students and practitioners techniques and strategies used in SLT. However, due to a time-delay in tagging BCTs in VEO version 2020, it was not possible to identify the exact time to the second a BCT occurred. As precise data collection for the identification and analysis of BCTs occurring in the assessment video was essential for this study, a Microsoft Excel template was used to document the exact time (minute and second) a BCT was present. Thus, VEO was used to play the assessment video and Microsoft Excel to document the occurrence of BCTs.

The ten second time window of the Excel template has been chosen for various reasons. First, ten seconds are a manageable timeframe in terms of remembering what has just been said. Thus, it was likely that participants were able to remember what has just been said and identify BCT types easier than with a larger time window. Second, as results of the BCT analysis of the assessment video showed (section 2.3.1), a number of 187 BCTs occurred within the 10:43 minutes video, which shows the importance of having fine-grained sections to identify BCTs as so many occur within the video. As previously mentioned, a less chunk-like approach has been chosen to identify BCTs by using the technology program video-enhanced observation (VEO) at the beginning of the project. However, this approach did not work, as the possibility to identify the exact time to the second a BCT occurred was not available in the 2020 version (section 2.2.4.2). Other technical programs for video coding, such as ELAN (Max Planck Institute for Psycholinguistics, 2023), exist. However, ELAN offers a variability of possibilities and features such as use and view annotations and/or create multiple tiers for coding video recordings. These features were not relevant for identifying BCTs in the assessment video, but would – because of the amount of additional information – possibly rather be distractive for participants, which is why it was decided that the project-custom-fitted Excel spreadsheet including only metrics which were needed to identify BCTs (e.g., time, phrase, BCT type) is the best option for identifying BCTs in this project.

The Microsoft Excel template was set up (by MD) specifically to identify BCTs in the assessment video — an example of a real-world SSD session — and to answer which BCT types can be identified in a German-speaking, representative real-world SSD intervention video. The template (Figure 7) included four columns: (A) "*Time* (German *Startzeit*)", (B) "*BCT*", (C) "*situation*" (German *Stelle*) and (D) "*notes*" (German *Anmerkung*). The rows in column A included time stamps of 10 seconds (e.g., first row: 00:00 min./sec., second row: 00:10 sec./min.). Coders inserted the present BCT(s) from the BCTTv1 in the column B "BCT(s)". The utterance in which the coder(s) identified the BCT was identified in the column C "situation". In case of questions or coder uncertainty, a "notes" column D was created. Figure 7 shows an excerpt from the Microsoft Excel template developed and used for the BCT coding of the assessment video.

A	B	C	D
Startzeit	BCT	Stelle	Anmerkung
00:00			
00:00			
00:00			
00:00			
00:10	7.1. prompts/cues	Probier nochmal -> Handbewegung	
00:10	6.1. Demonstration of the behaviour	Drache	
00:10	8.1. Behavioural practice/rehearsal	Probier nochmal	
00:10			
00:20	10.4. Social reward	Super, cool	
00:20			
00:20			
00:20			
00:30			
00:30			
00:30			
00:30			
00:40			
00:40			
00:40			
00:40			
00:50	1.1. Goal setting (behaviour)	Hör mal zu ich erklärs dir.. wir müssen gut hören..	
00:50			
00:50			
00:50			
01:00	6.1. Demonstration of the behaviour	/trrr/	
01:00	8.1. Behavioural practice/rehearsal	Probier mal	
01:00	7.1. prompts/cues	/tr/ -> Handbewegung	
01:00	2.2. Feedback on Behaviour	Super, genau	

Figure 7: Excerpt from the Microsoft Excel template developed to document the BCT coding of the assessment video

The coding procedure of the assessment video and the agreement on BCTs occurring in the assessment video are outlined in the next section.

2.2.4.3 Assessment Video Coding and Agreement Procedure

The procedure of coding the assessment video included several steps to ensure high agreement. First, both SLTs coded the assessment video individually and, second, the two SLTs met to compare and discuss coding results to then agree on coding outcomes and occurring BCTs. Coding the assessment video firstly aimed at identifying BCT types occurring and, secondly, to investigate which BCT types occur the most or least often — in other words, frequency of BCT types' occurrence.

Overall, the assessment video lasted for 10:43 minutes and contained utterances from the SLT and the child. An utterance consists of a group of words which belongs to a sentence but does not necessarily represent an entire sentence or a grammatical unit. Nevertheless, an utterance has a coherent intonation pattern and may be an acceptably elliptical form (e.g., to respond to a question). An utterance may last less or more than 10 seconds. SLTs were asked to watch the video and identify BCT types occurring per utterance of the therapist directed at the child.

As the list with the 17 identified BCT types was used to analyse the assessment video, 17 BCT types were potentially identifiable within an utterance. Thus, both SLTs listened to an utterance of the therapist in the video, stopped it, thought about whether a BCT type(s) (and if so, which one(s)) occurred in the utterance, and noted the BCT type(s) and the utterance it occurred in in the Excel spreadsheet; or, if no BCT type occurred, moved on. To ease the coding process, coders were asked to identify a BCT type once within an utterance, even if it occurred twice or more often within the same utterance. The rationale for deciding that each BCT type is coded just once within an utterance was established when MD first started to analyse the assessment video. It was quickly noticed that some BCTs occur more than once within an utterance — for example, the BCT 10.4. *Social reward* used to praise the child. This is an example of a BCT which can be represented by using single words which express verbal reward (e.g., “Super!” “Bravo!”). Thus, the rule of recording once only was suggested to ease the requirements for coders by avoiding the need to repeat code very small-sized sections. In addition, it was also assumed that if coders could identify a BCT accurately once within an utterance, this would also be true for identifying the same BCT type twice.

However, if different BCT types occurred within one utterance, each BCT types needed to be identified within the particular utterance. For example, if the coder identified the BCT 6.1. *Demonstration of the behaviour* twice within an utterance, he/she/they documented this BCT type once in the column of the utterance in the Excel spreadsheet. However, if the BCT 4.1. *Instruction on how to perform the behaviour* and 8.1. *Behavioural practice/rehearsal* also occurred in the same utterance – for one or more times – these were also documented in the Excel spreadsheet as these are different BCT types. Thus, if the same BCT type occurred more often within an utterance, coders were asked to document these once, regardless of the number of times these occurred within an utterance. Thus, the two BCT-trained SLTs had to code each occurring BCT type *once within an utterance* of the therapist in the assessment video and document this in the Excel spreadsheet.

The Excel template was organised into 10-second time stamps (section 2.2.4.2; Figure 7). The utterances from the assessment video might be contained within one 10-second time stamp or span two or more 10 second time stamps. This means that if an utterance lasts for e.g., twenty seconds, it goes over more than one timestamp. For example, the start of the utterance (the first "words") belong one 10-second timestamp (e.g., timestamp [00:10]), whereas the middle part belongs to the following 10-second timestamp (e.g., timestamp [00:20]) and the last ones to the next timestamp (e.g., timestamp [00:30]). If a BCT was identified within a single word such as 10.4. *Social Reward* "Perfect!", it was clear which timestamp this BCT type belonged to. If it was a BCT included within a longer utterance that spanned timestamps (e.g., 4.1. *Instruction on how to perform the behaviour*), this BCT had to be noted into the timestamp it started in — so, in the first 10-second timestamp it occurred — but not in the following timestamps even if the utterance went on, as this was still only a single BCT. Thus, BCT types were always noted in the first timestamp they occurred regardless of how long the utterance was.

In general, identifying a BCT within a therapy situation follows the coding rules set by Wood et al. (2015) (section 2.2.2.1). For some BCTs it may be true that single words indicate their presence, but the majority of BCTs are identified by a string of actions within a situation, which start and end at a certain point in the video. Thus, BCTs are often not identified by single words but, rather, by an entire string of actions embedded in utterances showing the BCTs' presence.

Both SLTs coded the assessment video individually using the VEO platform and Microsoft Excel template in December 2020. The present BCT types have been entered into the correct time stamp columns accompanied by the corresponding utterances and have been identified once within an utterance. Two different analysis have been used to investigate BCTs of the SSD intervention video: (1) an analysis of BCT types occurring in general in the video and (2) an exact item per item match to determine the level of coding accuracy.

First, to identify BCT types occurring in the assessment video, the BCT types identified by coders were noted and compared. For each of the 17 BCTs, agreement on the BCT type's presence (both coders identified the BCT type overall in the assessment video) or absence (both coders did not identify this BCT type within the assessment video) was calculated to investigate the intercoder agreement using percentage agreement (Gisev et al., 2013). If coder results were the same (e.g., both coders say the BCT type occurs or does not occur), percentage agreement is 100%. Thus, percentage agreement determined the level and degree of agreement on present/absent BCT types in the assessment video between coders (Gisev et al., 2013). If coders disagreed, the BCT type was discussed in the following face-to-face meeting to establish consensus. To assess whether coding results among the two SLTs can be seen as reliable and consistent, intercoder reliability has been calculated using Cohens' Kappa (Landis & Koch, 1977). Therefore, the result of percentage agreement has been used in the Cohens' Kappa formula. An intercoder reliability for present BCT types was considered as satisfactory agreement for Cohen's Kappa values >0.60. (Landis & Koch, 1977; Michie et al., 2013b). This value has been used as threshold for intercoder reliability of coding the assessment video.

Second, a more accurate item to item coding analysis has been conducted to determine which BCT type(s) occurs exactly in which utterance of the video. This analysis then also enabled the investigation of which BCT types occur the most or least often (frequency of BCT types' occurrence) in the assessment video. For this step, percentage agreement was also used to determine the level of intercoder agreement. The coding from both SLTs of all identified BCT types in each specific utterance was then compared item per item. This way it was possible to investigate the degree to which BCT identifications are identical (Gisev et al., 2013). The percentage of the agreement among the two coders on the presence and absence of BCT types in each utterance has been calculated. If both SLTs identified a particular BCT type within an utterance, the percentage agreement was 100%. If both SLTs did not identify a specific BCT type within an utterance, the percentage agreement was also 100%. By including every utterance and its coding in the calculation, it was possible to see for which utterances the two coders agree on the presence and absence (percentage agreement 100%) of particular BCT types, and which ones needed to be considered in the following discussion appointment among coders, as the coders did not yet agree on whether the BCT type occurred or did not occur in specific utterances of the assessment video.

Investigating the percentage agreement in terms of coding accuracy has been important because the assessment video was used to assess student SLTs and SLTs' coding accuracy when identifying BCTs from the assessment video after completing the BCT training workshop in Stage 2. Thus, the BCT coding from the two BCT-trained SLTs has been used to develop a benchmark and compare all coding results of participants in Stage 2 after the BCT training workshop. Similar previous studies have also established a consensus against which to compare and assess coding e.g., participants to (Wood et al., 2015).

Both the results on the presence/absence of BCT types as well as results of the more accurate item per item BCT coding analysis were discussed in a face-to-face meeting to agree on a consensus of present/absent BCT types and BCTs in utterances, and to develop a benchmark for the following stages of this study. Literature suggests that intercoder agreement and intercoder reliability is generally higher after discussing coding outcomes (Michie et al., 2013b). Therefore, discussing the coding outcomes to reach consensus on the coding results from DH and MD has been essential and took place in January 2021 in the “Logopädie Dornstauder” clinic. Thus, all calculations (percentage agreement and intercoder reliability) have been calculated before and after discussion.

2.2.4.4 Data Preparation and Analysis

As described above, intercoder agreement was calculated using percentage agreement (Gisev et al., 2013) for determining which BCT types occur in the video, as well as for a more detailed analysis of item per item BCT coding of each utterance. In addition, intercoder reliability has been calculated using Cohen’s Kappa (Landis & Koch, 1977) for investigating how reliable and consistent SLTs coded BCT types occurring within the video. Both calculations have been conducted using Microsoft Excel. After establishing the intercoder agreement in terms of the benchmark of BCTs present item per item of the assessment video, the frequency of BCT types has been determined. The Statistical Package for Social Sciences (*SPSS Statistics - Deutschland | IBM*, 2021) and Microsoft Excel were used. The SSD BCT list (section 2.3.1) was used to conduct a descriptive analysis to detect which BCT types (qualitative analysis) occur the most (quantitative analysis) in the assessment video. This analysis showed which BCT types occur within a real-world SSD intervention session and enabled the development of a benchmark against which participants’ item per item coding results from the workshop in Stage 2 could be compared. The following results section presents outcomes of the BCT coding of SSD intervention literature and the descriptive results of the BCT coding of the assessment video.

2.3 Results

This section outlines the results of identifying BCTs from the BCTTv1 by Michie et al. (2013b) in a real-world SSD session example video (assessment video) using the SSD BCT list, which includes BCTs previously identified in SSD literature to answer **RQ 1** (*Which BCT types can be identified from SSD intervention manuals and studies and from a German-speaking, representative real-world SSD intervention video?*). Developing the SSD BCT list including all BCT types identified in SSD intervention literature (SSD BCT list) has been essential, as this list was used as the basis for identifying BCTs in the assessment video. In addition, these BCT types have then been included in the BCT training workshop in Stage 2. In addition, the analysis of the assessment video has also been used to establish a benchmark against which the coding results of workshop participants from Stage 2 can be compared. Thus, the SSD BCT list formed the foundation for this study and was crucial for its processes and procedure.

2.3.1 Coding Results: Assessment Video

The assessment video was coded by two BCT-trained SLTs using the SSD BCT list developed from the SSD intervention literature coding (section 2.3.1). Qualitative data shows which BCT types occur and quantitative data shows how often these BCT types occur, with consideration given to the exact position/location of the BCT in the therapist's utterance during the assessment video. This was important, because there were two reasons in mind when coding the assessment video: first, to determine the presence and frequencies of BCT types in a real-world SSD intervention video example; second, to develop a benchmark (section 2.2.4.3) against which BCT coding results of workshop participants from Stage 2 could be compared. As workshop participants' coding is compared item per item to the benchmark established in this section, it was of great importance to not only investigate which BCT types occur within the video, but code each utterance of the therapist to determine the location/position of each BCT. First, intercoder agreement on BCT types and second on the exact location/position of BCTs in all utterances of the assessment video had to be established.

The SSD BCT list includes 17 BCTs (section 2.3.1) and was used for determining which BCT types occur in the assessment video. To do this, percentage agreement has been used to investigate intercoder agreement, whereas Cohens Kappa statistics has been used to determine intercoder reliability among the two BCT-trained SLTs (section 2.2.4.4). The percentage of agreement on BCT types from the SSD BCT list present in the assessment video was 82.5% before and 100% after the discussion. Cohens' Kappa statistics before discussion shows $\kappa=0.55$ (95% CI [0.24-0.76]), which is considered a moderate agreement. However, after discussion a perfect agreement was achieved ($\kappa=1.00$ (95% CI [0.18-0.82])). Thus, the intercoder agreement reached full consensus after the discussion and showed the highest intercoder reliability possible.

Fourteen of 17 BCTs from the SSD BCT list were identified in the assessment video. Table 9 gives an overview of the 14 BCTs found in the assessment video (using the SSD BCT list) compared to the 17 BCTs identified in the SSD intervention literature (using the BCTTv1). Thus, table 9 shows a tick next to the BCT types occurring in the assessment video, intervention literature, or both. If the BCT type did not occur, a cross is shown.

Table 9: BCTs identified in assessment video coding and SSD intervention literature coding

BCT type	Identified in assessment video	Identified SSD intervention literature
1.1. Goal setting (behaviour)	✓	✓
1.3. Goal setting (outcome)	✓	✓
1.4. Action planning	✓	✓
1.6. Discrepancy between current behaviour and goal	✓	✓
2.2. Feedback on behaviour	✓	✓
2.6. Biofeedback	X	✓
3.1. Social support (unspecified)	✓	✓
4.1. Instruction on how to perform the behaviour	✓	✓
6.1. Demonstration of the behaviour	✓	✓
7.1. Prompts/cues	✓	✓
8.1. Behavioural practice/rehearsal	✓	✓
8.6. Generalisation of target behaviour	X	✓
10.2. Material reward (behaviour)	✓	✓
10.3. Non-specific reward	✓	✓
10.4. Social reward	✓	✓
12.5. Adding objects to the environment	✓	✓
14.8. Reward alternative behaviour	X	✓

BCTs shown in Table 9 have been found to be present in SSD intervention literature and a real-world SSD intervention video example. Fourteen BCTs of the SSD BCT list occurred in the assessment video, meaning that three BCTs were found in the SSD intervention literature but not in the assessment video. However, the SSD BCT list including all 17 BCTs was used for the BCT training workshop in Stage 2, as the assessment video was used to assess participants' coding accuracy after completing the workshop. 18 other videos have been used as training videos — thus, the possibility that one or more of the three BCTs not found in the assessment video may occur in one of the training videos is provided for. Training videos were only used for the workshop and were not included in data analysis. Therefore, the 17 BCTs from the SSD BCT list have been used in the following Stage 2: the BCT training workshop for SLTs and SLT students.

Descriptive results in terms of the frequency occurrence of these 14 BCT types and identifying every BCT type once within an utterance (exact position/location) in the assessment video were also investigated to develop a benchmark against which participants' coding can be compared item by item. For this calculation, percentage agreement was used, as the degree to which BCT coding is identical and the general level of agreement between the two coders was of interest. The aim was to investigate whether the same BCT types can be identified in the same utterances by two coders. It also has to be noted that the possibilities of coding the utterances of the assessment video using the SSD BCT list is large, as the video included 109 codable timestamps with utterances and each utterance could be coded with one or more of the 17 BCT types from the SSD BCT list. Intercoder percentage agreement was 61.5% for the two coders before discussion of results, and 100% intercoder percentage agreement after discussion. The analysis of the coding from the two BCT-trained SLTs (MD and DH) revealed that, when identifying each BCT type once within an utterance, one hundred and eighty-seven BCTs (N=187) occurred in the assessment video. The therapist in the assessment video used 14 BCT types from the SSD BCT list within this 10:43min video. Some BCTs have been used frequently (e.g., 6.1. *Demonstration of the behaviour*) and some have been used rarely (e.g., 10.2*. Material reward (behaviour)*) (see Figure 8). Figure 8 gives an overview of the BCT types (x-axis) and the frequency use of BCT types (y-axis) identified in the assessment video already.

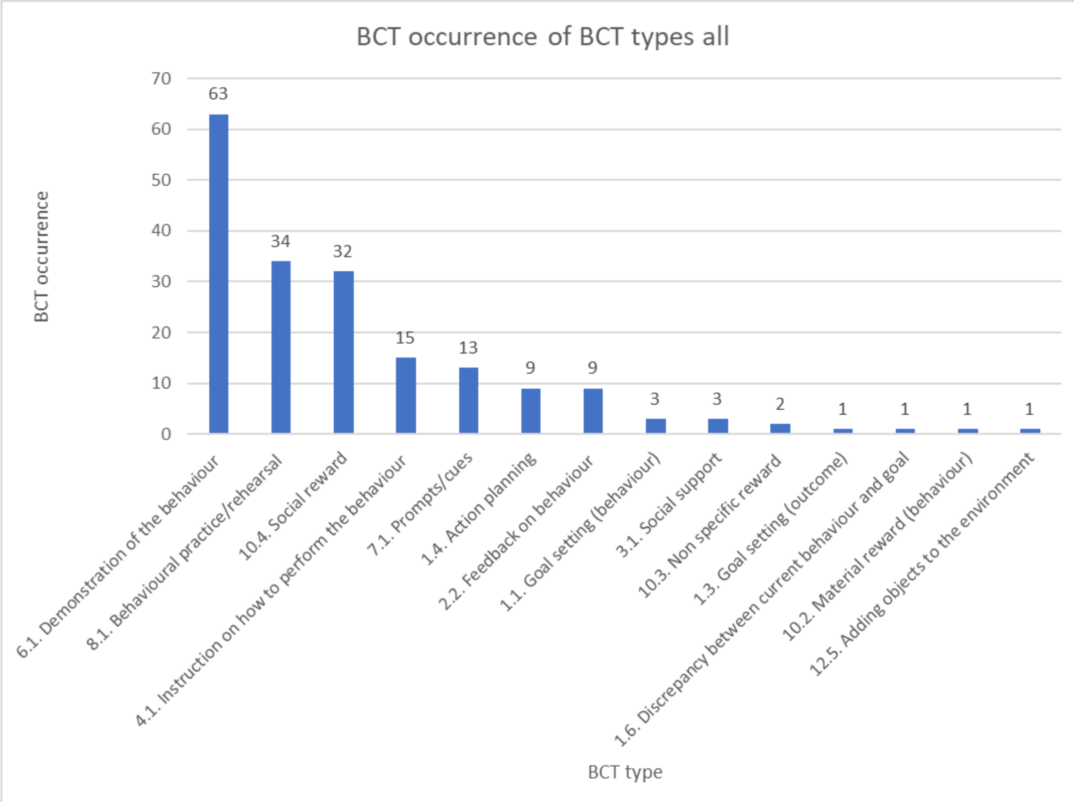


Figure 8: BCT types and their occurrences in the assessment video

Addressing BCT types, three BCTs (2.6. *Biofeedback*, 8.6. *Generalisation of target behaviour* and 14.8. *Reward alternative behaviour*) have not been identified in the assessment video compared to the SSD intervention literature. However, 14 of the 17 BCTs could be determined in the real-world assessment video and the SSD intervention literature.

Investigating the frequency of BCTs used in the assessment video, the BCT occurring the most is 6.1. *Demonstration of the behaviour* (63 occurrences), whereas 1.3. *Goal setting (outcome)*, 1.6. *Discrepancy between current behaviour and goal*, 10.2. *Material reward* and 12.5. *Adding objects to the environment* were used only once each. Therefore, a large variation among BCTs in terms of their frequency of occurrence can be observed. As outlined in Figure 8, seven BCTs were used three or fewer times within the assessment video whereas, as mentioned above, three of the 17 identified BCTs for SSD interventions were not used at all in the assessment video. In sum, the therapist used BCTs 187 times, including 14 BCT types from the SSD BCT list.

Thus, BCTs were identified in SSD intervention literature for German-speaking children including the three therapy approaches Minimal Pair (Weiner, 1981), Metaphon (Jahn, 2000, 2007) and

P.O.P.T. (Fox-Boyer, 2014b), which showed a positive impact on children with SSD in single-case and quasi-experimental studies. In addition, the assessment video was also coded using the SSD BCT list to see which BCTs occur in a real-world SSD session example. This way, BCTs for SSD intervention have been determined in both the literature and a clinical practice example, which provided the rationale and basis for which BCT types were included in the BCT training workshop in Stage 2.

2.4 Discussion

Stage 1 of this study aims to answer **RQ 1** *Which BCT types can be identified from SSD intervention manuals and studies and from a German-speaking, representative real-world SSD intervention video?*

For SSD intervention manuals and studies, it was expected that a small number of BCT types (10-15 BCT types) can be identified from the BCTTv1 (Michie et al., 2013b). This was expected because the BCTTv1 includes BCT types for a wide range of behaviour change, especially for public health interventions (Michie et al., 2013b) which typically do not occur in SLT. The results from identifying BCTs from the BCTTv1 in SSD intervention literature supported the direction, as 17 BCTs from the 93 BCTs in BCTTv1 could be identified. The result shows a reduced number of BCTs from the BCTTv1 are present in SSD interventions in comparison to the full taxonomy. Thus, it can be suggested that a limited set of the BCTs included in the BCTTv1 are applicable to SSD interventions. When applying BCTs to SLT interventions, it is therefore important to narrow the number of BCTs down to the ones relevant for each SLT intervention. Furthermore, it was predicted that not all BCT types but the majority of BCT types identified in the SSD intervention literature would also be found in the real-world SSD intervention video session (assessment video). This hypothesis was also well-founded, as 14 of the 17 BCTs identified in the SSD intervention literature could also be identified in the assessment video. For the assessment video it was also expected that some BCT types would be used more often than others by the therapist. Results supported this hypothesis, as BCT types varied in their occurrence.

The next sections outline the key findings of Stage 1 and discuss these for the BCT identification of SSD intervention literature (section 2.4.1), for the BCT identification of the assessment video (section 2.4.2), the results' implications for Stage 2 of this study (section 2.4.3), and the section's conclusion (section 2.4.4).

2.4.1 BCTs in SSD Intervention Literature

While BCTs have been used widely in public health (Michie, Atkins, et al., 2014), little is known about the presence of BCTs in SSD interventions. However, as SSD interventions are complex behaviour change interventions, it was assumed that a limited set of BCTs from the BCTTv1 (Michie et al., 2013b) occur in SSD intervention literature. Seventeen BCTs from the BCTTv1 were found in at least one of the three analysed SSD intervention manuals/studies. In percentage terms this means 18% (17/93 BCTs) of BCTs from the BCTTv1 have been found in the three therapy approaches: *Minimalpaartherapie* (Minimal Pair Therapy) (Weiner, 1981); *Metaphon* (Jahn, 2000, 2007); and *P.O.P.T.* (Fox-Boyer, 2014b). While one of the 17 BCTs from the BCTTv1 was found in at least one included SSD intervention, only six have been found in all three interventions (1.1. *Goal setting (behaviour)*, 1.4. *Action planning*, 4.1. *Instruction on how to perform the behaviour*, 6.1. *Demonstration of the behaviour*, 7.1. *Prompts/cues*, 8.1. *Behavioural practice/rehearsal*). The six BCT types found in all three SSD interventions are not surprising, as the nature of SSD intervention includes techniques such as giving instruction on how to produce a sound, demonstrating the position of lips/tongue and/or practising the behaviour in the therapy session (Furlong et al., 2021; Kim et al., 2012).

By identifying BCTs in SSD intervention manuals and studies, it has been observed that the identification of BCTs was easier in sections with examples of SSD intervention sessions in which authors demonstrate how to implement specific therapy content compared to theoretical information in the manuals/studies. For the current results it can be reported that the number of BCT types found in the three SSD interventions is similar (12 BCT types in Minimal Pair, 14 BCT types in Metaphon and 12 BCT types in P.O.P.T.). BCTs in Minimal Pair have been identified in the article/study by Weiner (1981), as there were no intervention manuals for applying the Minimal Pair approach for German-speaking children available — not surprising as this approach has been critiqued for German (Fox, 2009). However, the study included an example of a conversation with a child in a SSD intervention session. Here, compared to the rest of the article, the most BCT types have been detected. Metaphon (Jahn, 2000, 2007) and P.O.P.T. (Fox-Boyer, 2014b) both provide a detailed manual (book) on how to implement the intervention for German-speaking children with SSD. These two SSD intervention manuals include specific practice examples demonstrating how intervention content is being implemented. However, none of the literature (manuals/study) mentioned BCTs explicitly when indicating techniques used to change behaviour in children with SSDs. Nevertheless, 14 BCTs could be identified in Metaphon (Jahn, 2000, 2007) and 12 BCT types in Minimal Pair (Weiner, 1981) and P.O.P.T. (Fox-Boyer, 2014b) (section 2.3.1).

Thus, the finding that BCTs can be more easily detected from practical examples seems to support literature which suggests that techniques used in complex interventions can be detected better if they are reported in detail, as all three approaches investigated by this study included detailed information and examples of how to implement the theoretical knowledge directly in SSD sessions (Craig et al., 2013; Michie et al., 2013b; Wood et al., 2016). Many researchers report that complex interventions are often described inconsistently (section 1.3). Levels of complexity and their active components are therefore often lacking in intervention descriptions which impedes the conveyance of techniques used to change behaviour (Wood et al., 2016) in e.g., children with SSDs. Thus, the level of detail seems to facilitate (or hamper) how well BCTs can be identified from intervention descriptions. In a further step, one can assume that terminology used to describe complex interventions also impacts how well BCTs can be identified (section 1.2.3). If a concise terminology is used to describe how intervention content is being implemented, the identification of active components such as techniques used to change behaviour in children seems to be easier than when inconsistent terminology is being used. As previously mentioned, the three SSD intervention manuals did not explicitly describe BCTs; therefore, no consistent terminology has been used to describe BCTs. It would be interesting to see whether interventions can be implemented more consistently if the coherent terminology of the BCTTv1 is used to describe SSD interventions.

Intercoder agreement and intercoder reliability during BCT coding before discussion was relatively high for all three SSD intervention manuals and/or studies, with percentage agreement rated above 90% and Fleiss Kappa statistics above $\kappa=0.45$ (moderate agreement; section 2.3.1). After discussion, all three SSD interventions reached a percentage agreement of 100% and $\kappa=1.00$. This is in line with the literature, which indicates that intercoder agreement and reliability are usually higher after discussion of the coding results (Michie et al., 2013b). Percentage agreement for BCTs present in SSD interventions was high before discussing coding results. All coders had been trained on the BCTTv1 before coding the SSD intervention manuals/studies (section 2.2.2.1). As percentage agreement was already high before discussing the coding results, these findings suggest the realistic possibility that the BCTTv1 framework, with some training, could be reliably used and applied to SLT interventions. For these coding tasks, no time constraints were given — meaning that coders took the time they needed to code the interventions reliably. Previous studies mention that time limitation while working with BCTs may negatively influence coding results (Wood et al., 2016).

2.4.2 BCTs in a Real-world SSD Intervention Video Session

This study utilized the list of 17 BCTs (SSD BCT list) identified in SSD intervention literature to investigate which BCTs occur in a German-speaking, representative real-world SSD intervention video (referred to here as *assessment video*). The first hypothesis was that the majority but probably not all BCT types of the SSD BCT list also occurred in the assessment video. This was because different BCT types are used in different therapy situations and settings with the use of BCT types linked to the stage/task of the therapy session, the child's attention, or other factors. Results showed that 14 of the 17 BCT types from the SSD BCT list were found in the assessment video. Thus, the hypothesis proved correct. The second hypothesis suggested that some BCT types will occur more often than others. Results of the assessment video analysis confirmed this hypothesis. First, the three BCT types which did not occur in the assessment video are discussed, followed by the 14 BCT types which could be identified in the assessment video. The 14 present BCTs are discussed in the context of the frequency of their occurrence.

The three BCTs which were not found in the assessment video were: 2.6. *Biofeedback*, 8.6. *Generalisation of target behaviour,* and 14.8. *Reward alternative behaviour* (section 2.3.1. Table 9). Reasons why certain BCT types were not found in the assessment video may be linked to other active components from complex interventions such as how the child's SSD presents, the content of the intervention being delivered in this one video session, the structure of the SSD session, or the task and its purpose within the SSD session. For example, 8.6. *Generalisation of target behaviour* is described as a technique used to perform the target behaviour in other situations than the one the behaviour has been practised in. As the BCTTv1 (Michie et al., 2013b) was developed in the public health context, not all BCTs can be applied easily to SSD intervention sessions. Thus, for SSD therapy sessions, it was agreed (section 3.2.2) that this means that the desired behaviour is practised in another therapy task within a session. If this therapy session is about implementing a new behaviour (e.g., differentiate between two sounds) but not yet about practising the behaviour and performing it within different situations, the BCT type 8.6. *Generalisation of target behaviour* will not be used in the session. The structure of SSD intervention sessions has been outlined in section 2.1.2 and may also be linked to the BCT types and the frequency of BCT types used within a SSD session, which leads to the next hypothesis.

In addition to the prediction of the presence of BCT types in the assessment video, it was also hypothesised that some BCT types may occur more often in the assessment video than others. Results showed this to be correct, as the number of occurrences of BCT types varied greatly throughout the assessment video (section 2.3.2). The great difference in the occurrence of BCT types may be linked to additional active components impacting the therapy session (severity of SLT difficulty of the child, intervention content, structure of therapy session, the task and its purpose). As outlined in section 2.1.2 (structure of SSD intervention sessions), literature indicates that certain techniques are used in different stages of a therapy session (Furlong et al., 2021; Horton et al., 2004). It would therefore be reasonable to use BCTs such as 1.3. *Goal setting (outcome)* and 1.4. *Action planning* at the beginning and end the of a session rather than in the middle and less often than BCTs which are closely linked to the core nature of SSD sessions (e.g., demonstrating, practising) (Kim et al., 2012). In terms of the frequency of BCTs, this is supported by the fact that the BCTs 6.1. *Demonstration of the behaviour*, 8.1. *Behavioural practice/rehearsal* and 10.4. *Social reward* were used by far the most often in the assessment video. In addition, the two BCTs 6.1. *Demonstration of the behaviour* and 8.1. *Behavioural practice/rehearsal* also occurred in all three SSD interventions, which also stresses the importance of these techniques.

It also has to be noted that the BCT 4.1. *Instruction on how to perform the behaviour* is the fourth most occurring BCT in the assessment video which also speaks for its importance, as this BCT also occurred in all three SSD interventions (section 2.3.1). In addition, these BCTs can be linked to a phonological awareness task (section 2.2.3.3) such as the one conducted in the assessment video. For example, the therapist gives instruction on the task and/or how to produce the sound. Then the therapist demonstrates the words/sounds for the child to hear but may also demonstrate the correct sound by producing it. If the desired behaviours are to listen closely and produce a sound, demonstrating works for both. The task includes practising and rehearsing the two behaviours with many items/words. Social reward in terms of praising and positive reinforcement (verbal or non-verbal) are also often included in any SLT task to support children (Kim et al., 2012). So, three of the most occurring BCTs are linked to all SSD interventions included in this study and supported by literature (e.g., Furlong et al., 2021; Kim et al., 2012). This study has not aimed at investigating the location of BCT types within a SSD session — the current results only indicate which BCT types occurred the most within the assessment video but not at which stage they occurred. The results of the assessment video analysis indicate that considering the stage of the session seems to be relevant to the BCT types included.

In contrast to the BCTs used the most in the assessment video, the BCTs 1.6. *Discrepancy between current behaviour and goal*, 10.2. *Material reward (behaviour)*, 12.5. *Adding objects to the environment* and 1.3. *Goal setting (outcome)* only occurred once. Reasons why these BCT types have only been used once in this specific intervention session (assessment video) might also be linked to the intervention content, the task, its delivery and/or the performance and reactions of the child. For example, the BCT 1.6. *Discrepancy between current behaviour and goal* can only be used if the child presents a behaviour which allows for this (e.g., if the child shows a contact assimilation during labelling a word we are using in the task, then the therapist can use the incorrect utterance by the child and demonstrate the correct one and discuss the discrepancy between the current behaviour of the child and the goal).

All considerations about why certain BCT types occur in the assessment video and how frequently single BCT types occur show the level of complexity of SSD interventions. The stage of the therapy session, the child's difficulty, and the type of delivery are only three components included in complex interventions (section 1.1). The level of complexity can become even more tangled when considering that parents/carer, therapists, organisations and other professionals are sometimes also involved in SSD interventions. Thus, it is important to be explicit about every active component involved — stage of session, child's difficulty, type of delivery (section 2.2.3.3 for assessment video characteristics) — when identifying BCTs in SSD interventions, as other active components may impact which techniques are used to change behaviour in the child.

Results of the identification of BCTs in SSD interventions — both literature/manuals and a real-world SSD session — show that a number of BCTs from the BCTTv1 can be detected from SSD interventions. However, a limited number of BCTs from the BCTTv1 were identified which indicates that, in order to use BCTs from the BCTTv1, the relevant BCTs need to be identified from the specific SLT intervention. The current findings of the identification of BCTs in SSD intervention literature also show that the BCT framework can be applied in a reasonable and reliable way to describe SSD interventions, which indicates it may also work for further SLT interventions as at the heart of all SLT interventions is interaction, just as in SSD interventions. It has also been shown that coders receiving some BCT training were able to identify BCTs from SSD interventions reliably from literature/manuals and the real-world SSD session. This indicates that the BCT framework can be used and applied to SSD interventions with some training. Teaching the framework of BCTs to SLTs and SLT students might help them to describe intervention approaches and techniques used more clearly and explicitly, which could support them to reflect on their own practice and in implementing complex interventions.

2.4.3 Study Limitations

Three SSD interventions for German-speaking children were tested in terms of their effectiveness (section 2.1.1). The number of SSD interventions included in the BCT analysis of SSD literature is small because only evidence-based SSD interventions for German-speaking children have been included.

The assessment video was coded by using the SSD BCT list developed from the previous SSD intervention literature task, rather than the BCTTv1 (Michie et al., 2013b). This was decided for various reasons: (1) it was assumed that all BCTs occurring in SSD interventions had been covered by the literature coding task; (2) coders were able to focus in greater detail on a reduced number of BCTs (17 BCTs rather than 93 BCTs); (3) the second coder's (DH) availability to participate in the study was limited. The SSD intervention literature covers broad descriptions of the interventions (e.g., all stages of therapy), whereas the SSD intervention session showed an extract of a therapy session and therapy block. Thus, even though the list of the 17 BCT types and not the entire BCTTv1 was used to identify BCTs from the real-world SSD session, it is likely that all BCT types occurring in a SSD intervention have been covered. The identification of BCT types in the real-world SSD session was conducted to confirm that the BCTs found in the manual also translate to practice.

In addition, it has to be noted that results of the assessment video coding need to be considered carefully, as these relate to a single SSD intervention session. As SSD interventions are complex interventions, many components (section 1.2; e.g., the child's difficulty, the stage of the session/therapy process, the task, the delivery type and other people involved in the intervention, such as parents/carers) impact the use of BCT types and their frequency, which therefore may differ from one SSD session to another. Due to the heterogenous nature of SSD interventions, more videos from children with a similarity in the SSD profile, the phase of the therapy process, the sessions, the therapy approach, and the tasks would need to be coded to have a greater sample of SSD sessions and therefore more insight into which BCT types are used and in which frequency. However, there was consistency in the BCT types identified across the three studied intervention approaches which suggests that BCT types for SSD intervention have been covered reliably.

2.4.4 Conclusion

Stage 1 of this study suggests that 17 BCTs from the BCTTv1 (Michie et al., 2013b) occur in the three investigated SSD intervention manuals and studies: Minimal Pair (Weiner, 1981), Metaphon (Jahn, 2000, 2007) and P.O.P.T. (Fox-Boyer, 2014b). The number of BCTs identified in the therapy interventions P.O.P.T (Fox-Boyer, 2014b; 12 BCTs) and Metaphon (Jahn, 2000, 2007; 14 BCTs) and Minimal Pair Therapy (Weiner, 1981, 12 BCTs) were equally distributed among the three approaches. For Metaphon (Jahn, 2000, 2007) and P.O.P.T (Fox-Boyer, 2014b), manuals with detailed descriptions referring to implementing the intervention were available in German. The SSD intervention Minimal Pair (Weiner, 1981) has been described in a study which included a direct example situation of working with a child, including a transcript of a dialogue between the child and the therapist. Most BCTs of Minimal Pair have been identified in this dialogue which included much information on the direct application of BCTs.

It is suggested that the level of detail is linked to identifying BCTs (Beresford et al., 2018; Craig et al., 2013) — the more coherent and detailed the description of a SSD intervention, the more easily BCT types can be detected. Considering that all three SSD interventions included provided a good level of detail and included examples on how to implement the therapy content in SSD sessions, this suggestion can be supported. Six of the 17 BCTs were identified in all SSD interventions: 1.1. *Goal setting (behaviour)*, 1.4. *Action planning*, 4.1. *Instruction on how to perform the behaviour*, 6.1. *Demonstration of the behaviour*, 7.1. *Prompts/cues*, 8.1. *Behavioural practice/rehearsal*. It is not surprising that these six BCTs types occurred in all three SSD interventions, as these are typical techniques used in SSD intervention (Furlong et al., 2021; Kim et al., 2012). However, the six BCT types occurring in all three SSD intervention approaches have not been described explicitly as techniques used in the manual or instruction. Thus, using the framework of BCTs as descriptors is useful and applicable to SLTs in intervention approaches to help them to describe explicitly what is being done in intervention sessions and using a coherent and consistent terminology to do so.

Fourteen of the 17 BCTs were identified in the real-world SSD intervention session video, the assessment video. This finding shows the applicability of the BCT descriptors in clinical practice and that BCTs are indeed transferred into and used in practice. As there are several factors which may impact the use of BCT types (such as the therapy/session structure, the level of the child's difficulty or the therapy task and its purpose), future work could look at more real-world intervention sessions to see whether results of the current study hold across contexts. However, as a representative SSD intervention session video was chosen based on several parameters and consistency of BCT types across manuals of all three SSD intervention, there is no reason to expect differences.

This also accounts for the frequency of BCT types. The three BCT types 6.1. *Demonstration of the behaviour*, 8.1. *Behavioural practice/rehearsal* and 10.4. *Social reward* were found to be used more often than all other BCTs. Two of these BCTs (6.1. *Demonstration of the behaviour* and 8.1. *Behavioural practice/rehearsal*) show an overlap with the results of BCTs which were identified in all three SSD interventions. This also indicates that these techniques are important in SSD intervention. Overall, the use of BCTs in terms of their frequency also seems to depend on components such as therapy/session structure, content of an intervention, and/or progress of the child — and can therefore vary for SSD intervention sessions. However, results in terms of which BCT types have been identified in all three SSD interventions and used the most in the assessment video indicate that the techniques 6.1. *Demonstration of the behaviour* and 8.1. *Behavioural practice/rehearsal* are especially essential active components in terms of techniques used in SSD interventions to change behaviour in children.

The findings of Stage 1 have shown that the BCTTv1 can be used to identify BCTs in SSD interventions reliably and reasonably to describe techniques of interventions coherently and consistently. The next step is to establish whether SLTs and SLT students can be trained to recognise and understand the identified BCTs as a pathway to describing their own practice more consistently, as well as implementing these BCTs more consistently.

Chapter 3: Behaviour Change Technique (BCT) Training for Speech and Language Therapy (SLT) Students and Speech and Language Therapists (SLTs) (Stage 2)

This chapter covers the development and implementation of the Behaviour Change Technique (BCT) training workshop to explore the feasibility of developing a BCT training for Speech and Language Therapists (SLTs) and Speech and Language Therapy (SLT) students in relation to SSD interventions for children. This is done by investigating whether SLTs and SLT students are able to identify BCTs accurately after completing the BCT training. Teaching SLTs and SLT students the framework of BCTs might help them to describe techniques used in intervention approaches clearly and explicitly. In addition, it could support their concise and consistent implementation of interventions as well as their reflection on their practices.

The SSD BCT list developed by identifying BCTs in SSD intervention literature has been used as foundation for the BCT training in Stage 2 (section 3.2). Thus, workshop participants were introduced to the 17 BCTs and were trained to identify these BCT types in a real-world intervention video. This ability was tested through coding the assessment video at the end of the BCT training and to investigate whether it is possible to learn how to identify BCTs accurately (see Chapter 3). In the BCT training, training videos and the assessment video have been included (section 3.2.2).

3.1 Introduction

The usefulness of the Behaviour Change Technique Taxonomy version 1 (BCTTv1) (Michie et al., 2013b) for professions such as physiotherapy, occupational therapy and SLT has been widely confirmed in the literature and among allied health professionals (AHPs) (Dornstauder, 2020; Govender et al., 2015; Kolehmainen et al., 2012; Law et al., 2021; Michie, Atkins, et al., 2014; Rees et al., 2016; Richardson et al., 2019; Stringer & Toft, 2016b, 2016a). As previously outlined (section 1.4), the use of the BCTTv1 supports research, clinical practice and teaching in several ways to improve the implementation of complex interventions for clients/children. This review focuses on the clinical training of SLT students (and the requirements to graduate from SLT studies and work as SLTs in Austria) to then show how SLT students can benefit from training in the use of the BCTTv1. Furthermore, previous BCT training conducted with AHPs are outlined to give an insight into up-to-date results of BCT training and stress additional benefits from a BCT training for SLT students.

3.1.1 Clinical Training of SLT Students in Austria

The clinical training and education of student SLTs is regulated in the "Training Constitution by the Austrian Constitution of the Federal Minister for Health and Women's Affairs on Universities of Applied Sciences' baccalaureate degree programmes for training in the higher medical-technical services" ("*Verordnung der Bundesministerin für Gesundheit und Frauen über Fachhochschul-Bakkalaureatsstudiengänge für die Ausbildung in den gehobenen medizinisch-technischen Diensten*") (Bundesministerium für Gesundheit und Frauen, 2016). Overall, the main focus of the constitution lies in bridging theoretical knowledge and clinical, practical competences. Thus, the constitution includes the condition, that "Training shall be organised in such a way that the teaching of theoretical training content is coordinated, interlinked and interrelated with the teaching of practical skills and abilities." Consequently, a list of ten conditions is included in the federal law which all stress that the framework of the theoretical training needs to be linked to practical knowledge and skills. Furthermore, these technical skills should be taught, practised, reflected on and implemented in clinical practice, such as internship placements, and always be patient-centred and oriented. Overall, the practical training and clinical placements need to comprise at least 25% (which means at least 45 Points of the European Credit Transfer and Accumulation System (ECTS)) of the entire studies which, in Austria, last for three years. Student SLTs then graduate with a Bachelor's Degree.

The constitution, therefore, highlights the need for integrating practical competences within the training of student SLTs. Therefore, student SLTs need to develop clinical skills in order to graduate from the Bachelor's programme, which they develop and acquire in different internship placements such as hospitals, clinics or practices. As previously discussed (section 1.4.2), Denman et al. (2021) report that students learn techniques used for clinical training through different sources such as education at universities, discussions with peers and colleagues at placements and/or textbooks and research literature. All of these sources seem to use a varying terminology and vocabulary even when speaking of the same condition, difficulty of a patient and/or treatment method, strategy, technique and/or intervention for a patient (Cowie et al., 2001; Dornstauder, 2020; Rees et al., 2016). There is a lack of precise and consistent terminology not only for disorders in SLT, but also for the techniques, strategies and methods used to bring about behaviour change in patients/children (Law et al., 2008; Roulstone, 2015; Stringer & Toft, 2016a). Rees and colleagues (2016) also state that the lack of uniform terminology is one of the reasons that student SLTs are struggling to describe sufficiently explicitly techniques used in therapy sessions. Additionally, Horton et al. (2004) also report that SLT students — although completing the entire training, studies and classes — still show remarkable uncertainty in their clinical competence. They state that students feel as if ‘they are never actually taught how to ‘do therapy’’’ (Horton et al., 2004, p. 366). A project reported by Horton et al. (2004) — namely. “Developing Educational Resource Materials for Therapists: Enhancing Learning about Theory Intervention” which was supported by the Health Foundation (Ref. 4103/971) — reports student feedback on teaching resources such as “you get taught so much theory but nobody ever teaches you how to do the therapy” (Horton et al., 2004, p. 367).

Using the BCTTv1 (Michie et al., 2013b) in student SLTs clinical training and education would be a next logical step to offer a stringent and coherent terminology for describing techniques used in therapy sessions to bring about behaviour change for patients/children. In addition, as previously outlined, there are a number of great benefits for research and clinical practice, and lastly for the effective treatment provision of (our) patients and children with speech and language difficulties.

3.1.2 BCT Training for Allied Health Professionals

BCT training for AHPs can, on the one hand, comprise the area of supporting AHPs themselves to implement behaviour change in their daily work routine or, on the other hand, target the behaviour change interventions AHPs implement with patients/children. Thus, the first approach aims at supporting the competencies of AHPs in using BCTs in their professional daily routine to change how they integrate the concept of evidence-based practice (EBP) (Kolehmainen et al., 2012; Michie, Atkins, et al., 2014; Pearson et al., 2018), have healthy conversations with relatives of patients (Bright et al., 2021) or use e-health devices in their intervention delivery (Virtanen et al., 2021). However, these training objectives target more the therapists’ use of BCTs to support him/her/themselves rather than directly aiming at changing behaviour in patients. Therefore, the second type of BCT training focuses on the ability of AHPs to identify and detect active ingredients in complex interventions, which they deliver directly to patient. As outlined previously (section 1.2.2), in the context of SSD interventions, the SLT’s role is to deliver an intervention to children with SSD. Therefore, a key part of the SLT’s role is being an agent of change or delivery agent rather than a recipient of change (Law, 2019; Law et al., 2017), which is why this project focuses on the application of BCTs in SSD interventions delivered by SLTs. Thus, the literature on BCT training introduced here focuses on BCT training addressing interventions delivered by AHPs to patients (e.g., SLTs delivering intervention directly to children with SSD to enhance behaviour change in these children) (Dornstauder, 2020; Law, 2019).

Even though the BCTTv1 (Michie et al., 2013b) is considered as comprehensive and sound taxonomy, offering a common terminology to precisely identify, detect and report active ingredients of complex interventions (Wood et al., 2016), the mere fact of the BCTTv1's availability does not ensure that it is used accurately. Studies have shown that one needs to be trained in how to apply the BCTTv1 to be able to use it reliably, validly and confidently (Wood et al., 2015). Therefore, after the development of the BCTTv1 from 2010-2013 (Michie et al., 2013b), a cross-disciplinary training program was developed and evaluated (Wood et al., 2015). It aimed at enabling researchers, academics and practitioners to apply the BCTTv1 accurately by being trained in how to identify, detect and use BCTs of current interventions. Overall, the BCT training has been shown to support participants in learning how to code BCTs and how to use the BCTTv1 (Michie et al., 2013b; Wood et al., 2015). As findings of Stage 1 showed, a limited set of BCT types is relevant for SSD interventions. Thus, a more general training might not be useful for all SLTs, as it would include BCTs not relevant to certain therapy approaches. A SLT-specific approach, including BCTs relevant to the profession, would enable participants to focus on the BCT types occurring in SLT interventions. BCT types of SLT interventions may vary across SLT areas (e.g., SSD interventions compared to dysphagia interventions), which also shows the importance of identifying BCT types across different areas of SLT (Toft & Stringer, 2017).

The study by Wood et al. (2015) specifically evaluated the effectiveness of the BCT training programme by looking at whether participants improved their ability to apply the BCTTv1 and code BCTs in intervention descriptions reliably and accurately (Wood et al., 2015). They reported that two training formats had been used — a one-day workshop (participants N=109), and group tutorials held in four online sessions (participants N=52). In total, 161 participants took part in this study. Unfortunately, the exact professions of the participants are not mentioned in the study. Wood et al. (2015) only say that practitioners, students and/or academics interested "in investigating, reviewing, designing or delivering behavioural interventions (…)" (Wood et al., 2015, p.136) without any previous knowledge or experience could participate in the one-day workshop group. In contrast, participants in the distance-group online tutorial were recruited only if they had some previous experience with behaviour change interventions (Wood et al., 2015). This was justified by the different format of delivery (four 1-hour sessions over an average period of 6 weeks) and the completion of an additional, subsequent study task compared to the face-to-face workshop group. For the completion of the additional task, participants received a financial incentive (a honorarium of £506) (Wood et al., 2015). Overall, the professions were documented using the categories "practitioner" (N=12), "student" (N=57) and "academic" (N=40), rather than by exact professional titles.

However, the objective of the study was to compare whether face-to-face workshops and online group tutorials help to describe behaviour change interventions reliably by using BCTs. This was assessed by: (1) the inter-coder agreement about certain BCTs, the agreement on certain BCTs with BCT experts, and confidence in identifying BCTs; (2) asking participants whether the BCT training had been a useful experience for them; and (3) investigating participants' competence in agreeing on the presence of a BCT with expert consensus (acceptable standard has been set by a PABAK score of .60 and above, Wood et al., 2015, p.142).

Addressing the methods used, the researchers reported that they had assessed coding competence of both groups at the beginning and the end of the workshop using coding assessment tasks. Overall, materials used for both groups overlapped (e.g., previous taxonomies to explain how the BCTTv1 was developed, well-structured learning principles and objectives (Wood et al., 2015, p.140), except for one detail: The face-to-face one-day workshop group were introduced to 24 frequently identified BCTs from the BCTTv1, whereas the distance-group training comprised 44 BCTs from the BCTTv1, i.e. the same 24 as the face-to-face group and 20 additional BCTs to comprise a wider range (Wood et al., 2015). Even though 24 and 44 BCTs were introduced to the two participant groups, the coding assessment included only 12 BCTs for the workshop group and 17 BCTs for the online tutorial group. Results indicated that both BCT training types significantly improved their agreement on BCTs present in interventions between participants and BCT experts ($p<.05$) and the coding confidence of assessed BCTs ($p<.05$). However, intercoder agreement post BCT training did not increase for any of the groups. Nevertheless, participants evaluated the training as positive and reported that "the combination of practical tasks and the opportunity for structured discussion during the training was particularly useful" (Wood et al. , 2015, p.145). In addition, the BCT training supported practitioners, students and academics to understand when and why certain BCTs had been coded in specific contextual situations (Wood et al., 2015).

A second article by Wood et al. (2016) includes three experiments, conducted in the United Kingdom, which investigated whether the BCTTv1 (Michie et al., 2013b) and the training in its use (compared with no training) improved the quality of behaviour change intervention descriptions in terms of clarity and replicability (Wood et al., 2015). Three different participant groups were needed for different parts of the investigation: (1) 'writers', who watched a video of a behaviour change intervention and then had to describe the active components of the intervention using or not using the BCTTv1 (dependent on the group participants were allocated to); (2) 'raters', who were unfamiliar with the BCTTv1 and rated the intervention descriptions of the writers; and (3) ‘coders’, who were familiar and reliable users of the BCTTv1 and coded the intervention descriptions of the writers. The ‘writers’ group included practitioners, researchers and research students who were all healthcare professionals. Writers had to watch a video of a behaviour change intervention and then describe the active components of the intervention coherently. They were randomly assigned to two groups — one received the BCTTv1 to describe the intervention and the other group did not. However, no participants of the writers group received BCT training before describing the behaviour change intervention for the experiment. Raters were also healthcare professionals and trainees not familiar with the BCTTv1 and needed to rate the description from the two writer groups in terms of its clarity by using a four-point scale provided by the researchers. Coders had to be experts in the use of the BCTTv1, as they coded the intervention descriptions produced by writers. All three experiments from Wood et al. (2016) had a different number of participants for each of the three categories and a slightly different procedure.

Experiment 1 used a between groups design and compared the two ‘writers’ groups (describing an intervention by using the BCTTv1 or not using the BCTTv1). This experiment revealed that the quality of intervention descriptions did not improve when using the BCTTv1 compared to not using the BCTTv1. However, neither group — regardless of whether the BCTTv1 had been used or not — had received any training in how to use the BCTTv1 before the writing task of the experiment. Thus, results may also indicate that BCT training is essential to use the BCTTv1 effectively and describe behaviour change interventions reliably.

Experiment 2 also used a between groups design. Writers had to complete the behaviour change intervention description task before and after receiving BCT training. Both descriptions were then rated and coded (by raters and coders) and results compared. Results of Experiment 2 showed that participants’ behaviour change intervention descriptions improved after the BCT training which indicates that BCT training supports describing active components of behaviour change intervention more clearly and coherently.

Experiment 3 used a before-after within groups design by having two groups — one completing the writing task with the BCTTv1 and one without the BCTTv1. At the time both groups completed the first writing task, neither group had received BCT training. However, after the first writing task, both groups received BCT training and completed the writing task again. This time both groups were using the BCTTv1. In contrast to results of Experiment 2, coding agreement between the experts and participants was no higher for the behaviour change intervention descriptions by writers after the BCT training.

Overall, results of the three experiments were mixed as some results indicated that training in use of the BCTTv1 supports reporting behaviour change intervention more clearly whereas other results did not clearly replicate this (Wood et al., 2016). Wood et al. (2016) claim that these results are unexpected and difficult to explain, as the BCTTv1 (Michie et al., 2013b) seemed to have a positive impact in Experiment 2 but results of Experiment 3 did not show a significant difference between participants that used the BCTTv1 and those that did not. This could have been due to a variety of reasons — such as time-constraints, exhaustion of workshop participants due to the workshop's duration, or the content of the workshop (Wood et al., 2016). The diverse group of participants of the writers group (which comprised practitioners, researchers and research students) included in this experiment has not been mentioned as a factor for the different results of the three studies, even though the different levels of experience with behaviour change intervention surely influenced participants' ability to describe behaviour change intervention coherently. Each group of participants in the writers group seems to have had different levels of experience with behaviour change intervention. Practitioners may implement behaviour change interventions more than they describe them, whereas researchers may read more about behaviour change interventions rather than delivering them. Research students may currently learn what behaviour change interventions are and which components are included rather than implementing them. Thus, the level of experience and background from participants seems to play a crucial role in the outcome of the BCT training.

Bearing in mind results from Wood et al. (2016), SLTs participating in the current study needed to have a similar level of delivering SSD interventions, which are behaviour change interventions. In addition, participants in the SLT student group also needed a similar level of experience in delivering SSD interventions, so that results within groups could be compared more reliably. However, in terms of BCT training coding results, the fact that SLTs have more experience in delivering SSD interventions compared to SLT students', needs to be considered when comparing results among the two groups (SLTs and SLT students). As seen by Wood et al. (2016), experience with delivering behaviour change interventions may impact BCTTv1 training results

Based on the training results of available studies (Michie et al., 2013b; Wood et al., 2015), open-access, online BCTTv1 training was developed (Michie et al., 2013a) for people from research and practice interested in completing BCT training to then use this knowledge to identify, specify, evaluate, implement or design complex interventions to change behaviours. However, this online training has been criticised in the literature. Matthews et al. (2020) designed BCT training for sport and exercise science students, including tasks with and from the online BCT training (Michie et al., 2013a) as well as their own developed tasks. Students' satisfaction with the BCT training workshop was measured at the end. Results showed that participants were very satisfied with training tasks developed by Matthews et al. (2020), whereas they expressed dissatisfaction with the online BCT training, criticising its functionality and a lack of direct relevance to their particular professional field and future use of the BCTTv1.

In addition, students' skills in using BCTs had not increased after completing the BCT training, including all tasks (the online training and the specifically developed tasks) (Matthews et al., 2020). This was assessed by means of a short intervention description in which students had to identify six possible BCTs presented in a list. However, students' confidence and knowledge on behaviour change components did increase, as assessed by using a narrative case study. A main difference between online training and BCT training workshops was the way they were administered. In contrast to the online training, which can be completed anytime individually without an instructor, training workshops have individual instructors who interact with participants and can answer questions related to the topic directly.

However, results of BCT training workshops administered by instructors have also shown that many components — such as time and content — need to be considered carefully to meet the needs of participants and are pivotal for participants' learning outcomes (Matthews et al., 2020; Wood et al., 2016). For example, Matthews et al. (2020) concluded that, besides the difficulty of the BCT online training, the workshop duration/time seemed to be too short for students to have an impact on their use of behaviour change. They stress the need to embed "(…) behaviour change training into the allied health professional curriculum to ensure graduates are job ready with the knowledge, confidence and skills to support health related behaviour change within the wider health system" (Matthews et al., 2020, p.1). As reported above, results by Wood et al. (2016) also indicate that simple training on the BCTTv1 followed by an immediate task to e.g., use the BCTTv1 (Michie et al., 2013b) in behaviour change intervention descriptions might not be ideal, as experience with the taxonomy is still missing. In addition, having sufficient time and suitable workshop content are also pivotal for the success of BCT training (Wood et al., 2016).

As BCTs have the potential to describe very precisely the techniques used in complex interventions (section 1.2.4), it is suggested that a BCT training workshop on the BCTTv1 can support SLTs and student SLTs in understanding, identifying and applying BCTs to interventions (Rees et al., 2016). Studies conducted to evaluate the impact of BCT training to improve coding accuracy of participants (Michie et al., 2013b) or behaviour change intervention descriptions (Wood et al., 2015, 2016) have shown that training can be supportive. Skills in identifying BCTs have mostly been improved after BCT training (Michie et al., 2013b; Wood et al., 2015), whereas in one case study writing intervention descriptions with or without the BCTTv1 did not show a difference (Wood et al., 2016). Thus, BCT training for students and professionals such as SLTs delivering complex interventions is a key step towards identifying the active ingredients of complex interventions and to develop awareness of intervention components bringing about change in an intervention. Previous studies have also indicated that it is not enough simply to use the BCTTv1 but, rather, it is essential to complete training and gain some experience with it to use it accurately (Wood et al., 2016). Furthermore, both in-person and online delivery types of BCT training have been shown to be effective (Wood et al., 2015). Nevertheless, having an instructor "live" seems to be quite important according to the results from Matthews and colleagues (2020). This study also showed that it is important to make the BCT workshop content discipline-specific rather than using a more general BCT training such as the UCL online training. Thus, these results were considered for the current study. The next section introduces the clinical training of student SLTs in Austria linked to the BCTTv1 to show the benefits of BCTs for acquiring the clinical competencies required of SLTs.

3.1.3 Research Objectives Stage 2

Previous BCT trainings have included students, practitioners and academics interested in or working with behaviour change interventions (e.g., Wood et al., 2016) or for students of other AHPs (e.g., Matthews et al., 2020). A specific BCT training for student SLTs has not yet been developed. Overall, previous BCT training studies indicate that participants improve their knowledge of BCTs after completing training (e.g., Matthews et al., 2020). In addition, most studies investigating the coding skills of participants after completing BCT training also reveal that participants' coding accuracy improves (e.g., Michie et al., 2013; Wood et al., 2015). However, researchers also stress that the content and delivery of the BCT training seems to impact the extent to which participants' ability to code behaviour change intervention using the BCTTv1 improves (Matthews et al., 2020; Wood et al., 2016). To see whether a BCT training workshop enables SLTs and student SLTs to code BCTs in SSD interventions accurately, a BCT training for SLTs and SLT students aimed specifically at applying the BCTTv1 (Michie et al., 2013b) to SSD intervention for children was developed and delivered.

The BCTTv1 can help to identify active ingredients in SSD interventions if coding of BCTs in SSD interventions can be done accurately. This study, therefore, aims to develop a comprehensive training package that has a positive effect on the BCT coding abilities of participants. Furthermore, if coding accuracy rates of participants are reported to be high after completing a BCT training workshop, the BCTTv1 can be applied to test the effectiveness of active ingredients in SSD interventions. Therefore, before conducting any further research, the identification of BCTs in SSD interventions from SLTs and SLT students after completing a BCT workshop was investigated. Previously, Stage 1 targeted identifying BCTs in SSD interventions manuals, descriptions and studies (Chapter 2). In the current Stage 2, a BCT training workshop for SLTs and SLT students was developed, using the identified BCTs from the BCTTv1 which were present in the SSD intervention manuals/studies and a representative real-world SSD video. In addition, participants' perceptions of the BCTTv1 and its use and applicability for SSD interventions have also been examined. The following research questions were investigated in Stage 2:

RQ 2. *Can SLTs and SLT students be trained to identify BCTs in SSD interventions and are there any differences between the BCT coding accuracy of SLTs and SLT students?*

It is hypothesised that SLTs and SLT students are able to identify and code BCTs accurately and that the training results in a positive impact on coding accuracy, likewise as shown by the BCT training by Wood et al. (2015) that BCT training has a positive impact on participants' competence in using the BCTTv1. As discussed for the BCT training results of Wood et al. (2015), a group difference in coding accuracy between SLTs and SLT students is to be expected due to the different levels of expertise and experience. It is suggested that SLTs have greater clinical experience and practical knowledge compared to SLT students and therefore may code BCTs more accurately than SLT students.

RQ 3. *Do SLTs and SLT students think that the application of BCTs in SSD interventions with children is useful, and if so why, and do they think that the BCT training workshop should be included in the training curriculum of students?*

It is hypothesised that the application of BCTs in SSD interventions is seen as useful for naming and labelling explicitly what is being done in SSD interventions and which techniques are used by the therapist, as mentioned for other complex interventions (e.g., Beresford et al., 2018; Wood et al., 2016). However, it is expected that SLT students and SLTs think that some BCT types are more useful than others for SSD interventions with children. It is also hypothesised that SLTs and

SLT students will consider the BCT training workshop as helpful and hold the view that teaching BCTs should be included in the SLT training to help students to understand and label what is being done in SSD interventions. This hypothesis is supported by the results of Matthews et al. (2020), which showed that students found BCTs very useful for behaviour change interventions, as well as by results of Wood et al. (2015), which showed that participants found the BCT training helpful for the use of the BCTTv1.

3.2 Methods

This section focuses on the methods of a BCT training workshop for SLTs and SLT students. The previous Stage 1 determined the presence of BCTs within SSD intervention literature and a real-world videotaped SSD session (referred to as 'assessment video'). Seventeen BCTs from the BCTTv1 (Michie et al., 2013b) were found in SSD intervention literature and 14 of these 17 BCTs (BCT SSD list) were found in the assessment video (section 2.3). In the current Stage 2, a BCT training workshop using the BCTTv1 for SLTs and SLT students was developed to answer **RQ 2.** *Can SLTs and SLT students be trained to identify BCTs in SSD interventions and are there any differences between the BCT coding accuracy of SLTs and SLT students?* Participants were trained to identify and code the 17 BCTs from the BCTTv1 during a series of training videos used in the workshop. At the end of this BCT training workshop, the coding accuracy of SLTs and SLT students was tested by using the assessment video. In addition, participants completed a survey on whether they thought that the BCT training workshop was helpful and whether BCTs are useful for SSD intervention to answer **RQ 3.** *Do SLTs and SLT students think that the application of BCTs in SSD interventions with children is useful, and if so why, and do they think that the BCT training workshop should be included in the training curriculum of students?* Hence, the outcome and benefits of this training in terms of both coding accuracy and subjective measures were determined. This chapter provides detail on the development, materials, participants, procedure and data preparation of the BCT training workshop. This stage aims to address **RQ 2** and **RQ 3** (section 3.1.3). The following sections give an overview of the rationale for using specific methods of the overall study design and describe the BCT training workshops' development, materials, participants, procedure and data preparation.

3.2.1 Overall Study Design

According to the six major mixed methods design types by Creswell and Plano Clark (2011), this study employs an embedded mixed-method study design, as both quantitative and qualitative data is collected and analysed traditionally to answer the stated research questions (Creswell & Plano Clark, 2011). First, a quantitative approach was used to collect data on whether BCT workshop participants can be trained to identify BCTs in SSD interventions (**RQ 2**). Secondly, a qualitative approach was used by conducting a survey to investigate whether participants thought that the BCT training workshop had been helpful for them, and whether they think that BCTs are useful for SSD intervention (**RQ 3**). Thus, **RQ 2** has been answered by using a quantitative approach and **RQ 3** by using a qualitative approach.

Ethical approval is also relevant for Stage 2 and Stage 3, and was obtained by Newcastle University (section 2.2.1; Ref. 18360/2019; updated Ref. 18225/2021). The Vienna Ethics Committee was consulted and indicated that no approval was required (Appendix D). Participating children and parents had to give their consent (Appendix G and Appendix H). In the context of research methods, workshops which are specifically developed to investigate and/or acquire new knowledge are a suitable format for collecting data addressing stated research questions (Ørngreen & Levinsen, 2017). Hence, as Stage 2 of this study aims, amongst other questions, to answer whether students and SLTs are able to identify BCTs of the BCTTv1 (Michie et al., 2013b) in SSD video sequences, a workshop was an appropriate format for teaching the BCTTv1. Participants received intensive training (section 3.2.2.1) in the coding process whilst using presentations, assessments, frameworks and tasks in a supportive and innovative environment (Wood et al., 2015). In the light of the Covid-19 pandemic, workshops were all held online using Zoom and provided the additional benefit of being a feasible, practical and acceptable way of carrying out a research project and adhering to necessary restrictions (e.g., social distancing) during these times. In general, online workshops are seen to be more cost and time effective compared to face-to-face tutorials and have been successfully used in BCTTv1 coder training (Wood et al., 2015). Therefore, the rationale for choosing a workshop as research method for this research stage was driven by methodological factors (e.g., suitable for answering the stated questions), and by decisions on feasibility.

3.2.2 BCT Training Workshop for SLT Students and SLTs

The following sections describe five important stages for the BCT training workshop for SLTs and SLT students: First, the development of the workshop is described. Second, workshop materials which were developed and used within the training are presented. Third, the participants, comprising SLTs and SLT students, are introduced. Fourth, the procedure of the BCT training workshop is described. The BCT training workshop for SLT students and SLTs differed in some minimal aspects, which are also explained in a section of the procedure (section 3.2.2.4.3). Fifth, an overview of data preparation is given. To provide an overview of the chronological procedure of the BCT training workshop for SLTs and SLT students, including material developed and used for the BCT training, a flowchart is presented in Figure 9. Differences between the BCT training workshop for SLT students and the one for SLTs were present due to time constraints of the SLT group. The differences are highlighted in grey in the flowchart and described in the section procedure (section 3.3.3.4.3). The main difference between the SLT student and SLT workshop was the duration, as the students' workshop lasted 24 hours over four days, whereas the SLT workshop lasted 12 hours over two days.

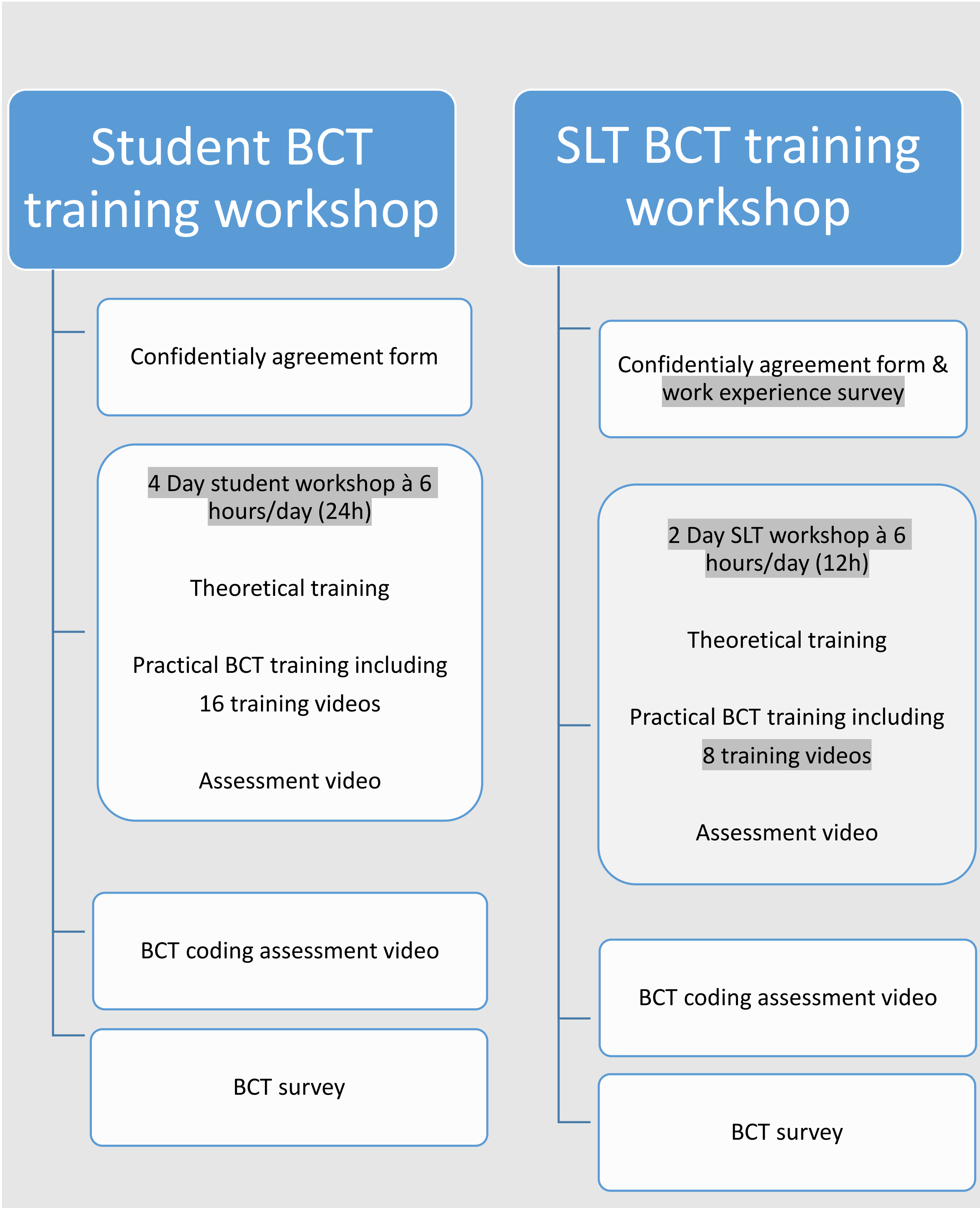


Figure 9: Flowchart overview of materials used in the BCT training for SLT students and SLTs in chronological order

The first section gives detail on the development of the BCT training workshop. The BCT training workshop of Stage 2 aimed to answer the main research question — whether SLTs and SLT students can be trained to identify BCTs in SSD interventions. The BCT survey used in Stage 2 (section 3.2.2.3.2) investigates whether SLTs and SLT students think that the BCT training workshop is helpful for practitioners and SLT students, and whether BCTs are useful for SSD intervention. Thus, the following sections explain the development, materials, participants, procedure and data preparation of the BCT training workshop.

3.2.2.1 Workshop Development

The preparation for the BCT training workshop started in October 2019, when MD completed the BCT Taxonomy online training by the UCL (Michie et al., 2013a) (see certificate Appendix L). In addition, information on previous BCT training workshops in the field of allied health sciences (Wood et al., 2015, 2016) had been collected. Also, research on BCTs in the context of health professionals, especially in the context of SLTs, has been investigated to include current knowledge from the literature as well as previous studies (Rees et al., 2016; Stringer & Toft, 2016b, 2016a; Toft & Stringer, 2017). As the BCTTv1 (Michie et al., 2013b) has been used widely in the public health context (Michie, Atkins, et al., 2014), the investigation of BCTs and their use in SLT goes back to Atkinson and Stringer (2016), Spalding and Stringer (2016) and Stringer and Toft (2016a) but has not yet been investigated in detail (Barnett, 2022). Hence, investigating whether SLTs and SLT students can learn to identify BCTs from SSD interventions is a new and innovative undertaking. Thus, the first objective of the workshop was teaching the origin and theoretical background of BCTs. Second, the 17 BCTs from the BCTTv1 identified in SSD literature and the assessment video in Stage 1 were taught in terms of coding rules (section 2.2.2.1), definitions, and examples. The BCT training workshop aimed at teaching participants how to identify and code accurately BCTs within SSD intervention videos. To achieve this, the following programmes were used in the online workshop:

- Zoom (software program for video conferencing) to hold the online workshop with students and SLTs
- Microsoft PowerPoint for presenting the theoretical BCTTv1 background
- a learning and teaching tool called Video Enhanced Observation (VEO) for recording and showing the training videos tagged with BCTs
- Kahoot, a game-based learning platform (for students only due to time issues)
- Microsoft Excel for the BCT coding of training videos and the assessment videos

Like the study reported earlier (section 1.4) by Wood et al. (2016), the BCT training workshop comprised three main components (Figure 10). The three components in the BCT training workshop of Stage 2 were:

- a theoretical BCT training, which comprises the SSD BCT list developed in Stage 1 (section 2.4.4)
- a practical BCT training using written SSD intervention excerpts for the student group only, and 18 training videos developed in Stage 1 (section 2.2.3) for both groups
- the assessment video (section 2.2.3) to test participants' BCT coding accuracy after completing the BCT training workshop.

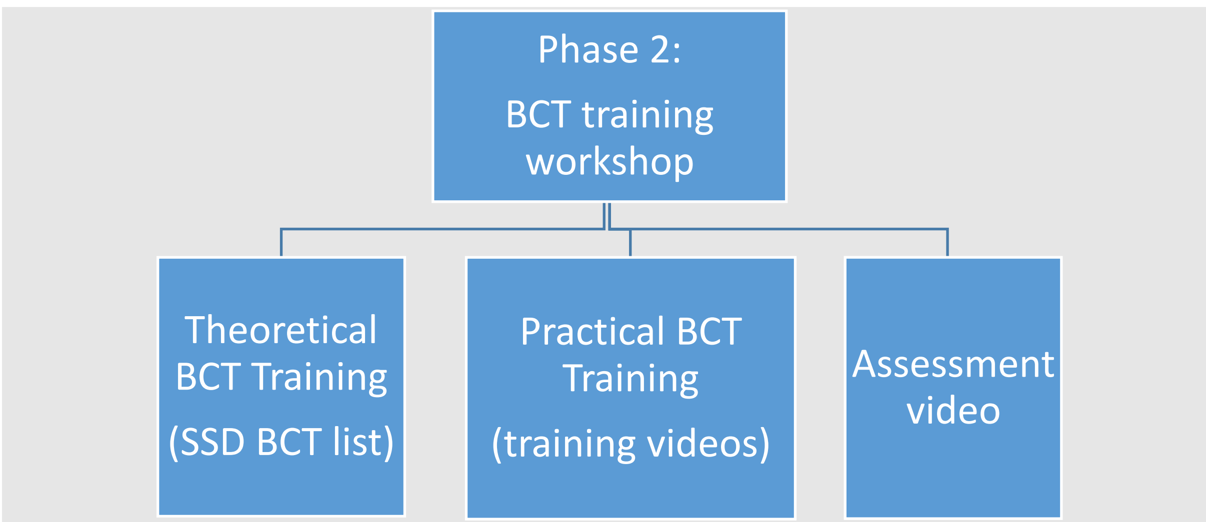


Figure 10: Overview of developed BCT training materials used in the BCT training workshop in Stage 2

The next sections (sections 3.2.2.2.1, 3.2.2.1.2 and 3.2.2.1.3) give a description of the developed training components and their contents, and explain the rationale for using them.

3.2.2.1.1 Theoretical BCT Training

The theoretical training of the BCT workshop included the background of the BCTTv1 (Michie et al., 2013b), and the relevance of the link from the BCTTv1 to SLT and SSD. The main part of the theoretical training comprised the 17 SSD BCTs which were identified in Stage 1 (section 2.4.4). First, the original BCTTv1 was used to talk through the 17 BCTs found in SSD intervention literature and videos. Second, a separate SSD BCT list documenting the same 17 BCTs was developed specifically for the workshop and included BCT definitions and examples for SSD interventions. The development of all components included in the theoretical training is outlined in this section.

The theoretical part of the BCT training workshop started with an introduction to BCTs and the BCTTv1 and why this taxonomy was developed. Examples from the use of BCTs in health psychology and public health were given, with links to recent examples such as the Covid-19 pandemic, during which BCTs were used to reduce the SARS-CoV-2-transmission (West et al., 2020). Participants engaged with the 93 BCTs in the BCTTv1 to get a sense of the taxonomy.

The link between the BCTTv1 and SLT was introduced using research by, amongst others, Stringer and Toft (2016b, 2016a), who outline how the BCTTv1 may be beneficial and useful for SLT. An insight into the three SSD interventions — Minimal Pair (Weiner, 1981), Metaphon (Jahn, 2000, 2007) and P.O.P.T. (Fox-Boyer, 2014b) — which were coded in Stage 1 (section 2.1.1) was given. Finally, the SSD BCT list (section 2.4.4) was introduced to participants. This comprised the original BCTTv1 definition and examples, as well as definitions and examples developed specifically for SSD intervention situations, which are introduced in Table 10 below.

As mentioned previously, Stage 1 of this study focused on identifying the most commonly used BCTs in SSD intervention literature and a real-world SSD session video. This was done in order to only use BCTs which occur in SSD interventions and to reduce the number to a manageable and relevant amount of BCTs for the BCT training workshop. As results of Stage 1 (section 2.3.3) have shown, 17 BCTs were identified from three evidence-based SSD interventions and the assessment video. In the workshop, these 17 BCTs were explained in detail in terms of their definition and the contexts in which they may occur in general public health and, specifically, in SSD interventions. The BCTTv1 includes a list which reports examples of BCTs in a rather broad public health context. To ensure that workshop participants understood each BCT in detail and in the context of SSD intervention, an additional example list for using these BCTs in the SSD context was developed.

The developed SSD BCT example list was discussed alongside two other BCT-experienced SLTs (MD + SB and DH). MD produced the examples for each of the 17 BCTs and then had separate online meetings with each of the two other SLTs in December 2020 to discuss the examples and their definitions, and to see whether they agreed or did not agree. The SSD BCT example list received a percentage agreement of 96%. DH, a very experienced SLT and lecturer of SLT at the University of Applied Sciences in Vienna (DH; SLT for 36 years and SLT lecturer for 26 years;

also participated in the assessment video coding task) agreed with MD on all definitions and SSD interventions examples for the individual BCTs, whereas SB (at the time a PhD candidate of Newcastle University) and MD could not agree completely on the meaning of BCT 12.5. *Adding objects to the environment*. It is not completely clear how this BCT directly applies to SLT sessions as the description in the BCTTv1 is "a*dd objects to the environment in order to facilitate performance of behaviour*" (Michie et al., 2013a). In the context of SSD intervention, MD felt the description could apply to using a mirror or eating confetti for facilitating a new behaviour (e.g., the resting position of the tongue), with an object being added to the therapy environment to facilitate the performance of a new behaviour. In contrast, SB felt that the environment should be "outside of the therapy session" — for example, the home environment — and not the environment in a therapy session. Therefore, despite discussing this BCT, it was still not 100% clear on how this BCT could be used within SLT sessions and there remained no agreement between MD and SB on this BCT.

As MD has identified some objects to facilitate new behaviours in the SSD therapy manuals in Stage 1 (e.g., a mirror) as 12.5. *Adding objects to the environment*, the understanding/interpretation of the BCT definition that objects such as a mirror can be added to the SLT session has been used in this study, although it was still not clear to MD and SB whether the "environment" includes the SLT sessions or only the home environment. It was agreed that usual therapy material is not automatically 12.5. *Adding objects to the environment*, except if it is used to facilitate a new behaviour. Therefore, this BCT did not get a positive intercoder agreement and is the reason there was 96% agreement (rather than 100%) for the list of 17 BCTs. Table 10 shows the label of the BCT, the group the specific BCT belongs to along with the developed SSD definition and the new defined and agreed examples for SSD intervention. The original BCTTv1 including definitions of all BCTs can be found online (Michie et al., 2013a).

Table 10: SSD BCT example list

#	Label from BCTTv1	SSD Definition	SSD Example
1.	**Goals and planning**		
1.1.	**Goal setting (behaviour)**	Set or agree on a goal defined in terms of the behaviour to be achieved	*"We try to **say** the /s/ **correctly** for each word (on the card), with our tongue behind our teeth. You can take a token for **each sound**. When you've got five tokens, we are done."* *"Let's try to realize the sound /f/ correctly for eight times during the game/exercise/task!"*
1.3.	**Goal setting (outcome)**	Set or agree on a goal defined in terms of a positive outcome of wanted behaviour	*"You can take a token for each **correctly realized** /s/ sound."*
1.4.	**Action planning**	Prompt detailed planning of performance **(actions/tasks/exercises in the therapy session)** of the behaviour (must include at least one of context, frequency, duration and intensity). Context may be environmental (physical or social) or internal (physical, emotional or cognitive) (includes 'Implementation Intentions')	*"We try to say the /s/ correctly for each word (on the card), with our tongue behind our teeth. You can take a token for each sound. **When you've got five tokens, we are done.**"* *"Whenever we've got 5 stamps with a sunflower on it, we are done for today!"*
1.6.	**Discrepancy between current behaviour and goal**	Draw attention to discrepancies **between a person's current behaviour** (in terms of the form, frequency, duration, or intensity of that behaviour) and the **person's previously set outcome goals**, **behavioural goals or action plans** (goes beyond self-monitoring of behaviour)	*"Is it **utterfly** or **butterfly**?" (if e.g., a child just said utterfly instead of butterfly)*
2.	**Feedback and monitoring**		

2.2.	**Feedback on Behaviour**	Monitor and provide **informative or evaluative feedback on performance** of the behaviour (e.g., form, frequency, duration, intensity) (**Give feedback addressing the behaviour** of the child including at least one of the information from above)	*"I've seen that you didn't put your teeth on your lips."* *"Great - you've realized the /sch/ sound correctly!"*
2.6.	**Biofeedback**	**Provide feedback about the body (e.g., Physiological or biochemical state) using an external monitoring device as part of a behaviour change strategy**	"**Can you feel** the air while doing the /f/ sound?"
3.	**Social support**		
3.1.	**Social support**	Advise on, arrange or provide social support (e.g., from friends, relatives, colleagues, buddies or staff) or non-contingent praise or reward for performance of the behaviour. It includes encouragement and counselling, but only when it is directed at the behaviour. **In therapy session: non-contingent praise or reward directed at performance of target behaviour - done by therapist** (Support for the child by friends/and family for performance of target behaviour)	*"Let's try it again, I know **you can do it**!"*
4.	**Shaping knowledge**		
4.1.	**Instruction on how to perform the behaviour**	**Advise or agree on how to perform the behaviour (includes 'Skills training')** Instructions on how to perform the desired/target behaviour, steps and tasks explained by the therapist.	*"Close your teeth and "sharpen" your lips."*
6.	**Comparison of behaviour**		

6.1.	**Demonstration of the behaviour**	Provide an observable sample of the performance of the behaviour, directly in person or indirectly e.g., via film, pictures, for the person to aspire to or imitate (includes ‘Modelling’). Therapists **demonstrate** the desired/target behaviour by showing the child how to do it and by producing it (demonstrate it).	*"Look! - **fishhhhhh**" (also: look at me - it is fishhh)*
7.1.	**Associations**		
7.1.	**Prompts/cues**	Introduction and use of **prompts/cues** (e.g., sound cards/sound symbols/prompts and cues for sound production) for the realization and performance of a desired/target behaviour.	*"Look! - **fishhhhhh**" **(with using a supportive prompt/cue for doing the sound /sh/)*** *(also: look at me - it is fishhh)*
8.	**Repetition and substitution**		
8.1.	**Behavioural practice/ rehearsal**	The therapist prompts practice or rehearsal of the performance of the behaviour one or more times in a context or at a time when the performance may not be necessary, in order to increase habit and skill. (Description e.g., Therapist demonstrates target sounds and the child gets asked to repeat and try the sound. Therapist and child name alternately cards including words with the target sound)	**"You have** a go - /sh/." "It's **your turn** now - /sh/, let's try."

8.6.	**Generalisation of target behaviour**	Advise to **perform the wanted behaviour** (e.g., realization of /f/ correctly), which is already performed in a particular situation **in another situation during the therapy session** (e.g., game/task or maybe spontaneous speech during the therapy situation) (e.g., after practising the isolated /f/ sound in a Table setting the /f/ it will be tried to also produce the /f/ correctly in a setting on the floor by doing the /f/ sound as the sound of a toy car)	*"We've practised the /f/ sound here at the Table and we're now trying to do the same sound for each time we're driving with one of the toy cars on the floor."*
10.	**Reward and threat**		
10.2.	**Material reward (behaviour)**	The child gets a material reward (e.g., sticker) for each try/effort and/or progress in performing the behaviour and can take it home (not just something to play and practice with in the therapy session, but something he*she can keep).	*"When you've tried to say the /f/ sound and the task is completed, you get one of the stickers."*
10.3.	**Non-specific reward**	The child is allowed to **do something fun (rewarding action)** for each try/progress/practice. *(difference to 10.2. material reward here for the therapy session: even though popup pirate swords are material, children cannot keep them after the session. Hence in the discussion it was agreed that material reward will only be things children can keep, whereas non-specific reward will be things such as token, swords etc. during the therapy tasks)*	*"Each time you've tried to say the /f/ sound, you can put one of the swords into the pop-up pirate's barrel."*

10.4.	**Social reward**	**Verbal/non-verbal reward** (e.g., praise, high-five) after the child tried to perform the behaviour and/or made progress in the target behaviour (includes positive reinforcement) - without giving any further information on how the behaviour was performed (otherwise it may also be 2.2. Feedback on the behaviour e.g., "Super, great! The /f/ sounded correctly!")	***"Super, great!"***
12.	**Antecedents**		
12.5.	**Adding objects to the environment**	Add objects/material to the therapy sequence, which support and facilitate the **performance** of the target behaviour **directly** (e.g., edible confetti, a mirror for showing how to produce a sound). It does not include all therapy materials in general!	*"I put one of the edible confetti on the sleeping place of the tongue (palate) now and you try to put the tip of the tongue on the confetti every time you say /t/."* *"You can see how your teeth are on your lips each time you say a /f/."*
14.	**Scheduled consequences**		
14.8.	**Reward alternative behaviour**	Reward for performance of **alternative** (and **progressive**!) **behaviour** (compared to the unwanted behaviour) (e.g., reward when child uses correct sound group but maybe not the target sound yet - for example the child already uses a fricative /f/ for the /s/ sound, before that it was substituted by plosives, so there is progress but not the target behaviour yet)	*"Well done, did you hear, the was already a hissing noise when you tried to say the /s/."*

The list in Table 10 was used in the BCT training workshops and all three SLTs agreed on the SSD examples included on the list. However, addressing the BCT type 2.6. *Biofeedback*, a discussion in the BCT training workshop of SLT students took place. SLT students argued that the SSD example of BCT 2.6. *Biofeedback* "Can you feel the air while doing the /f/ sound?" does not match the original definition of 2.6. *Biofeedback* “using an external monitoring device as part of a behaviour change strategy” (BCTTv1), as no external monitoring device has been used. They argued that a BCT type including tactile-kinaesthetic feedback would be more suitable, as this describes that feedback such as air is felt by the child (e.g., the hand feels the air stream) compared to using an external device, which is clearly not the case here. Thus, this BCT type has been ignored in the assessment coding of the SLT students’ workshop. Previously, this BCT had been coded from therapy manuals and had therefore been included in the BCT SSD list. It does not occur in the assessment video, so the exclusion did not affect the primary benchmark assessment video coding. However, for the SLT BCT training workshop, the BCT type remained included in the BCT SSD list to see whether this discussion also took place in the SLT BCT training workshop. SLTs also mentioned that this definition might not capture the meaning of 2.6. *Biofeedback*. Thus, SLTs agreed with the opinion of SLT students and the BCT example needs to be changed for further use. For coding the assessment video nothing had to be changed, as the BCT type 2.6. *Biofeedback* did not occur in the video.

After looking at the SSD BCT list with its definitions and examples, the last part of the theoretical training followed. As mentioned in Stage 1, there were five coding rules: (1) “only code BCTs that are directly applied to the target behaviour(s) and population(s)”; (2) “do not infer the presence of a BCT”; (3) “take care distinguishing between BCTs that differ in terms of their behaviour change type (i.e. behaviour versus outcome)”; (4) “code technical terms and packages of BCTs that map onto BCTs in the taxonomy” (Wood et al., 2015, p. 140); and (5) BCTs sometimes represented by an action verb were included in the BCT online training (Michie et al., 2013a; Wood et al., 2015). These principles are crucial for accurate BCT coding as they are considered as coding rules (section 2.2.2.1). Thus, participants were taught how to apply the five coding principles of coding BCTs from the BCT taxonomy online training by UCL and also as used in the study by Wood et al. (2015).

The theoretical training was delivered in different formats, such as short periods of PowerPoint presentations, reading relevant research articles (Dornstauder, 2020; Michie et al., 2013b; Stringer & Toft, 2016b, 2016a) and presenting summaries of research articles in groups to other participants. As soon as the theoretical training was completed, the practical BCT training, which is explained in the next section, followed.

3.2.2.1.2 Practical BCT Training

The main objective of the practical BCT training was to teach participants how to code BCTs from SSD intervention video sessions, called the training videos. In the first workshop, which was held with SLT students, coding of written intervention excerpts from speech sound therapy interventions (Fox-Boyer, 2014b; Jahn, 2000, 2007; Weiner, 1981) and Kahoot quizzes (a game-based learning platform) were also included in the practical training to provide a variation in workshop tasks. However, the BCT coding of written excerpts was taken out of the programme of the SLT workshop due to time issues. In addition, it was reported by SLT students of the current project that these two tasks had not been supportive in becoming confident coders. They claimed that written excerpts were much harder to code and reported much more uncertainty in coding them than video session sequences. The BCT workshop developed and held by Wood et al. (2016) served as a basis for structuring and developing the workshop content. The focus of the current workshop was on learning how to code BCTs using videos rather than written SSD interventions. Although the study by Wood et al. (2016) included videos in the BCT training, the BCT training was assessed by written intervention descriptions. The results from coding written interventions were mixed. In contrast, the current study investigated whether SLTs and SLT students can learn how to code BCTs in a real-world SSD intervention video rather than a written intervention excerpt to help SLTs and SLT students to describe therapy techniques more clearly and explicitly, to support their reflection on their clinical practice and to implement complex interventions more coherently. Therefore, following the example of Wood et al. (2016) of structuring the tasks gradually, easier tasks in terms of shorter video sequences with fewer BCTs included were completed at the beginning of the workshop, with harder tasks (longer training videos, including more BCTs) done at the end of the workshop.

The BCT training coding sessions were carried out using the training videos, which were saved on the Video Enhanced Observation (VEO) platform. Microsoft Excel was used to document coded BCTs from the training videos by each participant and Zoom breakout sessions for working in groups. Interactive coding sessions were held with the whole group, in pairs, and individually, using the training videos. Results of the training coding sessions were discussed by participants and MD in a group at the end of coding sessions, to ensure understanding of the results (consensus on BCTs delivered was reached verbally and not documented, as this took place for training purposes).

3.2.2.1.3 Assessment Video

The development of the assessment video, the rationale for choosing this video out of all 19 recorded videos as the assessment video, and the characteristics of the assessment video have been explained in detail in the methods of Stage 1 (section 2.2.3.3). Overall, the five parameters determining which video was chosen as assessment video were: (1) audio and visual quality of the video; (2) duration of the video; (3) the type of tasks included in the video; (4) variation in terms of including components from the three SSD interventions used in this study; and (5) whether the child could focus on the task during the session.

The presence of BCTs within the assessment video was determined by two BCT-trained SLTs in Stage 1 (section 2.3.2). Both SLTs coded the video independently and an agreement was reached on the occurrence of BCTs in the assessment video. Thus, the coding results of the two SLTs were used as a benchmark against which the BCT coding outcomes of workshop participants from Stage 2 were compared, item by item.

3.2.2.2. Surveys

In addition to the SSD BCT example list, training videos and assessment videos, two workshop materials have been used for data collection. Data on work experience information and participants' opinion on BCTs in the context of SSD intervention was gathered using two surveys. First, the work experience survey investigated the working background of the participating SLTs. Second, the BCT survey investigated the opinion of SLTs and SLT students on the use and applicability of BCTs SSD interventions and on the BCT training. Both surveys are explained in the next section.

3.2.2.2.1 Work Experience Survey

A few days before the workshop started (see Figure 9, section 3.2.2), a survey addressing work experience data (Appendix M) was sent to participating SLTs. This survey was not sent to students as the information asked for was either known by the university already (work experience data) or did not apply to students at this stage (e.g., SLT working experience). Returning the survey prior to the workshop was mandatory for SLTs to participate in order to assure that all participating SLTs were experts in the field of SSD interventions.

The survey recorded some basic information on gender, age, the country SLTs work in, job title, level of professional qualification, and country of graduation. Furthermore, professional information, such as years of experience with children with SSD, weekly caseload of children with SSD in therapy, the use of specific SSD therapy approaches/interventions, native language of the SLT, age of children each SLT works with, work setting and funding of the working place were ascertained. This background information assured that participating SLTs were specialised in the treatment of children with SSD and had a relevant clinical background.

3.2.2.2.2 BCT Survey

The survey addressing the use and applicability of BCTs in SLT, specifically for SSD was sent to both groups at the end of each workshop (Appendix N). It contained seven main and four sub questions, both quantitative and qualitative. The survey asked students and SLTs how helpful they think BCTs are for SSD intervention, which BCTs out of the 17 BCTs they think are the most helpful ones for SSD intervention, and which BCTs they would also rate as useful for DLD. Students and SLTs were asked whether they think that the BCT training helped them to capture and name the actions and techniques of the therapist better than before the training and whether they think that BCT training should be taught in SLT programmes. The survey contributed to answering **RQ 3** (section 3.1.3).

3.2.2.3 Participants

Stage 2 took place online between January and April 2021. Participants were recruited by the Austrian SLT Association “logopaedieaustria” and the University of Applied Sciences, Vienna — namely, “Fachhochschule Campus Wien”. The recruitment process took place from October 2020 until January 2021. In sum, eleven (N=11) SLT students and ten SLTs (N=10) participated in the workshops and completed all the tasks so their data could be analysed. Workshops for SLTs and students were held in two separate groups to have a manageable group size, facilitate organisation/timing, and to ensure members of each group had a similar level of expertise, experience and clinical background.

3.2.2.3.1 SLT Students

In October 2020, 40 SLT students from the University of Applied Sciences (“FH Campus Wien”) were invited to take part in the “BCTs in Interventions for Children with SSDs” workshop, which started in January 2021. The workshop was developed and led by Melanie Dornstauder (MD). In Austria, SLT studies and training are held at a Bachelor level over three years of full-time study, after completion of which graduates are certified SLTs. Students from Year 2 (Y2) and Year 3 (Y3) were chosen to participate in the workshop for the following reasons: First, in Y3 they have completed 3062.5 of 3375 hours and Y2 students 2100 of 3375 hours of all theoretical studies. Both stages (Y2 and Y3) have covered child language disorders. Second, addressing clinical training, Y3 students have already completed 762.5 of 1125 hours of clinical training, whereas Y2 students have only completed 125 of 1125 hours. Although Y2 students have had less clinical training, the focus within these clinical training blocks has been on child language disorders which means that they have already had experience with SSD. Therefore, students of both groups (Y2 and Y3) are able to understand and analyse clinical SLT sessions, even though the level of experience differs. Third, these students were flexible during the required timeframe and could claim the 24 hours (1 ECTS) from the workshop as part of their “area of specialization” from clinical training. Due to COVID-19 restrictions and regulations, in-person lectures or workshops at the university were not possible. Thus, this workshop was conducted as an online workshop, which was a popular way among researchers to conduct workshops during the pandemic (Shamsuddin et al., 2021). A maximum of 15 participating students was set to have a manageable number of participants and also enough participants to gather data from. In addition, Kooloos et al. (2011) show that students prefer subgroups of 5 participants, which means that three subgroups can be formed with 15 participants. Thus, the group size of 15 also assures that enough time for questions from each participant is given during the online training. Wood et al. (2015) also conducted six BCT coder training workshops and their group sizes included between 9-29 participants. Therefore, it was suggested that 15 participants are approximately the mean of the group sample size from Wood et al.'s (2015) BCT coder training and therefore suitable for a BCT training workshop.

The inclusion criteria for students to participate in the workshop were:

- Mandatory return of confidentiality agreement prior to the workshop (Appendix O)
- Studying SLT in Y2 or Y3
- Attending the entire workshop
- Having access to the internet and hardware such as laptop

Eleven students (N=11, all female) registered for the workshop, three of the second year and eight students from the third year. All eleven students were accepted and met the inclusion criteria.

Two additional students in their third year helped to set up the content of the workshop (section 2.2.2.1), as they were included in the literature coding process (section 2.2.2) and were therefore already familiar with the BCTTv1, having completed the BCTTv1 online training for the literature coding process.

3.2.2.3.2 SLTs

The recruitment of the SLTs took place from June 2020 until February 2021 via a call in the journal of the professional body of the Austrian SLTs "LogoThema of logopaedieaustria" (Appendix P), and via posts on social media channels (Facebook and Instagram) using the clinic account from MD's clinic "Logopädie Dornstauder". In addition, an article on BCTs and SLT was published in June 2020 including a separate call to participate in the workshop — also in the journal "LogoThema".

The inclusion criteria for SLTs to participate in the workshop were:

- Mandatory return of the work experience survey prior to the workshop
- Mandatory return of confidentiality agreement prior to the workshop
- Area of specialisation in working with children with SSD
- Speaking and understanding German
- Possibility of attending the entire workshop (both dates) online
- Having access to the internet and hardware such as laptop

Seventeen SLTs were interested in participating in the workshop. The number of places were cut down to a maximum of 15 participants in order to guarantee good quality of the workshop. As the number of interested parties was higher than fifteen, SLTs were randomly accepted (having been drawn randomly by writing their names on a piece of paper and picking 15 papers). Overall, fifteen SLTs (N=15) started the two-day workshop, whereas only ten SLTs (N=10) participated on both days of the workshop, five SLTs having dropped out. Dropouts mainly concerned the second workshop day: two SLTs could not participate due to a COVID-infection, two others could not make it due to private commitments and one dropped out as the coding task was not finished and returned. Hence, the data of ten SLTs (N=10) and eleven students (N=11) was analysed and used for answering the research questions.

3.2.2.4 Procedure

In January 2021, an online BCT training workshop for SLT students of the University of Applied Sciences of Vienna took place. In March/April 2021 the same online BCT workshop for SLTs took place. However, due to time constraints affecting the SLT group, the workshop for SLTs needed to be shortened and was held over two days in 12 hours, whereas the SLT student group had 24 hours over 4 days (see full information about training differences in section 3.2.2.4.3). Resources for the workshop had been developed continuously by MD from September 2019 until December 2020. Two steps of the procedure were the same for both groups: receiving the workshop material including the confidentiality agreement, and the orientation task. Both are explained in the next two paragraphs, before the training for SLT students and SLTs is outlined.

SLTs and students who registered for the BCT training received information on the timetable (Table 11), the confidentiality agreement, the PowerPoint presentation and the Zoom link via email prior to the workshop. To ensure that participants had the information ready at the start of the workshop it was deliberately sent just before the BCT workshop. All participants returned the confidentiality agreement before the workshop. As the procedure of the BCT training for the two participant groups differed slightly in terms of content, due to time constraints, there are two sections, one for the SLT student procedure and one for the SLT procedure, explaining each procedure in detail.

At the beginning of the workshops for SLT students and SLTs and before any BCT training, an orientation task was conducted, to get participants started on the topic of techniques and methods in SSD intervention. Participants were asked to discuss and reflect on techniques and methods they use in SSD intervention and how they would describe these. This orientation task was done to introduce and direct the focus of participants on the actions of the therapist, rather than thinking of children's SSD, therapy content and/or process. The objective of this BCT training workshop was aimed at identifying techniques used by SLTs during SSD sessions. Starting with an orientation task helped to set the focus on the relevant themes of the BCT workshop training (e.g., observing therapists' behaviour and techniques used in the SSD session). The further procedures were slightly different for SLTs and SLT students and are outlined in the next sections.

3.2.2.4.1 BCT Training for SLT Students

The workshop for SLT students was held over four days (a total of 24h): three days in a row, then a break of two weeks to allow for consolidation of the knowledge just acquired with one last day after the two-week break. Each day lasted six hours, excluding breaks. The first three days were held consecutively from Thursday to Saturday. The fourth day took place two weeks after the first workshop block. During the two-week consolidation stage all students had an internship and hence the chance to observe other SLTs in their work or even carry out therapy themselves. Hence, clinical situations to observe whether SLTs in clinical settings make (unconscious) use of BCTs were possible, as well as consciously trying to use BCTs by the SLT students themselves. The workshop hours for students were recorded as clinical hours and therefore supported students in finishing their clinical training during the COVID-19 pandemic (as clinical training had been severely impacted at the start of the pandemic, with students unable to attend placements as usual).

The first day focused on the theoretical training. The workshop started with the orientation task in which students were asked to think about techniques and methods used in SSD intervention. Descriptions of methods and techniques were collected from participants and were discussed in a group setting among participants. This way, all participants were focused on what therapists do in SSD intervention. Subsequently, the theoretical training and background on BCTs and the BCTTv1 (Michie et al., 2013b) followed. The end of the first day was dedicated to the link between BCTs and SSD intervention and included an overview of the 17 BCTs which were identified in SSD interventions (Stage 1) for monolingual German-speaking children. The SSD BCT list of the 17 identified BCTs was explained, discussed and supported by general examples taken from the BCTTv1 and SLT interventions.

On day two, students received extracts of SSD and DLD intervention manuals, and were asked to identify BCTs occurring in the intervention manual. For this task, students were in groups of two, using Zoom break-out rooms looking at lexical-pirate (Motsch & Ulrich, 2012) and context-optimization (Motsch & Riehemann, 2008) interventions for children with DLD; and at P.O.P.T. (Fox-Boyer, 2014b), Metaphon (Jahn, 2000, 2007) and Minimal Pair (Weiner, 1981) interventions for children with SSD. Results and questions were discussed as a group. At the end of day two, nine training videos were coded for BCTs with students working in pairs of two. Coding results were discussed in the entire group after every second coded video.

Day three continued to focus on the practical BCT training of students, as they analysed and discussed coding results of a further nine training videos. Altogether, students analysed 18 training videos in pairs on day two and day three of the workshop.

The introduction of the SSD BCT example list (section 3.2.2.1.1) took place on the fourth day of the workshop. These examples had been developed by MD and discussed and agreed on with other experienced BCT SLTs (DH and SB) after the first workshop block (after the first three days). The SSD BCT example list was developed after the first student workshop block, as the first workshop days showed that examples specifically for a SLT related context are needed for participants to see and understand how BCTs can be applied in SSD. Thus, the SSD BCT example list was introduced and discussed in detail before the assessment video coding task. Afterwards, students were asked to analyse and code the assessment video (section 2.2.3.3. Table 8, code 3_O_C_R) by themselves within three hours, save the document, and send it immediately back to MD via email. The last task was the BCT survey, which was also completed by all students.

When completing the assessment video coding tasks, students started to report their workshop experiences in an online discussion without being explicitly asked. An informal discussion — about the time available to learn how to code BCTs reliably, the duration of the coding task, the Excel spreadsheet used for the coding task and the number of BCTs included — commenced. The informal participant comments were also noted and considered in the further process of the workshop revision (section 3.3.2.3).

3.2.2.4.2 BCT Training for SLTs

The BCT Workshop for SLTs was held on two single days, with two weeks in between — one day in March 2021 and one day in April 2021. Each day lasted six hours (a total of 12h). It was important to offer a do-able and manageable amount of time for clinicians, as practitioners participated voluntarily and some could not have done so if the workshop had lasted longer. Due to the clinical experience and expertise of SLTs compared to SLT students, the reduction of time was seen as reasonable. In addition, clinicians reported that they were experiencing more stress than usually due to the COVID-19 pandemic (student SLTs also, but the training workshop substituted some clinical hours, hence students did not experience higher caseloads than before but rather got the chance to complete their clinical training hours by participating in the workshop). SLTs received confirmations of participation at the end of the workshop.

In general, the core procedure was comparable to the students' workshop (Figure 9 in section 3.2.2 and Table 11 in section 3.2.2.4.3), with the exception of the intervention manual coding and a limited number of videos to analyse and train in BCT skills. On day one, the same orientation task as for students took place. SLTs were asked to think about techniques and methods they use in SSD interventions and focus on what they do as therapists in those sessions. Ideas and terms were collected in one group and discussed. Then a very short SSD therapy intervention introduction followed. The introduction was short, as SLTs are already familiar with the content of SSD therapy intervention. An introduction on BCTs and the BCTTv1 (Michie et al., 2013b) followed. The links between BCTs and SSD intervention were introduced by focusing on the 17 BCTs occurring in SSD intervention. Practitioners received the example list "SSD BCT example list" developed from the BCTTv1 by MD, and examples were discussed in break-out rooms in groups of two. After completing this session, questions were discussed in a group setting. SLTs then analysed four training videos using the SSD BCT example list and an Excel file to note the occurring BCTs.

On day two, SLTs analysed and coded four more BCT training videos during the workshop. Coding results from the training videos were again discussed in a group setting. The last two tasks of the second workshop day were the same as with students: analysing and coding the assessment video and the BCT survey. All documents were returned immediately via email to MD. The next section details the differences between the students' and SLTs' BCT training workshops.

3.2.2.4.3 Difference Between BCT Training of SLTs and SLT Students

A few differences between the BCT Training of SLTs and students were present due to time constraints affecting the SLT group and different levels of experiences. SLTs wanted to participate but could not arrange 24 hours for the workshop, hence 12 hours were planned, which worked well as, due to the professional experience of SLTs, less time was needed for theoretical content than the with students. The number of training videos was reduced and coding written intervention manuals with BCTs was not done with the SLTs based on the feedback of students, who reported that these tasks were rather confusing and did not really enhance BCT coding knowledge. Table 11 gives a short overview pointing out the differences between groups in terms of time allocated to certain tasks, the tasks themselves, and the number of training videos which were coded by groups. The order of the workshop content and tasks given below is the order delivered in the workshops, with the exception of the "Introduction of SSD BCT example list" (section 3.2.2.1.1). This list was developed after the first two workshop days with the students and therefore introduced later to students than to SLTs, for whom this list was available right at the start of the BCT workshop.

Table 11: Summary of BCT training in Stage 2: Timetable and comparison of SLT students and SLTs workshop

Task	Objective	Time Students (N=11)	Time SLTs (N=10)
		WORKSHOP DAY 1 (6 hours)	**WORKSHOP DAY 1 (6 hours)**
SHORT SURVEY AND FRAMEWORK PRE BCT TRAINING			
Survey and Framework pre-BCT Training	Identifying key techniques SLTs and students use the most within SSD interventions pre-BCT training	00:30 hour	00:30 hour
THEORETICAL TRAINING			
Introduction SSD and DLD Intervention	Short repetition of SSD and DLD interventions to assure same theoretical level within group	01:00 hour	00:30 hour
Theoretical background on BCTTv1 and BCTs	Introduction to BCTTv1, outline concept of BCTs	01:00 hour	00:30 hour
Link between SSD Intervention and BCTs	Explanations and examples of rational for using BCTs in SSD interventions	01:30 hour	00:30 hour
Introduction of 17 BCTs from the BCTTv1 and BCT Coding Principles	Learning 17 BCTs from the BCTTv1 in the context of public health (labels, definitions) and appropriateness of coding by learning the five coding principles	02:00 hours	01:00 hour
		WORKSHOP DAY 2 (6 hours)	
Introduction to the SSD Example List[2]	Learning 17 BCTs from the BCTTv1 in the context of SSD intervention	introduced on Day 4	01:00 hour
Coding SSD and DLD manuals in written form	Practise to identify and code BCTs in written therapy manuals	01:00 hour	none
PRACTICAL TRAINING			

[2] This resource was developed after the first two student workshop days and therefore presented later to students than to SLTs.

Analysing SSD session videos and coding them with BCTs	Practise to identify and code BCTs in SSD video sequences and consolidate learning from before	04:00 hours 9 videos (overall 18 videos)	01:30 hour 4 videos (overall 8 videos)
Discussion of coding results	Ensuring the same understanding and correct identification and use of BCTs in SSD intervention	01:00 hour	00:30 hour
		WORKSHOP DAY 3 (6 hours)	**WORKSHOP DAY 2 (6 hours)**
PRACTICAL TRAINING			
Analysing SSD session videos and coding them with BCTs	Practise to identify and code BCTs in SSD video sequences and consolidate learning from before	05:00 hours 9 videos (overall 18 videos)	02:00 hour 4 videos (overall 8 videos)
Discussion of coding results	Ensuring the same understanding and correct identification and use of BCTs in SSD intervention	01:00 hour	00:30 hour
		WORKSHOP DAY 4 (6 hours)	
THEORETICAL TRAINING			
Introduction to the SSD Example List[3]	Learning 17 BCTs from the BCTTv1 in the context of SSD intervention	02:00 hour	Introduced on Day 1
ASSESSMENT VIDEO			
Final BCT Coding of assessment video	To use BCTs in SSD intervention context and identify and analyse them. The coding task also serves as assessment of students' and SLTs coding ability.	03:00 hours	03:00 hours
BCT survey	Gathering information on students and SLTs perception on the use of BCTs in SSD intervention and overall SLT.	01:00 hour	01:00 hour
	OVERALL WORKSHOP DURATION	**24:00 hours**	**12:00 hours**

[3] This resource was developed after the first two student workshop days and therefore presented later to students than to SLTs.

3.2.2.4.4 Assessment Video Coding

Coding the assessment video was the last task in the workshop. This task was conducted to assess participants' coding accuracy after completing the BCT training workshop. It collected data on how well students and SLTs were able to identify and code utterances from the therapists by using the 17 BCTs used in the workshop. Therefore, gathered data answers the research question that asked whether students and SLTs can be trained to identify BCTs in SSD interventions.

As previously explained, two BCT-trained SLTs coded the assessment video in a first step and reached an agreement on the BCTs present (section 2.3.2) to have a benchmark against which to compare the coding from workshop participants. The coding procedure from the assessment video in the workshop is similar to the coding procedure from the two BCT-trained SLTs in Stage 1 (section 2.2.4) and also used the software VEO to play the videos and a coding template developed with Microsoft Excel to document the BCTs identified within the assessment video. The Excel template was the same as for the initial coding of the assessment video conducted by the two SLTs (section 2.2.4.2) and categorized the 10:43 minutes of the video into 10-second time stamps. Participants were asked to identify each BCT within an utterance of the therapist once and document the identified BCT in the Excel template. The four columns "time", "BCT", "situation", and "notes" were included, so participants could note the exact occurrence of a BCT within an utterance in the document (Microsoft Excel BCT coding template excerpt in section 2.2.4.2).

Participants were asked to identify each occurring BCT within an utterance just once in order to lower the coding requirements for coders, as previously reported (section 2.2.4.2). During the first coding process in Stage 1, conducted by the two BCT-trained SLTs to establish a benchmark, it had been noticed that some BCTs may occur more often within an utterance (e.g., 10.4. Social reward with the utterances "Super!" "Bravo!"). On this rationale, was decided that coding each BCT type once within an utterance would give enough insight into whether participants are able to code BCTs accurately — meaning that, if they could code them correctly once, they could also identify it twice within the utterance. This was decided to ease the coding process for participants.

However, even though participants were asked to identify each occurring BCT within an utterance once, the procedure of assessing BCT coding accuracy used in this study is still fine-grained. This is the first study of its kind, which aimed to investigate whether SLTs and SLT students can be trained to identify BCTs in a real-world intervention and whether participants think that the BCTTv1 is useful for SSD interventions. To do so, it was decided that detailed BCT coding accuracy is important, to enable participants to understand the concept of BCTs and the BCTTv1 globally. By completing a workshop and BCT training asking for this type of detail, it is suggested that participants can transfer theoretical knowledge of the BCTTv1 — for example, the individual BCT types — to practical situations of clinical interaction. Using video-enhanced observation (VEO) has increased in SLT and educational teaching in recent years (Seedhouse, 2022). Thus, using a common and explicit language to teach and talk about techniques used in a real-world intervention, it is important to look at the interaction of a therapist and child on a very detailed level. Observation is a core part of the clinical training of SLTs and identifying and discussing fine-grained interactional aspects in a therapy session is therefore essential for SLT students to transfer knowledge from theory and apply it in practice. Using a common language to do so supports both students and teachers/lecturers. Therefore, as the real-world SSD intervention video showed a clinical situation between a child and a therapist, participants were asked to code this interaction on this detailed level. In contrast, studies by Wood et al. (2015, 2016) assessed the BCT coding accuracy of participants after the BCT training with a lower level of detail (e.g., identifying a BCT type once within a video not for every single occurrence of this BCT type) and these studies have shown mixed results on participants' coding accuracy.

SLTs and SLT students may benefit differently from this type of detailed BCT training. By using the framework of BCTs and its terminology, the implementation of techniques used in interventions may be described more explicitly and consistently. SLT students, in particular, gain an insight into "how therapy works", whereas SLTs are given the opportunity to use the concept of BCTs to reflect on their own practices which may be especially useful in challenging clinical situations. BCTs help practitioners to see which techniques a child responds well to, and which one may not work as well as desired.

Participants used the three hours allocated for the coding task (Table 11 in section 3.2.2.4.3) to watch the assessment video, stop it whenever they identified a BCT type and documented the BCT type in the Excel template. They did this by documenting each BCT type once per utterance (of the therapist) in the correct ten-second time stamp column of the Excel template. If two different BCT types occurred within an utterance, both types had to be documented (each BCT type just once though). Then participants could continue the video. Each participant completed the coding task individually, by herself/himself/themselves. In addition, during the assessment coding task, questions asked by students were not answered by MD so that their coding ability without additional input could be accurately assessed after the workshop. All students were online and put their microphones on mute (on Zoom). Once the three hours were over, they were asked to save the file and send it to MD via email. Afterwards, data was prepared ready for analysis.

3.2.2.5 Data Preparation

To analyse the data of the assessment video coding from workshop participants from Stage 2, the Statistical Package for Social Sciences (SPSS, 2021) and Microsoft Excel were used.

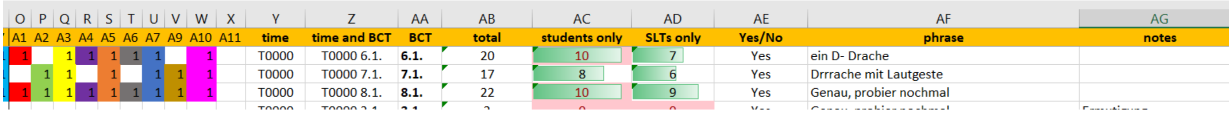
Work experience Survey

First, data from the work experience survey for SLTs was entered manually by MD into SPSS to analyse it by using descriptive statistics. A simple coding system was used to collate the information gathered from the survey and categorial information (e.g., 0=female, 1=male, 2=diverse) was entered in numbers. Graphs and Figures were created in Excel, as this program is more flexible for creating Graphs/Figures that include all the information needed for displaying the results comprehensively (e.g., Excel offers more flexibility in labelling bars compared to SPSS).

BCT Coding Assessment Video

All participants sent their coding results saved in an individual Excel files to MD, who transferred the coding results into one Excel sheet. The participants' template included the columns "*participants*" (which have been coded, e.g., A9), "*time*" stamps (in 10 seconds, e.g., T0550), "*BCT*" (type of BCT, e.g., 6.1.), "*phrase*" (utterance of the therapist/child) and "note" (if participants wanted to note something about their coding). The BCT column included a drop-down list with all 17 available BCTs.

After entering all participants' data into one Excel dataset, the columns "*time*" and "*BCT*" were combined (e.g., T0550_6.1. column "*time and BCT*"), to see which BCTs participants identified within one 10-second block and therefore all utterances occurring within this 10-second time stamp. If a participant identified a BCT in a certain line (=utterance within the video), it was coded with "1" in the column of the individual participant ("A1-A11"). If there was no BCT coded, the Excel cell was left empty (with a dot). Other columns such as "*total*", "*students only*", "*SLTs only*" and "*Yes/No*" have been added after entering the data, to get an overview of how many BCTs were identified by all, by students only, by SLTs only, and by MD (Yes= MD identified a BCT, No= MD did not identify a BCT). Figure 11 shows an example of how the data spreadsheet was organised.



O	P	Q	R	S	T	U	V	W	X	Y	Z	AA	AB	AC	AD	AE	AF	AG
A1	A2	A3	A4	A5	A6	A7	A9	A10	A11	time	time and BCT	BCT	total	students only	SLTs only	Yes/No	phrase	notes
1		1	1	1	1	1		1		T0000	T0000 6.1.	**6.1.**	20	10	7	Yes	ein D- Drache	
	1	1		1		1	1	1		T0000	T0000 7.1.	**7.1.**	17	8	6	Yes	Drrrache mit Lautgeste	
1	1	1	1	1	1	1	1	1		T0000	T0000 8.1.	**8.1.**	22	10	9	Yes	Genau, probier nochmal	

Figure 11: Example of Microsoft Excel data spread sheet with entered BCT coding data

Once the data of all 21 participants had been entered into Excel, it was analysed using descriptive and inferential statistics for each group (students and SLTs) and for students and SLTs as one group. To assess whether participants can be trained to accurately identify BCTs in SSD interventions, participants were asked to identify each BCT occurring once within an utterance. Thus, the analysis focused on each BCT coded once within an utterance. SPSS was used to conduct adequate correlation analysis, such as the link between the frequency occurrence of BCTs and the coding outcomes of participants for BCTs which occurred often. To look at which BCT types were identified incorrectly — BCT identified although none was present, wrong BCT identified, BCT not identified at all — a BCT error analysis was conducted using Excel.

BCT Survey

The BCT survey data was entered manually by MD in SPSS to analyse the data. Variables for the BCT survey have been created and added, also using a simple coding system to enter the information (e.g., Likert Scales 1=very helpful, 2=rather helpful, 3=rather not helpful, 4=not helpful). The three open-ended questions which were added to one Likert-Scale and two yes/no questions to justify the choice of answer were analysed separately by using thematic analysis and building thematic categories in Excel.

3.3 Results

In this section, the results of Stage 2 are presented. First, this includes data about the work experience background and the working experience of the SLTs (N=10, as student SLTs were not able to answer these questions yet due to not yet having sufficient working experience). Second, BCT coding results from the assessment video of the workshops with student SLTs (N=11) and SLTs (N=10) follow. The BCT coding results of both groups are compared to the coding outcomes of the benchmark developed by two BCT-trained SLTs in Stage 1 (section 2.3.2) to answer **RQ 2.** *Can SLTs and SLT students be trained to identify BCTs in SSD interventions and are there any differences between the BCT coding accuracy of SLTs and SLT students?* The third part of the results sheds light on responses from the BCT survey, which included data on whether SLTs and student SLTs find BCTs helpful for SSD intervention and useful for SLT interventions in general to answer **RQ 3.** *Do SLTs and SLT students think* *that the application of BCTs in SSD interventions with children is useful, and if so why, and do they think that the BCT training workshop should be included in the training curriculum of students?*

All results were analysed using SPSS and/or Excel. Descriptive results for the benchmark SSD assessment video coding and the percentage agreement on the BCT coding have been presented in Chapter 2 (section 2.3.2). Through the percentage agreement a benchmark was established, against which the accuracy of coding attempts from workshop participants were measured (section 2.3.3). Overall, descriptive statistics for BCT coding results of participants are presented, as these allow an insight into relevant data by single numbers (Robson & McCartan, 2016). Two calculations are fundamental for this result chapter: the *overall BCT identification rate* and the *BCT type identification rate*. The results of the overall BCT identification rate gives an insight into the global view of how well participants performed on the BCT identification tasks (average of all participants across all BCTs, regardless of BCT type). As this is a new form of training, it was of interest to see how well individual BCT types have been coded to understand and evaluate the success of the training in more detail. Thus, the BCT type identification rate looked at each BCT individually in terms of how well each BCT type was identified by the various participants. Two different analyses have been conducted for investigating whether SLTs and student SLTs are able to code BCTs reliably within the assessment video: the overall BCT identification rate (section 3.3.2.1) and the BCT type identification rate (section 3.3.2.2). Inferential statistics was used to show differences between groups. Analyses of types and calculations are mentioned briefly here, whereas the results are presented in detail in section 3.3.2 BCT coding assessment video.

The last results section focuses on the answers from the BCT survey completed by SLTs and student SLTs. The survey looked at participants' opinions on the use and application of the BCTTv1 (Michie et al., 2013b) for SLT, especially for SSD intervention with children and the curriculum of SLT training. All analyses are explained in detail in the relevant sections. The following section gives background information on the working experience of participating SLTs.

3.3.1 Work Experience of SLTs

At the beginning of the BCT training, a survey was used to examine the work experience background and working experience of participating SLTs. The objective of the survey was to investigate how much and what type of experience they had with SSD, as this experience might have had an impact on practitioners' BCT coding abilities and answers on the use of

BCTs in SSD interventions. Table 12 gives an overview of the work experience background and working experience of the ten participating SLTs.

Table 12: Descriptive results of work experience data from SLTs (N=10)

Work experience Data SLTs	Frequencies		Work experience Data SLTs	Frequencies	
Measures	N=10	%	Measures	N=10	%
Gender			Funding of workplace		
female	10	100.0	public	33.3	
male	0	0.0	private	66.7	
divers	0	0.0	Level of "professional" qualification		
Age Groups			Non-university: Diploma	3	30.0
20-30	5	50.0	University: Undergraduate/Bachelor degree	6	60.0
31-40	3	30.0	University: Masters degree	1	10.0
41-50	2	20.0	University: Dr. (PhD)	0	0.0
51-60	0	0.0	University: Other (e.g., Diploma)	0	0.0
60+	0	0.0	Years of experience with children with Speech Sound Disorder		
Country of work			Mean	4.86	
Austria	9	90.0	Standard Deviation	5.47	
Sweden	1	10.0	Minimum	0.50	
Job Title			Maximum	19.00	
Speech and Language Therapist	10	100.0	Weekly caseload of Speech Sound Disorder children		
Special Educator	0	0.0	1-5	1	10.0
Psychologist	0	0.0	6-10	5	50.0
Linguist	0	0.0	11-15	3	30.0
Teacher	0	0.0	16-20	1	10.0
Pedagogue	0	0.0	21-25	0	0.0
Medical Doctor	0	0.0	26-30	0	0.0
Other (please specify)	0	0.0	31-35	0	0.0
Country of Graduation			Age of children with Speech Sound Disorder in clinical setting		
Austria	8	80.0	0-3:11 years-old	7	29.9
Germany	1	10.0	4-6:11 years-old	10	41.7
Sweden	1	10.0	7-11:11 years-old	7	29.2
Work Place (multiple answers possible)			12-16:11 years-old	0	0.0
Hopsital	3	21.4	17+ years-old	0	0.0
Rehabilitation center	0	0.0	Awareness of concepts/therapy interventions for children with Speech Sound Disorders		
"Wahllogopäden" SLT without a direct insurance contract (private SLT, self-employed)	7	50.0	Psycholiguistically-Oriented Phonology Therapie (P.O.P.T.)	9	36.0
"Kassenlogopäden" SLT with a direct insurance contract (self-employed)	1	7.1	Phonetic-Phonological Therapy	3	12.0
Nursery/kindergarten (mainstream)	2	14.3	Metaphon	1	4.0
Nursery/kindergarten (special)	0	0.0	Minimal Pair Therapy	2	8.0
School (mainstream)	0	0.0	Phonetic Therapy	3	12.0

School (special)	0	0.0	Myofunctional Therapy	2	8.0
Day care centre	0	0.0	Verbal development dyspraxia intensive therapy (*German*: Verable Entwicklungsdyspraxie intensiv Therapie; VEDiT)	1	4.0
Health clinic/centre	0	0.0	Movement-assisted sound initiation (*German*: Bewegungsunterstütze Lautanbahnung; BULA)	1	4.0
Other	1	7.1	swedisch therapy programmes	1	4.0
			Zollinger (Name of a SLT who works with a developmental approach)	2	8.0

100% of participating professionals in the workshop were female and SLTs, with no other profession (such as a teacher or psychologist) represented. The majority had an undergraduate degree in SLT (N=6/10), three SLTs had a non-university diploma, and only one had completed a postgraduate degree. Results show that participants were mainly aged between twenty and forty years (N=8/10), with two participants being over 41 years old. The majority of SLTs work in Austria (N=9/10) and graduated in Austria (N=8/10). Multiple answers were possible for the question about the workplace, as SLTs often have more than one placement. Thus, seven SLTs work privately as self-employed SLTs. whereas only one SLT has a direct insurance contract. Three SLTs are employed in a hospital, two in a nursery and one works within a family support centre (category “other”). Overall, two thirds of placements and institutions of SLTs participating in this workshop are privately funded (privately funded institutions/placements=66.7%, publicly funded institutions=33.3%). A great range can be observed in work experience, with one SLT having worked in the profession for 19 years and another for half a year having just recently qualified. Three questions were directly linked to the working experience of SLTs with children with SSD to ensure that participating SLTs have treated the investigated disorder. The majority have about six to 15 children with SSD on their weekly caseload, whereas only one SLT has one to five and another SLT sixteen to twenty children with SSD a week. 30% of children treated by the participating SLTs are aged 0:00-3:11 years, another 30% are aged 7:00-11:11 years old, whereas over 40% of children are 4:00-6:11 years old. The last question asked SLTs whether they are aware of any concepts and therapy interventions used in SSD therapy and found some interesting results. The Psycholinguistically-Oriented Phonological Therapy (P.O.P.T.) (Fox-Boyer, 2014b) was mentioned by nearly all SLTs (N=9/10), followed by some more general terms such as phonological-phonetic therapy (N=3/10) and phonetic therapy (N=3/10). Other therapy approaches for SSD mentioned one to three times were Metaphon (Jahn, 2000, 2007), Minimal Pair (Weiner, 1981), “Bewegungsunterstütze Lautanbahnung” (BULA; engl. “*movement assisted sound initiation”*) (Weinrich & Zehner, 2011), Swedish therapy programmes (which have not been named) and “verbal Entwicklungsdyspraxie intensive Therapie” (VEDiT; engl. “*verbal development dyspraxia intensive therapy*”, meaning childhood apraxia of speech)

(Schulte-Mäter, 2010). Other therapy approaches such as using myofunction therapy components and "Zollinger" (2007) (who uses a developmental approach) were also mentioned in the context of SSD intervention.

3.3.2 BCT Coding Assessment Video

This section presents the BCT coding results of the assessment video by workshop participants after the BCT training workshop. As mentioned before (section 2.3.2), intercoder agreement results from two BCT-trained and experienced SLTs were used as a benchmark against which the coding accuracy of SLTs and SLT students was measured. Descriptive results from the assessment video were presented in Chapter 2 (section 2.3.2).

First, coding results on the *overall BCT identification rate* are presented from all participants and by group (student SLTs and SLTs), followed by a group comparison. Second, coding results on the *BCT type identification rate* are presented as the results of one whole group (SLTs and student SLTs together) to answer the above stated research questions (section 3.3). Participants' performance was investigated by using these two different BCT identification rates, which are explained in detail below.

The *overall BCT identification rate* looked at how many BCTs overall a participant could identify correctly (in terms of recognising the BCT and identifying the accurate/correct BCT type code – matched 1:1 with the benchmark from the assessment video). All instances of correctly identified BCTs were summed up and then divided by the number of BCTs occurring. For example, if N=187 BCTs occurred in the sample video and a participant identified N=134 BCTs (recognised the BCT and identified correct BCT type), the 134 gets divided by 187, which gives an overall BCT identification rate of 71.65%. Hence, this participant identified 71.65% of the BCTs occurring in the assessment video correctly. Therefore, the overall BCT identification rate addresses the research question how reliably student SLTs and SLTs can identify BCTs from the assessment video.

In contrast, the *BCT type identification rate* considered specifically how well each individual BCT type was identified by participants and therefore whether there is a difference in the coding accuracy of certain BCT types. As this BCT training is novel, this additional metric was of interest to see whether some BCT types were easier or more reliably coded than others. Thus, the percentage rate for each specific BCT types gets individually calculated. The BCT 6.1. *Demonstration of the behaviour* occurs 63 times in the sample video. If a participant identified this BCT 33 times correctly, then he/she received a BCT type identification rate of

52.38% for the BCT 6.1. *Demonstration of the behaviour*. Another, rather different, example for this calculation would be BCT 1.4. *Action planning*, which only occurs once within the assessment video (which implies it occurred only in one utterance throughout the entire video), and the participant identified this BCT correctly for this one time. Thus, the participant got a BCT type identification rate of 100% for BCT 1.4. *Action planning*.

Results of the overall BCT identification rate therefore provide information on the global view of how well participants were able to identify BCTs in the assessment video, whereas the BCT type identification rate investigated how well each specific BCT type was recognised and identified correctly by participants. Thus, both calculations have been used, as their focus is different (overall BCT identification vs. BCT type identification) and offers valuable information for addressing the research aims.

Therefore, this section first presents the *overall BCT identification rate* coding results from the assessment video of workshop participants post BCT training as results of one group (all participants) and as group comparison (student SLTs and SLTs). Then, *BCT type identification rate* coding results from all participants as one group are presented to compare the coding accuracy of certain BCT types.

3.3.2.1 Stage 2 Overall BCT Identification Rate

The following section shows results from the *overall BCT identification rate* of all participants, a group comparison, and individual results of each SLT student and SLT. The overall BCT identification rate calculated the percentage of correctly recognised and identified BCTs by participants and was matched 1:1 to the benchmark from the intercoder coding results (section 2.3.2) of the assessment video to assess coding accuracy of workshop participants. The overall BCT identification rate provides a global view of participants' coding ability but does not give an insight into which BCT types have been coded better or worse (this question is investigated in the section "BCT type identification rate"). Results shown in this section therefore aim to answer the research question whether, after being trained to identify BCTs, SLTs and SLT students are able to reliably code a representative SSD sample video with the 17 identified BCTs from the BCTTv1 (Michie et al., 2013b). In this context, "reliably coded" means that participants can recognise the occurring BCTs and identify the accurate BCT type/code. A BCT was counted as correctly identified if participants coded the correct utterance and BCT type. All instances of correctly coded BCTs were summarised and divided by the number of occurring BCTs (N=187), which then gives the overall BCT identification rate. Therefore, all 187 instances of occurring BCTs have been included in the analysis. First, this was calculated for all participants as one group, followed by a group comparison of the BCT overall identification rate by SLT students and SLTs, as well as some more insight into the coding results of the two individual groups (SLT students and SLTs).

3.3.2.1.1 All Participants

Figure 12 gives an insight into the coding results on the overall BCT identification rate of the assessment video from all participants (N=21).

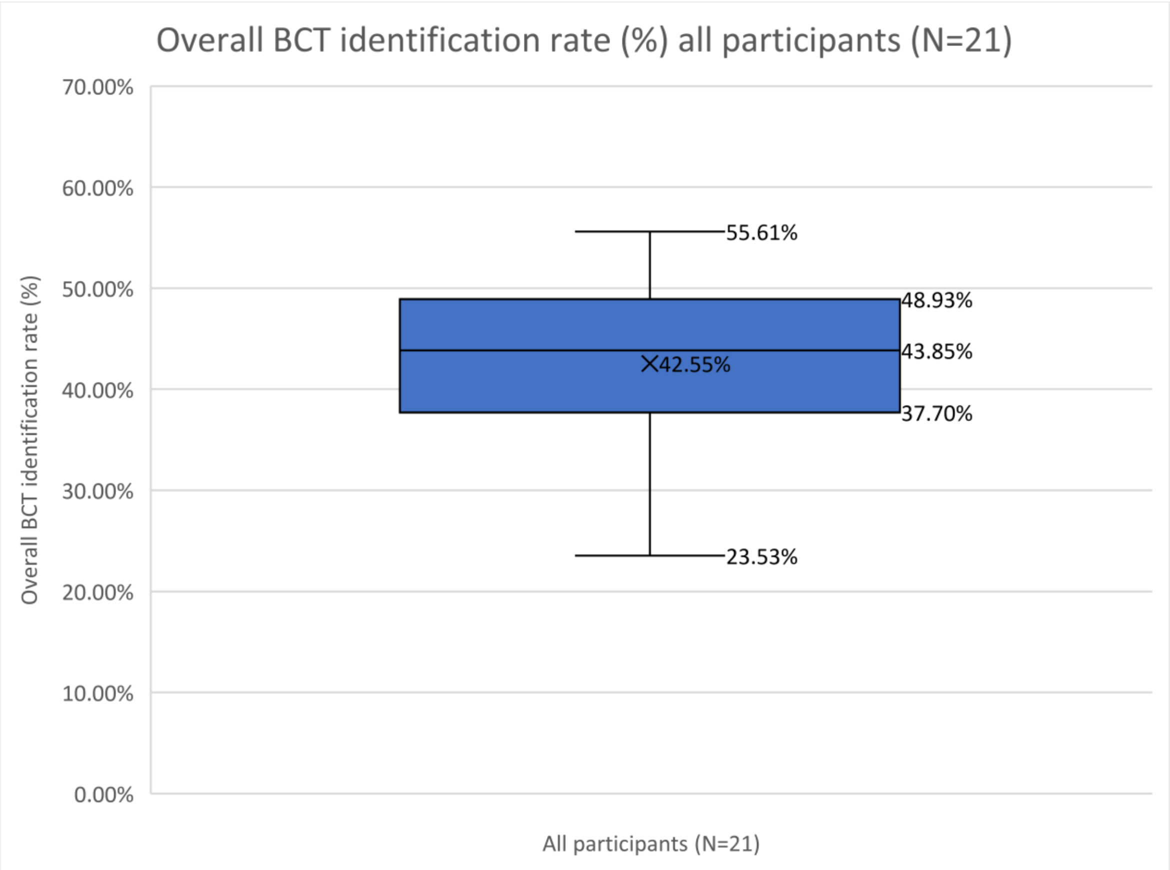


Figure 12: Overall BCT identification rate by all participants (N=21)

The boxplot in Figure 12 shows that the overall BCT identification rate mean of all participants (N=21) is 42.55%, with a similar median of 43.85%. The highest overall BCT identification rate is 55.61%, with the lowest 23.53%. These results show that participants, on average, identified less than half of the BCTs occurring in the SSD assessment video.

3.3.2.1.2 Group Comparison

In the following, results of the *overall BCT identification rate* are presented and compared between groups. A brief comparison on the overall identification results of student SLTs (N=11) and SLTs (N=10) has been conducted to show differences between groups. Again, to be transparent, all 187 instances of occurring BCTs have been included to show an accurate mean and median of all participants. The descriptive measures for the overall BCT identification rate for student SLTs and SLTs can be found in Figure 13.

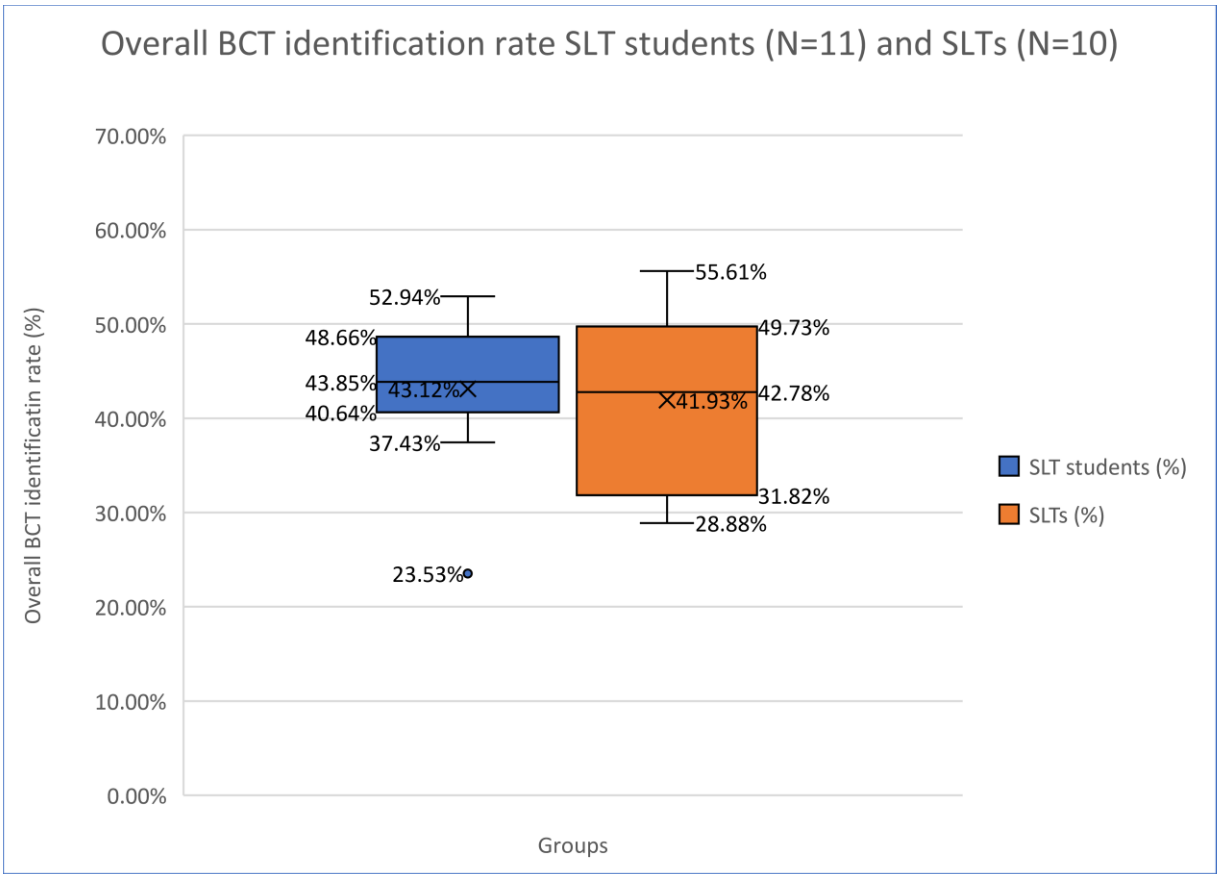


Figure 13: Overall BCT identification rate by groups (SLT students N=11 and SLTs N=10)

The comparison of the overall BCT identification rate between groups shows that SLTs (N=10) and SLT students (N=11) show a similar mean of M=43.12% (SLT students) and M=41.93% (SLTs). The range for the overall BCT identification rate for students is 29.41%, including one outlier with 23.53% (the lowest coding accuracy among both groups). For SLTs, the range is 26.73%, and therefore quite similar to the one from the SLT students. Medians of both groups are also similar (SLT students Median = 43.85%, SLTs Median = 42.78%). Overall, comparing the BCT identification rates of both groups, no significant difference between SLT students and SLTs can be determined as coding results between groups are very similar, which was confirmed by the result of the non-parametric Mann-Whitney U test. The non-parametric test was chosen as groups have unequal group sizes (SLT students N=11, SLTs N= 10). The test investigated whether there is a significant difference in the mean values of the overall BCT identification rate between SLT students or SLTs, which has not been confirmed by the results which show no significant difference among the groups (U=53.50; p=.916; SLT students median= 43.12% compared to SLTs median=41.93%). Ranks of the Mann-Whitney U test for SLTs and SLT students are shown in Table 13.

Table 13: Ranks of the Mann-Whitney U test for SLT students and SLTs comparison of overall BCT identification rate means

	groups	Participant N	Mean rank	Sum of ranks
Mean overall BCT identification rate	SLT students	11	11.14	122.50
	SLTs	10	10.85	108.50
	Total	21		

Furthermore, individual results for the overall BCT identification rate of both groups will be shown next.

3.3.2.1.2.1 SLT Students

To see how accurately individual students coded the 187 instances of occurring BCTs in the SSD sample video, Table 14 presents details on the BCT overall identification rate per student (N=11). Thus, Table 14 shows the number of occurrences for each BCT in the second column (overall instances of occurring BCTs in the assessment video N=187). Furthermore, it gives an insight into how often each student identified each of the 187 instances of BCTs. It then calculates the *overall BCT identification rate* by summarising all correctly identified BCTs and dividing this number by the 187 instances of BCTs occurring in total (according to the assessment video). If students did not identify specific BCT types at all, a zero was used to document this (e.g., person B4 did not identify the BCT 1.4*. Action planning* a single time although it occurred 9 times, which is shown by the “0” in the column). Table 15 shows individual students’ performance (B1-B11) on the overall BCT identification rate from the SSD sample video.

Table 14: SLT students (B1-B11) overall BCT identification rate from the assessment video coding

BCT	BCT occu rr-ence	B1	B2	B3	B4	B5	B6	B7	B8	B9	B10	B11
1.1. Goal setting (behaviour)	3	0	0	0	2	1	0	1	0	2	1	2
1.3. Goal setting (outcome)	1	0	1	1	0	0	1	0	1	1	1	1
1.4. Action planning	9	2	1	2	0	4	3	5	2	3	2	3
1.6. Discrepancy between current behaviour and goal	1	1	1	1	1	1	1	1	1	1	1	1
10.2. Material reward (behaviour)	1	1	1	1	1	1	1	1	1	1	1	1
10.3. Non specific reward	2	0	0	0	1	1	1	1	1	2	1	0
10.4. Social reward	32	27	6	25	25	26	23	9	18	19	22	22
12.5. Adding objects to the environment	1	1	1	1	1	1	1	1	1	1	0	1
2.2. Feedback on behaviour	9	6	5	1	7	7	7	6	5	7	8	6
3.1. Social support	3	0	0	0	0	1	0	0		0	0	0
4.1. Instruction on how to perform the behaviour	15	5	5	5	5	5	3	6	4	4	6	4
6.1. Demonstration of the behaviour	63	30	12	16	32	33	25	28	22	20	32	24
7.1. Prompts/Cues	13	7	6	6	8	9	8	11	8	9	7	9
8.1. Behavioural practice/rehearsal	34	8	5	11	8	9	8	6	16	10	10	11
total number of identified BCTs	**187**	**88**	**44**	**70**	**91**	**99**	**82**	**76**	**80**	**80**	**92**	**85**
Overall BCT identification rate per student		**47.06%**	**23.53%**	**37.43%**	**48.66%**	**52.94%**	**43.85%**	**40.64%**	**42.78%**	**42.78%**	**49.20%**	**45.45%**

Looking at Table 14, it can be seen that the highest overall BCT identification rate by a student is 52.94%, which means that this student identified well over half of the BCTs occurring in the assessment video. The lowest overall BCT identification rate is 23.53%, which means that this student identified fewer than 1 in 4 of the occurring BCTs in the assessment video correctly.

3.3.2.1.2.2 SLTs

Results of the overall BCT identification rate by SLTs (N=10) was also examined individually by each participating SLT to investigate SLTs' performance on all 187 occurring instances of BCTs from the assessment video. Again, Table 15 shows the number of occurrences for each BCT in the second column (overall instances of occurring BCTs in the assessment video N=187), and then shows how often each SLT identified each of the 187 instances of BCTs. The *overall BCT identification rate* was then calculated by summing all correctly identified

BCTs and dividing these by the 187 instances of occurring BCTs. As for the student group, BCTs which were not identified/recognised by SLTs were documented with zero. Table 15 shows individual SLT's performance (A1-A10) on the overall BCT identification rate from the assessment video.

Table 15: SLTs (B1-B11) overall BCT identification rate from the assessment video coding

BCT	BCT occurrence	A1	A2	A3	A4	A5	A6	A7	A9	A10	A11
1.1. Goal setting (behaviour)	3	0	1	1	1	1	0	1	1	0	1
1.3. Goal setting (outcome)	1	0	0	0	1	1	1	0	0	0	1
1.4. Action planning	9	7	6	3	7	2	3	4	5	5	2
1.6. Discrepancy between current behaviour and goal	1	1	1	1	1	1	1	1	1	1	1
10.2. Material reward (behaviour)	1		0	0	0	1	1	0	0	0	0
10.3. Non specific reward	2	1	1	1	0	0	1	1	1	1	0
10.4. Social reward	32	18	15	13	26	23	19	22	17	25	12
12.5. Adding objects to the environment	1	1	0	0	0	1	1	0	0	1	0
2.2. Feedback on behaviour	9	7	6	4	5	6	5	4			1
3.1. Social support	3	1	0	0	1	0	0	0	0	1	1
4.1. Instruction on how to perform the behaviour	15	3	2	4	5	4	5	6	5	4	3
6.1. Demonstation of the behaviour	63	30	26	17	34	32	25	18	18	28	16
7.1. Prompts/Cues	13	8	7	8	7	10	7	9	8	9	7
8.1. Behavioural practice/rehearsal	34	14	6	6	16	11	14	11	4	18	9
Total number of identified BCTs	**187**	**91**	**71**	**58**	**104**	**93**	**83**	**77**	**60**	**93**	**54**
Overall BCT identification rate by SLTs		**48.66%**	**37.97%**	**31.02%**	**55.61%**	**49.73%**	**44.39%**	**41.18%**	**32.09%**	**49.73%**	**28.88%**

Table 15 shows that the highest overall BCT identification rate by a SLT is 55.61%, whereas the SLT with the lowest percentage recorded an accuracy rate of 28.88%. This means that the SLT with the highest overall BCT identification rate could identify slightly over half of the occurring BCTs in the SSD sample video, whereas the lowest overall BCT identification rate shows that slightly over a quarter of the BCTs were identified. Therefore, the overall BCT identification rate shows rather uncertain coding and low percentages, as the received percentages show that participants hardly identified half of the BCTs occurring.

Overall, no significant difference for the overall BCT identification rate between SLTs and SLT students could be determined in the analysis and the results of Mann-Whitney U test.

Therefore, group differences have not been explored in further analysis such as the BCT type identification rate and the following section and analysis focuses on the BCT type identification rate of both groups combined and shows whether some BCT types were identified better than other BCT types by workshop participants.

3.3.2.2 Stage 2 BCT Type Identification Rate

Regarding the coding results of all occurring BCT types within the SSD video sample, another calculation — namely, *BCT type identification rate* — has been calculated. Previously, the overall BCT identification rate gave an insight into how well participants (also compared by groups of SLTs and SLT students) were able to identify BCTs in general. However, when analysing whether there is a difference in coding accuracy for particular BCT types, the BCT type identification rate is fundamental, as this one calculates how well participants, as a group, coded and identified the specific and individual BCT types from the SSD sample video. A comparison of the two rates would not add useful information as both identification rates look at different issues and answer different questions. The overall BCT identification rate looks at the ability to identify BCTs in general for both groups aggregated, the two groups individually and every individual participant. Thus, this is the metric relevant for the coding ability of all participants, both groups and individuals. In comparison, the BCT type identification rate looked at how consistently individual BCT types were identified across all participants (SLTs and SLT students as one group).

Therefore, the *BCT type identification rate* analysis sheds light on all participants' performance as a group (N=21) on identifying specific BCT types from the assessment video and was conducted to see whether some BCTs are more consistently identified than others. As this BCT training is novel, it was of interest whether there was any difference in how reliably some BCT types were identified by participants. This information helped to improve the BCT training of Stage 3.

Again, as for all results, the descriptive results presented in section 2.3.2 serve as the benchmark against which participants' BCT coding is compared. The second column of Table 16 shows the total number of occurrences for each BCT type in the assessment video for comparison. The analysis conducted was descriptive — to look at standard deviations (SDs) and means for all participants across every single BCT occurring in the assessment video to compare participants' performance (Field, 2017; Robson & McCartan, 2016). This analysis gives an overview of the performance of students' and SLTs' coding of the assessment video as one group, and therefore the ability to identify the single BCT types after the training of

Stage 2. These results are shown in the third column of Table 16, which summarises the descriptive results of the BCT type identification rate by both groups, across every single BCT type.

Table 16: Descriptive results of BCT type identification rate by all participants of the assessment video (seven most used BCTs in bold)

BCT Type	Occurrence of BCTs	Total (N=21)	
	Total Number	SD Total (%)	Mean Total (%)
6.1. Demonstration of the behaviour	63	30.95%	39.15%
8.1. Behavioural practice/rehearsal	34	32.06%	29.55%
10.4. Social reward	32	22.65%	61.31%
4.1. Instruction on how to perfom the behaviour	15	35.92%	29.52%
7.1. Prompts/cues	13	33.75%	61.54%
1.4. Action planning	9	21.09%	37.57%
2.2. Feedback on behaviour	9	17.68%	54.50%
1.1. Goal setting (behaviour)	3	21.99%	25.40%
3.1. Social support	3	13.75%	7.94%
10.3. Non specific reward	2	30.30%	35.71%
1.3. Goal setting (outcome)	1	n/a*	52.38%
1.6. Discrepancy between current behaviour and goal	1	n/a*	100.00%
10.2. Material reward (behaviour)	1	n/a*	61.90%
12.5. Adding objects to the environment	1	n/a*	66.67%

*n/a=not applicable as there was only one observation and the SD cannot be calculated (#DIV/0)

Four BCTs only occurred once within the SSD sample video (1.3. *Goal setting (behaviour)*, 1.6. *Discrepancy between current behaviour and goal*, 10.2. *Material reward* and 12.5. *Adding objects to the environment*). The BCT 1.6. *Discrepancy between current behaviour and goal* was identified by all participants and therefore received a *BCT type identification rate* of 100%. Among the 14 BCTs which occurred more than once in the assessment video, the BCTs 7.1. *Prompts/cues* (M=61.54%) and 10.4. *Social reward* (M=61.31%) were identified and coded correctly the most across participants according to the groups' mean. The BCT 3.1. *Social* *support* (M=7.94%) showed the lowest mean of the participant group and was therefore identified less often than all other BCTs.

Looking at the seven most commonly occurring BCTs of the assessment video (Table 16, BCTs in bold), means and standard deviations vary. In general, the overall number of BCT occurrences of the assessment video among the seven most frequently occurring BCTs differs greatly (e.g., 1.4. *Action planning*: 9 occurrences, 6.1. *Demonstration of the behaviour*: 63 occurrences), as some BCTs occur more often than others. As these seven BCTs occurred the most within the assessment video, the further result description focuses on these. The four BCTs 6.1. *Demonstration of the behaviour* (M=39.15%), 1.4. *Action planning* (M=37.57%), 8.1. *Behavioural practice/rehearsal* (M=29.55%) and 4.1. *Instruction on how to perform the behaviour* (M=29.52%) show a rather low mean. In contrast, the three BCTs 2.2. *Feedback on behaviour* (M=54.40%), 10.4. *Social reward* (M=61.31%) and 7.1. *Prompts/Cues* (M=61.54%) were identified more easily and show a higher mean (in fact, the highest of all BCT types as explained above). Overall, from a visual analysis, it can be noted that the most frequent occurring BCTs of the assessment video show a low mean and a great standard deviation of the BCT type identification rate (e.g., compare 8.1. *Behavioural practice/rehearsal* M=29.55% and SD=32.06% and 4.1. *Instruction on how to perform the behaviour* M=29.52% and SD=35.92%). One exception is 1.4. *Action planning*, which shows a rather low mean (M=37.57%) and also a lower standard deviation (SD=21.09%), but at the same time occurs less often than the BCTs mentioned above. The next section focuses on the qualitative results from the BCT survey completed by participants of the BCT training workshop.

3.3.2.3 Informal SLT Student Comments

SLT students started to give comments on the assessment coding task after completing it, without being explicitly asked for feedback. This task had not been pre-planned. However, an informal discussion about the SLT students' workshop and assessment coding experience took place and informal comments noted and considered in the revision process of the BCT training workshop in Stage 3. Comments were made concerning the amount of time given to practising the coding of BCTs prior to the assessment coding task — students reported that they did not have enough time to learn how to code BCTs reliably. Also, the number of BCTs included were "too many and this was confusing and hard to apply in the coding task". In addition, the Excel spreadsheet used to document the identified BCTs was found to be a confusing template, as there was no transcript from the intervention session included (utterances from therapist and child). Students reported that it was hard to note utterance said by the therapist in line with the correct time stamp and the identified BCTs. In addition, participants found the stipulation to document a BCT type just once within an utterance hard as they constantly had to double-check whether a certain BCT type had already been noted within an utterance. All these informal participant comments were included in the workshop revision process of the BCT training workshop for Stage 3, as this information was found to be valuable and helpful — even though the discussion that took place was unplanned and informal.

3.3.3 The Use and Application of the BCTTv1 for SLTs and SLT Students in SSD Interventions

This part of the results section focuses on the outcomes of the BCT survey that SLT students and SLTs filled out at the end of the BCT training in Stage 2. The survey investigated the participants' opinions on the use and application of the BCTTv1 (Michie et al., 2013b) in SLT, especially for working with children with SSD. The detailed survey content can be found in Appendix N.

Five different sections are investigated in this section to answer the research questions. First, a quantitative analysis of the most useful BCTs according to students and SLTs will be shown, linked to a qualitative analysis in which reasons for these decisions given by students and SLTs will be reported. The most useful BCTs according to students and SLTs are shown rated and ranked. Second, information on students' and SLTs' opinions about which five BCTs were used the most in SSD intervention is included. When developing the survey, it was decided that participants should pick the five BCT types they think are most used in SSD interventions. A third step examined whether students and SLTs think that BCTs help to label actions and techniques used in SSD intervention more explicitly. Lastly, results on the reported usefulness of BCTs for clinical training in the curriculum of SLT students are shown. As all research questions were aimed at collecting general data on these issues rather than comparing group differences and opinions between SLTs and students, results will be displayed as a group in general, with some exceptions when displaying group difference is useful for later results and/or the discussion.

3.3.3.1 Usefulness of BCTs

The opening question of the survey was rather general, and asked SLTs and students how useful BCTs are in interventions for children with SSD. Figure 14 below gives an overview of participating SLTs' (N=10) and students' (N=11) answers.

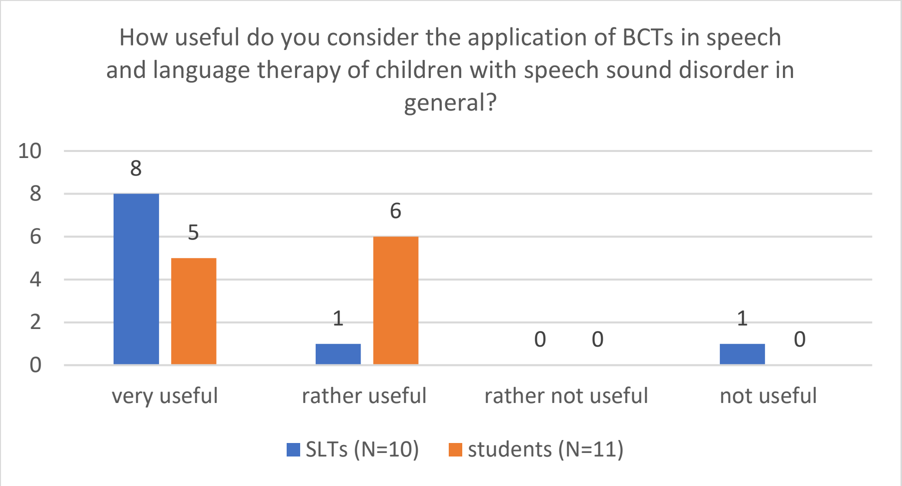


Figure 14: Responses of SLTs (N=10) and SLT students (N=11) on how useful they consider the application of BCTs in SLT of children with SSD

Looking at Figure 14, it can be observed that most answers refer to BCTs being very useful (N=13/21) or rather useful (N=7/21). Only one SLT indicated that BCTs are not useful for SSD intervention. Interestingly, in general more SLTs (N=8/10) than students (5/11) suggested that BCTs are very useful with the majority of students (N=6/11) saying that BCTs are rather useful. Nevertheless, twenty participants out of twenty-one consider BCTs as useful in SLT of children with SSD.

Reasons for the decisions of students and SLTs were investigated in a qualitative analysis. All participants were asked to indicate five (or more) reasons for their decision on whether they think that BCTs are useful for SSD intervention. Categories have been created with all answers which were mentioned more than once. Answers which only occurred once have, due to their rare occurrence, not been included here but are attached in Appendix Q. Overall, 101 answers were given by twenty-one participants. Figure 15 shows a flowchart with the procedure of the qualitative analysis of participants' answers.

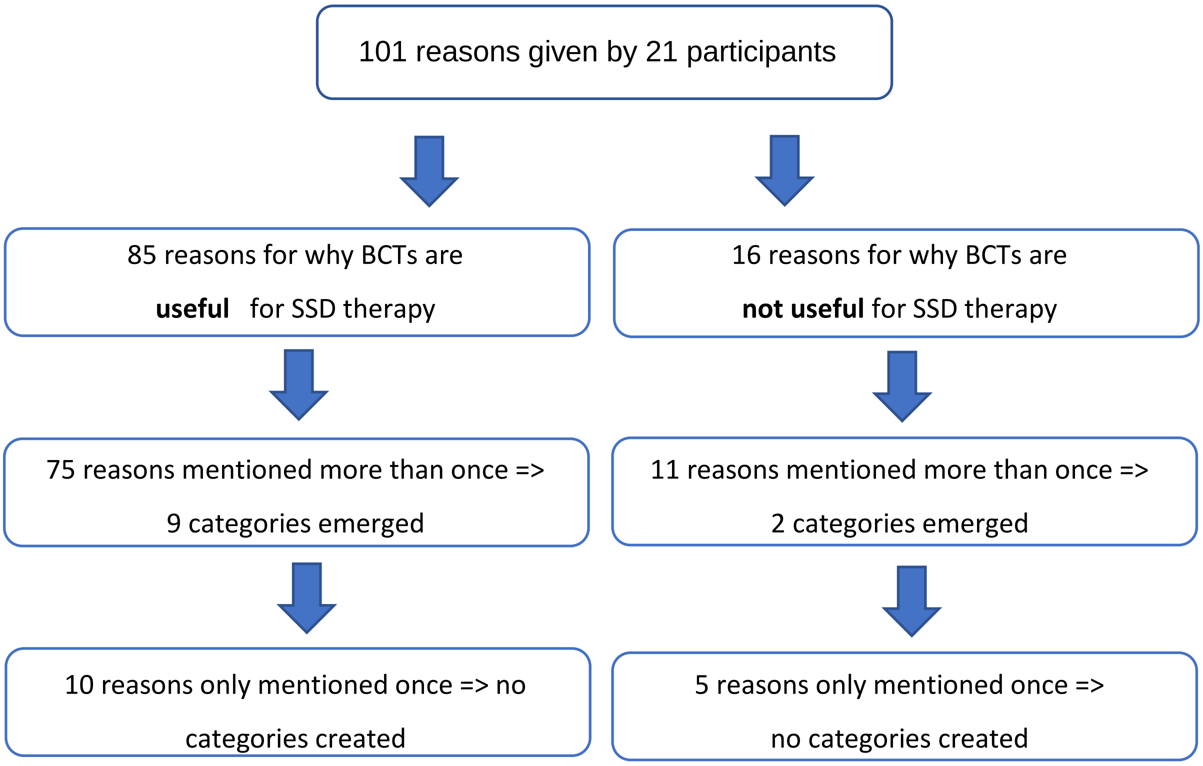


Figure 15: Flowchart of qualitative analysis addressing why participants (N=21) think that BCTs are useful or not useful for SSD interventions

Overall, all twenty-one participants gave 101 reasons for why BCTs are or are not useful for SSD therapy. Most answers were positive towards BCT use in SSD therapy intervention (N=85) with only a small number of reasons why BCTs are not useful for SSD therapy (N=21). Using thematic analysis (Braun & Clarke, 2021), categories were created for answers occurring more than once, as categories then emerged from the data. As Braun and Clarke (2021) state, the "inclusion of data extracts serves two main purposes: evidencing your analytic claims, and allowing the reader to judge the fit between your data and your understandings and interpretations of them. You should select a number of extracts (per theme) that most strongly and clearly evidence your analytic claims." (Braun & Clarke, 2021, p. 133). It is for this reason, that examples of the participants' answers represented in the categories were included in the results, and that answers that only occurred once were included in Appendix Q. Nine categories have been found in participants' seventy-five answers for why BCTs are useful in SSD therapy and two categories emerged from the reasons why BCTs are not useful in SSD therapy. Reasons mentioned only once for why BCTs are useful or not useful can be found in Appendix Q. Figure 16 shows the nine categories and the number of answers for each category of why BCTs are useful for SSD intervention.

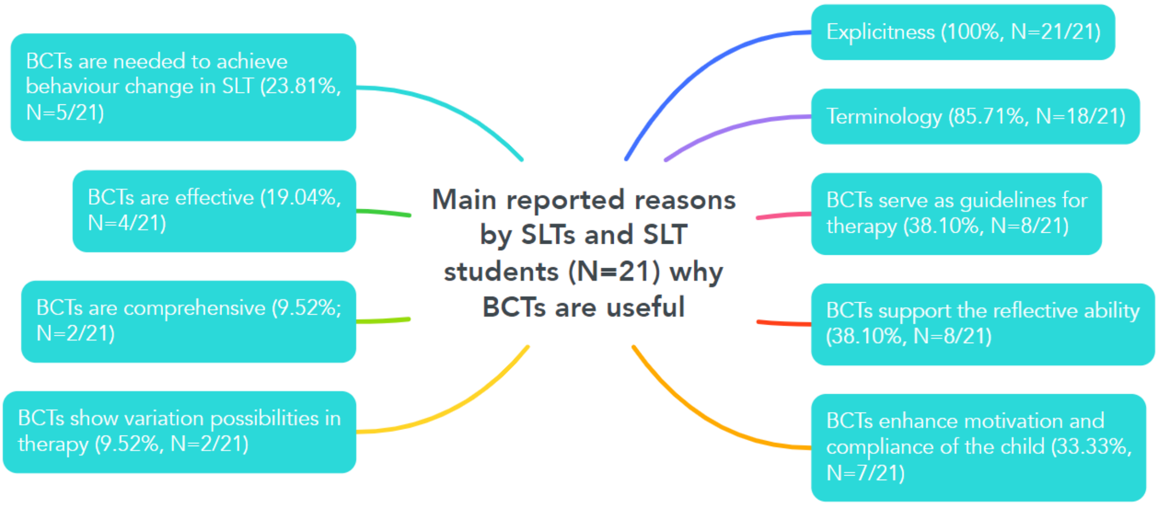


Figure 16: Main reasons reported by SLTs and SLT students (N=21) in nine categories on why BCTs are useful in SSD intervention

Every student and SLT (100%, N=21/21) referred to the explicitness of BCTs and mentioned BCTs as useful for SSD interventions, as using and applying BCTs provide the possibility of being very clear and precise about the techniques used. Participants reported that therapists' actions are made more transparent, and the awareness of what to do and how to do it as a therapist is supported. Some examples of statements from participants include "unconscious behaviour [of the therapist] is moved to the fore", "not only the therapy method but also the didactic to convey knowledge is central" and "sensitisation for implicit therapy behaviour". In addition, explaining therapy content and the delivery of therapy content for parents and carers was seen to be easier and more tangible when using BCTs.

The category explicitness is closely followed by the category terminology, which was mentioned by 85.71% of participants (N=18/21). The main arguments were that BCTs serve as coherent and consistent terminology, as BCTs are explicitly defined. Thus, participants mostly reported that BCTs provide "a coherent terminology", "exact definition [of behaviour change techniques], "names for techniques" and therefore a possibility for "comparison of techniques". Traceability of actions when using BCTs is good and different AHPs would be able to discuss several components of a therapy when using the same terminology. In addition, participants noted that BCTs go beyond the description of the content of an intervention and therefore make processes tangible by using consistent terminology. Thus, some participants noted that "it is important, that as SLTs, we refer to one coherent terminology for what we do" and "coherent terminology supports to exchange views on one's own behaviour [with other professionals]". Also, according to participants, replication of therapy interventions in research or clinical practice would be supported by using one terminology. Comparisons of different therapy interventions can also be made more easily when using a coherent terminology.

38.1% of participants (N=8/21) mentioned that BCTs can serve as guidelines as they are very transparently defined and contribute to the implementation of an intervention. An example statement for supporting this view is “[BCTs give] an indication for therapy implementation”. Thus, participants argue, that BCTs can serve as guiding principles for how to carry out an intervention as precise techniques help to apply interventions. In addition, participants claimed that BCTs help newly qualified practitioners to plan and apply an intervention. Moreover, some even said that BCTs might also be helpful for parents and caregivers, to understand and support their children at home and to gain understanding of how SLT interventions work, as BCTs are very tangible and clearly arranged. An example statement supporting this view is “parents/caregivers have something to orientate in terms of therapy session content”.

The same number of participants (38.1%, N=8/21) as for guidelines mentioned that BCTs help practitioners to reflect on their own therapeutic actions. Additionally, some mentioned that BCTs enable a different view on therapy and to adapt the therapeutic actions specifically for the individual child. Analysing of therapy sessions to reflect on therapeutic actions is also made easier when using BCTs, as they are well structured and defined. Some also claimed that using BCTs helps to document the therapy session afterwards in terms of therapy actions.

Other reported reasons for why BCTs are useful in SSD intervention were that using BCTs enhance the motivation and compliance of the child (33.33%, N=7/21), that BCTs are needed for facilitating behaviour change (23.81%, N=5/21), that BCTs are effective (19.04%, N=4/21) and comprehensive (9.52%, N=2/21) and offer a variation in therapy interventions (9.51%, N=2/21).

Overall, 16 answers were given by 21 participants regarding reasons why BCTs are not useful. Two categories were found within 11 answers, as these reasons were given by more than one person (single answers are attached in Appendix Q). The two categories are shown in Figure 17.

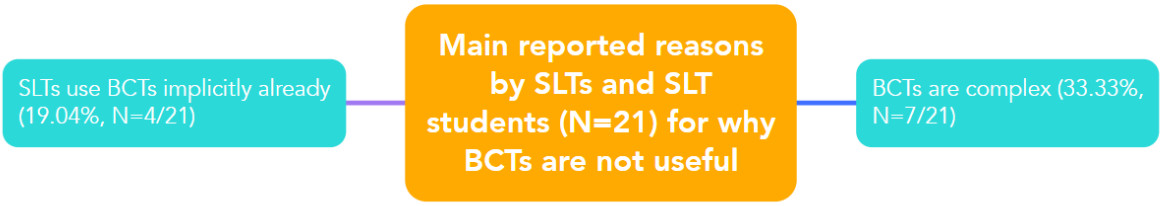


Figure 17: Main reported reasons by SLTs and SLT students (N=21) and two categories on why BCTs are not useful in SSD intervention

The most reported reasons by 7/21 participants for why BCTs are not useful for SSD intervention was the complexity of BCTs. Participants said that the BCT training is very time-consuming and complex to apply. The second most reported reasons for why BCTs are not useful in SSD intervention was the statement that practitioners are using BCTs implicitly already (N=4/21) without labelling the actions as such. Addressing the issue that SLTs use BCTs implicitly already, a person mentioned that “working following her gut instinct” had worked well so far and that knowing which BCT had been used would not add anything to her professional action.

3.3.3.1.1 BCT Rating and Ranking

To further investigate SLT and student opinion and experience after the BCT training on the use of BCTs for SSD intervention, questions were more detailed in the following sections. Participants completed a rating for all seventeen BCTs from very useful to not useful for each BCT individually — rating options were: 1 = very useful, 2 = rather useful, 3 = rather not useful, 4 = not useful. Table 17 shows the descriptive measures of the BCT rating results (options of rating 1-4) listed from best to lowest rated BCT type completed by all students (N=11) and all SLTs (N=10) counted as one group (N=21).

Table 17: Descriptive results of BCT rating by SLT students and SLTs (N=21)

BCT type	Mean	Median	SD	Min.	Max.	Range
6.1. Demonstration of the behaviour	1.00	1.00	.000	1	1	0
2.2.Feedback on behaviour	1.05	1.00	.218	1	2	1
4.1. Instruction on how to perform the behaviour	1.05	1.00	.218	1	2	1
8.1. Behavioural practice/rehearsal	1.05	1.00	.218	1	2	1
7.1. Prompts/cues	1.14	1.00	.359	1	2	1
1.6. Discrepancy between current behaviour and goal	1.24	1.00	.436	1	2	1
10.4. Social reward	1.38	1.00	.590	1	3	2
1.4.Action planning	1.48	1.00	.512	1	2	1
1.1.Goal setting (behaviour)	1.62	2.00	.590	1	3	2
2.6. Biofeedback	1.67	2.00	.730	1	3	2
10.3. Non-specific reward	1.76	2.00	.700	1	3	2
1.3.Goal setting (outcome)	1.81	2.00	.680	1	3	2
10.2. Material reward (behaviour)	1.81	2.00	.814	1	3	2
12.5. Adding objects to the environment	1.90	2.00	.700	1	4	3
3.1. Social support (unspecified)	1.95	2.00	.805	1	3	2
8.6. Generalisation of target behaviour	2.10	2.00	.995	1	4	3
14.8. Reward alternative behaviour	2.33	2.00	.966	1	4	3

Note. Rating options: 1= very useful, 2= rather useful, 3= rather not useful, 4= not useful

Considering descriptive measures of both groups across all seventeen BCTs, the rating results of the BCT survey scoring system show that the BCT 6.1. *Demonstration of the behaviour* was rated as very useful (1) by each participant (N=21/21) and therefore shows a mean of M=1.00 and no standard deviation (SD=.000). Three other BCTs were also rated well (mostly very useful =1 and some rather useful =2) and were therefore rated on second place equally each: 2.2. *Feedback on the behaviour*, 4.1. *Instruction on how to perform the behaviour* and 8.1. *Behavioural practice/rehearsal*, all showed equal values for means, medians and standard deviations (M=1.05, Median=1, SD=.218), closely followed by the BCT 7.1. *Prompts/cues* (M=1.14, Medan=1.00). BCTs with comparably lower ratings and therefore poorer ranking are 14.8. *Reward alternative behaviour* (M=2.33, Median=2.00, SD=.966) and 8.6. *Generalisation of target behaviour* (M=2.10, Median=2, SD=.995).

The next analysis focused on the ranking of all seventeen BCTs by SLTs and students, to see which BCTs are especially useful for SSD intervention according to students and SLTs. Both groups ranked the seventeen BCTs in position one to seventeen and were asked for their personal opinion on how useful each BCT is compared to all other BCTs. It should be noted that the order of the ranking does not necessarily indicate that the BCT ranked at the end is not useful at all, merely that it may be less useful than some other BCTs. One student did not complete the ranking correctly as two numbers were used twice. Hence, this student's data has been excluded and the data analysis of the BCT ranking only includes twenty participants. For the ranking, participants used the numbers one to 17 to rank the 17 BCTs in terms of their usefulness from 1 (most useful) to 17 (least useful). Table 18 first shows the descriptive measures of the BCT ranking of SLTs and students as one group (N=20), starting with the best ranked to the lowest ranked BCT type.

Table 18: Descriptive results of BCT ranking by SLT students and SLTs (N=20)

BCT type	Median	SD	Range	Min.	Max.
6.1. Demonstration of the behaviour	2	1.669	5	1	6
4.1. Instruction on how to perform the behaviour	4	2.793	10	1	11
8.1. Behavioural practice/rehearsal	4	3.152	13	1	14
7.1. Prompts/cues	5	3.861	14	1	15
2.2. Feedback on behaviour	5.5	2.452	9	1	10
1.4. Action planning	8	3.948	14	1	15
1.6. Discrepancy between current behaviour and goal	8	3.310	11	2	13
10.4. Social reward	8	4.171	13	1	14
10.3. Non-specific reward	10.5	4.110	14	2	16
1.1.Goal setting (behaviour)	11	3.598	13	3	16
2.6. Biofeedback	11.5	3.920	12	5	17
1.3.Goal setting (outcome)	12	3.120	15	2	17
10.2. Material reward (behaviour)	13	3.833	14	3	17
3.1. Social support (unspecified)	14	2.845	9	7	16
12.5. Adding objects to the environment	14	3.397	13	4	17
8.6. Generalisation of target behaviour	15.5	3.643	11	6	17
14.8. Reward alternative behaviour	15.5	4.418	13	4	17

Note. Ranking from 1 (most useful) to 17 (least useful)

Descriptive measures of the BCT ranking from SLTs and students show again that the BCT 6.1. *Demonstration of the behaviour* was ranked highest by most participants (Median=2, min=1, max=6, SD=1.669, range=5). Other BCTs ranked in first place by some participants and with good medians were 4.1. *Instruction on how to perform the behaviour* (Median=4, min=1, max=11, SD=2.793, range=10), 8.1. *Behavioural practice/rehearsal* (Median=4, min=1. Max=14, SD=3.152, range=13), 7.1. *Prompts/cues* (Median=5, min=1, max=15, SD=3.861, range=14) and 2.2. *Feedback on behaviour* (M=5.5, min= 1, max=10, SD=2452, range=9), with all of these BCTs showing a higher range and SD than 6.1. *Demonstration of the behaviour*. The two BCTs 8.6. *Generalisation of target behaviour* (Median=15.5, min=6, max=17, SD=3.643, range=11) and 14.8. *Rewarding alternative behaviour* (Median=15.5, min=4, max=17, SD=4.418, range=13) show the lowest median and have been ranked worse than any other BCTs. The boxplots in Figure 18 also present the visualised results of the BCT ranking for all participants (N=20).

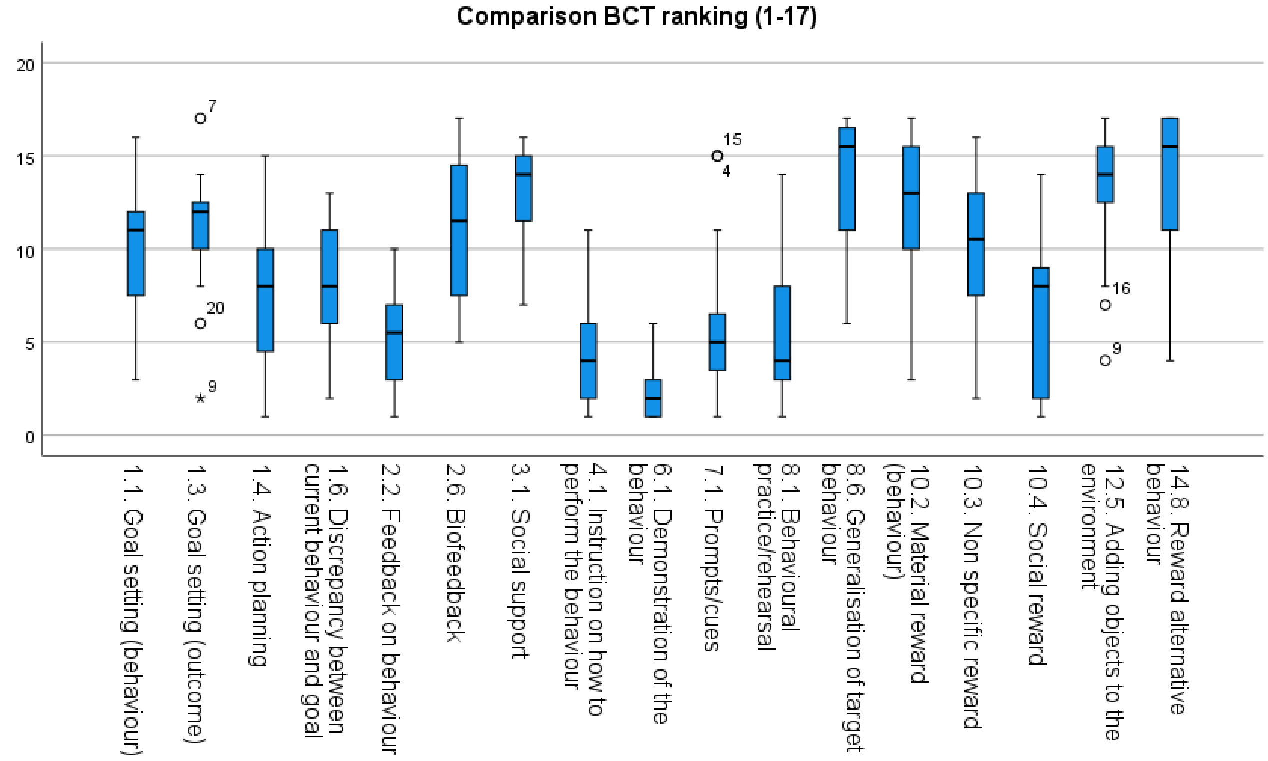


Figure 18: BCT rating by SLTs and SLT students as one group (N=20)

The findings of the descriptive data in Table 18 can be confirmed with the boxplots of Figure 18 which visualise the results. The lower the boxplots in Figure XX are, the better their ranking. Hence, 6.1. *Demonstration of the behaviour* is clearly ranked the best, whereas 14.8. *Reward of alternative behaviour* got ranked the worst. Outliers can be found for some BCTs (e.g., 1.3. *Goal setting (behaviour)*), meaning that one or more participants ranked this BCT differently than the majority of SLTs and students.

3.3.3.1.2 The most common BCTs

As this study investigates the applicability and use of BCTs in SSD interventions, SLTs and students were also asked which five BCTs out of the 17 identified BCTs they think are the most commonly used BCTs in daily SLT practice. Figure 19 shows all 17 BCTs and SLTs and students' answers addressing the most commonly used BCTs for SSD intervention in clinical SLT practice.

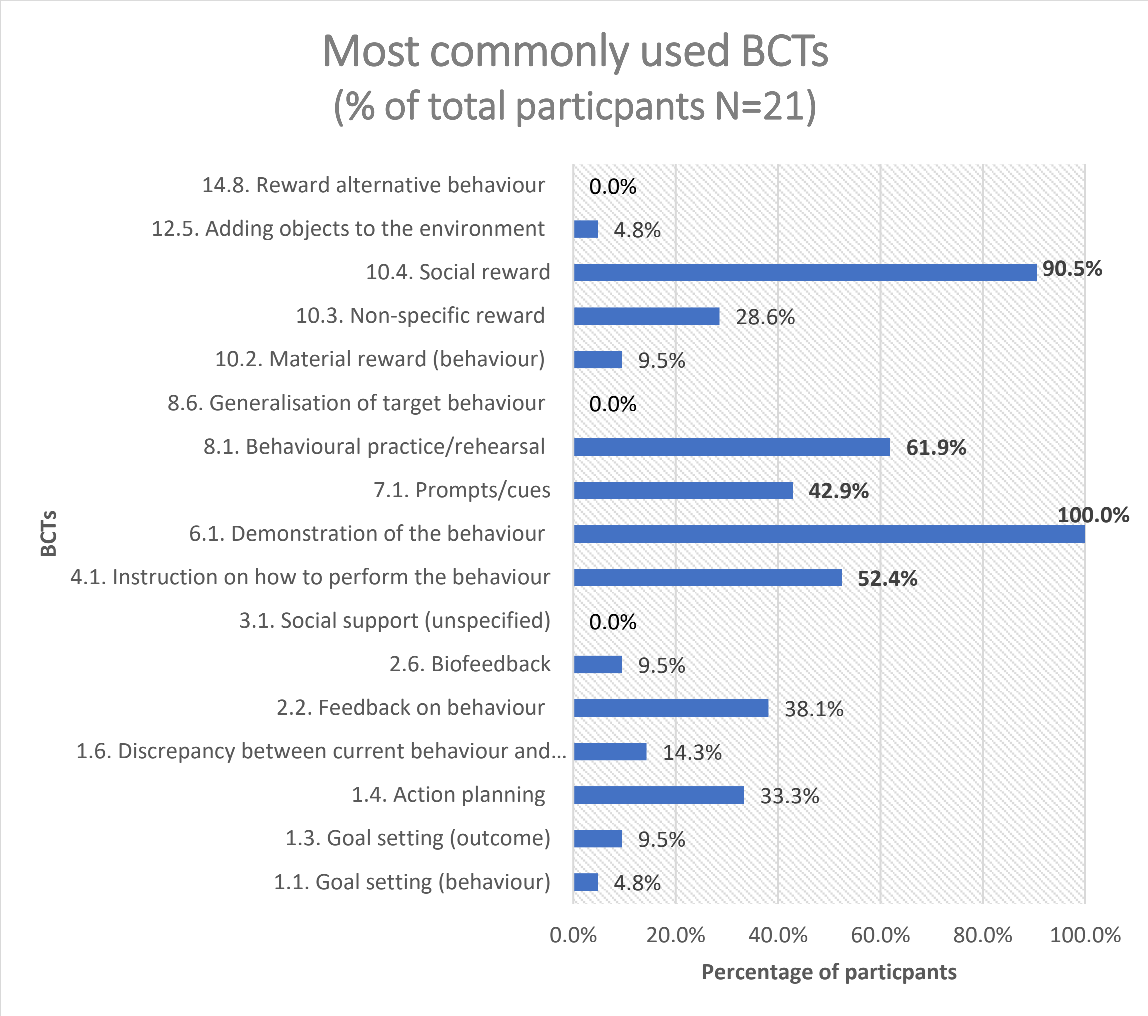


Figure 19: Most commonly used BCTs in clinical practice according to SLTs and SLT students (N=21), values >40% written in bold text

100% of students and SLTs mentioned the BCT 6.1. *Demonstration of the behaviour* as one of the most commonly used for therapy intervention with children with SSD in daily SLT practice, followed by 10.4. *Social reward* (90.5%). Ranked in places three to five are the BCTs 8.1. *Behavioural practice* (61.9%), 4.1. *Instruction on how to perform the behaviour* (52.4%) and 7.1. *Prompts/cues* (42.9%). Furthermore, the BCTs 2.2. *Feedback on behaviour* (38.1%) and 1.4. *Action planning* (33.3%) were also recognised as commonly used in SSD intervention. SLTs and students did not mention the three BCTs 14.8. *Reward alternative behaviour*, 8.6. *Generalisation of target behaviour* and 3.1. *Social support (unspecified)* when choosing the five most commonly used BCTs for SSD intervention with children in clinical practice.

3.3.3.2 BCTs for Explicitness of Labelling Actions in SSD Interventions

Students and SLTs were asked whether the BCT training and video analysis of therapy sequences completed in the workshop helped them to capture and name the actions and techniques of the therapist more easily (and/or better) than before the BCT training. All twenty-one participants answered this question with yes (100%) and therefore think that BCTs help to explicitly label actions in SSD interventions.

3.3.3.3 BCTs for Clinical Training of SLT Students

SLTs and students were asked whether they think that teaching BCTs in speech therapy training would be useful. Figure 20 displays the overall results for both groups (N=20), with the exclusion of one SLT, who did not answer this question.

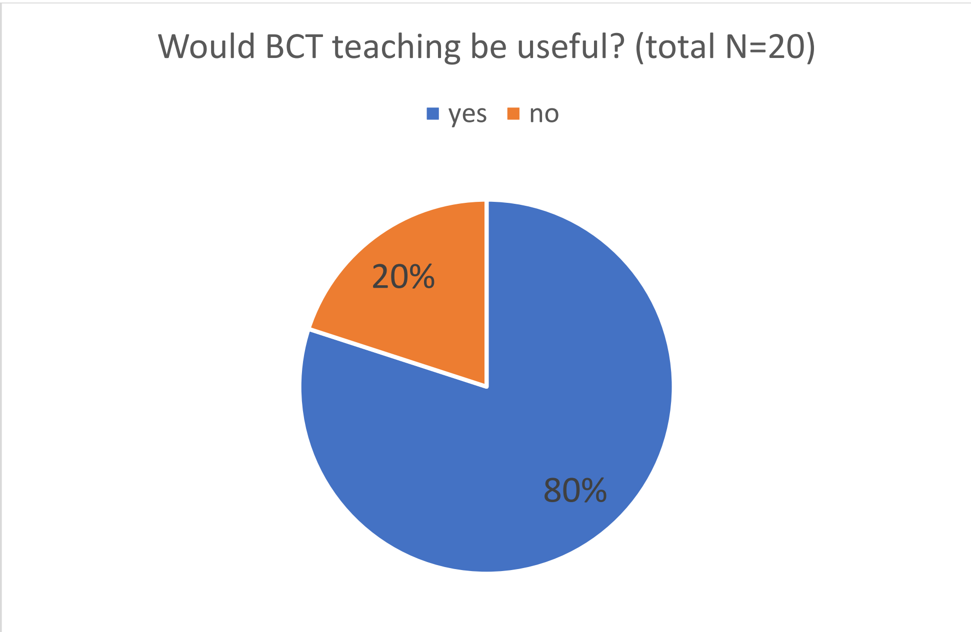


Figure 20: Participants (N=20) answer to whether teaching BCTs in SLT training would be useful

One fifth of participants answered that BCT teaching in SLT training would not be useful (20%, N=4/20), but the high majority of participants said otherwise (80% yes to BCT teaching, N=16/20). As it was of interest to compare SLTs' and student SLTs' thoughts on this, these results have additionally been split into the two groups, as Table 19 shows.

Table 19: SLT students (N=11) and SLTs (N=9) answers about whether they think that teaching BCTs is useful

	students (N=11)	SLTs (N=9)
yes	72.7 % (N=8)	88.9% (N=8)
no	27.3 % (N=3)	11.1% (N=1)

The majority of participants from both groups endorsed teaching BCTs embedded in the SLT training. Participants were additionally asked to justify their choice on whether they think that teaching BCTs in SLT training would be useful and were prompted to do this by an open-ended question f. One participant had to be excluded from the quantitative analysis but answered the open-ended question and is included here. In general, participants (N=21) gave answers of different length and detail. Responses were categorised, and answers given more than once determined new categories. Due to the mainly long answers, direct quotes are not given here but rather summarised in the categories below. Hence, nine categories supporting the opinion that BCTs should be taught in SLT programmes evolved and are shown in Figure 21.

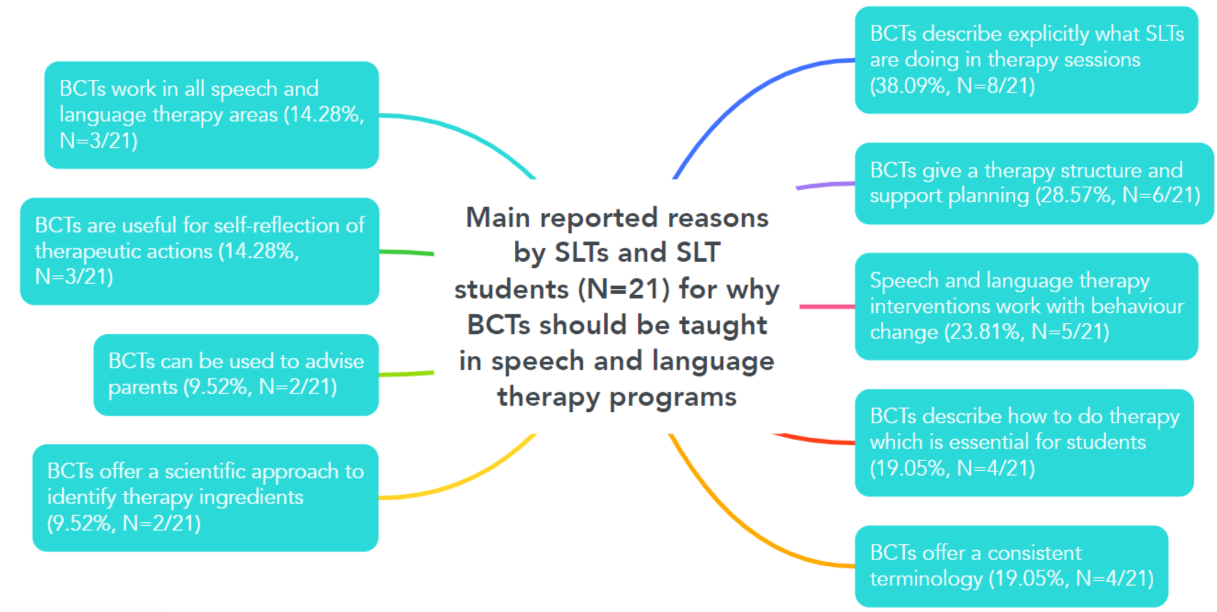


Figure 21: Main reported reasons by SLTs and SLT students (N=21) why BCTs should be taught in SLT programs

The main reason why BCTs should be taught in SLT programmes for students given by 38.09% of participants (N=8/21) was that BCTs describe explicitly what SLTs are doing in therapy sessions. By using BCTs, practitioners, students and lecturers can explicitly describe what is being done in therapy sessions. In addition, 28.57% of participants (N=6/21) also state that BCTs can give students a structure of therapy and are an aid for planning therapy sessions. Five responses (23.81%) indicated that SLT interventions are behaviour change interventions, therefore use BCTs constantly and thus BCTs should be involved in the curriculum. Two further reasons given for why BCTs should be taught in SLT classes were that BCTs explain how to do something in therapy sessions and that this is an especially essential tool for newly qualified SLTs (19.05%, N=4/21). Furthermore, according to 19.05% of participants (N=4/21), BCTs offer a consistent terminology, which is also helpful for students. Three participants (14.28%) indicated that BCTs are used throughout all SLT areas (e.g., neurological disorders such as dysphagia) and therefore should be taught in the training curriculum. Other reasons for why BCTs should be taught were their usefulness in self-reflection of therapeutic actions (14.28%, N=3/21) and using BCTs to advise parents on what is being done in speech and language sessions and how they can support their child at home (14.28%, N=3/21). Two people reported that BCTs give a scientific approach to therapy ingredients and should therefore be taught in SLT studies.

Four out of 21 participants (19.05%) claimed that BCTs should not be taught in SLT training. Only one category was necessary in respect to these responses, as there were so few answers regarding reasons for not teaching BCTs. First, two out of 21 participants (9.52%; one SLT and one student) reported that it is not necessary to teach BCTs as SLT students implicitly learn how to deliver therapy content in their clinical sessions anyway. In addition, these two participants also said that people studying SLT should have a “therapeutic personality” and therefore be able to e.g., motivate children without BCTs having to be taught. One other participant (4.76%, student) said that teaching BCTs takes too much time and is too complex for SLT training, but could imagine that an additional training for qualified SLTs would be reasonable. Another reason for why BCTs should not be taught in SLT programmes, mentioned by one person (4.76%, student), was that there is no difference in the outcome, whether someone uses BCTs or not. Lastly, one person (4.76%, student) claimed that BCTs are not used in all SLT areas and therefore teaching BCTs is not useful.

Overall, there was quite a mix of answers. Comparing responses of people who support that BCTs should be taught in SLT programmes with those who do not support this, contradiction and different opinions can be found. Nevertheless, the majority of all SLTs and students who participated (80%, N=16/20) advocate for teaching BCTs in SLT programmes. Interestingly, only one SLT (11.1%, N=1/9) argued that BCTs should not be taught in SLT programmes, whereas three students (27.3%, N=3/10) shared this opinion. Overall, the groups had similar views and did not express any apparent differences for why BCTs should be taught or for why BCTs should not be taught.

3.3.4 Chapter Summary for informed decision-making of BCTs used in next Stage

This section presented the BCT coding results of students (N=11) and SLTs (N=10) participating in the BCT training workshop. Analysis looked at the BCT coding accuracy of participants in terms of the overall BCT identification rate, the BCT type identification rate and coding errors. Participants' coding accuracy of the overall BCT identification rate and the BCT type identification rate was not as high as desired. This was true across SLTs and SLT students. BCT training workshop participants were able to identify BCTs and BCT types; however coding accuracy was lower than expected.

These current findings raise the question why BCT coding results were low. One possibility is that the number of BCTs included in the workshop were too many so the coding procedure was too complex. Thus, to make the BCT training workshop more effective it was necessary to determine which BCTs are the most informative ones in order to include fewer BCTs in a condensed and revised BCT training workshop. The rationale for including a smaller number of BCTs in the revised BCT training workshop is explained and justified in Chapter 4. The inaccurate coding results also suggests that the BCT training needs to focus more on the coding principles (Wood et al., 2015), as participants coded BCTs which were not present or not directed at the target behaviour. In addition, the previous section 3.3.3 investigated participants' opinions on the use and application of BCTs for SSD interventions and SLT in general. The great majority of participants think that BCTs are useful for SSD intervention. The aim of the next stage is to simplify the BCT training workshop and to make the training more effective. Therefore, these results are discussed in the next section to make informed decisions on the structure, content and delivery of the BCT training workshop in Stage 3.

3.4 Discussion

Stage 2 of this study investigated **RQ 2.** *Can SLTs and SLT students be trained to identify BCTs in SSD interventions and are there any differences between the BCT coding accuracy of SLTs and SLT students?* Results showed that participants are able to code BCTs to an extent — they were roughly 50% accurate in coding the real-world SSD intervention session video. Therefore, the hypothesis that the BCT training workshop has a positive impact on students and SLTs coding skills can in general be accepted, as SLTs and SLT students were able to identify BCTs but, to be confident that the training leads to accurate coding, accuracy would ideally be higher. BCT coding accuracy rates for both the overall BCT identification and BCT type identification remained lower than expected across both participant groups, SLTs and SLT students. Also, it was expected that SLTs would identify BCTs more reliably than SLT students due to their clinical experience. However, contrary to what was expected, no group differences in coding accuracy results were shown.

In addition, Stage 2 also looked at **RQ 3.** *Do SLTs and SLT students think that the application of BCTs in SSD interventions with children is useful, and if so why, and do they think that the BCT training workshop should be included in the training curriculum of students?* It was suggested that SLT students and SLTs think that BCTs from the BCTTv1 (Michie et al., 2013b) are useful for SSD interventions, although some BCTs may appear to be more useful than others. Students and SLTs agree that the BCT training workshop should become part of their training programme. Both hypotheses can be accepted, as all participants agreed 100% that BCTs from the BCTTv1 are useful in SSD interventions, and showed by completing a BCT rating and ranking that some BCT types are considered to be more important for SSD interventions with children than others. Finally, participants agreed that the BCT training workshop supports SLT students and should be included in the training curriculum of SLTs. The following sections discuss reasons for these results.

3.4.1 BCT Coding

This section discusses the results of **RQ 2**, which explored whether SLTs and SLT students can be trained to identify BCTs in a real-world SSD intervention example using 17 BCTs from the BCTTv1 (Michie et al., 2013b) and to examine participant group differences in coding outcomes. Results from the coding task of Stage 2 showed that participants were able to identify BCTs in the assessment video, but the coding accuracy had been lower than expected. This was true for both analyses — the overall BCT identification rate (M=42.55%; section 3.3.2.1) and the BCT type identification rate (coding scores varied throughout BCT types; section 3.3.2.2) — and, surprisingly, across both participant groups (section 3.3.2). The overall BCT identification rate shows how accurately SLTs and SLT students could code BCTs, whereas the BCT type identification rate compares how accurately each BCT type was identified and is linked to understand differences between BCT types. The following sections discuss these two rates.

3.4.1.1 Stage 2 Overall BCT Identification Rate

One possible reason for the low coding accuracy among participants might be the number of BCTs included in the BCT training workshop. Seventeen BCTs were included and taught in detail in the BCT training workshop, whereas only 14 BCTs occurred in the assessment video and have therefore been assessed. It may be that 17 BCTs were too many to include for the

BCT training workshop and video assessment coding task. The high number of BCTs was also raised as an issue in the informal SLT student comments feedback on the workshop. However, other BCT workshop studies have assessed coding reliability of participants after workshops taught between 24 and 44 BCTs (Wood et al., 2015) or even the entire BCTTv1 which includes 93 BCTs (Wood et al., 2016). It has to be noted that these studies (Wood et al., 2015, 2016) used different tasks to assess the coding ability of participants. Wood et al. (2015) assessed the coding ability before and after the workshop using written intervention descriptions. The study by Wood et al. (2016) used a video showing an intervention and asked participants to write an intervention description afterwards; one group used the BCTTv1 to describe the interventions, whereas the other group described the intervention without BCTTv1. Thus, the study by Wood et al. (2015) resembles the current study more as participants had to identify BCTs rather than write intervention descriptions using the BCTTv1, but still differs in the way BCT coding accuracy was assessed.

To the author's knowledge, the current study is unique as coding accuracy of BCTs included in an intervention video has been assessed item per item, rather than BCT types only. Thus, it is assumed that the BCT coding was challenging for participants due to the number of BCTs in the video, as every BCT type occurring within the 104 utterances of the assessment video had to be coded. Unfortunately, no study seems to compare BCT coding accuracy of written intervention descriptions and videos of interventions. This way it could be investigated whether different ways of assessing coding ability, for example by using intervention videos or written intervention descriptions to assess participants' coding skills, influences the outcome and results of BCT coding accuracy rates. Currently, it is uncertain to what extent the format of assessing the BCT coding accuracy impacts BCT coding results. Thus, results of the available studies cannot be compared directly to the current BCT coding outcomes.

The coding system and evaluation of participants' coding accuracy could also be responsible for the low coding outcomes of the overall BCT coding. Participants' coding was assessed by coding the assessment video using a Microsoft Excel spreadsheet. The recording system of identified BCTs required participants to note the utterance (phrase) used by the therapist in the correct time column (time stamp) and note the identified BCTs (sections 2.2.2.2 and 3.3.2.1). Retrospectively, it has to be noted that this system placed a high processing load onto participants and meant that students and SLTs had to cope with a lot of tasks at once. For example, they could not exclusively focus on detecting BCTs from the video, but also needed to keep track of the exact utterance, remember the phrase, and note down the phrase into the correct time column. Thus, simplifying the recording of BCTs identified by participants is essential for any further investigations into the identification of BCTs in SSD intervention videos.

SLT students reported that the coding task was too complex and time consuming. This could be alleviated by, for example, providing a well-structured template with a transcript of the video included. This way, coding accuracy could still be assured as all utterances from the video are included but the coding task would be easier for participants as they only need to note the BCT type according to the accurate utterance. This simplified coding procedure would also save time during the coding task. Time might also have been a factor that impacted the low coding rates of participants, as time constraints were set for the coding task. However, three hours were available to code the 10:43 minute assessment video, which seemed to be appropriate. Wood et al. (2016) included a nine-minute video which participants watched and consecutively had to describe the interventions using BCTs. However, even though both studies included videos, the current study differed in that it demanded the coding of every BCT instance accompanied by the correct BCT type within an utterance compared to BCT types occurring within the general video. Nevertheless, the duration of the intervention videos was similar.

Surprisingly, no significant group differences between SLTs' and SLT students' coding rates were found when conducting the Mann-Whitney U test (section 3.3.2.1.2), even though a difference in the BCT coding rates between the two groups had been expected, as SLTs have more experience in the practical implementation of SSD interventions than SLT students.

SLT students received double the amount of time (24h) of the BCT training workshop compared to the practitioner group (12h). With only half of the training time compared to students, the BCT training seems, nevertheless, to have been adequate for practitioners as their coding rates turned out to be the same (section 3.2.2). SLT students have less clinical experience than SLTs do. Thus, longer workshops for students may have helped to compensate their lack of experience compared to SLTs. Besides the difference in the duration of the BCT training workshop between groups, content was also slightly different for both groups. Thus, SLT students received more training on coding SSD intervention videos compared to SLTs (section 3.2.2; eight training videos for SLTs and 16 for SLT students). The difference in the number of BCT training videos could also have had an impact on the BCT coding accuracy rate of both groups. For example, students might have achieved better results as they had received more training, and SLTs may have had lower results as fewer training videos were used in the workshop.

Considering the difference in clinical experience of the two groups, they may be relying on different things being available as resources for them when coding BCTs. SLT students may have theoretical knowledge, such as the evidence base practice (EBP) framework, to support them in coding BCTs, whereas practitioners use their clinical expertise. Thus, there might be a difference in how SLT students apply theoretical knowledge of the BCT SSD list compared to how SLT practitioners use the knowledge of the BCT SSD. Students are used to applying theoretical frameworks and complying with all specifications as they have little practical experience they can build on. Thus, students may stick more to coding rules and coding requirements than SLT practitioners as, in turn, practitioners have much more experience to draw from.

Overall, more experience can be seen as an advantage for any practical and clinical therapeutic situation. However, when identifying or implementing theoretical frameworks such as SSD BCTs, sticking to specified rules is essential for identifying BCTs correctly. When combining coding rules, practitioners still retrieve their practical experience and link this to the theoretical framework and then code BCTs. This link may be misleading though — the plain utterance in the session might not itself include a BCT but practitioners may see the greater picture or the intent of the SLT in the video and therefore infer and then code a BCT based on their own experience (Wood et al., 2015). In contrast, it is suggested that students have little practical experience to build on. In addition, students are used to learning theoretical content and applying this to case studies and/or videos. They may, therefore, find it easier to stick to coding requirements as their practical experience is not as extended as that of the practitioners. Linking this suggestion back to the model of evidence-practice (Dollaghan, 2007) (section 1.2.1), it would suggest that the practice expertise of students (=internal evidence) is lower as their clinical expertise to date is limited, and the pillar including external evidence, such as theoretical knowledge and frameworks retrieved from scientific studies, higher. Thus, students may have an advantage for coding BCTs accurately, as they are used to applying theoretical frameworks and do not rely on practical knowledge compared to practitioners, but rather follow coding rules strictly.

3.4.1.2 Stage 2 BCT Type Identification Rate

In order to develop a clearer interpretation of coding accuracy and understand how successful the training was, it was important to look in detail at individual BCT types and how consistently they were identified across participants. The BCT type identification rate shows the extent to which differences between the individual BCT types were clearly understood. This may indicate whether they were taught sufficiently clearly and explicitly in the training. The BCT type identification rates varied greatly among the 14 occurring BCT types of the assessment video (section 3.3.2.2). BCT coding results and explanations for these are discussed for the least (4 BCT types, see below) and most occurring BCTs (7 BCT types, see below) of the assessment video, to attempt to link the occurrence of BCTs to the coding accuracy of participants.

Four BCTs (1.3. *Goal setting (outcome),* 1.6. *Discrepancy between current behaviour and goal*, 10.2. *Material reward (behaviour)*, 12.5. *Adding objects to the environment*) occurred only once within the assessment video. However, three of these BCTs achieved noticeably high coding results (1.6. *Discrepancy between current behaviour and goal*, 10.2. *Material reward (behaviour)* and 12.5. *Adding objects to the environment)* compared to most other BCTs.

For example, the one instance of the BCT 1.6. *Discrepancy between current behaviour and goal* occurring in the assessment video was identified by all participants (M=100%). It is suggested that SLTs and SLT students are skilled in drawing attention to children's speech forms and picking them up when comparing the current utterance of the child to the desired utterance. The task to discriminate phonemes is included in most SSD interventions (e.g., Fox-Boyer, 2014b; Jahn, 2000, 2007) and refers to the phonological awareness skills of the child. Thus, it is not surprising that this BCT was detected well by all participants in the context of a SSD therapy task.

The two other BCT types occurring once within the video and coded well were 10.2. *Material reward (behaviour)* and 12.5. *Adding objects to the environment.* Both BCTs require the involvement of "materials or objects", which can be seen in the video. Thus, these BCTs may be coded more easily as their appearance is very explicit. This suggestion is supported by the fact that the BCT type 7.1. *Prompts/cues* which did not occur once but in fact 13 times was among the best coded BCT types.

The three BCTs 10.2. *Material reward (behaviour)*, 12.5. *Adding objects to the environment* and 7.1. *Prompts/cues* have one thing in common — namely, the visual recognition. The BCT 7.1. *Prompts/cues* uses visual stimuli in the assessment video by using hand prompts. (It should be noted that stimuli do not need to be visual for 7.1. *Prompts/cues* but have been used as such in this particular SSD session, section 3.2.2.1.1 Table 10). Thus, coding results indicate that BCT types which are visually explicit in the assessment video were identified more easily than those that were subtler, as these three BCTs show some of the highest BCT coding rates among all 14 occurring BCTs of the assessment video (only the BCT 1.6. *Discrepancy between current behaviour and goal* has a higher coding rate) (section 3.3.2.2). However, it still has to be considered that two of these BCTs only occurred once within the video, which is why coding accuracy of participants has to be interpreted with caution for these BCTs. The data still shows the tendency that less often occurring BCTs seem to be identified more easily than BCTs which are present more often in the assessment video. Reasons why BCT types occurring less often can be identified well may be linked to the therapeutic task in hand as well as the saliency of the BCT type.

In contrast, coding results of the seven most occurring BCTs (6.1. *Demonstration of the behaviour*, 8.1. *Behavioural practice/rehearsal,* 10.4. *Social reward*, 4.1. *Instruction on how to perform the behaviour,* 7.1. *Prompts/cues*, 1.4. *Action planning* and 2.2. *Feedback on behaviour*) showed a mixed picture. BCTs occurring between 9 and 63 times within the assessment video have been considered as the most occurring BCTs, even though the range is high. This is because only three BCTs occurred more than 30 times (6.1. *Demonstration of the behaviour*, 8.1. *Behavioural practice/rehearsal* and 10.4. *Social reward*) and all others between three and 15 times (section 3.3.2.2).

Overall, results indicate that participants had more difficulty in coding frequently present BCTs as they show lower coding accuracy results. This was true for the most occurring BCTs 6.1. *Demonstration of the behaviour,* 8.1. *Behavioural practice/rehearsal,* 4.1. *Instruction on how to perform the behaviour* and 1.4. *Action planning,* which were identified by less than 40% of participants. However, the fact that these BCT types occurred many times more compared to other BCT types occurring once to nine times could also mean that it is harder to consistently code these frequently present BCT types for the item per item analysis that was used in this study to assess coding reliability. In short, when there are many instances of one BCT type, it is harder to identify all of them, compared to BCT types occurring less often. If coding BCTs had been assessed by identifying every BCT type once within the video, as in a study by Michie et al. (2013b), BCTs occurring more often would have had better chance of being detected due to their frequent occurrence. This resembles the findings of Michie et al. (2013b), which suggest that frequently occurring BCTs have been coded more reliably, assessing coding accuracy by asking participants to identify present BCT types once but not every instance of each BCT type.

This discussion now moves on to consider the content and meaning of BCT types identified less reliably than others to develop a clearer interpretation of how well BCT types are identified or what needs to be considered when teaching these BCT types. It is suggested that BCT types of the current study affected by low coding accuracy are those applied implicitly for the majority of time in SSD interventions with children. Opening tasks (Furlong et al., 2021; Horton et al., 2004), which explain what is happening next in an explicit utterance (e.g., "*I am now going to explain how to do this, then show how to do it and then we practice it*") sometimes also occur in SSD sessions. Such an utterance then includes all four most occurring BCTs explicitly (1.4. *Action planning*, 6.1. *Demonstration of the behaviour,* 8.1. *Behavioural practice/rehearsal* and 4.1. *Instruction on how to perform the behaviour).* However, for the majority of these BCT instances, it is suggested that these BCTs are mostly applied without being explicitly mentioned during the SSD intervention tasks with children. These implicit utterances may present as "Open your mouth widely like a lion" (4.1. *Instruction on how to perform the behaviour)*, "Look at me, my mouth is widely open" (6.1. *Demonstration of the behaviour)* and/or "Let's give it another try" (8.1 *Behavioural practice/rehearsal*). Thus, it is suggested that planning, instructing, demonstrating and practising a behaviour often takes place in SSD intervention for children without being pointed out explicitly.

It is also suggested that being more explicit in giving instructions might also involve more complex language, which may be why SLTs are less likely to introduce activities in this way as children with communication difficulties can have trouble to understand such instructions. This may present differently in SLT sessions with adults (Toft & Stringer, 2017), as exercises and tasks are often explained in more detail for transparency and the patient's compliance. However, as BCTs for giving instructions or rehearsing exercises (1.4. *Action planning*, 6.1. *Demonstration of the behaviour,* 8.1. *Behavioural practice/rehearsal* and 4.1. *Instruction on how to perform the behaviour)* seem to be used rather implicitly without being explicitly mentioned, it is assumed and shown in the coding results of this study that coding these BCTs is harder than coding BCTs which can be identified by visual stimuli such as objectives and/or materials (e.g., 10.2. *Material reward (behaviour)* or 7.1. *Prompts/cues* the way this BCT was used in the assessment video). Thus, these BCTs often require a verbal stimulus which needs to be recognised by coders to be able to code it accurately. This may not fully apply for the BCT 6.1. *Demonstration of the behaviour,* as this could also be recognised visually; however, to code the BCTs 1.4. *Action planning*, 4.1. *Instruction on how to perform the behaviour* and 8.1. *Behavioural practice/rehearsal* a verbal stimulus is needed. In addition, these four BCTs often seem to lack clear boundaries as their transition is fluent and cannot be demarcated from each other explicitly as they are strongly connected (e.g., demonstrating a behaviour often goes hand in hand with behavioural practice/rehearsal in SSD intervention). This study did not aim to identify patterns of BCT types; however, it has been observed that the three BCTs 4.1. *Instruction on how to perform the behaviour,* 6.1. *Demonstration of the behaviour* and 8.1. *Behavioural practice/rehearsal*, which were also identified in all SSD interventions included, occurred in combination especially frequently. As explained before, the nature of SSD interventions supports the combination of these three BCTs (section 2.4).

The BCTs 10.4. *Social reward* and 2.2. *Feedback on behaviour* were the exception among frequently present BCTs as both have been coded better than all other BCTs occurring often (over 50%). These two BCTs are related to each other, as both are directed to the child as reaction to an action from the child. For example, 10.4. *Social reward* may be a verbal or non-verbal reward after the child tries to perform a behaviour without any further information on the behaviour. In contrast, 2.2. *Feedback on behaviour* always includes informative or evaluative feedback on the performance on the behaviour of the child. These two BCTs can even be combined in an utterance, such as “Super, you spotted the /s/ sound correctly at the beginning of the word sun!” In this case, both BCTs are coded for this utterance. Thus, it can be seen that these BCTs are highly related in context and in their use, as both are used as response to the child’s action. Therefore, they may be easier to code as they follow directly from an utterance of the child and are not included in a longer instructive string of utterance by the therapist (such as an utterance which includes more BCTs e.g., 1.4. *Action planning,* 6.1. *Demonstration of the behaviour,* 8.1. *Behavioural practice/rehearsal* and 4.1. *Instruction on how to perform the behaviour*). However, as these two BCT types show many similarities and differences are fine, it was observed during data analysis that the two BCT types 2.2. *Feedback on behaviour* and 10.4. *Social reward* were often mistaken for each other, as discriminating between these two BCT types seemed to be difficult, probably due to their similar nature.

Overall, BCT types occurring more often also have the potential to be missed more often in the video. Thus, reliability of BCT coding is not necessarily linked to the content or meaning of a BCT but could also show that it is harder to code every instance of a BCT type which occurs frequently. This is especially true for item by item analysis, when coders are asked to identify every occurring instance of a BCT type, as was used to assess coding accuracy in this study. However, when assessing coding accuracy differently — for example, coding each BCT type once if it occurs in the video — frequently occurring BCT types would be at an advantage, as there are more possibilities for coders to identify them. However, considering the content of BCT types for developing a clear interpretation of coding accuracy, participants may have easily been confused with similarities of BCT types as some are rather hard to differentiate according to their descriptions in the taxonomy or in the context of practical application. In addition, BCT types might overlap in the practical therapeutic context which can also add confusion. For example, the BCTs 6.1. *Demonstration of the behaviour* and 8.1. *Behavioural practice/rehearsal* may raise the question whether demonstration is already practising. However, for the BCT training workshop, examples for SSD interventions have been defined for BCT descriptions and explanations to avoid such coding confusion (section 3.2.2). The distinctiveness of BCT descriptions is mentioned in many studies and reported as an issue when using the BCTTv1 for describing complex interventions (Matthews et al., 2020; Wood et al., 2016). Therefore, the possibility of confusion from explanations and descriptions of BCTs needs to be considered for both the BCTTv1 and the SSD BCT list developed in this study (section 3.2.2.1.1. Table 10).

Further sections discuss results of the BCT survey, which investigated whether the use of the BCTTv1 for SSD interventions is seen as useful for labelling what SLTs are doing in SSD intervention sessions. It also looked at SLT students' and SLTs' opinions about teaching BCTs in the SLT curriculum for SLT students.

3.4.2 Application and Use of the BCTTv1 for SSD Interventions and for SLT Student Training

This section aims to discuss the results of **RQ 3**, which investigated SLTs' and students' opinions on the application of the BCTTv1 (Michie et al., 2013b) in SSD interventions with children. In addition, it investigated whether SLT students and SLTs think that the BCT training workshop should be included in the SLT student training.

Overall, the BCT survey indicated that, with one exception, all participants consider BCTs "rather useful" or "very useful" for SSD interventions with children (section 3.3.3.1). Participants were asked to give reasons for their answer choice. The most mentioned reasons are discussed below. Even though one participant did not agree in general that BCTs are useful, all SLTs and SLT students (even the one person) replied that BCTs are useful for reporting explicitly which techniques are being used in SSD interventions. These results are in line with literature about complex interventions, as researchers stress that BCTs have the power to identify and report active ingredients coherently (section 1.2.2) (e.g., Craig et al., 2008). This leads straight to the issue around terminology, which is to date inconsistently used for SSD interventions when reporting techniques used (section 1.2.3). Thus, the vast majority of participants mentioned that BCTs provide a coherent terminology for reporting techniques used to implement the content of a SSD intervention. This opinion is also in line with current research, as Wood et al. (2016) found that participants report that the BCTTv1 has been "useful" and "desirable" for reporting interventions clearly. Many researchers note (section 1.2.4), that describing, reporting, developing, designing, implementing, evaluating through e.g., replicating and teaching complex interventions currently lack a common terminology and active ingredients are therefore not identified and described coherently (Craig et al., 2008; Michie et al., 2013b). Thus, the need for a consistent terminology and the use of BCTs to achieve this has also been discussed widely in literature.

Furthermore, 8 of 21 participants also found that BCTs are useful when reflecting on their own therapeutic actions as they help to structure therapy sessions and provide a more aware view of therapy delivery. Matthews et al. (2020) and Weissman et al. (2022) also reported that the identification of BCTs can support the ability of the therapist to reflect on his/her own therapeutic actions. However, rather than for therapists, these studies used BCTs in the context of a BCT training for sport and exercise science students and a sport programme for children and youth including coaches (Matthews et al., 2020; Weissman et al., 2022). Nevertheless, even though the results are not from a AHP related field, programmes being delivered in these studies are similar to SLTs delivering SSD interventions (section 3.1.2) (Matthews et al., 2020; Weissman et al., 2022).

The last reason for why BCTs are seen to be useful in SSD interventions, and one mentioned by more than five participants, addresses motivation and compliance of children. SLT students and SLTs noted that they think BCTs enhance children's compliance and motivation. Indeed, as the BCTTv1 includes BCTs which aim at rewarding or supporting children socially (e.g., 3.1. *Social support (unspecified)* and 10.4 *Social reward)*), children are supported in staying concentrated and motivated when participating in and completing the planned task. Many other BCTs such as 1.4. *Action planning* also contribute to the level of motivation, for especially older children, as the process of therapy and its tasks is made explicit and therefore clear to follow. If this process includes informing children on the beginning or end of a task, it may support their motivation. However, the extent and type of impact of a single BCT is not yet investigated for many areas (Michie et al., 2018) such as SLT and still needs to be investigated.

Two reasons were mentioned as to why BCTs are not useful in SSD interventions. Seven students claimed that BCTs are complex, and four students reported that SLTs use BCTs implicitly already. The latter has been reported by researchers in the field of SLT (Stringer & Toft, 2016b; Toft & Stringer, 2017) and is not in question. Thus, even without completing discrete training in BCTs, SLTs use these. However, even if SLTs use BCTs implicitly, it does not necessarily mean that they describe these techniques explicitly by using the framework of BCTs, which offers a coherent terminology for doing so. If SLTs want to establish a common terminology and describe as well as implement techniques used in interventions coherently and explicitly, BCT training is important. Describing explicitly what is being done in a therapy intervention versus using techniques implicitly can be context related. Thus, in a therapy session while working with a child, it may not be as important to explicitly describe what is being done in that moment, whereas in a research context the explicitness of what is being done in a therapy session plays a vital role. For example, when conducting a study on the effectiveness of a SLT intervention, it is essential to make explicit what is being done implicitly to identify active ingredients of the intervention, report the intervention coherently and/or test its effectiveness and examine what works (section 1.2) (Michie et al., 2018). In addition, the same is true for a teaching context. SLT students need to know what is being done which way in a therapy session to learn how to transfer their theoretical knowledge into practice. Therefore, a common and explicit language in a teaching context is also important and can be supported by using the BCTTv1.

The complexity of BCTs and the current version of the BCTTv1 has also been criticised by participants of the BCT training conducted by Wood et al. (2016), who reported that using the BCTTv1 has been challenging although the overall application has been "useful". However, participants' use of the BCTTv1 has been assessed by describing a complex intervention using the BCTTv1, rather than identifying specific BCTs in detail. The study by Matthews et al. (2020), who also conducted a BCT training with students, reported that students found some BCTs difficult to understand and apply in a practical setting.

To investigate whether SLT students and SLTs think that some BCTs are more useful than others, a BCT rating (using a Likert Scale from 1=very useful to 4= not useful) and a BCT ranking (participants should put the 17 SSD BCTs in their personal order in terms of how useful the BCT is for SSD intervention) have been conducted (section 3.3.3.1). Results from both the BCT rating and BCT ranking show that the BCT 6.1. *Demonstration of the behaviour* was rated as "very useful" by every participant and ranked the highest. In addition, the BCT types 2.2. *Feedback on the behaviour*, 4.1. *Instruction on how to perform the behaviour,* 7.1. *Prompts/cues* and 8.1. *Behavioural practice/rehearsal* were also rated and ranked highly, and thus were seen as very useful by participants. These results are interesting, as these BCT types have also been amongst the most occurring BCTs within the assessment video, which indicates their importance for SSD interventions. In contrast, the BCTs 14.8. *Reward alternative behaviour* and 8.6. *Generalisation of target behaviour* were both rated and ranked very low and did not occur at all in the assessment video. Besides having discussed reasons for why BCTs may have not been used in this assessment video (section 3.4.1), this result may also give an insight into the importance of BCT types for SSD interventions.

Results for the question which BCTs are used most commonly in SSD interventions according to SLTs and SLT students also show a clear overlap with the ones occurring the most in the assessment video or ranked/rated as the most useful BCTs. Thus, summarising the BCT types from these questions, it can be said that BCTs 6.1. *Demonstration of the behaviour*, 8.1. *Behavioural practice/rehearsal*, 4.1. *Instruction on how to perform the behaviour*, 7.1. *Prompts/cues*, 2.2. *Feedback on the behaviour,* 10.4. *Social reward* and 1.4. *Action planning* seem to be essential for SSD interventions. Five of these seven BCT types (section 3.4.1: the BCT types 1.4. *Action planning*, 4.1. *Instruction on how to perform the behaviour*, 6.1. *Demonstration of the behaviour*, 7.1. *Prompts/cues*, 8.1. *Behavioural practice/rehearsal*) were ones that were identified in every included SSD intervention in Stage 1 (section 2.3). The nature of SSD interventions consists of demonstrating, practising, instructing a behaviour (accompanied by prompts), feedback on the behaviour and social reward to motivate the child (Fox-Boyer, 2014b; Furlong et al., 2021; Kim et al., 2012). In addition, the process of the task is also often explained so the child can navigate it well and be led by the therapist through the session. Thus, it seems as if the above-mentioned BCT types are the most important BCTs for children in SSD interventions aimed at changing behaviour. This is supported by the literature, as results of the current study are in line with one evidence-based SSD intervention approach for German-speaking children. The intervention approach P.O.P.T. by Fox-Boyer (2014) is the only one that includes all seven BCT types. In contrast, the Minimal Pair approach includes six of the seven BCT types (Weiner, 1981) and Metaphon (Jahn, 2000, 2007) includes five, which is still close to seven. Thus, applying these results to the currently available SSD interventions for German-speaking children indicates that the most effective SSD approach (P.O.P.T. by Fox-Boyer; 2014) includes all BCT types which are seen to be the most frequent, helpful and commonly used within SSD interventions. In a nutshell, results of this study fit together nicely with the most effective SSD intervention in German-speaking countries.

This study went on to investigate whether SLTs and SLT students think that the BCT training workshop assists in the explicit labelling or naming of what techniques are being used in SSD interventions. Participants decided unanimously that BCTs help to label therapists' actions more explicitly in SSD interventions. Interestingly, this result was also shown in the first section of the BCT survey when participants were asked whether they think that the application of BCTs from the BCTTv1 is useful for SSD interventions. Except for one participant, all others mentioned the component "explicitness" as an important reason for the meaningfulness of BCTs in SSD interventions in the first section of the survey already (sections 3.3.3.1 and 3.3.3.3). Literature supports these results and confirms that the BCTTv1 provides a coherent taxonomy for coherently and explicitly describing techniques used in complex interventions such as SSD interventions (sections 1.2.2, 1.2.3 and current section at the beginning).

Results from the last part of the BCT survey indicate that 80% of participants think that the BCT training workshop should be included in the training of SLT students (section 3.3.3.4). When asked to justify this choice, the reasons for including the BCT training workshop in the SLT curriculum were diverse but the ability to describe techniques for SLT more explicitly was mentioned the most. Some participants also indicated that BCTs give a therapy structure and make planning easier. However, in terms of therapy structure it is assumed that certain BCT types are used in specific stages (e.g., 1.4. *Action planning* in opening stage), rather than that BCTs are giving the therapy structure. Different stages of therapy may ask for different techniques to be used, whereas saying that BCTs give the structure would be misleading. It may just be that BCTs are used appropriately and accordingly in each specific stage of the therapy (Furlong et al., 2021; Horton et al., 2004) (sections 2.4.2 and 3.4.1). Nevertheless, as some participants indicated, BCTs may support SLTs, or rather SLT students, in planning the therapy process and give guidance in how to “do” therapy and describe techniques used in a therapy session (Rees et al., 2016). Some participants, for example, indicated that BCTs are essential for SLT students. Other studies (e.g., Matthews et al., 2020) have also found that the use of the BCTTv1 supports students in planning and implementing intervention content. Additionally, participants reported again that BCTs provide a consistent terminology for describing active components in SLT interventions (sections 1.2.2, 1.2.3 and current section). Some reasons for why BCTs should not be included in the SLT curriculum were given by four out of 21 participants. It has been suggested that as SLT students learn how to deliver therapy in the clinical placements implicitly training in the use of BCTs is therefore not necessary. This response contradicts what most participants of this study and some other studies (e.g., Matthews et al., 2020) found, as these report that the explicitness of BCTs would support students to apply techniques more confidently. In addition, studies (e.g., Horton et al., 2004) have shown that SLT graduates are often uncertain about “how to do therapy” (Horton et al., 2004, p.382). Thus, it is indicated that BCTs could support the majority of SLT students in implementing intervention content. However, these students are correct in the assumption that BCTs are used implicitly by most SLT students and SLTs (Stringer & Toft, 2016b). Another main reason given for why BCTs should not be taught in the SLT curriculum is that it takes too much time and is too complex to learn. It has been acknowledged in the literature that BCT trainings are rather time-consuming (Wood et al., 2016). So, it has to be investigated and considered carefully whether such a training pays off. In addition, the issue around the complexity of the BCTTv1 has been discussed previously in the current chapter and has been noted by other researchers (Matthews et al., 2020; Wood et al., 2016). Even though the BCTTv1 can be improved in terms of descriptions and clarity (Wood et al., 2015), the benefits of using the BCTTv1 in the context of SLT interventions seem to outweigh this.

3.4.3 Study Limitations

In the BCT training workshop for SLT students, it was noticed that the BCT type 2.6. *Biofeedback* has been included in the SSD BCT list, although the original definition of the BCTTv1 (Michie et al., 2013b) refers to external devices to get feedback. However, this BCT was interpreted incorrectly by the three SLTs who agreed on the SSD examples and has therefore been included in the list, although the use of external devices did not occur in any of the three SSD intervention manuals. Biofeedback has therefore been mistaken with tactile-kinaesthetic feedback. A BCT type capturing this is not yet available.

The way BCT coding accuracy of participants has been assessed seemed to be complicated for participants and there could have been an easier system which would have spared SLTs and SLT students some steps within this process. This could have been achieved by providing a coherent transcript of the assessment video and including all available BCT types to choose from in the specific utterances. Due to their limited availability the duration of the workshop for SLTs was shorter than the one for SLT students. Future studies may consider that the length of the workshop for both groups is the same for better comparability.

This leads to another important limitation of this study. A pre- and post-BCT coding accuracy assessment would have added the possibility of comparing coding accuracy results of participants before and after the BCT training workshop. While the current procedure can determine whether BCTs can be coded to an extent, an evaluation of whether this ability to code BCTs is significantly improved by undertaking the training, requires before and after data. Thus, by using a pre-and post-test, the improvement of participants' coding skills after completing the BCT training workshop could be assessed. This would also investigate the effectiveness of the BCT training workshop.

Participant feedback suggested the number of BCTs included was too many and the session to code the assessment video was too short. It is assumed that these factors affected the coding ability negatively as SLT students reported that they did not have enough time to learn how to code BCTs reliably. If BCT training were to be integrated in SLT training, it would need to be done in a way that was manageable within the syllabus and curriculum.

3.4.4 Implications for Stage 3

The BCT workshop training was revised and simplified for Stage 3. Thus, results of Stage 2 were the foundation for deciding which BCTs are included in the revised BCT workshop in Stage 3. The rationale for deciding BCT types included in Stage 3 is based on the most frequent, helpful and commonly used BCT types according to the assessment video and participants in Stage 2. Results of Stage 2 also give ideas for revising the theoretical and practical training in terms of practising BCT coding — for example, using fewer videos but coding them in more detail as results indicated that certain BCT types need more qualitative practice rather than superficial coding. In addition, a pre- and post-BCT training workshop coding assessment is planned to investigate the effectiveness of the training.

3.4.5 Conclusion

Stage 2 of this study shows that SLTs and SLT students can learn to code BCTs used in a real-world SSD intervention video session. However, coding accuracy was found to be low across participant groups with no group difference between SLTs and SLT students. Reasons for the low overall BCT identification rate may be the relatively high number of BCT types included in the BCT training or the process that participants were asked to follow for their coding accuracy to be assessed. Addressing the low coding accuracy results of the BCT type identification rate, it was found that BCTs occurring less often were coded better than BCTs frequently occurring within the assessment video. A BCT type occurring frequently can be missed more often than a BCT occurring less often, which could explain why BCTs more prevalent in the assessment video were coded less accurately than BCTs occurring less often.

However, the current findings also showed content related patterns which may be linked to the low coding accuracy of some BCT types. Those which could be visually recognised within the video — for example ‘material’ (10.2. *Material reward*) — were identified better than BCT types which were harder to define such as 6.1. *Demonstration of the behaviour*. Thus, the nature and meaning of BCT types may determine how well they can be identified and coded by participants in the context of SSD interventions.

Participants also rated and ranked some BCTs as being more useful for SSD intervention than others. Results from participants’ BCT rating and ranking referring to the most helpful BCTs in SSD interventions showed an overlap with results from the most frequent BCTs occurring in the assessment video. Thus, these results match nicely, and findings show that the seven BCTs 1.4. *Action planning*, 2.2. *Feedback on behaviour*, 4.1. *Instruction on how to perform the behaviour*, 6.1. *Demonstration of the behaviour*, 7.1. *Prompts/cues*, 8.1. *Behavioural practice/rehearsal* and 10.4. *Social reward* are (according to participants) the most helpful and common in SSD intervention and (according to the assessment video) the most frequent ones occurring within the assessment video (section 2.3.2). Moreover, all these seven BCTs have also been found in the SSD intervention approach P.O.P.T. for German-speaking children (Fox-Boyer, 2014b), which shows the most evidence for effectiveness among all SSD interventions for German-speaking children.

Almost all participants (N=20/21; 95%) reported that BCTs are in general useful for SSD interventions. The explicitness of BCTs from the BCTTv1 has been stated as the main reason for considering BCTs useful in SSD interventions and also for teaching and including the taxonomy in the curriculum of SLT students. Whereas all participants agree that the BCTTv1 helps to label techniques used in SSD interventions explicitly, the vast majority of SLTs and SLT students share the opinion that the BCTTv1 should be included in the curriculum of SLT students.

Chapter 4: Revised Behaviour Change Technique (BCT) Training for Speech and Language Therapy (SLT) Students (Stage 3)

The fourth chapter covers the development and implementation of a simplified and revised BCT training workshop. The rationale for changing and adapting several parameters for the revised BCT training workshop, based on results of Stage 2, are discussed and outlined in detail. The research objectives and research questions of Stage 3 are introduced, followed by methods and results of the revised BCT training workshop, as well as a discussion about these.

4.1 Introduction

The need to have a clear description, list, or taxonomy for identifying active ingredients such as techniques used in complex interventions (e.g., SSD interventions) has been discussed widely in current literature (sections 1.2.2, 1.2.3 and 1.2.4). SLT students especially would benefit from having a clear and explicit taxonomy of the techniques used in SSD interventions to bring about change in the child/patient, as they often feel uncertain about how to 'do therapy' (sections 1.4, 2.1.2, 3.1.1 and 3.1.2). A previous section (1.4.1) highlights the benefits of using the BCTTv1 (Michie et al., 2013b) for SSD intervention, whereas sections 1.4.2 and 3.1.2 stress why BCT training could support student SLTs to put their previously received theoretical knowledge into clinical practice and apply these skills. The current chapter comprises testing a revised BCT training workshop. Thus, based on results of Stage 2, adaptations and changes were made to the BCT training workshop to see whether these changes impact the BCT coding results of participants.

4.1.1 Research Objectives Stage 3

Previous BCT trainings have been developed for health professionals (Chapter 3) (e.g., Wood et al., 2015). However, a specific BCT training for SLT students which assesses the coding ability of participants pre- and post- BCT training, has not yet been conducted. It has been suggested that using the BCTTv1 (Michie et al., 2013b) can support SLT students in planning therapy sessions, implementing intervention content and reflecting on their own therapeutic actions (section 3.4). A BCT training workshop for SLT students was developed and carried out, as explained in Chapter 3. However, coding results at the end of the workshop showed lower coding accuracy than initially expected (sections 3.3.2.1 and 3.3.2.2). Reasons which may have contributed to the low BCT coding accuracy of participants in Stage 2 could have been: (1) the large number of BCT types included in the training; (2) a lack of detail given on how to code BCTs in the training workshop; and/or (3) too complex coding requirements used for the assessment video coding; (4) the complicated Excel spreadsheet which did not include a transcript of the assessment video making the documentation of identified BCTs difficult; and (5) too little time to code the assessment video. After an informal discussion following the BCT training workshop with SLT students (section 3.3.2.3), changes and adaptations have been made to the BCT training workshop using the results of Chapter 3 as the foundation in the informed decision-making process. Thus, the results of Chapter 3 have formed the rationale for changing and modifying the BCT training workshop in Chapter 4, by reducing the number of BCT types included in the BCT training workshop and changing the requirements and material of the assessment video coding procedure. The following research questions have been investigated:

RQ 4. *Does simplifying the BCT training workshop and reducing the number of BCT types included increase the BCT coding accuracy of SLT students from before to after workshop training?*

Overall, it is hypothesised, that SLT students can code BCTs noticeably better and more accurately after completing the BCT training workshop compared to before the training. Due to the revised coding requirements compared to Stage 2 (initial BCT training on how to identify BCTs in SSD interventions), the overall BCT coding accuracy is also expected to be higher than in Stage 2. In addition, as fewer BCT types are included in the revised BCT training, the coding of BCT types is also expected to be more accurate.

The survey which had been used in the initial BCT training workshop has also been revised and adapted in terms of the number of BCT types included. Participants receiving the revised BCT workshop may have a different opinion on the use of the BCTTv1 for SSD interventions. Thus, this survey has been conducted using the adapted version. The following research question was investigated:

RQ 5. *Do SLT students doing the revised BCT training workshop think that the application of BCTs in SSD intervention with children is useful and if so why, and do they think that the simplified BCT training workshop should be included in the training curriculum of SLT students?*

It is hypothesised that SLT students consider the use of BCTs in SSD interventions for children as useful, even though some BCTs are seen to be more useful than others. It is also suggested that SLT students think that students would benefit from including the revised BCT training workshop in the SLT training curriculum.

4.2 Methods

The previous BCT training workshop in Stage 2 aimed to train SLTs and SLT students to identify BCTs in a SSD intervention video sessions accurately and to investigate participants' responses to the most useful and common BCTs in SSD interventions (section 1.5, **RQ 2** and **RQ 3**). Participants in Stage 2 were SLTs and SLT students. However, the BCT training workshop in Stage 2 showed lower coding accuracy among participants than expected (section 3.3.2), as SLT students only identified 43% and SLTs 42% of present BCTs accurately. Also, results showed no noticeable difference between the coding accuracy of SLTs and SLT students and low coding results among all analyses and groups (section 3.3.2.1). Therefore, a decision was made to focus just on SLT students for this Stage 3 workshop. Because it has the possibility of including a BCT training unit in the SLT training curriculum is being looked into, students seemed the natural participant group. Also, SLT students could be recruited more easily and have more time available for the training. Overall, the large number of BCT types included, the lack of detail on how to code BCTs accurately, and the complex coding requirements of the assessment video may have, according to verbal participant feedback, been responsible for low coding results at Stage 2. The current aim of optimising the workshop was to raise BCT coding accuracy among participants. The rationale on which components of the workshop were revised and simplified are outlined in the current chapter. Stage 3 first aims to answer **RQ 4.** *Does simplifying the BCT training workshop and reducing the number of BCT types included increase the BCT coding accuracy of SLT students from before to after workshop training?* as well as **RQ 5.** *Do SLT students doing the revised BCT training workshop think that the application of BCTs in SSD intervention with children is useful and if so why, and do they think that the simplified BCT training workshop should be included in the training curriculum of SLT students?*

Two important results were decisive in terms of adaptations and changes to the BCT training workshop in Stage 3 to simplify and maximise the effectiveness of the training, which is measured by the BCT coding accuracy of participants: (a) considering which BCTs *occur the most in the assessment video* (section 2.3.2), and (b) survey respondents' answers on which BCTs are seen as the *most helpful* and the *most common ones in SSD interventions* (sections 3.3). These two outcomes from Stage 2 built the rationale for deciding which BCTs were included in the workshop for Stage 3 and answer the current research questions, which are explained and outlined in the following sections.

The following chapters give an overview into the study design for Stage 3 and the adaptations and changes made to the BCT training workshop based on the results of Stage 2. The informed decision-making process of BCTs used in Stage 3 was outlined in Chapter 3 (section 3.3.4), whereas the following sections introduce the changes and adaptions in detail.

4.2.1 Overall Study Design

As the general overall study design of the BCT training workshop remains the same as in Stage 2, only changes and adaptations to the BCT training workshop in terms of re-coding the assessment video as coding requirements, the theoretical and practical BCT training, assessment video coding, materials, participants, procedure and data preparation are explored in the next sections.

A baseline coding task was added to the BCT training workshop in Stage 3, to measure workshop participants' coding accuracy before and after the workshop and give an indication whether the BCT training workshop improves coding accuracy. Overall, the baseline coding was a newly developed and added task for Stage 3, as results from Stage 2 showed that a comparison between the ability to code the assessment video with BCTs before and after the training would have given greater information on the effectiveness of the BCT training workshop. Comparing coding skills of participants has also been used in previous studies assessing BCT coding accuracy, even though the procedure and study aim differed compared to the current study (Wood et al., 2015). The use of baselines provides a powerful and reasonable tool to compare abilities and test training strategies in terms of effectiveness (Bellg et al., 2004) before and after an intervention. A baseline was used for testing the BCT training and measuring the effectiveness of the BCT training workshop. This measure is explained in the following sections.

4.2.2 Workshop Adaptations and Changes

In Stage 3, participants were trained, as in Stage 2, to identify BCTs accurately from the assessment video with changes to the workshop duration, its focus, dosage, content and material having been made. The mode of delivery continued to be online, as the pandemic still impacted the implementation of face-to-face workshops. Thus, adaptations and changes affected all components of the workshop except the mode of delivery.

The number of included BCTs was cut down from 17 to 7. This decision influenced the benchmark developed in Stage 2, as the BCT coding process in Stage 2 included 17 BCTs compared to the 7 in Stage 3. In addition, as coding accuracy was low in Stage 2 and the workshop of Stage 3 aimed at improving coding accuracy, the coding requirements were also changed. Therefore, the assessment video was re-coded, the theoretical and practical training was adapted, and the coding requirements for coding the assessment video revised. Smaller modifications were made to the included materials. In the workshop in Stage 3, only SLT students participated as Stage 2 results showed no noticeable difference in the coding accuracy amongst SLTs and SLT students. SLT students reported in an informal discussion after the workshop in Stage 2 that they felt the time allocated for practising BCT coding and the assessment coding task had not been sufficient. Based on this oral and informal feedback from SLT students (section 3.3.2.3), the procedure of the BCT workshop changed in terms of time allocated to certain tasks, e.g., more time for the theoretical training to teach certain BCTs of the BCTTv1 (Michie et al., 2013b) relevant for SSD intervention. The flowchart in Table 20 shows a comparison of the main changes between the BCT training workshops of Stage 2 and Stage 3.

Table 20: Comparison of BCT training workshop of Stage 2 and Stage 3

Stage 2		**Stage 3**
SLT students (N=11)	SLTs (N=10)	SLT students (N=8)
Confidentiality agreement	Confidentiality agreement	Confidentiality agreement
No survey used	Work experience survey	Work experience survey
Orientation task	Orientation task	Baseline coding
Theoretical training on BCTTv1 17 BCTs	Theoretical training on BCTTv1 17 BCTs	Theoretical training on BCTTv1 7 BCTs Additional examples
Practical training Coding 16 training videos	Practical training Coding 8 training videos	Practical training Coding 3 training videos Detailed discussions on coding results (more time allocated)
Assessment video coding	Assessment video coding	Assessment video coding
BCT survey	BCT survey	BCT survey
4 days (24 hours)	2 days (12 hours)	3 days (24 hours)

The main differences between the BCT training workshop in Stage 2 and Stage 3 are highlighted in blue in Table 20. Overall, the number of days over which the workshop took place changed due to the availability of students in Stage 3, whereas the duration (24 hours) stayed the same when comparing it with the SLT student workshop of Stage 2. The main changes were the time allocated for each task, the reduction of BCTs (17 BCTs in Stage 2 and 7 BCTs in Stage 3) and adaptations to some content (DLD and SSD introduction). The included tasks and material differed in terms of the number of training videos, the baseline coding task, and the work experience survey. Results on the training video coding were discussed in more detail, as more time had been allocated for this task. The time for coding the assessment video was increased, as feedback from Stage 2 participants indicated that 3h had not been enough time to code a 10:43 minute video using BCTs. Therefore, six hours were allocated to the final coding of the assessment video: 3 blocks of 2 hours (total = 6 hours), coding 3:50 min. of the video in each block. Breaks were scheduled between the blocks. Table 21 gives a detailed overview of the BCT training workshop procedure in Stage 3 (tasks, activity/objectives and allocated time).

Table 21: Overview of BCT training in Stage 3

WORKSHOP DAY 1 (8 hours)		
Tasks	**Activity/Objectives**	**allocated Time**
BASELINE CODING		
Baseline Coding pre-BCT training workshop	To generate data on coding ability pre BCT training workshop by video coding (1:30 min. video sequence)	00:30 hour
THEORETICAL TRAINING		
Introduction on Speech Sound Disorder Intervention	Assure same theoretical level within group	00:30 hour
Theoretical Background on BCTTv1 and BCTs	Understand the concept of BCTs	01:00 hour
Link between SSD Intervention and BCTs	Understand rationale for using BCTs in SSD interventions	01:00 hour
Introduction of 7 BCTs from the BCTTv1 and BCT Coding Principles	Knowing the 7 BCTs from the BCTTv1 in the context of public health (labels, definitions), knowing the five coding principles	02:30 hours
Introduction to the SSD Example List	Knowing when to code the 7 BCTs from the BCTTv1 in the context of SSD intervention	01:30 hours
PRACTICAL TRAINING		
BCT coding Training Video 1	Orientating/familiarising with BCTs and familiarise), attempt to code BCTs accurately	01:30 hours

	and discussing coding results of one training video by using the 7 taught BCTs from BCTTv1	
WORKSHOP DAY 2 (8 hours)		
THEORETICAL TRAINING		
Repetition of seven BCTs used in SSD Intervention	Assure same level of knowledge and refresh content after break of 3 weeks	02:00 hours
PRACTICAL TRAINING		
BCT Coding Training Video 2	Code one training video in pairs (zoom break-out session) and discuss coding outcomes in group to ensure equal understanding of how to identify and code BCTs in SSD video sequences	03:00 hours
BCT Coding Training Video 3	Code one training video individually and discuss coding outcomes in group to ensure equal understanding of how to identify and code BCTs in SSD video sequences	03:00 hours
WORKSHOP DAY 3 (8 hours)		
PRACTICAL AND THEORETICAL TRAINING		
Comparison BCT coding outcomes and open questions on theoretical issues	Discuss BCT coding outcomes of previous training videos and remaining open questions to then start the final coding task	00:30 hour
Assessment VIDEO		
Final BCT coding of the assessment Video	Assessment video coding	06:00 hours
BASELINE CODING		
Baseline Coding pre-BCT training workshop	To generate data on coding ability post BCT training workshop by video coding (1:30 min. video sequence)	00:30 hour
BCT SURVEY		
BCT survey	Implementation of BCT survey and closing of BCT training workshop	01:00 hour

As content was adapted and changed, more time could be used for the description of the seven included BCTs and how to code these in the training videos. Three different video types have been used in Stage 3, which are shown in Figure 22.

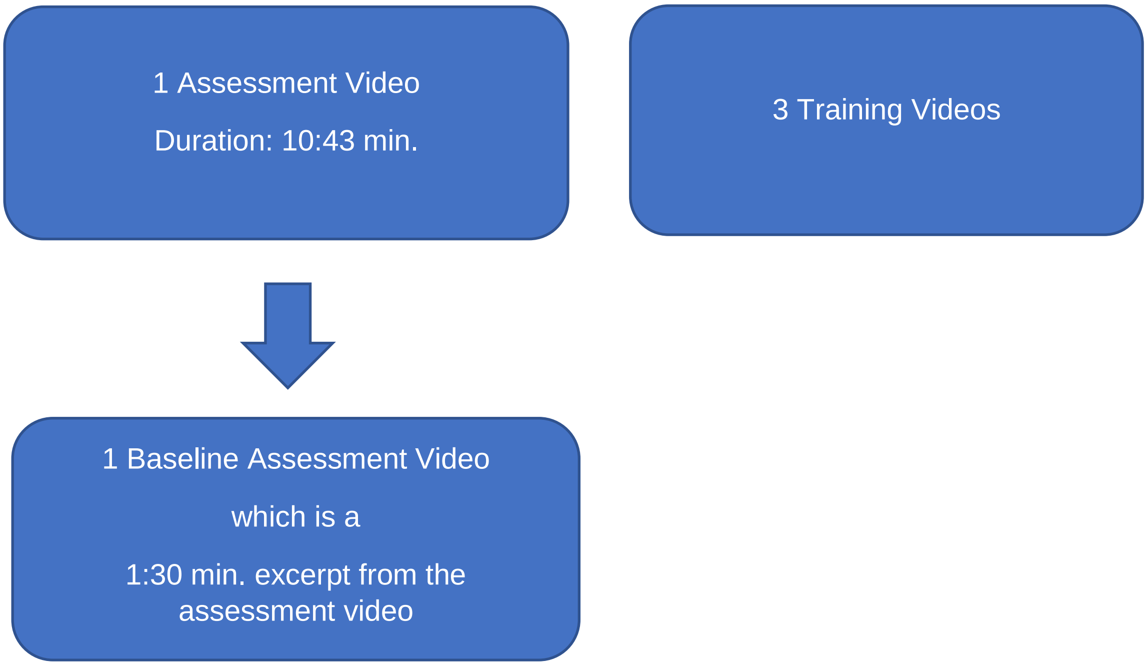


Figure 22: Videos used in the BCT training workshop of Stage 3

The assessment video of Stage 2 and Stage 3 was the same. However, as a baseline measure was added to Stage 3, an excerpt of 1:30 minutes of the *assessment video* has been used for the baseline coding. This video excerpt is called *baseline assessment video*. In addition, three *training videos* from Stage 2 have also been used in Stage 3. The decision-making process for each is outlined in the next sections. All components included in the BCT training workshop which were adapted and changed are outlined in detail in the following sections.

4.2.2.1 BCT Types in Stage 3 and Theoretical BCT Training

The theoretical training in Stage 3 has been the foundation for explaining the concept of the BCTTv1 (Michie et al., 2013b), its purpose, and the link to SLT. Only the seven BCTs included (Table 21 below) in Stage 3 are introduced and explained in detail, followed by examples (section 3.2.2.1.1). Thus, in comparison to Stage 2, students did not engage with the complete BCTTv1 which includes 93 BCTs but were explicitly taught the seven BCTs included in Stage 3. One difference between the BCT training workshop of Stage 2 and Stage 3 was that information which did not contribute directly to the coding of BCTs in the SSD intervention video sessions was reduced to allow more time available for the training videos and the coding task. For example, the theoretical training of Stage 2 included an introduction on DLD and SSD and all available interventions for German-speaking children; this was omitted in Stage 3. Only the interventions used in the research project (Minimal Pair; Metaphon; P.O.P.T.) were mentioned and introduced briefly. Thus, the theoretical training in Stage 2 lasted nine hours for SLT students and 4 hours for SLTs (see differences in Table 11, section 3.2.2.4.3), whereas 6.5 hours were allocated for theoretical information in Stage 3. In addition, as the number of BCTs included in Stage 3 was drastically reduced (from 17 BCTs in Stage 2 to 7 BCTs in Stage 3, section 3.3.4), more time was available to focus on the 7 BCTs in Stage 3.

The rationale for deciding which BCTs to keep in the workshop training was based on three findings of Stage 2:

- The **most frequent BCTs** occurring in the assessment video (Table 22)
- The **most useful BCTs** for SSD intervention according to SLTs and SLT students when ranking and rating BCTs in the Stage 2 survey (Table 22).
- The **most commonly used BCTs** ones in SSD intervention according to SLTs and SLT students' answer in the BCT survey (Table 22).

Following this rationale, Table 22 shows the seven BCTs which were included in the BCT training workshop of Stage 3. All of these seven BCT types (Table 22) were present as the most frequent BCT types in the assessment video and were reported as the most helpful and most commonly used BCTs in the BCT survey by participants of Stage 2.

Table 22: Seven BCTs from the BCTTv1 used in Stage 3 revised BCT training workshop

1.4. Action planning
2.2. Feedback on behaviour
4.1. Instruction on how to perform the behaviour
6.1. Demonstration of the behaviour
7.1. Prompts/cues
8.1. Behavioural practice/rehearsal
10.4. Social reward

As discussed in section 3.4.1, the remaining BCTs tended to have a high standard deviation — meaning that there had been large variability in participants' ability to identify them in the BCT training workshop of Stage 2. This note is important, as "the most frequent, most useful and most common" BCTs do not seem to be the easiest to identify. Hence, more time was allocated to teach these seven BCTs in detail in terms of comprehensiveness and transparency, using further examples for these BCTs in SSD interventions in the PowerPoint presentation of the workshop. The reduction of BCT types (from 17 in Stage 2 to 7 in Stage 3) was also suggested to support participants to focus more on coding accuracy. Actual definitions for the seven target BCTs and SSD examples have not been updated or changed, as these remained the same as in Stage 2.

Differences between the theoretical trainings of the workshops therefore existed mainly in the time allocated, some content included (detail on DLD and SSD) and the number of BCTs taught. A detailed procedure of the theoretical training is included later in the procedure section (section 4.2.2.6). The following section describes the changes and adaptations made to the practical BCT training of the workshop.

4.2.2.2 Re-coding of Assessment Video

The same assessment video as in the BCT training workshop of Stage 2 was used in Stage 3 to assess participants' overall coding ability after completing the BCT training workshop. However, as the number of BCTs was reduced, re-coding of the assessment video with the seven remaining BCT types was conducted. In addition, as coding results showed a low accuracy rate in Stage 2 (section 3.3.2), and the workshop in Stage 3 aimed at simplifying the coding procedure and focusing strongly on coding accuracy, coding requirements were changed for Stage 3. In Stage 2, coders were asked to code a BCT type per utterance only once even if the same BCT type occurred more often within one utterance (section 3.2.2.4.4). It had been suggested that it would ease the coding process if participants could identify a BCT more than once (e.g., twice within an utterance). However, as results of Stage 2 showed low coding accuracy to meet the criteria of accurate coding for Stage 3, coding requirements in Stage 3 asked participants to identify, code and document every single BCT type in its frequency within an utterance of the assessment video. For example, if the BCT type 7.1. *Prompts/cues* occurs three times within a single utterance, participants had to document this BCT type three times within this utterance. Feedback from Stage 2 had shown that the procedure to document BCTs was seen as complicated and complex, due to the process and the Excel spreadsheet (noting a BCT type once in an utterance meant having to check whether they had already documented a certain BCT type or not). Noting every single BCT occurring spares participants the need to think about whether one BCT type has already been noted within a certain utterance or not and therefore makes the procedure easier for participants as they do not need to think about whether they have already noted a BCT or not but can just document every BCT occurring. Also, by documenting every single BCT occurring, a more detailed picture of the coding accuracy is given to investigate the BCT workshop's success. This way, it has been possible to assess the effectiveness of the BCT training workshop by investigating whether participants were able to identify each and every BCT occurring in the assessment video accurately.

Therefore, the assessment video was re-coded by the same two BCT-trained SLTs considering the seven BCT types and adapted coding requirements for Stage 3. This was done to establish a new benchmark for Stage 3 against which coding results of workshop participants were then compared.

As in Stage 2, the program Video Enhanced Observation (VEO) was used to analyse the assessment video and an Excel template used to document all BCTs identified by the two BCT-trained SLTs. However, the template was revised in terms of structure and content as participants in Stage 2 had given oral feedback that they struggled to note all present BCTs in the Excel template used in Stage 2. In addition, as Stage 3 focused more on coding accuracy, it was important to capture each and every single BCT within an utterance. Therefore, the Excel template used in Stage 3 was set up differently, as outlined in the next paragraph and shown in Figure 23, which presents the template used in Stage 2 and Figure 24, which shows the template used in Stage 3.

	A	B	C	D
1	Time	BCT	Phrase	Notes
2	00:00			
3	00:00			
4	00:00			
5	00:00			
6	00:10			
7	00:10			
8	00:10			
9	00:10			
10	00:20			
11	00:20			

Figure 23: Excel spreadsheet used in Stage 2

	A	B	C	D	E	F	G	H	I
1	**Time**	**Phrase**	**1.4.** Action planning	**2.2.** Feedback on behaviour	**4.1.** Instruction on how to perform the behaviour	**6.1.** Demonstration of the behaviour	**7.1.** Prompts /cues	**8.1.** Behavioural practice/ rehearsal	**10.4.** Social reward
2	T0050	M: Wir haben jetzt lauter Kärtchen, wo wir Wörter drauf haben, und deine Ohren, und ich und du ganz gut hinhören sollen							
3	T0100	M: ob wir das /tr/, probier mal, so /trrrr/							
4	T0100	R: (Versuch /tr/)							
5	T0100	M: Achtung /t/ - /t/ - /trrrr/							

Figure 24: Revised Excel spreadsheet Stage 3

The previous Excel template (Figure 23) used in Stage 2 provided columns for “time stamps” (fixed), “BCT menu” (fixed, participants chose from 17 BCTs via drop-down menu), “situation” (open) and “notes” (open). Informal SLT student feedback from Stage 2 (section 3.3.2.3) indicated that this structure was difficult to use and apply in practice, as the coding procedure included parallel actions such as pausing, entering the accurate identified BCT and the relevant utterance for each BCT. This cost participants much effort and time. In contrast, the new Excel template provided the entire transcript of the video already linked to the correct time stamp, so participants could see the written transcript of the utterances occurring in the video matched to the correct time. In addition, the seven BCT types were written in columns in the first row. Thus, participants could enter the number of times a BCT occurred within an utterance. Participants could only enter numbers 1-4 in the provided cells (e.g., “1” meaning this BCT occurs once within this utterance, “2” BCT occurs twice, etc.) for the utterance of the therapist. The column “notes” was omitted, as it had not been used once by participants in Stage 2. The cells of children’s responses (Figure 24, line 4, R: (Versuch /tr) (the word ‘Versuch’ in German means ‘try’) were grey and inactive, which ensured that participants only identified BCTs in the utterances from the therapists. Explanations on how to use the template were given at the beginning of each coding task.

The re-coding process of the assessment video followed the same procedure as in Stage 2 (section 2.2.4). However, using the new coding requirements (identifying every single BCT per utterance), re-coding results of the two BCT-trained SLTs in Stage 3 show that 246 BCTs occur in the assessment video. Figure 25 gives an overview of the coding results of Stage 3 in terms of BCT types and number of occurrences.

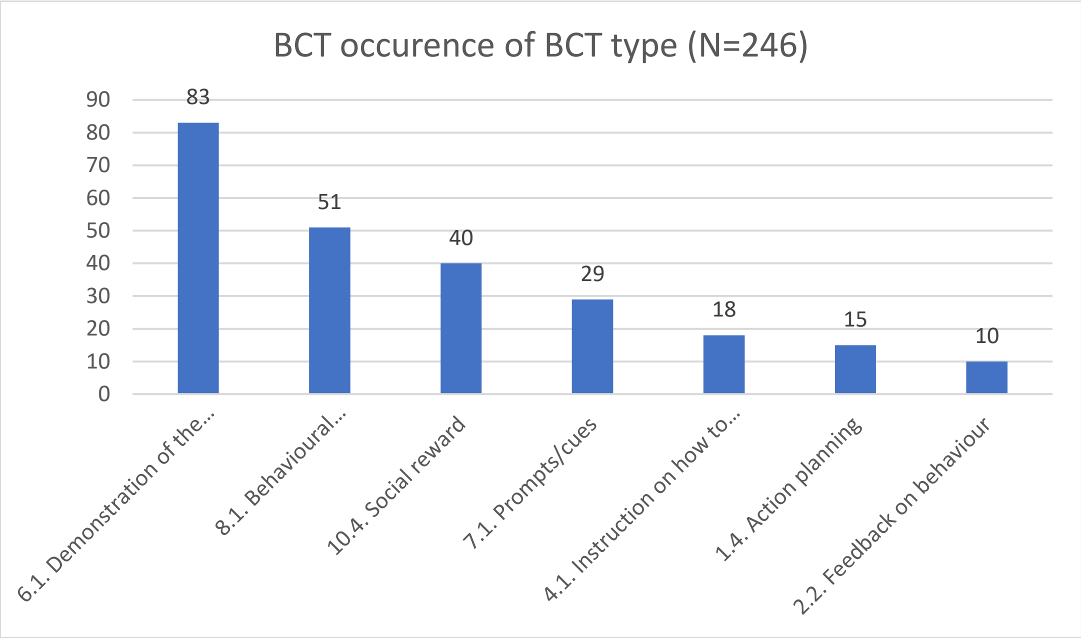


Figure 25: Descriptive results of BCT types and number of occurrences (N=246) in Stage 3 (with revised BCT coding requirements)

The most occurring BCT (6.1. *Demonstration of the behaviour)* was used 83 times, followed by 8.1. *Behavioural practice/rehearsal* (N=51), 10.4. *Social reward* (N=40) and 7.1. *Prompts/cues* (N=29). The three BCTs 4.1. *Instruction on how to perform the behaviour* (N=18), 1.4. *Action planning* (N=15) and 2.2. *Feedback on behaviour* (N=10) have been used less frequently in the assessment video. The variation in frequency between the most used BCT (6.1. *Demonstration of the behaviour*, N=83) and the least frequently used BCT (2.2. *Feedback on behaviour*) is quite large. Thus, some BCT types occur more often in the assessment video than others. Further sections explain the differences between the assessment video coding tasks of Stage 2 and Stage 3.

4.2.2.3 Assessment Video Coding Task

As explained previously, the assessment video from Stage 2 was also used to assess participants' coding accuracy after completing the workshop in Stage 3. Initially, the assessment video had been carefully devised on the basis of quality, duration, task, variation and focus (section 3.2.2.1.3), so there was no need to make any changes based on these criteria as the video was fit for the coding purpose. Overall, coding requirements and the Excel template used were different in Stage 3 compared with Stage 2. However, both tasks assessed the coding accuracy of participants after completing the BCT training workshop. As changes and adaptations were made to the BCT training workshop in Stage 3 (section 4.2.2; e.g., coding requirements), the coding results of Stage 2 and Stage 3 cannot be compared like-for-like. Nevertheless, the results show how well each workshop worked in terms of the coding accuracy of participants. Thus, the outcomes of the assessment coding tasks give an insight into which workshop worked better in terms of coding accuracy. The next paragraph briefly outlines the differences between the assessment video coding task of Stage 2 and Stage 3.

The assessment video coding task in Stage 3 was completed by all participating students (N=8). Overall, the assessment video coding task at the end of the BCT training workshop in Stage 3 differed from that of Stage 2 in (1) the coding requirements (code each and every occurring BCT), (2) the Excel template used which included the written transcript of the assessment video in Stage 3 and (3) the time allocated for the coding task (more time in Stage 3). The coding requirements of the assessment coding task for participants in Stage 3 were congruent with those for the two BCT-trained SLTs, meaning participants were asked to code each and every BCT occurring within an utterance of the therapist. Thus, even if the same BCT type occurred more than once within one utterance, participants were asked to document the BCT type in the correct line of the Excel template by choosing the BCT type(s) in the drop-down window of the template. VEO was used to watch the video and the revised Excel template was used to document the BCTs present in the assessment video (section 4.2.2.2 and Figure 24). The template used in Stage 3 was more structured and included the written transcript of the assessment video accompanied by time stamps and the seven BCT types. Another major difference between the assessment coding tasks of Stage 2 and Stage 3 was the time allocated for the coding task. Due to the two BCT-trained SLTs’ experiences and oral reports of workshop participants from Stage 2, the time allocated was raised from three hours in Stage 2 up to six hours in Stage 3. Thus, participants of Stage 3 had six hours to code the assessment video.

4.2.2.4 Baseline Coding

A baseline coding task was conducted in the Stage 3 workshop to compare coding results of participants before and after the BCT training workshop to see whether the BCT training had been effective. Thus, students coded the baseline assessment video (an excerpt of 1:30 minutes from the assessment video) before receiving any BCT training and again after completing the BCT training. An A-B-A design was added to Stage 3, in which (A) a baseline coding task was used, (B) then the BCT training workshop was delivered, and (A) afterwards the baseline coding task was conducted again to measure whether coding accuracy of participants improved after the BCT training workshop. This procedure allowed the comparison of pre- and post-testing of BCT coding.

An excerpt from the assessment video was used for the baseline coding task based on experiences of Stage 2. It was not realistic, due to time constraints. to have participants code the full assessment video before and after the BCT training sessions. Due to the number of

BCTs present across the assessment video, it was assumed that a short excerpt would still be representative of the range of BCTs and give an insight into the overall BCT coding ability. Therefore, a 1:30 minutes clip from the assessment video (from 00:50 seconds to 2:20 minutes) was carefully selected to ensure that the 7 target BCTs occurred at least once during the excerpt so that a variation of BCT types is given and to see whether participants are able to identify every BCT type. In sum, 33 BCTs occurred in the baseline assessment video (6.1. *Demonstration of the behaviour* nine times, 1.4. *Action planning* seven times, 7.1. *Prompts/Cues* six times, 8.1. *Behavioural practice/rehearsal* four times, 4.1. *Instruction on how to perform the behaviour* four times, 10.4. *Social reward* two times and 2.2. *Feedback on the behaviour* once).

The baseline coding (excerpt from the assessment video) was coded before and after the BCT training workshop and was used to assess progress following the workshop. The whole assessment video coding was used as a way of comparing coding results of Stage 2 and Stage 3. The assessment coding task in Stage 3 may also have contributed positively to SLT students' coding skills as it provided more time and possibilities for practising the coding before completing the second baseline coding task.

The baseline coding results from participants have also been compared to the benchmark which was established by the two BCT-trained SLTs, as the 1:30 minutes from the baseline assessment video is a part of the assessment video. Therefore, the established benchmark is also valid for the baseline assessment video. In addition, the same coding requirements (coding every single occurring BCT in the baseline assessment video) as for the assessment video coding task have been used. Also, both VEO (to analyse the video) and the same Excel template as for the assessment video coding task for Stage 3 (section 4.2.2.1) were used with the 1:30 minutes transcript.

At the beginning of the workshop in Stage 3, students received VEO access to the baseline extract from the assessment video and the revised Excel template was sent to all participants. Additionally, a list of the seven BCTs (Appendix R) included in the BCT training workshop in Stage 3 was provided by using the number and label (e.g., 2.2. *Feedback on behaviour*) of the seven BCTs from the BCTTv1 (Michie et al., 2013b). SLT students only received the list of the seven BCT types and did not receive any further information on BCT types and/or how to code BCT types before the baseline coding task. The baseline coding task before the workshop was to watch the 1:30 minutes video and code present BCTs according to the list of seven BCTs. Even though students asked questions about which BCT type to code for specific situations in the video (which was to be expected), answers and information in response to the questions were only given after completing the baseline coding task to ensure reliability. The same procedure was conducted at the end of the workshop, when students had completed the BCT training and had the SSD BCT example list available when coding the baseline excerpt. Results from the baseline coding task before and after the workshop were then compared to see whether coding accuracy of students was greater after than before the workshop.

4.2.2.5 Practical BCT Training

The practical BCT training focused on how to code the theoretically introduced BCTs from the BCTTv1 (Michie et al., 2013b) in videos of SSD intervention sessions, the *training videos*. Oral feedback from participants in Stage 2 and the low coding results indicated that practising the coding process in videos supports coding accuracy. Participants also suggested including fewer training videos, but discussing the ones included in more detail. Thus, the practical BCT training was adapted in terms of training videos included. Stage 2 included 16 training videos for the SLT students' group and eight training videos for the SLT group, whereas Stage 3 now included only three training videos. Besides the students' feedback, a further rationale for including only three training videos was the limited time available for the workshop. The first video was used to introduce the coding process in general and to become familiar with coding. Thus, a short (compared to all other videos) video sequence of 04:28 minutes was used and 1:30 hours allocated for the first video at the end of the first day. To assure enough time for training video 2 (duration 09:55 minutes) and training video 3 (duration 11:54 minutes) to be coded, discussed in pairs and then in the entire group, three hours (double amount of time than for training video 1 as these videos last longer) were allocated for these two training videos on day two. Therefore, the distribution of the workshop time for the practical training in Stage 3 differs considerably from that of Stage 2. In Stage 3, three training videos were practised over 7:30 hours, whereas in Stage 2 the workshop for SLT students included 16 training videos over 11:00 hours, and 8 training videos in 4:30 hours. A timetable of the workshop procedure is introduced in the procedure section 4.2.2.7, once all BCT training workshop components are explained.

All videos included in this study, the selection criteria for the children in the videos, their SSD difficulties, and the general therapy content of the videos have been described in section 2.2.3. The three training videos in Stage 3 were also used in Stage 2 (as part of the 8 training videos for the SLT workshop or 16 training videos for the student workshop included). It was decided to use three training videos compared to 8 or 16 in Stage 2, to focus on quality and accurate coding. The same decision criteria as for the assessment video were used (quality, duration, task, variation and focus; section 2.2.3.3) for choosing the three training videos. The training video for day 1 was around five minutes, as less time was available; those used on day 2 were around 10 minutes long, corresponding to the length of the assessment video. Table 23 shows the four videos included in Stage 3 (three training videos and the same assessment video as in Stage 2.

Table 23: Four video sequences of SSD interventions used in the BCT training workshop for SLT students in Stage 3

code	duration	use
1_0_C_R	10:43	Baseline assessment video (1:30 minutes excerpt) and Assessment video (10:43 minutes)
18_15_S_4	4:28	training video 1
1_0_C_B	09:55	training video 2
9_6_G_1	11:54	training video 3

4.2.2.6 Surveys

The work experience survey and BCT survey used in Stage 2 were also used in Stage 3, with small adaptations. First, in Stage 2 the work experience survey had been used with SLTs only (section 3.3.2), whereas after conducting the workshop it would have been of interest to know whether the student group had work experience other than in SLT, as results indicated little difference between the two groups' (section 3.3.2.1) BCT coding results. Students with work experience related to SLT or their experiences from other areas may influence students' ability to identify BCTs. Thus, the work experience survey used for students was adapted in Stage 3 (Appendix S). Second, the BCT survey was adapted to ask students' views and opinions on the seven BCTs' usefulness in SSD interventions and the SLT curriculum (Appendix T) (as in Stage 2, section 3.2.2.2.2). Questions (e.g., Would you say that teaching BCTs in speech and language therapy studies is useful?) which did not depend on the number of BCTs remained the same. On the other hand, questions such as the BCT ranking or rating which included 17 BCT types in Stage 2, had to be adapted to only include the current seven BCT types of Stage 3. Thus, the BCT survey was adapted to accommodate the revised number of BCTs and to see whether students felt that the revised version of the BCT training workshop was helpful for SSD interventions and student training.

4.2.2.7 Participants

In October 2021, SLT students from the University of Applied Sciences of Vienna ("Fachhochschule Campus Wien" (FHCW)) were invited to take part in the "Behaviour Change

Techniques in Interventions for Children with SSDs". The workshop date was set for 17th December 2021 and 7th and 8th of January 2022. This time only students from Year 2 (Y2) were chosen, as this cohort had the flexibility to attend the workshop dates, whereas Year 3 (Y3) students had a different schedule than the cohort of 2020 resulting from the impact of Covid-19. Students participating in the revised BCT training workshop of Stage 3 were different students to those participating in Stage 2.

In Stage 2, the majority of students were Y3 students, but Y2 students did also participate. As no large difference between students of the second year of studies and students of the third year of studies was observed in Stage 2, the participation of Y2 students was welcomed. By the time of the workshop, students had already completed the majority of theoretical training of the SLT bachelor course (2025 of 3375 hours) and covered all child language disorder content, including SSD. With respect to clinical training, only 200 of the 1137.5 hours had been completed by the start of the workshop, but all these had taken place in the paediatric area with children experiencing mostly DLD and SSD.

A maximum of ten students per workshop was maintained as workshops of Stage 2 had confirmed that more participants would not be suitable for this type of training. Eleven participants took part in the online workshop in Stage 2, which showed that more participants would be more challenging in an online training which includes BCT video coding. In addition, many qualitative discussions are included in the programme and these are more difficult to moderate as large group discussions in virtual environments, which also suggested limiting the participant number. In addition, research suggests that students prefer subgroups of five (Kooloos et al., 2011). Thus, ten participants form two subgroups, 5 peers each. Also, ten participants seem to be a manageable number of participants in an online workshop, so that everyone is able to actively take part (Shamsuddin et al., 2021).

Inclusion criteria for students remained the same as in Stage 2 and contained the mandatory return of the confidentiality agreement prior to the workshop (Appendix O), attending the entire workshop and having access to the internet and hardware such as a laptop. As in Stage 2, students had the chance to claim 25 hours (1 ECTS) from the workshop as part of their clinical training. Overall, ten students (N=10) registered for the workshop, but only eight students (N=8) completed the entire workshop and all tasks. The two dropouts occurred because of Covid-19 related issues.

4.2.2.8 Procedure

Adaptations and changes to the BCT training workshop were made from August until November 2021. The Stage 3 online BCT training workshop took place on 17th December 2021 and 7th-8th January 2022 with a group of Y2 SLT students (N=8) described above, all attending the University of Applied Sciences (Fachhochschule Campus Wien) in Vienna. Participants received organisational information such as the timetable, confidentiality agreement (Appendix O) and the zoom link via email four days prior to the workshop. The confidentiality agreement had to be returned before the workshop. All other specific BCT related information was sent during the first day of the workshop, after completion of the baseline coding, as this ensured that none of the participants had the chance to read specific BCT related training information before the workshop. This applied for all other workshop documents such as surveys and access to videos: participants received them at the time needed but not sooner than necessary.

Overall, the workshop was held over 3 days and a total of 24 hours, split in three 8h days excluding breaks (8am – 6pm with 1h break at noon and four 15 min. breaks throughout the day). One day took place in December 2021, followed by a break of three weeks which gave the possibility to observe whether BCTs were used in students' current clinical placement and provided opportunities for consolidating the BCT content.

4.2.2.9 Data Preparation

The analysis of the collected data was conducted by using the Statistical Package for Social Sciences (SPSS, 2021) and Microsoft Excel. The work experience and BCT survey results were entered into the same dataset in SPSS, whereas the baseline and final coding results of the assessment video were entered into Excel and then transferred to SPSS for some more calculations. The following sections now describe the data analysis procedure for each used measure.

The data analysis of the work experience survey was identical to the process used in Stage 2 (section 3.2.2). Data was entered manually into SPSS and a simple coding system used to analyse it. Some graphs and Figures were created in Microsoft Excel to display the results more comprehensibly.

Participants entered the data of the baseline coding pre-BCT training workshop into a structured Microsoft Excel spreadsheet (section 4.2.2.2. Figure 24). The data of all students was then transferred onto one spreadsheet and analysed by using Excel. Later analysis, comparing pre-BCT training outcomes and post-BCT training outcomes, was conducted in SPSS, as this software provided more data analysis possibilities compared to Microsoft Excel.

As the final BCT coding spreadsheet for the assessment coding task, in which participants entered their data, had been significantly revised, data preparation and analysis was simpler than in Stage 2. The column "time" and "utterance" were combined with all BCT columns (one for each of the seven BCTs), to create a list of all BCTs and their time stamps (including the appropriate utterance). Then, data was analysed by using descriptive and inferential statistics in Microsoft Excel and SPSS.

The data analysis for the BCT survey followed the same procedure as in Stage 2. SPSS was used to analyse the survey data in the same SPSS dataset as the work experience survey and data from Stage 2.

4.3 Results

This section presents the results of the revised BCT training workshop conducted in Stage 3 to see whether participants achieve better coding accuracy after completing the simplified BCT training workshop. Thus, this section investigates whether coding accuracy from participants is higher after completing the BCT training workshop compared to before the workshop. Overall, even if differences between the training in Stage 2 and Stage 3 exist, coding accuracy of participants between Stage 2 and Stage 3 can be compared. The two research questions investigated in Stage 3 are:

RQ 4. Does simplifying the BCT training workshop and reducing the number of BCT types included increase the BCT coding accuracy of SLT students from before to after workshop training?

RQ 5. Do SLT students think that the application of BCTs in SSD intervention with children is useful and if so why, and do they think that the simplified BCT training workshop should be included in the training of SLT students?

The following sections present the results of the revised and simplified BCT training workshop, which was conducted with SLT students (N=8) to answer the above-stated research questions. First, data from the work experience of students have had during their training and clinical placements are shown. This was done to get an impression of participants' experience and professional background. Then, to answer **RQ 4**, three analyses have been conducted: (1) comparing the baseline coding pre- and post-training; (2) the assessment coding task, which determines students' coding accuracy after completing the simplified BCT training workshop by using the complete assessment video; and (3) the comparison of the coding accuracy of participants from Stage 2 and Stage 3. This chapter also includes a section on the effectiveness of the BCT training workshop of Stage 3, using a t-test including students' pre- and post-workshop BCT coding results of the baseline coding. In addition, participants' coding results after completing the initial BCT training workshop of Stage 2 (Chapter 3), and coding results of participants after completing the simplified BCT training workshop (Stage 3) are compared and used for the Mann-Whitney U group comparison test (section 4.3.3.3) to investigate, after which BCT training participants achieved better coding accuracy. Lastly, the BCT survey results from participants are presented to collect data on participants' opinions of the BCTTv1's (Michie et al., 2013b) use in the context of SSD interventions. In addition, students were asked whether the simplified BCT training should be included in the curriculum of SLT training. Adaptations were made to the BCT survey in terms of number of BCTs included (section 4.2.2.6) to answer **RQ 5**.

4.3.1 Work Experience Background of SLT Students

Participating students (N=8) received a survey at the beginning of the BCT training, which aimed at collecting data addressing some basic information on participants (e.g., age), and then asked about their experience with children with SSD in clinical settings. Previous completed study and/or other professional qualifications were also of interest as this usually contributes to the professional behaviour as a SLT student. An overview of the work experience data of students is given in Table 24.

Table 24: Descriptive results of work experience data students (N=8)

Work experience Data Students	Frequencies		Work experience Data Students	Frequencies	
Measures	N=8	%	Measures	N=8	%
Gender			Number of children with SSD treated under guidance		
female	7	87.5	1-5	3	37.5
male	1	12.5	6-10	2	25.0
nonbinary	0	0,0	11-15	2	25.0
Age Groups			16-20	1	12.5
20-30	8	100.00	21-25	0	0.00
31+	0	0.00	26-30	0	0.00
Level of any previous professional qualification			31-35	0	0.00
non-academic degree	5	62.5%	36-40	0	0.00
undergraduate degree	3	37.5%	more than 41	0	0.00
Studies/Professions completed previously			Age of children (in years) with SSD in clinical setting		
non	5	62.5	0-3:11	7	28.0
linguistic	2	25.0	4-6:11	8	32.0
kindergarten teacher	1	12.5	7-11:11	7	28.0
Person available in environment of student working in social or healthcare			12-16:11	2	8.0
yes	5	62.5	17+	1	4.0
no	3	37.5	Awareness of concepts/therapy interventions for children with SSDs		
Number of children with SSD observed in clinical setting			P.O.P.T	8	33.3
1-5	0	0.00	PLAN	3	12.5
6-10	0	0.00	Metaphon	1	4.2
11-15	0	0.00	Minimal Pair	3	12.5
16-20	1	12.5	phonetic therapy	1	4.2
21-25	2	25.0	myofunctional therapy	1	4.2
26-30	0	0.00	PMS	2	8.3
31-35	0	0.00	BULA	1	4.2
36-40	1	12.5	Lexical pirate	1	4.2
more than 41	4	50.0	Context optimization	3	12.5

One male and seven female students participated in the BCT training, all being between 20-30 years old. Three students had already completed other studies — such as linguistic or pedagogic — and had an undergraduate degree. Five participants have people in their home environment who work in social or healthcare. All students had observed at least 16 children with SSD in clinical settings, and the majority had already seen over 36 children. However, three out of 8 students had treated at least 1-5 children with SSD by the time of the project, two students had treated 6-10 children with SSD, two further students had treated 11-15 children with SSD and one student had already treated 16-20 children with SSD under supervision in clinical placements. Most of these children were aged between 4:00-6:11 years, whereas the age groups 0-3:11 years and 7-11:11 are also well represented. When asked about therapy concepts for children with SSD, the majority of students answered that they know "Psycholinguistisch Orienterte Phonologie Therapie" (P.O.P.T, engl.: "Psycholinguistically Oriented Phonology Therapy") (Fox-Boyer, 2014b), "Patholinguisticher Ansatz" (PLAN, engl. "Patholinguistic Approach") (Siegmüller & Kauschke, 2016), Minimal Pair (Weiner, 1981) and Context-optimization (Motsch & Riehemann, 2008). Other therapy approaches were occasionally mentioned — for example, Metaphon, phonetic therapy, myofunctional therapy, "Bewegungsunterstützte Lautanbahnung" (BULA) "movement-assisted sound initiation" and lexical pirate.

4.3.2 Baseline Coding

As explained in the methods section of this chapter (section 4.2 and 4.2.2.1.2), a baseline coding task was developed for Stage 3 to investigate whether workshop participants had better coding accuracy results after completing the simplified BCT training workshop, compared to before the workshop. Thus, using the baseline coding task shows whether the BCT training workshop has a positive impact on the coding accuracy of students and investigates whether the training has been effective. A short extract from the assessment video (section 4.2.2.1.2) has been used for the baseline coding task to compare the coding ability of participants before and after the training. Students were asked to code every single BCT occurring within an utterance of the therapist in the baseline coding extract.

This section gives an overview of students' (N=8) coding results of the baseline task. First, the overall BCT identification rate of the baseline task is shown (section 4.3.2.1). The overall BCT identification rate is concerned with the general coding ability of students, regardless of BCT types in terms of specifying which BCTs were coded correctly or incorrectly (section 3.2.2.4.4). Second, the BCT type identification rate results are presented (section 4.3.2.2). The BCT type identification rate looks at how well students identified the different BCT types occurring (section 3.2.2.4.4). Identification rates were collected and calculated before and after the workshop. Thus, results pre- and post the BCT training workshop are presented and can be compared to see whether participants' coding accuracy was better after completing the BCT training workshop or not.

4.3.2.1 Baseline Coding pre-and post BCT Training: Overall BCT Identification Rate

The results of the baseline coding comprise outcomes before and after the BCT training. As the objective of the baseline coding was to Figure out whether students' ability to code and identify BCTs correctly had improved after completing the BCT training, results pre- and post BCT training are presented for direct comparison (Field, 2017). The overall BCT identification rate per student (N=8) from the baseline coding is presented in Figure 26.

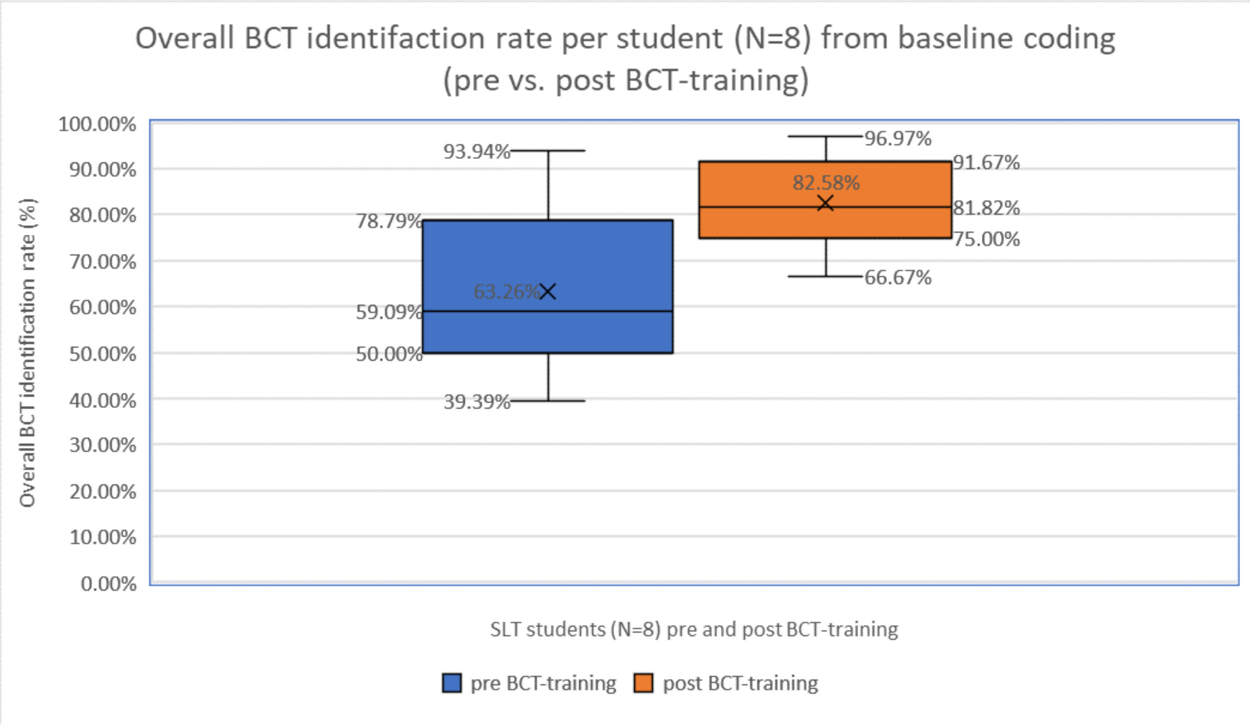


Figure 26: Overall BCT identification rate per SLT student (N=8) from baseline coding (pre vs. post BCT training)

Boxplots shown in Figure 26 display an improvement of students' BCT coding ability after the BCT training. Overall, students' mean BCT identification rate pre BCT training was 63.26% compared to 82.58% post BCT training, showing an improvement of 19.32%. In addition, SD was greater before the BCT training (SD=17.85%), and lower (SD=9.95%) after the BCT training. Smaller SD in general means that students coded more consistently which, in this instance, was also more accurately (highly consistent coding could also have been less accurate). Thus, results show that students coded more accurately and consistently, with less variation. This can also be confirmed when looking at the range, which also improved after completing the BCT training (range=30.30%), compared to before the BCT training (range=54.55%), even though there is still a rather great variance. Overall, baseline coding results post BCT training for the overall BCT identification rate (82.58%) are higher than before.

Coding results of the baseline coding were also analysed using a t-test to see whether the improvement of 19.32% was a significant improvement in students' coding abilities after completing the BCT training. All seven BCTs types which occurred in different numbers 33 times and the codings of all eight students were included in the t-test. Table 25 gives an overview of the descriptive measures included in the t-test.

Table 25: Descriptive measures of the overall BCT identification mean pre- and post BCT training used for the t-test

	Mean	N	SD
Total pre-training (%)	63.26%	33	2.193
Total post-training (%)	82.58%	33	1.767

Results from the conducted t-test show a significant increase in students' performance post BCT training compared to their BCT coding abilities before the BCT training (mean1-mean2= 19.32%, 95-CI [7.73%; 30.84%]), t (32) = 3.416, p-value=.002. Considering Cohen's d=.595 (95-CI [.220; .961]), a medium effect size can be observed, as d>.50 (Cohen, 1988). Therefore, students were able to identify BCTs significantly better after completing the BCT training.

The following analysis look at baseline results showing students' individual improvements in terms of their BCT coding ability pre- and post the BCT training workshop. Figure 27 shows the mean of the overall BCT type identification rate before and after the BCT training for each student individually (C1-C8).

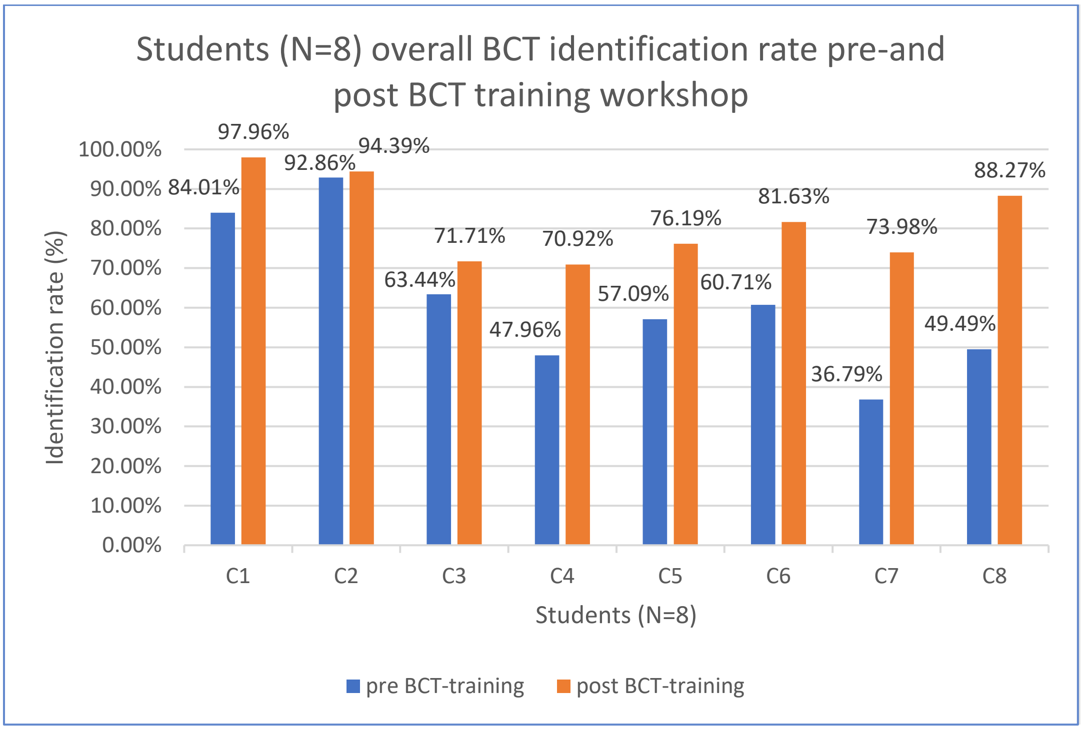


Figure 27: SLT students (N=8; C1-C8=students) overall BCT identification rate pre- and post BCT training

Comparing pre-and post BCT training coding results from the overall BCT identification rate per student, it can be seen that all eight students showed improvement in their coding abilities after completing the BCT training. The range between improvements is great, with the highest at 38.78% (C8) and the lowest at 1.53% (C2). However, it has to be noted that students who made rather small improvements, such as C2 and C1, had already achieved quite high coding percentages before the BCT training. As these two students coded very well before the training, opportunity for improvement was limited. The reverse is also true in terms of students showing weak coding skills before the training — these students achieved the highest improvements of coding results after the training (e.g., C7 and C8). Overall, when considering the BCT identification rate from the baseline coding for each student individually after the BCT training, all students achieved a coding result above 70%, with four students between 70-80% and the rest above 80%. Thus, clear improvement in the BCT coding ability before and after the BCT training can be seen for each student.

The next analysis shows results before and after the BCT training workshop in terms of the BCT type identification rate. Thus, results show how well different BCTs were coded pre- and post the BCT training workshop.

4.3.2.2 Baseline Coding pre-and post BCT Training: BCT Type Identification Rate

Each BCT was examined in terms of its BCT type identification rate which shows how well it was identified by students (N=8) in the baseline coding before and after the BCT training. Table 26 shows descriptive results, such as the total number of each BCT occurrence in the baseline, and the mean and SD for each BCT pre- and post BCT training. Figure 28 gives a visual overview of the pre- and post-coding results of the BCT type identification rate.

Table 26: Descriptive results of BCT baseline coding by SLT students (N=8) by BCTs

		Pre BCT training students (N=8)		**Post BCT training students (N=8)**	
BCT type	**Correct Occurrences of BCTs total number**	**Mean (%)**	**SD (%)**	**Mean (%)**	**SD (%)**
1.4. Action planning	7	83.93%	11.92%	71.43%	20.20%
10.4. Social reward	2	75.00%	37.80%	87.50%	23.15%
2.2. Feedback on behaviour	1	62.50%	51.75%	87.50%	35.36%
4.1. Instruction on how to perform the behaviour	4	53.13%	43.17%	59.38%	39.95%
6.1. Demonstration of the behaviour	9	70.83%	23.76%	98.96%	3.93%
7.1. Prompts/cues	6	58.33%	32.12%	81.25%	31.42%
8.1. Behavioural practice/rehearsal	4	31.25%	25.88%	87.50%	18.90%

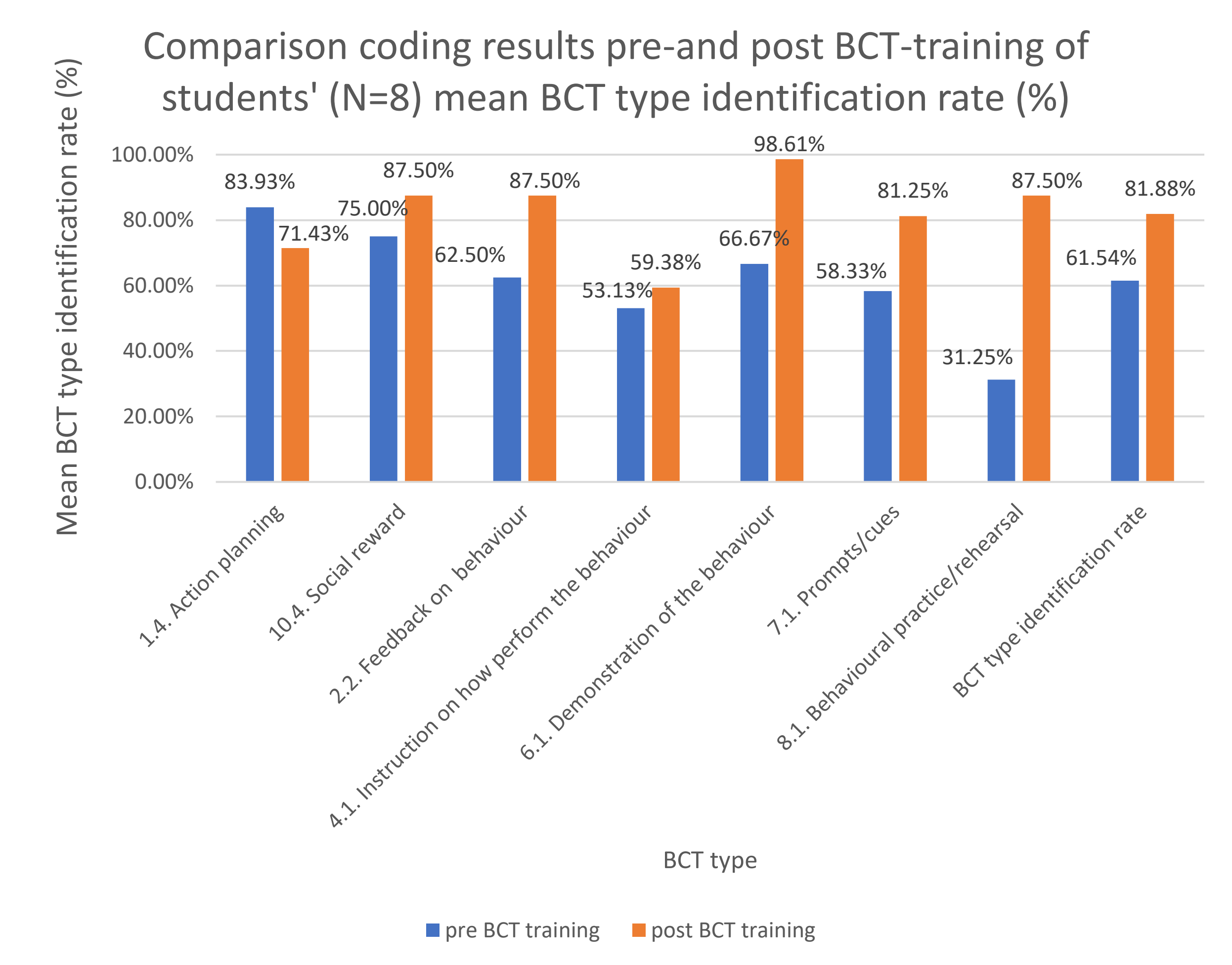


Figure 28: Overview of the comparison between SLT students' (N=8) coding results of BCT type identification rate means pre- and post BCT training

Overall, after BCT training, five of the seven BCTs were coded correctly with values over 80%, and coding was more accurate for the majority of BCTs than before the training. Two BCTs — 1.4. *Action planning* (post BCT training M=71.43%) and 4.1. *Instruction on how to perform the behaviour* (post BCT training M=59.38%) — were both below 80% and therefore show rather uncertain coding results. Nevertheless, most BCTs were coded successfully with more accurate outcomes.

Results shown in Table 26 and Figure 28 show increased mean values for all BCT types which suggests an improvement in the ability to identify BCTs, with the exception of BCT 1.4. *Action planning*, which achieved worse coding results for the mean and SD after the BCT training (M=71.43%, SD=20.20%) than before (M=83.93%, SD= 11.92%). The highest increase of 56.25% for the mean of the BCT type identification rate can be seen for 8.1. *Behavioural practice/rehearsal*. The BCTs 6.1. *Demonstration of the behaviour* (mean BCT type identification rate increase 27.53%) and 2.2. *Feedback on behaviour* (mean BCT type identification rate increase 25.00%) also showed a high increase in their means, and lower SD values, which indicated that students coded these BCTs more reliably. In addition, 6.1. *Demonstration of the behaviour* shows a mean of 98.96% post BCT training, which is close to a 100% and therefore the best results among all BCT types occurring in the baseline coding.

Concluding the baseline coding section, results showed that students were able to code BCTs significantly better after than before the BCT training, as the t-test between the results pre- and post BCT training of the overall BCT identification mean has shown (section 4.3.2.1). Thus, the impact of the BCT training on students' coding ability was significant.

4.3.3 BCT Coding Assessment Video

This section focuses on the coding results of the full-length assessment video completed by all participating students (N=8) after completing the BCT training. First, an overview of the overall BCT identification rate from all participants' coding is given. Second, the BCT type identification rate per BCT is shown to investigate which BCTs were coded reliably and which show low coding accuracy. Coding requirements for the BCT assessment video coding in Stage 3 were to code every single BCT present within an utterance.

4.3.3.1 Stage 3 Overall BCT Identification Rate

The overall BCT identification rate (regardless of the BCT type) of students (N=8) is given in descriptive measures in Table 27, to get an overview of students' overall coding abilities. Figure 29 shows the boxplot of descriptive results of students' overall BCT identification rates to visualize results.

Table 27: Descriptive results of overall BCT identification rate by SLT students (N=8)

Measures	Students (N=8)
Mean	75.81%
SD	4.86%
Range	16.26%
Maximum	83.33%
Minimum	67.07%
Median	75.81%

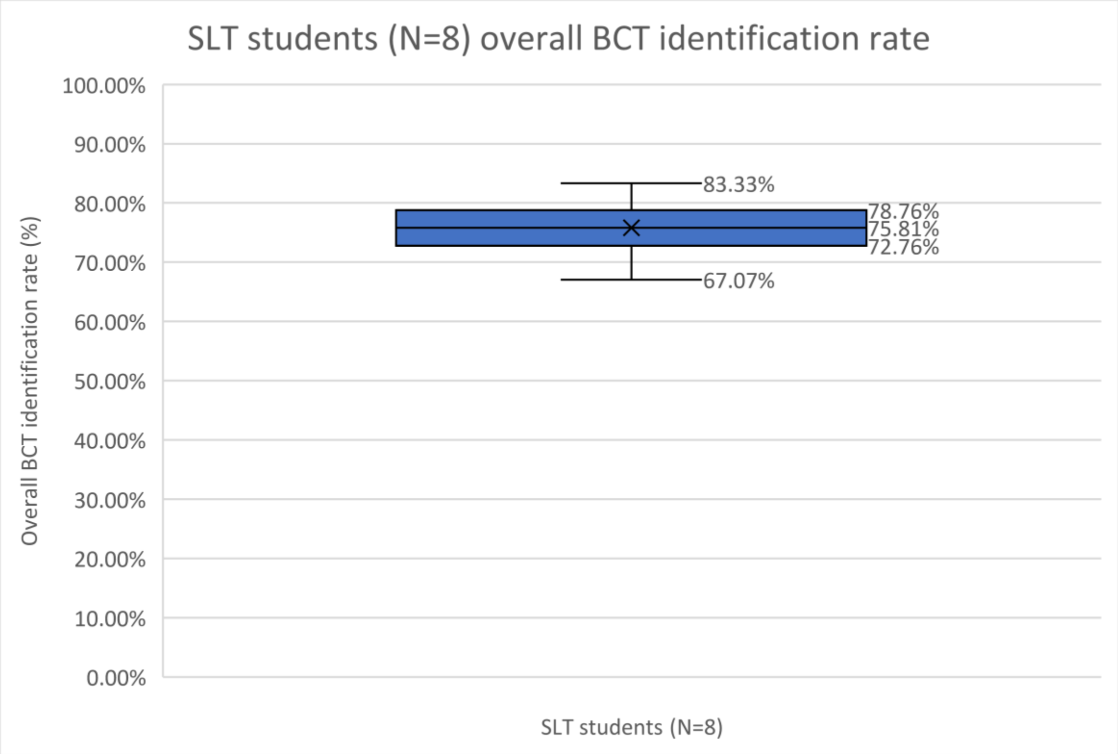


Figure 29: SLT students (N=8) overall BCT identification rate

Both mean and median values for the overall BCT identification rate of students are 75.81%, with a SD of 4.86%. Minimum is at 67.07%, whereas maximum is at 83.33%. Thus, a range of 16.26% is shown.

Furthermore, performances of each individual student have been investigated and compared using the overall BCT identification rate, to see the individual performance of each student on the overall BCT identification rate. As previously explained, to calculate the *overall BCT identification rate* the total of correctly identified BCTs is summarised and divided by the total of occurring BCTs occurring in the SSD intervention sample video — here N=246. If students did not identify a BCT, a zero would have been used to document this. However, was not necessary since all students identified each BCT at least once. Table 28 shows students' performance (C1-C8) on the overall BCT identification rate from the SSD sample video.

Table 28: Overall BCT identification rate per SLT student (N=8; C1-C8)

BCT	BCT occurrence	C1	C2	C3	C4	C5	C6	C7	C8
1.4. Action planning	15	8	13	10	7	12	7	7	5
10.4. Social reward	40	31	32	32	27	31	33	31	34
2.2. Feedback on behaviour	10	7	9	6	7	7	3	8	7
4.1. Instruction on how perform the behaviour	18	14	14	11	13	7	8	15	13
6.1. Demonstration of the behaviour	83	70	72	62	75	65	74	64	68
7.1. Prompts/cues	29	24	29	5	18	24	24	24	22
8.1. Behavioural practice/rehearsal	51	40	36	39	30	39	36	44	39
Total numbers of identified BCTs	**246**	**194**	**205**	**165**	**177**	**185**	**185**	**193**	**188**
Overall BCT identification rate per student	**100%**	**78.86%**	**83.33%**	**67.07%**	**71.95%**	**75.20%**	**75.20%**	**78.46%**	**76.42%**

As Table 28 shows, the highest overall BCT identification rate achieved by a student is 83.33% (C2) and the lowest 67.07% (C3). Students' performances on the BCT type identification rate are presented in the next section.

4.3.3.2. Stage 3 BCT Type Identification Rate

This analysis looked at the coding results for each of the seven BCTs, to see which ones were frequently coded correctly or incorrectly by students (N=8). Descriptive results for each BCT are given in Table 29. As this analysis focuses on the BCT types individually, the BCT type identification rate has been used to display the results.

Table 29: Descriptive results of the BCT type identification rate by SLT students (N=8) of coding the assessment video

		Students (N=8)	
BCT Type	**Total occurrences of BCTs within assessment video**	**Mean correct identification of BCTs**	**SD referring to correct BCT occurrences**
6.1. Demonstration of the behaviour	84	83.20%	24.83%
10.4. Social reward	41	77.97%	27.65%
7.1. Prompts/cues	29	76.23%	22.47%
8.1. Behavioural practice/rehearsal	51	74.26%	29.54%
4.1. Instruction on how perform the behaviour	19	68.01%	26.94%
2.2. Feedback on behaviour	10	66.96%	17.27%
1.4. Action planning	15	57.50%	31.89%

Descriptive results show that the mean values for correct identification across BCTs range from 57.50% for the BCT 1.4. *Action planning* to a mean of 83.20% for the most frequently occurring BCT 6.1. *Demonstration of the behaviour*. Looking at Table 29, it can be observed that lower occurring BCTs had lower identification rates. Thus, it seems that BCTs occurring more often were identified better by students than BCTs occurring less frequently (e.g., 10.4. *Social reward* occurring 41 times, having a mean of 77.97% compared to the BCT 1.4. *Action planning* occurring 15 times, having a mean of 57.50%). Thus, a correlation analysis between the occurrences of BCT types and the means of students' BCT type identification rate was conducted using Pearson's correlation coefficient to determine whether a relationship between the occurrence of BCTs and the mean exists (Field, 2009). It is suggested that BCTs occurring more often are easier to identify and therefore show a higher mean. Figure 30 shows the correlation between the BCT occurrence and mean of students in a scatterplot.

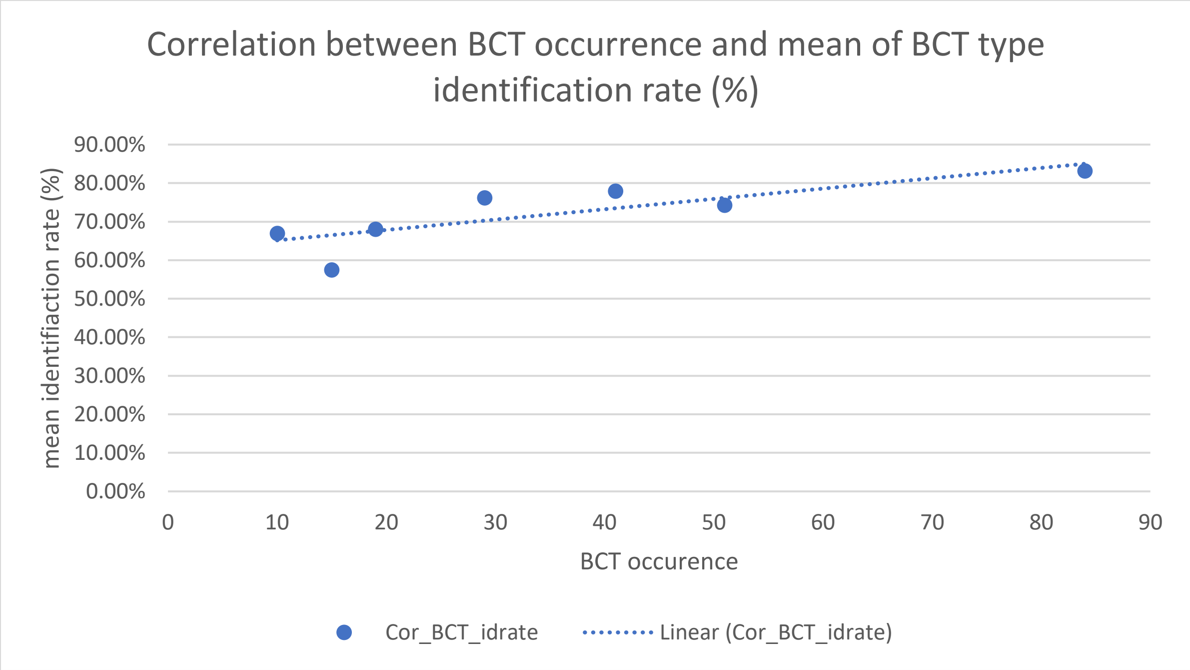


Figure 30: Scatterplot of the correlation analysis between BCT occurrence and mean of BCT type identification rate

The correlation analysis using Pearson's correlation coefficient revealed a result of r=.813 and p=.026, which shows a significant correlation between the number of BCT occurrences and the BCT type identification means of students. This result needs to be considered with caution, however, as there were only eight students and seven BCTs included, and therefore the number of observations is low. Thus, to see whether there is indeed a positive tendency between BCT occurrences and the ability to identify them better needs to be investigated using a larger sample.

4.3.3.3 The Effectiveness of the simplified BCT Training: Comparison of the initial BCT Training Workshop (Stage 2) and the simplified BCT Training Workshop (Stage 3)

The following section looks at results of the initial BCT training in Stage 2 and, to the extent possible, compares these to results from the simplified BCT training of Stage 3. Overall, both stages investigated whether SLTs and/or SLT students can be trained in how to identify BCTs used in SSD interventions. However, there were differences between the BCT training workshop of Stage 2 and that of Stage 3 (section 4.2.2) — for example, in terms of number of BCT types included (17 BCTs in Stage 2, 7 BCTs in Stage 3) and coding requirements (Stage 2: code every BCT once within an utterance, Stage 3: code every single BCTs within an utterance). The differences in the coding requirements results in a different number of occurring BCTs in Stage 2 compared with Stage 3. In addition, participants between the two stages also differed (Stage 2: SLTs and SLT students N=21; Stage 3: SLT students N=8).

Even though the same assessment video was used for BCT coding in both stages, coding requirements were different. Hence, as the BCT training workshop for Stage 3 used different coding requirements than the BCT training workshop in Stage 2, the benchmark developed by the two BCT-trained SLTs changed in Stage 3 (section 4.2.2.1). In addition, not only coding requirements changed but also the number of BCT types included in the BCT training workshop in Stage 2 (17 BCT types) and Stage 3 (seven BCT types). Considering this, a general comparison of the overall BCT identification rate needs to be considered with care, as both stages included a different number of occurring BCTs due to the coding requirements (Stage 2 number of BCTs occurring N=187; Stage 3 number of BCTs occurring N=249) and BCT types. Nevertheless, a comparison between the mean values of overall BCT identification rates of participants in Stage 2 and Stage 3 should indicate whether an improvement of coding accuracy has been reached in Stage 3.

In sum, the mean values of the overall BCT identification rates from 21 participants in Stage 2 (SLTs N=10, students N=11) and 8 participants of Stage 3 (students only, N=8) from the BCT coding task of the assessment video have been included in the following non-parametric Mann-Whitney U test. This analysis has been conducted to show whether there was a significant improvement of the coding accuracy of participants in Stage 3 after completing the revised BCT training compared to Stage 2. The Mann-Whitney U test is a non-parametric test which investigates differences between two independent groups (Field, 2017), which means that this test is highly appropriate for this purpose as participants from Stage 2 and Stage 3 are the independent groups which in addition show unequal groups sizes (Stage 2 N=21; Stage 3 N=8). Table 30 gives the detailed information on results of ranks.

Table 30: Ranks of the Mann-Whitney U test for Stage 2 and Stage 3 means of the overall BCT identification rate

	Stage	N participants	Mean rank	Sum of ranks
Mean BCT type identification rate	2	21	11.00	231.00
	3	8	25.50	204.00
	Total	29		

The results indicate a significant difference between participants' coding results of the two stages (U=.000, p<.001; Stage 2 median=43.85% compared to Stage 3 median=75.81%). Thus, results from the Mann-Whitney U test reject the null hypothesis and it can therefore be concluded that participants of Stage 3 were able to identify BCTs significantly better after completing the revised BCT training, compared to participants of Stage 2 with the initial BCT training.

Thus, for comparing the coding accuracy of these two stages in more detail and investigating whether certain BCT types, and if so which BCT types, were coded significantly better in Stage 3 than in Stage 2, a further analysis was conducted. As 17 BCT types were included in Stage 2 and 7 BCT types in Stage 3, only BCT types included and taught in both stages are used in this comparison conducted using the Mann-Whitney U test. These are the seven BCT types 1.4. *Action planning*, 2.2. *Feedback on behaviour*, 4.1. *Instruction on how to perform the behaviour*, 6.1. *Demonstration of the behaviour*, 7.1. *Prompts/cues*, 8.1. *Behavioural practice/rehearsal* and 10.4. *Social reward*. The comparison of the BCT type identification rates of participants from Stage 2 and Stage 3 shows how well participants in Stage 2 were able to identify and classify these seven BCTs, compared to participants in Stage 3. Therefore, it gives a detailed insight into whether participants were able to code certain BCT types significantly better and more accurately after the initial BCT training in Stage 2 or the simplified BCT training in Stage 3.

The Mann-Whitney U test showed no significant results for three of the seven BCT types, meaning that these BCT types have not been identified as having been coded significantly better in Stage 3 compared to in Stage 2, even though an improvement can be seen as the mean is higher in general. P-values were corrected for multiple comparisons to adjust the level of statistical significance correctly for the current results (number of comparisons = 7, p-value .05/7 = .007 is the significance level for the current results). The three BCT types were 1.4. *Action planning* (U=46.00, p=.198; Stage 2 median=33.33% compared to Stage 3 median=62.50%), 2.2. *Feedback on behaviour* (U=27.00; p=.140, Stage 2 median=57.14% compared to Stage 3 median=68.75%) and 7.1. *Prompts/cues* (U=147.50, p=.262; Stage 2 median=66.66% compared to Stage 3 median=81.25%). However, results for four of the seven BCT types showed that participants were able to identify and code these BCT types significantly better in Stage 3 than in Stage 2. The BCT types for which significant results can be reported are 4.1. *Instruction on how to perform the behaviour* (U=56.00, p=.004; Stage 2 median=47.61% compared to Stage 3 median=68.75%), 6.1. *Demonstration of the behaviour* (U=648.00; p<.001; Stage 2 median=42.85% compared to Stage 3 median=95.83%), 8.1. *Behavioural practice/rehearsal* (U=281.00, p<.001; Stage 2 median=14.28% compared to Stage 3 median=87.50%) and 10.4. *Social reward* (U=325.00, p<.001; Stage 2 median=69.05% compared to Stage 3 median=87.50%). Thus, three of the BCT types have not been shown to have been identified more accurately by participants after completing the BCT workshop in Stage 3 compared to Stage 2 coding results, whereas for four BCTs a significant increase in coding accuracy was shown after completing the BCT workshop from Stage 3 compared to Stage 2.

Summarising the main findings of these comparisons, the non-parametric Mann-Whitney U test (ranking of means from overall BCT identification rates Stage 2 and Stage 3) and the t-test conducted with the baseline coding show that the revised BCT training implemented in Stage 3 had a positive impact on the coding accuracy of participants and therefore seems to be a more effective methodology for training SLT students to identify BCTs.

4.3.4 The Use and Application of the BCTTv1 for SLT Students in SSD Interventions

The BCT survey aiming at answering **RQ 5** (*Do SLT students doing the revised BCT training workshop think that the application of BCTs in SSD interventions with children is useful and if so why, and do they think that the simplified BCT training workshop should be included in the training curriculum of SLT students?)* has also been used in Stage 3, with some smaller adaptations. Since seven BCTs were included in Stage 3, compared to 17 BCTs in Stage 2, the BCT survey has been revised in terms of BCTs included. Accordingly, questions in the survey included the seven BCTs used in Stage 3 (section 4.2.2).

In Stage 3, all students (N=8) completed the BCT survey with the same five sections as in Stage 2 (section 3.2.2.2), only adapted in terms of the number of BCTs included. Thus, results of the most useful and most common BCTs with reasons for students' decisions and students' opinions on the usefulness of the BCT training for SLT students are presented.

4.3.4.1 Usefulness of BCTs

First, students (n=8) were asked how useful, in general, they consider the application of BCTs in SLT of children with SSD. Figure 31 shows results of participants' responses.

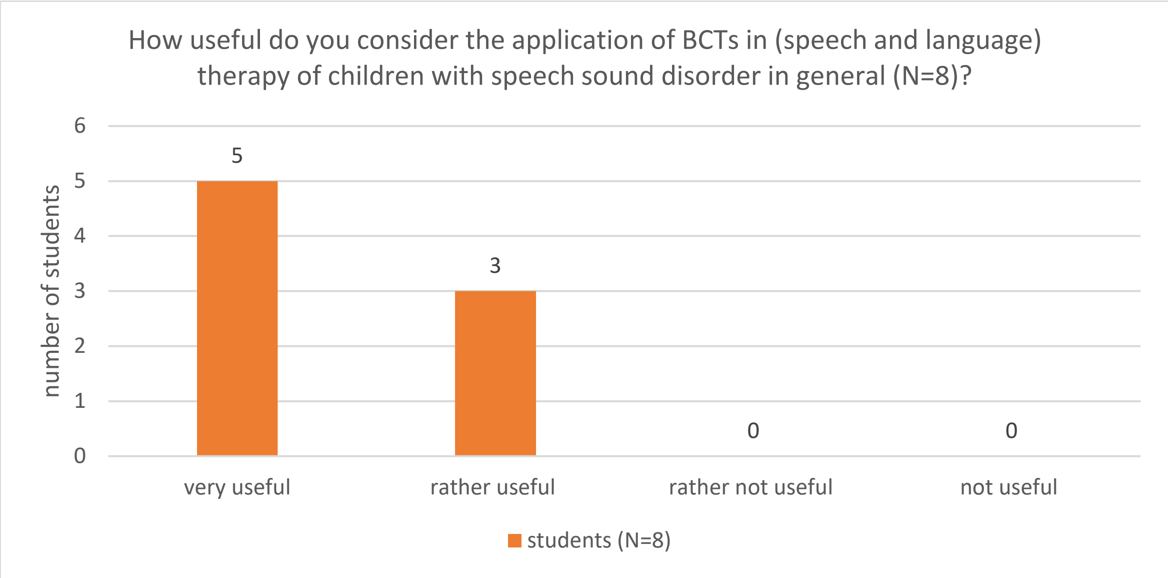


Figure 31: Responses of SLT students (N=8) on how useful they consider the application of BCTs in SLT of children with SSD

The majority of students (N=5/8) claimed that BCTs are 'very useful' for SLT, especially for SSD interventions. Only three students responded that BCTs are 'rather useful', and none of the students chose the answers 'rather not useful' and 'not useful'.

Students had the chance to justify their answer choice in an open-ended question, which was analysed qualitatively. Participants were asked to give five or more reasons for their choice, which resulted in 33 answers by eight participants. Answers occurring more than once were then put into categories (meaning the same reason must occur at least twice). If an answer only occurred once, no category was established and these answers have not been included in the data representation due to their single occurrence (the single answers are shown in Appendix Q). The flowchart in Figure 32 gives an overview of the procedure.

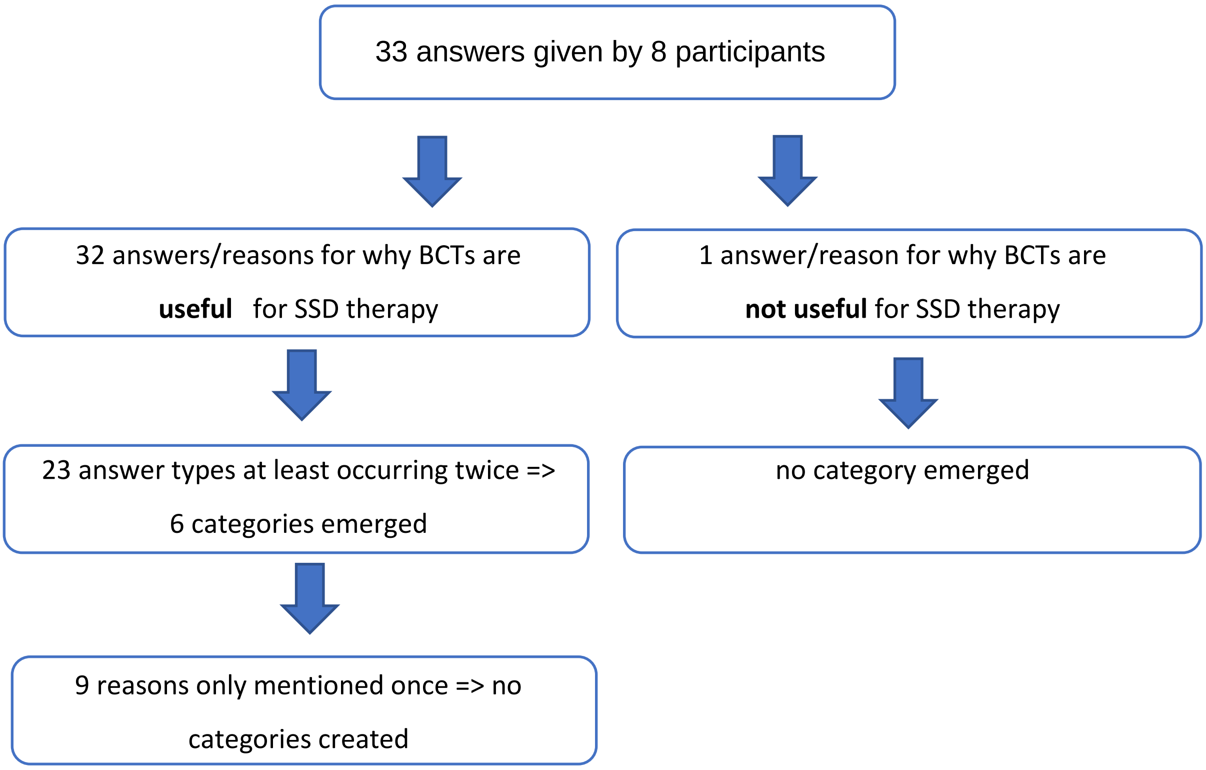


Figure 32: Flowchart of qualitative analysis addressing why SLT students (N=8) think that BCTs are useful or not useful for SSD therapy

One reason was given to explain why students felt BCTs were not useful for SSD therapy, whereas all others supported the usefulness (N=32). In sum, six categories for why BCTs are very useful or useful emerged, whereas just one reason for why they are not was mentioned. Categories have only been created if an answer type occurred more than once, but as there was only one answer explaining why BCTs are not useful, this reason is also given to show the full picture and both categories. Figure 33 shows the categories found in students' answers.

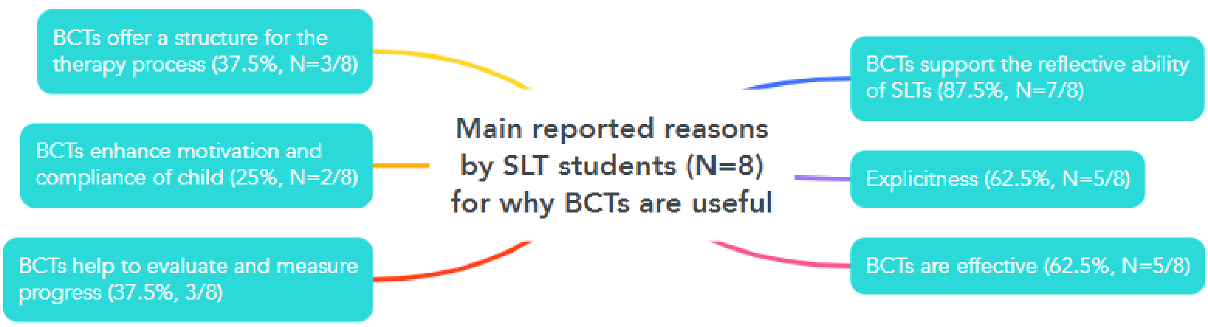


Figure 33: Main reported reasons by SLT students (N=8) in six categories on why BCTs are useful in SSD intervention

The most mentioned reason for why BCTs can be useful in SLT and SSD intervention was that BCTs support the reflective ability of SLTs (87.5%, N=7/8). In addition, students (62.5%, N=5/8) claimed that BCTs enable everyone involved in the therapy process and students to speak explicitly about what is being done in therapy sessions. Students also mentioned that BCTs are effective (37.5%, N=3/8), offer a structure for the therapy process (37.5%, N=3/8) and help to evaluate and measure progress (37.5%, N=3/8). Two students said that BCTs enhance the motivation and compliance of children (37.5%, N=3/8).

The single reason given for why BCTs are not useful in SLT was “time”. One participant claimed that learning how to code and use BCTs was very time-consuming. Overall, the majority of reasons were positive and support the use and application of BCTs in SLT and SSD interventions.

4.3.4.1.1 BCT Rating and Ranking

A BCT rating was conducted using the seven included BCTs (1.4. Action planning, 2.2. Feedback on behaviour, 4.1. Instruction on how to perform the behaviour, 6.1. Demonstration of the behaviour, 7.1. Prompts/cues, 8.1. Behavioural practice/rehearsal and 10.4. Social reward), to see which BCTs students regard as very useful for SSD interventions, and which are not seen as useful at all. All students (N=8) completed a rating of all 7 BCTs from very useful to not useful for each BCT type individually (rating options were: 1= very useful, 2= rather useful, 3= rather not useful, 4= not useful). Descriptive measures showed that only the rating options very useful (1) and rather useful (2) were used by students, which clearly indicated that students think seven BCT types are either very useful (1) or rather useful (2).
The following analysis focused on the BCT ranking. Students ranked the seven included BCTs from one to seven in their importance and usefulness for SSD intervention according to their personal opinion. A BCT ranked in the last place does not necessarily imply that this BCT is not useful at all, but shows that it may not be as important as the BCT placed first. A note to this effect was given to students in the survey. Participants ranked the seven BCTs in terms of their usefulness from 1 (most useful) to 7 (least useful). Descriptive measures of the BCT ranking in Table 31 give an overview, followed by boxplots in Figure 34, which visualise these results.

Table 31: Descriptive results of BCT ranking by SLT students (N=8)

BCT type	Median	SD	Range	Min.	Max.
6.1. Demonstration of the behaviour	1.50	2.066	6	1	7
2.2. Feedback on behaviour	3.00	1.553	4	1	4
4.1. Instruction on how to perform the behaviour	3.00	1.598	5	1	6
7.1. Prompts/cues	4.00	1.458	4	2	6
8.1. Behavioural practice/rehearsal	4.00	1.642	5	1	6
1.4. Action planning	6.00	1.923	6	1	6
10.4. Social reward	7.00	2.053	5	2	7

Note. Ranking from 1 (most useful) to 7 (least useful)

Students ranked the BCTs using the scale one (most useful) to seven (least useful), and this was used to investigate descriptive results shown in Table 31. Results show that the BCT 6.1. *Demonstration of the behaviour* was ranked as most useful among students (N=8), and therefore shows the best median (median=1.50). Nevertheless, this BCT also shows the highest SD (SD=2.066) and a high range of six, which means a high variability in the ranking. The two BCTs 2.2. *Feedback on behaviour* and 4.1. *Instruction on how to perform the behaviour* follow both with the same median (3.00), and were therefore ranked as the second most useful BCTs. The BCT types 7.1. *Prompts/cues* and 8.1. *Behavioural practice/rehearsal* were placed as third useful BCTs, even though the median is already higher (and therefore worse than for BCT types placed as first and second most useful BCTs; median=4.00). Overall, all BCTs show a rather high range and therefore variance, as also seen in the boxplots in Figure 34. As the ranking reached from one (most useful) to seven (least useful), a value lower on the plot means a higher ranking in Figure 34.

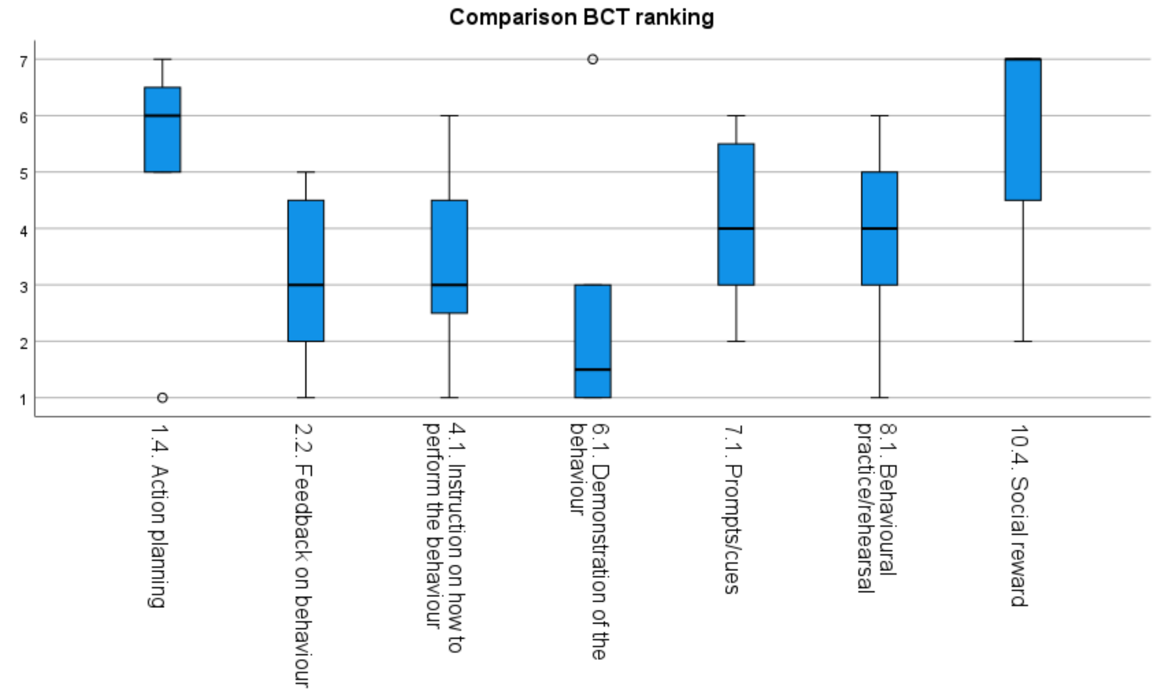


Figure 34: BCT ranking by SLT students (N=8)

The boxplots of Figure 34 and data from Table 31 show that students think that some BCT types are more useful than others (e.g., 6.1. *Demonstration of the behaviour* is very useful, 10.4. *Social reward* is the least useful BCT type). However, combining the results of the *BCT rating* (in which all seven BTCs have been rated with very useful (1) and rather useful (2)) with the results of the *BCT ranking*, it can be suggested that students advocate the usefulness of these BCT types in SSD interventions, even though some BCT types are seen as more useful than others.

4.3.4.1.2 The most common BCTs

Students were asked which five of the seven BCTs they think are the most commonly used BCTs in SSD interventions in clinical SLT practice. It was decided in Stage 2 that, rather than including all BCTs (17 BCT types in Stage 2), only five should be chosen. For comparability between the two stages, the number of BCT types which should be chosen – five – has not been changed in Stage 3. Thus, all seven BCTs were available to choose from, and students had to document which five they see as the most commonly used BCT types for SSD interventions. Figure 35 shows the responses of all students (N=8) for all seven BCTs.

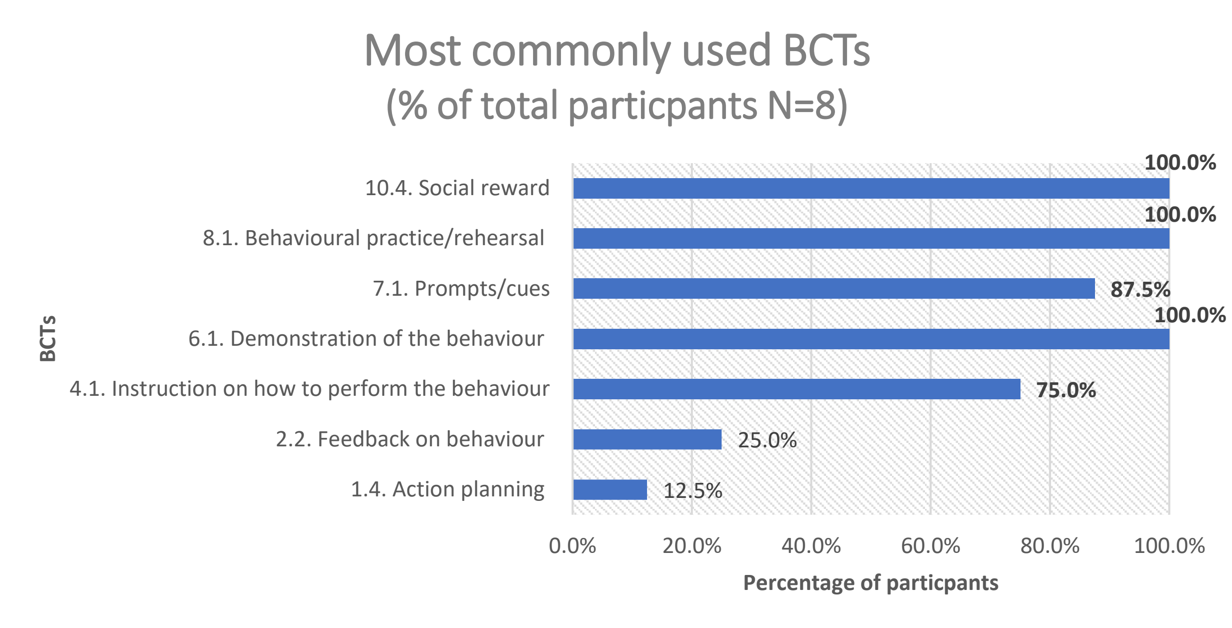


Figure 35: Most commonly used BCTs in clinical practice according to SLT students (N=8)

Results representing the five most commonly used BCTs in SSD interventions according to SLT students chosen from the seven available BCTs are the BCTs 10.4. *Social reward*, 8.1. *Behavioural practice/rehearsal*, 6.1. *Demonstration of the behaviour,* 7.1. *Prompts/cues and* 4.1. *Instruction on how to perform the behaviour*. All students mentioned the three BCT types 10.4. *Social reward*, 8.1. *Behavioural practice/rehearsal* and 6.1. *Demonstration of the behaviour* as the most commonly used BCTs for SSD interventions. *Prompts/cues* (7.1.) was chosen by 78.5% of students, and 4.1. *Instruction on how to perform the behaviour* by 75.00% of students. A minority of students saw 2.2. *Feedback on behaviour* (25.00%) and 1.4. *Action planning* (12.5%) as the most commonly used BCTs in SSD intervention.

4.3.4.2 BCTs for Explicitness of Labelling Actions in SSD Interventions

As it was of interest whether SLT students would see BCTs as helpful for labelling actions of SLTs more explicitly, this was the next question. Students could answer “yes” or “no” and were then asked to provide reasons for their choice. 100% of participants (N=8) answered that BCTs help to label the actions of therapists more explicitly.

4.3.4.3 BCTs for Clinical Training of SLT Students

Lastly, in Stage 3 students were also asked whether they thought that having BCTs included in their study programme would be useful. Responses of all eight students are displayed below in Figure 36, followed by an analysis of an open-ended question in which students were invited to justify their answer choice.

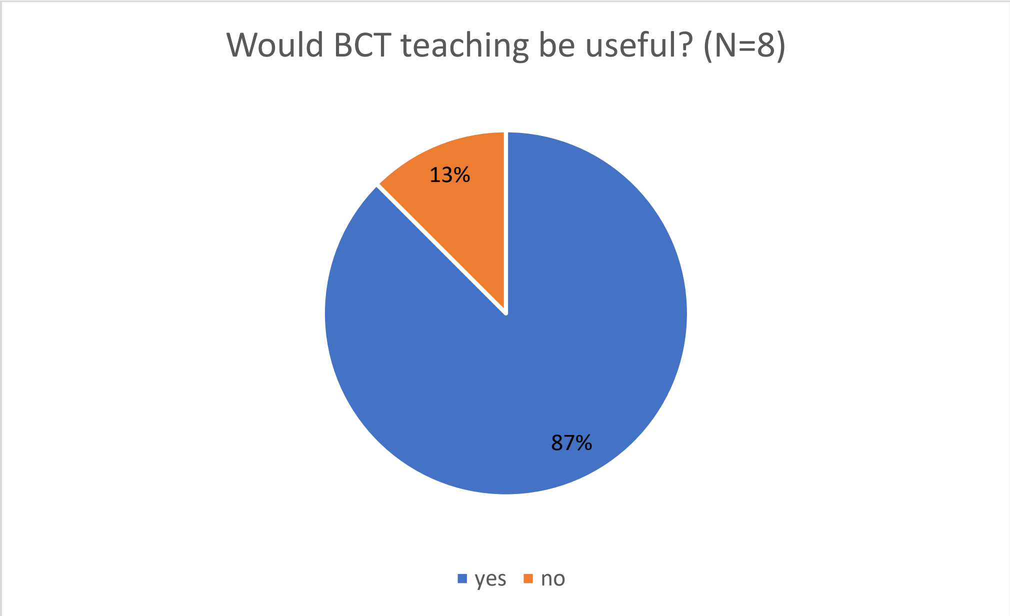


Figure 36: SLT students (N=8) answers' to whether teaching BCTs in SLT programmes would be useful

The vast majority of students (87%, N=7/8) answered that teaching BCTs in SLT programmes would be useful for prospective therapists, whereas only 13% (N=1/8) said no. To understand reasons for both answers, an open-ended question investigated students' expressed opinions further and are given below.

As the first question had required a simple yes or no response, the possibility to explain their choice was given to participants and responses to this question included several different reasons (multifaceted responses). All eight students offered a justification for their response, giving a variety of reasons. The answers were qualitatively analysed and clustered into categories. Explanations occurring more than once have formed a category. Two responses only occurred once and have not been included in the categories but are reported in sentences. Overall, five categories were developed on the base of the eight students' answers (N=17). Figure 37 gives an overview of students' responses.

Figure 37: Main reported reasons why BCTs should be taught in SLT programmes (N=17)

Three reasons why students think that BCTs should be taught in SLT programmes were mentioned by four of the eight participants — for example, the usefulness of BCTs for self-reflection and therapeutic actions, the suggestion that BCTs give a therapy structure and make the planning of therapy sessions easier and that BCTs explain how to do something in therapy and that this is essential for students. In addition, the explicitness of BCTs helps students to see and describe what SLTs are doing in therapy sessions (25%, N=2/8). Another reason why BCTs should be taught mentioned by students was the suggestion that BCTs work in all SLT areas (37.5%, N=3/8). One student mentioned that BCTs are helpful for identifying facilitators and barriers for the effectiveness of therapy sessions (12.5%, N=1/8).

Only one student said that BCTs should not be taught in SLT programmes, arguing that BCTs cannot be used in all areas of SLT. Nevertheless, even this student mentioned that BCTs help one analyse and reflect on one's own behaviour. In summary, the great majority of students (87%, N=7/8) thought that BCTs should be taught in SLT programmes, whereas only one student disagreed with this suggestion while also mentioning the positive impact of BCTs on the therapeutic profession. The next section discusses results of Stage 3.

4.4 Discussion

This section discusses the findings on **RQ 4.** *Does simplifying the BCT training workshop and reducing the number of BCT types included increase the BCT coding accuracy of SLT students from before to after workshop training?* Results indicated that students were able to code BCTs more accurately after completing the simplified BCT training workshop compared to before the workshop and also compared to the initial BCT training workshop of Stage 2. Thus, the hypothesis can be accepted. Coding accuracy of individual BCT types was also more accurate than in Stage 2. In addition, coding accuracy of BCT types also improved for six of seven BCT types after completing the BCT training in Stage 3 compared to before the BCT training. The hypothesis that coding accuracy for BCT types would be more accurate after the BCT training in Stage 3 can be accepted, except for the BCT 1.4. *Action planning*, which was coded slightly less well after than before the BCT training. Furthermore, Stage 3 investigated **RQ 5.** *Do SLT students doing the revised BCT training workshop think that the application of BCTs in SSD interventions with children is useful and if so why, and do they think that the simplified BCT training workshop should be included in the training curriculum of SLT students?* The hypothesis that SLT students would consider the use of BCTs in SSD interventions for children as useful can be accepted. Results of the BCT ranking and rating also show that some BCTs are considered more useful for SSD interventions than others. The vast majority of students report that students would benefit from the inclusion of the BCTTv1 (Michie et al., 2013b) in SLT training. These results are discussed in detail in the following sections.

4.4.1 Baseline Coding pre-post BCT Training

This section aims to discuss the results contributing to the answering of **RQ 4**, which looked at whether completing the simplified BCT training for students improved their coding accuracy compared to before the training, including the overall BCT identification rate (section 4.3.2.1) and the BCT type identification rate (section 4.3.2.2). The baseline coding results of the overall BCT identification rate showed an improvement of almost 20% for students' coding accuracy after completing the simplified BCT training. The conducted t-test showed a significant improvement of students' coding accuracy after the revised BCT training workshop (section 4.3.2.3). Overall, this result indicates that the revised and simplified BCT training for SLT students was effective and supports students' ability to code BCTs more accurately than without such BCT training.

Participants' coding competence before and after BCT training has also been assessed by Wood et al. (2015) by identifying BCTs in written behaviour change intervention descriptions (Wood et al., 2015). As described in detail in section 1.4, the study by Wood et al. (2015) differs in terms of participants, duration and delivery of the workshop, as two groups participated in this study. In addition, written behaviour change intervention descriptions were used to assess coding accuracy before and after the BCT training, including more BCTs than in the current study (12 BCTs for the workshop group and 17 BCTs for the distance group). Nevertheless, results of the current study can most likely be compared to Wood et al.'s (2015) results of the "agreement with expert consensus", as this was developed by expert coders by coding and discussing coding results of the behaviour change interventions descriptions. These results and the consensus established have then been used as a benchmark against which to compare trainees' coding to determine their coding accuracy. Results also showed that the training of the BCTTv1 (Michie et al., 2013b) increased trainees' coding accuracy as agreement with expert consensus was higher after than before the BCT training. Thus, results of the current study showing that BCT training increases participants' coding accuracy are in line with available literature (Wood et al., 2015).

Even though the overall BCT coding rate improved after the BCT training, it has to be noted that participants were surprisingly good at the coding task before the training as their overall BCT identification rate was at 63.26%. This showed that students were able to identify two thirds of BCTs occurring in the baseline coding video. In addition, even coding results of the overall BCT identification rate for Stage 2 assessed after completing the BCT training were below the coding results of Stage 3 baseline coding before the BCT training (Stage 2 overall BCT identification rate after BCT training = 42.55%, section 3.3.2.1). Reasons for this result might include the reduced number of BCT types included in Stage 3. As there were just seven BCTs included in Stage 3, the number of BCT types to identify in the baseline video seems to have been more manageable for SLT students. In addition, the names of the seven BCT types selected for Stage 3 (1.4. *Action planning*, 2.2. *Feedback on behaviour*, 4.1. *Instruction on how to perform the behaviour*, 6.1. *Demonstration of the behaviour*, 7.1. *Prompts/cues*, 8.1. *Behavioural practice/rehearsal*, 10.4. *Social reward*) may have been quite transparent in terms of their meaning. As previously noted, these seven BCT types are commonly used and implicitly described in SSD interventions (sections 2.3 and 3.4.2) and thus SLT students may have an idea of the meaning of most of these terms. Even though the exact meaning of some BCT types may be different to how SLT students interpret them, the results on the overall BCT identification rate seem to show that their sense of what these BCT types may mean was good. Especially terms such as "feedback", "instruction", "demonstration", "prompts/cues", "practice" and "reward" are often used throughout several SLT interventions and their manuals and therefore might be responsible for students' familiarity with them and the good coding results before the BCT training.

Even though the overall BCT identification rate of students was good before the training, an even higher overall BCT identification rate (82.58%) and an improvement of 19.32% was found after the BCT training in Stage 3, which shows that the BCT training has a positive impact on the coding accuracy of workshop participants. Also, the extent of the individual variability suggests that training is very useful to level the playing field. Some individuals benefit more than others from the BCT training, but after the BCT training everyone is more consistently at a higher level of accuracy.

In terms of the BCT type identification rate, looking at the percentage of coding accuracy, it increased for six of the seven BCT types (10.4. *Social reward*, 2.2. *Feedback on behaviour*, 4.1. *Instruction on how to perform the behaviour*, 6.1. *Demonstration of the behaviour*, 7.1. *Prompts/cues*, 8.1. *Behavioural practice/rehearsal*). It was not possible to compare the coding results of every single BCT type in a t-test, as these seven BCT types only occurred between one and nine times in the baseline video which, due to the low number of occurrences, does not allow conducting a t-test. However, the percentage of coding accuracy allows an insight into SLT students' coding improvement and these results give further insight into which BCT types were coded more accurately after the BCT training than before, which applies for all six above-mentioned BCTs (10.4. *Social reward*, 2.2. *Feedback on behaviour*, 4.1. *Instruction on how to perform the behaviour*, 6.1. *Demonstration of the behaviour*, 7.1. *Prompts/cues*, 8.1. *Behavioural practice/rehearsal*). However, the BCT type 10.4. *Social reward* achieved a high coding accuracy rate mean (M=75.00%) before and after (M=87.50%) the training. Thus, even though the students' coding accuracy mean increased after the training, this BCT type can be identified quite well without much training. Findings of the study conducted by Wood et al. (2015) did not assess participants' coding accuracy on the BCT 10.4. *Social reward*, but on 10.3. *Material reward (behaviour)*, which belongs to the same BCT group '10. Reward and threat' of the BCTTv1. This may indicate that BCTs linked to reward may be identified better without training than other BCT types.

Interestingly, the BCT type 1.4. *Action planning* was coded slightly better before (M=83.93%) than after the BCT training (M=71.43%), even though the coding accuracy rate after the training is still high. However, reasons for the lower coding accuracy after the BCT training compared to before may be linked to definitions and examples included in the BCT SSD list (section 3.2.2.1.1), which may have confused students more than supporting them. For the baseline coding before the BCT training, students only received the BCT SSD list with terms for each BCT type, without any further explanation. Thus, after the training students were aware of the BCT definitions. The SSD intervention definition used from the SSD BCT list based on the BCTTv1 (Michie et al., 2013b) used for 1.4. *Action planning* was '*Prompt detailed planning of performance (actions/tasks/exercises in the therapy session) of the behaviour (must include at least one of context, frequency, duration and intensity). Context may be environmental (physical or social) or internal (physical, emotional or cognitive) (includes 'Implementation Intentions')*'. Coding results indicated that students may have been less certain about when to code this BCT type after than before the BCT training, in terms of the first utterance in which 1.4. *Action planning* is being used by the therapist or also in the following utterances if 1.4. *Action planning* (e.g., as an explanation of how the task works) continues over more utterances. It is assumed that the current explanations confused students more than they helped as they coded this BCT better before the BCT training when only having the BCT SSD list with terms available, and that maybe explaining more explicitly that if this BCT is used in an utterance and goes over more utterances (for example because some explanations are longer or children interrupt during the therapist explains it) the BCT type has to be coded in every occurring utterance, coding results might have been more accurate. The BCT types 1.4. *Action planning* is therefore likely to require more than one utterance, while other BCT types such as 10.4. *Social reward* may typically involve short utterances (e.g., “Good job!”). The BCT 1.4. *Action planning* has also been the second most frequently occurring one in the baseline video excerpt, which can be considered when interpreting coding results. On the one hand, coding results of Stage 2 indicated that the most frequently occurring BCTs tend to be harder to identify (section 3.3.2.2). On the other hand, BCT coding results from the entire assessment video in Stage 3 found that BCTs occurring more often also tend to be coded more accurately (section 4.3.3.2). It may be that transcribing and transposing the interaction onto the Excel sheet supported students strongly, as they were able to tie observations and identified BCT types to utterances more accurately. As the transcript showed every utterance, the chance of missing BCT types was reduced. In addition, when considering other results of the baseline coding, the most frequently occurring BCT within the video excerpt was coded the most accurately with a BCT type identification rate of M=98.61% after the BCT training. Thus, these results would contradict the suggestion that BCTs occurring the most are harder to identify than the ones occurring less often. Thus, it seems that the impact of the number of occurrences on the coding accuracy is still uncertain.

In addition, no result of the baseline coding showed BCT types which achieved poor coding accuracy before and after the BCT training, as students’ coding accuracy improved for six BCTs after the BCT training and was lower for a single BCT type which had higher coding accuracy before the BCT training. Thus, there was not a single BCT type which was coded with low accuracy both before and after the training. The steepest learning curve in terms of coding accuracy could be observed for BCT 8.1. *Behavioural practice/rehearsal* as coding accuracy improved by over 50%. Thus, the examples and descriptions of the BCT type used in BCT training seemed to have clarified when this BCT needed to be coded within the video. In contrast, the lowest improvement of coding accuracy was found for BCT 4.1. *Instruction on how to perform the behaviour*, which showed a coding accuracy improvement of just 6.25%. Nevertheless, even though improvement was rather low, this BCT type received a BCT type identification rate of almost 60% after the BCT training having been coded with a coding accuracy of 53.13% before and 59.38% after the BCT training workshop. At the same time, this was also the lowest BCT type identification rate after completing the BCT workshop among all seven BCTs (even the BCT 1.4. *Action planning* which received lower coding accuracy after than before the training had a higher coding accuracy after the training than the BCT 4.1. *Instruction on how to perform the behaviour*).

It had been suggested in Stage 2 that BCT 4.1. *Instruction on how to perform the behaviour* is often used implicitly in SSD intervention with children and therefore maybe hard to code, as sometimes no explicit instruction of a behaviour occurs in the intervention session when working with children. This may also contribute to the rather low coding result. In contrast, the same has been suggested for BCT 8.1. *Behavioural practice/rehearsal*, which shows the highest BCT coding accuracy in the baseline coding. Thus, other reasons such as not enough practice for BCT 4.1. *Instruction on how to perform the behaviour,* or poor description of the BCT and its examples from the BCT SSD, could have been responsible for the low coding results. Nevertheless, the baseline coding accuracy results of participants indicate that the BCT training was beneficial across all BCT types, which is in line with the results from the BCT training from Wood et al. (2015), even though trainings, participants and delivery differed.

4.4.2 BCT Coding

Just as in the previous baseline coding section (section 4.4.1), results in this section provide insights into whether students' coding accuracy improved after completing the simplified BCT training, compared to the coding accuracy results of participants in Stage 2 who completed the initial BCT training workshop (section 3.2.2). Both results on the overall BCT identification rate and on the BCT type identification rate were investigated using participants' assessment coding results. These results are discussed in this section, followed by a discussion of the comparison of Stage 2 and Stage 3 results.

4.4.2.1 Stage 3 Overall BCT Identification Rate

Students' overall BCT identification rate of the assessment coding task in Stage 3 showed a mean of M=75.51%. This shows higher coding accuracy than for the overall BCT identification rate of the initial BCT training workshop in Stage 2, which had been M=42.55% for all participants. To investigate whether differences in the overall BCT identification rate between both stages are significant, a Mann-Whitney U test was conducted using the mean values of the overall BCT identification rates of participants in Stage 2 (N=21) and participants in Stage 3 (N=8). Results of the Mann-Whitney U test showed significant results, meaning that participants completing the revised and simplified BCT training in Stage 3 showed significantly better coding accuracy compared to participants completing the initial BCT training workshop of Stage 2. Comparing these results has to be considered cautiously, as the two workshops differed in some ways (section 4.4.2). As the two stages tested two different experimental conditions (BCT coding results of initial BCT training of Stage 2 and revised BCT training of Stage 3), the main parameter of difference between the two stages was the number of BCTs included. The comparison of the overall BCT identification rates of the two stages indicates that participants received better overall BCT identification rates after completing the simplified BCT training workshop in Stage 3 compared to the initial BCT training workshop in Stage 2. Thus, results give a strong indication that the BCT training workshop of Stage 3 was more effective. As discussed in Stage 2 (section 3.4.1), it therefore seems that the adaptations and changes — such as (1) reducing the number of BCTs included in the workshop from 17 to 7, (2) changing the coding requirements from coding a BCT once within an utterance to coding every single BCT within an utterance, (3) revising the templates used for assessing participants coding accuracy by, for example, including the written transcript of the video, (4) using fewer training videos but discussing these in more detail and (5) providing more time to code the assessment video — seemed to have an impact on the coding accuracy results.

As there has not yet been a BCT training which has been revised in the mentioned parameters and gone on to measure coding accuracy amongst the participants including one or more of the five adaptations, these results cannot be compared to recent literature. However, Wood et al. (2015) evaluated the BCT training conducted and received data on the helpfulness of tasks included. They found that practical tasks for practising coding skills and discussions on coding results were supportive in developing BCT coding accuracy. Overall, both components were included in Stage 2 and Stage 3, whereas they were weighted differently in Stage 3. The latter focused more on practising coding skills in detail by using fewer training videos but having more time to work with each one. In addition, the time for discussions was also increased in Stage 3. Reducing the number of BCTs included in the training also seemed to support students to concentrate on a smaller number of BCTs in detail and may have had a positive effect on coding accuracy. The change of the coding requirements and revising the assessment templates also seemed to contribute to simplifying the BCT training, as – according to participants – both were much clearer and straightforward (section 4.2.2). All in all, the adaptations and changes to simplify the BCT training workshop seemed to increase overall BCT identification accuracy of participants.

4.4.2.2 Stage 3 BCT Type Identification Rate

In terms of the BCT type identification rate, only the seven BCT types which were included in both stages can be compared. Looking at the percentages of the BCT type identification rates of Stage 2 and Stage 3 for each of these BCT types individually, every single BCT type of the seven BCT types included in both stages was identified better after the BCT training workshop in Stage 3 compared to Stage 2 (1.4. *Action planning,* 2.2. *Feedback on behaviour,* 4.1. *Instruction on how to perform the behaviour,* 6.1. *Demonstration of the behaviour*, 7.1. *Prompts/cues*, 8.1. *Behavioural practice/rehearsal* and 10.4. *Social reward*). The Mann-Whitney U test was conducted for every single BCT type, to see whether the coding accuracy improvement of participants between Stage 2 and Stage 3 is significant. Results showed that three BCTs — 1.4. *Action planning,* 2.2. *Feedback on behaviour* and 7.1. *Prompts/cues* — were not identified significantly better in Stage 3 compared to Stage 2. In comparison, significantly better coding results were shown for the four BCTs 4.1. *Instruction on how to perform the behaviour,* 6.1. *Demonstration of the behaviour*, 8.1. *Behavioural practice/rehearsal* and 10.4. *Social reward.*

Interestingly, two of the three BCT types which were not coded significantly better in Stage 3 occurred fewer times than all other BCTs (1.4. *Action planning* occurred N=15 times in the assessment video and 2.2. *Feedback on behaviour* occurred N=10 times). As discussed previously, the definition and examples for BCT 1.4. *Action planning* are assumed to be not explicit enough which may result in the lower coding accuracy of students (section 4.4.1). The BCT type 2.2. *Feedback on behaviour* already showed a BCT type identification rate of M=54.50% in Stage 2 which was already amongst the best coded BCT types in that stage. In Stage 3, an increase of the BCT type identification rate has still been shown (M=66.96%), albeit the lowest increase among all seven BCTs and not significant. Even so, an increase of coding the BCT 2.2*. Feedback on behaviour* was found. Stage 2 coding revealed that this BCT was sometimes mistaken for 10.4. *Social reward* and vice-versa (section 3.4.1.2), as they are closely related in the context of SSD interventions. The BCT 2.2*. Feedback on behaviour* always contains evaluative information on the performed behaviour, whereas 10.4. *Social reward* includes a non-verbal or verbal reward. However, if the therapist gives a verbal reward and includes evaluative feedback within this utterance, both BCTs need to be coded (Michie et al., 2013b). Thus, this BCT may need more examples and explanations in the SLT context to clarify when which has been used. Wood et al. (2015) also explained that some BCTs are interpreted by trainees in the context of their profession. This could then influence coding results, as participants code these BCTs from their experience rather than complying with the coding rules. Results from 7.1. *Prompts/cues* also show no significant better coding accuracy for Stage 3 compared to Stage 2. However, this BCT was coded quite well by participants in Stage 2 with a Mean=61.54% which presented the best coded BCT type among all BCT types occurring more than once within the assessment video (section 3.3.2.2). In Stage 3, this BCT was coded with a Mean=76.23%, which is also quite high, although no significant increase has been found.

In contrast, a significant increase in coding accuracy in Stage 3 compared to Stage 2 was found for the four BCT types 4.1. *Instruction on how to perform the behaviour,* 6.1. *Demonstration of the behaviour*, 8.1. *Behavioural practice/rehearsal* and 10.4. *Social reward.* The steepest positive increase was shown for BCT 8.1. *Behavioural practice/rehearsal* (BCT type identification rate M=29.55% in Stage 2 and M=74.26% in Stage 3) (sections 3.3.2.2 and 4.3.3.2). Thus, the Mann-Whitney U test confirmed that a significant increase in coding accuracy of participants has taken place in Stage 3 compared to Stage 2 results. This finding is interesting, as this BCT has also been improved the most in the pre versus post training baseline coding (section 4.4.1). The BCT types 4.1. *Instruction on how to perform the behaviour,* 6.1. *Demonstration of the behaviour* and 10.4. *Social reward* were also coded significantly better in Stage 3 than in Stage 2. These results indicate that the simplified BCT training conveyed the meaning of these BCT types in the training videos, theoretical and practical training particularly more effectively in Stage 3 than in Stage 2. In addition, the change in coding requirements and the inclusion of fewer BCT types in the BCT training workshop of Stage 3 seemed also to contribute to the better coding accuracy results.

Findings from the baseline coding, the comparison of the overall BCT identification rate from Stage 2 and Stage 3 coding accuracy as well as the comparison between the BCT type identification rate of Stage 2 and Stage 3 all indicate that coding accuracy increased after completing the simplified BCT training with the reduced number of BCTs. The next section discusses results of the BCT survey used in Stage 3.

4.4.3 Application and Use of the BCTTv1 for SSD Interventions and for SLT Student Training

This section discusses the results answering **RQ 5**, which investigated SLT students' opinions on using BCTs in SSD interventions with children and whether they think that BCT training should be included in SLT training.

Results of the BCT survey showed that all students indicated that the application of BCTs in SSD interventions for children are 'very useful' (N=5/8) or 'rather useful' (N=3/8). When asked why, the main reasons mentioned were the possibility to reflect on their own therapeutic actions by using BCTs (N=7/8) and the explicitness of BCTs which helps everyone involved in the therapy process to know what is being done in SSD sessions (N=5/8). The vast majority of students noted that BCTs support the ability of therapists and/or students involved in SSD intervention sessions to reflect on the techniques they use in practice. Findings from other studies reported that BCTs can support practitioners to reflect on their own actions, although these studies have been carried out targeting sport students and sport coaches (Matthews et al., 2020; Weissman et al., 2022). However, SLTs as well as coaches seem to benefit from identifying BCTs in their interventions to reflect on which techniques they use often or less and adapt accordingly to the child or the requirements of an intervention. For example, the assessment video revealed that the therapist used the BCT 10.4. *Social reward* quite often. Identifying this technique enables therapists to decide whether the frequent use of this BCT is appropriate for the child in the SSD session as it motivates the child or whether it may hold the child back from improvement as he/she thinks that everything is carried out correctly already. It is important to distinguish between reward without feedback and evaluative feedback which enables the child to learn from it. This becomes transparent when considering the BCT types 2.2. *Feedback on behaviour* and 10.4. *Social reward* and can be explained well to students when contrasting these two BCT types. Further, students reported that BCTs enable people involved in the SSD therapy process to speak explicitly about what is being done in the sessions. The terminology itself was not given as a reason for why BCTs in SSD interventions are useful. However, as BCTs and the BCTTv1 (Michie et al., 2013b) provide a coherent terminology on techniques and students mentioned that BCTs help them to be explicit about what is being done in SSD interventions, it is suggested that by being positive about BCTs students also think of the coherent terminology included in the BCTTv1.

The BCT rating and ranking served to see whether students think that specific BCT types are more useful than others. Overall, all seven BCTs included in Stage 3 were rated and ranked highly, meaning that all BCTs were seen as useful for SSD interventions. Results of the BCT ranking and rating in Stage 3 are also in line with the results of Stage 2, as the seven BCTs included in Stage 3 were also ranked highly and rated well in Stage 2. As only seven BCTs were included in Stage 3, variation was limited and this had an impact on the results as some BCTs were ranked and rated equally. The BCTs 4.1. *Instruction on how to perform the behaviour* and 6.1. *Demonstration of the behaviour* were voted the most useful BCTs for SSD intervention. The BCTs 2.2. *Feedback on behaviour*, 7.1. *Prompts/cues*, 8.1. *Behavioural practice/rehearsal*, 1.4. *Action planning* and 10.4. *Social reward* followed closely. The differences in the rating and ranking were so low that all of these BCTs can be reported as being considered very useful for SSD interventions. This can also be supported by the general findings of this study, as all seven BCTs were identified in the SSD intervention approach P.O.P.T. (Fox-Boyer, 2014b). In addition, the nature of SSD interventions corresponds with the seven BCTs as instructing, demonstrating, giving feedback, using prompts/cues, practising the behaviour, planning actions and rewarding children are frequently included in SSD sessions (Furlong et al., 2021). However, some BCTs, such as 1.4. *Action planning,* may refer to a certain stage of the task conducted in the SSD intervention such as the beginning.

Therefore, compared to other BCTs, 1.4 may occurs less frequently than e.g., 8.1. *Behavioural practice/rehearsal* which is usually repeated often. Thus, it seems that the stage of the therapy process or the task has an impact on the types of BCT occurring — for example, at the start of a therapy session 1.4. *Action planning* may occur more often, as explanations frequently take place at the beginning of a task, whereas other BCT types such as 8.1. *Behavioural practice/rehearsal* may appear more often in the middle of a therapy session, such as when practising a task.

Looking at students' opinions of the most common BCTs used in SSD interventions, the picture of BCT ranking and rating almost repeats itself, as the BCTs 8.1. *Behavioural practice/rehearsal,* 6.1. *Demonstration of the behaviour* and 10.4. *Social reward* were seen as the most commonly used BCTs, followed by 7.1. *Prompts/cues*, 4.1. *Instruction on how to perform the behaviour,* 2.2. *Feedback on behaviour* and 1.4. *Action planning*. The BCT 1.4. *Action planning* was reported as the least used BCT in SSD interventions, which would be in line with the suggestion above that this BCT is mostly used at the beginning of a task. Therefore, compared to other BCTs which are used while conducting the SSD task, 1.4. *Action planning* seems to be used less often. In contrast, all students chose the BCT 10.4. *Social reward* as one of the most commonly used BCTs, albeit that at the same time they rated and ranked this BCT as being less useful than all other BCTs. It therefore prompts the question whether students may have misunderstood and thought that they should report which BCTs were the most commonly used ones in the assessment video rather than which BCT types they think are the most commonly used ones in SSD interventions.

Comparing the responses of the question which BCTs students think are used the most frequently in SSD interventions to the BCTs that actually occurred most often in the assessment video, the order of BCTs matches (sections 4.2.2.1 and 4.3.4.1.3). Thus, students either achieved these results by chance, or maybe thought they should report which BCTs were used most frequently in the assessment video compared to the most commonly used ones in SSD interventions generally. Here, the wording of the question in the BCT survey may not have been explicit enough. Nevertheless, the BCT rating and ranking gave a broad insight into which BCTs students think are the most useful ones. In addition, these results are almost (with the exception of the BCTs 1.4. *Action planning* and 10.4. *Social reward*) equal to the ones from the question about the most commonly used BCTs in SSD interventions, which also seems to speak for the importance of the BCT types 8.1. *Behavioural practice/rehearsal,* 6.1. *Demonstration of the behaviour,* 7.1. *Prompts/cues*, 4.1. *Instruction on how to perform the behaviour* and 2.2. *Feedback on behaviour*.

Furthermore, the BCT survey enquired about students' views on whether BCTs help to label the actions from therapists in SSD interventions more explicitly. Findings show clearly that all students think that BCTs help to describe therapists' actions more explicitly. This finding is in line with results of Stage 2 and the literature, as it is often reported that BCTs provide the possibility of reporting the "how" of active components, namely the techniques used to implement content in complex interventions (Michie et al., 2013b). Wood et al. (2016) also report that BCTs offer a common language for accurately reporting and describing active components of complex interventions. As discussed earlier (section 1.4.2), these responses support the suggestion that students benefit strongly from using BCTs to explain "how to do" therapy (Rees et al., 2016), as this was found to be confusing for many SLT graduates (Horton et al., 2004).

One main part of the BCT survey contained the question whether SLT students think that the BCTs should be taught in SLT training and therefore be included in the curriculum. The vast majority (87%) think that teaching BCTs would be useful for SLT students, prospective SLTs. These results are similar to those from Stage 2, in which 80% of participants agreed that BCTs should be taught in SLT training. All participants provided reasons for their choice which mainly overlap with reasons given for the first question which investigated whether BCTs are useful in SSD interventions. At this point, students stressed again that BCTs explicitly describe what is being done in therapy sessions and are therefore essential for SLT students as they describe how to do 'something' in therapy, which is assumed to relate to "how to do therapy" (Horton et al., 2004, p.382). It has also been suggested that BCTs support self-reflection of actions in the therapy process. As these two reasons have already been discussed at the beginning of this section, this part focuses on all the other reasons given for why BCTs should be taught. Students reported that BCTs give a therapy structure and enable them to plan sessions more easily. However, it is suggested that BCTs support the means of delivering intervention content within a task rather than providing an overall "therapy structure". Nevertheless, it could be that students meant structuring a task rather than a therapy structure as they also mentioned that BCTs support planning a therapy session.

As discussed before, some BCTs seem to be used more often at the beginning of a therapy session or at the beginning of a new task within a therapy session — for example, 1.4. *Action planning* — compared to other BCTs such as 6.1. *Demonstration of the behaviour* or 8.1. *Behavioural practice/rehearsal* which would be more likely to be used in the core of practising the task, described as 'doing the task' by Horton et al. (2004, p. 376). It has not been an objective of this current study to investigate which BCTs occur in which stage/stage of a therapy session. However, this would also be interesting and could support students even more in planning how to deliver and implement intervention content.

Lastly, the fact that BCTs are used in all SLT areas has been stressed (Stringer & Toft, 2016b). Moreover, Toft and Stringer (2017) already used the BCTTv1 to describe head and neck cancer dysphagia interventions, which shows that not only the paediatric SLT area would benefit from using the BCTTv1, but also other areas such as SLT related difficulties in the field of neurology. It was of special interest that the only reason given for why BCTs should not be taught was that they cannot be used in all areas of SLT which, as described above, contradicts the literature. However, BCT types and how frequently specific BCT types are used may vary slightly across SLT areas. This would also be interesting to investigate further. However, the current study indicated that the BCT types included in different SSD interventions varies (six of the 17 BCT types occurred in all three SSD interventions — Minimal Pair, Metaphon and P.O.P.T.). However, five of the six BCT types occurring in all three SSD interventions match the most frequently occurring (according to the assessment video), as well as the most useful and most frequent BCT types (according to participants). Thus, it can be assumed that a variation of BCT types might also be found throughout different areas of SLT. For example, when working with adults, the BCT 10.2. *Material reward* may not be used compared to SLT sessions with children who may receive a sticker at the end of a task. Overall, results clearly support the use and application of the BCTTv1 in the training of SLT students.

4.4.4 Study Limitations

Several components of the BCT training workshop between Stage 2 and Stage 3 were changed — for example, the number of BCTs included, the workshop and assessment material, and the time available for assessment coding task. It remains unclear which specific changes were important to improve the coding accuracy of participants. However, due to the time constraints and logistics affecting the conduct this study, introducing changes more slowly or systematically was not feasible within this project.

Eight students participated in Stage 3, and this was a small sample size. Results were very consistent across individual participants which suggests that the results would hold in a larger sample size. Future work could build on this and test this BCT training workshop procedure across several groups such as SLT students and SLTs.

The question about which BCTs students think are commonly used in SSD interventions was stated clearly — *Out of the 7 identified BCTs for therapy intervention with children with speech* *sound disorder, which 5 BCTs do you think are the most commonly used ones in SLT daily practice?* However, as students had coded a video with BCTs before, it would have been prudent to stress that the question related to the use of BCTs in SSD interventions in general and was not linked to which BCTs they thought were commonly used in the current video. Thus, phrasing the question more precisely, or even explaining that this question was not linked with the recent coding task, could have ensured that students understood correctly what they were being asked to do. As this was not explicitly done, it has to be kept in mind that the students' answers may reflect the most common BCTs in the coded video rather than their opinion of the most common BCTs in SSD interventions in general. Also, it was noticed that the last question aimed at investigating whether BCTs should be taught in the area of SLT. However, a second question evaluating the current simplified BCT training workshop would have been interesting to see whether this training was satisfying for students and which parts could be improved.

In hindsight, the wording of the BCT survey (Appendix N) may not have been explicit enough, especially for questions 1, 2 and 7 which included the words "useful" and "helpful". Analysing the answers of these questions and reflecting on these questions showed that there was room for interpretation in terms of how the question is intended, which then leads to uncertainty in answering the question. Question 1 asked "How useful do you consider the application of BCTs in speech and language therapy of children with speech sound disorder in general?" This question can either target at how useful BCTs are seen for SLTs in terms of whether the techniques help to convey the content of an intervention to the child, or whether BCTs are useful for children with SSD and help them to e.g., produce a sound more easily. Here, the usefulness of BCTs targeted at the practitioner level, meaning that the questions asked whether BCTs help practitioners to transfer the content of an intervention into clinical practice. The same issue is true for question 2 and 7, as question 2 asked to rate the 17 BCTs for speech and language therapy of children with speech sound disorder from very useful to not useful and question 7 asked whether participants think that teaching BCTs in speech and language therapy studies would be useful. However, both questions do not explicitly say in which way the term "useful" in meant. So, when reading these questions, the thought "useful for what?" could arise. However, as the context has always been on SLTs and SLT students, both questions target at whether BCTs are useful for SLTs and SLT students to transfer theoretical knowledge into clinical practice. Adding this information to the questions using the words "useful" and "helpful" would have added clarity and explicitness.

4.4.5 Conclusion

The baseline coding results have shown that students achieved significantly higher BCT coding accuracy after completing the simplified BCT training. Thus, the revised and simplified BCT training workshop definitely increases the BCT coding accuracy of students, which has also been found in similar studies (e.g., Wood et al., 2015). Students showed higher coding accuracy for six out of seven BCT types (10.4. *Social reward*, 2.2. *Feedback on behaviour*, 4.1. *Instruction on how to perform the behaviour*, 6.1. *Demonstration of the behaviour*, 7.1. *Prompts/cues*, 8.1. *Behavioural practice/rehearsal)* after the BCT training, although no increase was found for the BCT 1.4. *Action planning*.

Comparing the mean values of the overall BCT identification rate of the assessment video coding task from Stage 2 and Stage 3, a significant increase of coding accuracy was shown in the Mann-Whitney U test. This means that coding accuracy is significantly higher for participants who completed the simplified BCT training of Stage 3 compared to those completing the initial BCT training from Stage 2. Hence, (1) adapting the BCT training in terms of number of BCTs included, (2) changing coding requirements, (3) revising the template to assess coding accuracy, (4) using less training videos but discussing these in more detail and (5) allowing more time to code the assessment video all seemed to have a positive impact on participants' coding accuracy. In addition, this increase of coding accuracy was also true for the BCT type identification rate as every single BCT type showed an increase of identification rate percentage. In general, the Mann-Whitney U test for each individual BCT type showed that four of the seven BCT types were coded significantly better in Stage 3 than in Stage 2, whereas a significant increase was not found for three BCT types.

In the BCT survey, the vast majority of students reported that BCTs are useful in SSD interventions as they help to reflect on one's own therapeutic actions. Also, the explicitness of BCTs in supporting understanding what is done in a SSD intervention session was affirmed by all students. These findings are in line with other research on the BCTTv1 (Michie et al., 2013b) for complex interventions (e.g., Matthews et al., 2020; Weissman et al., 2022; Wood et al., 2016). With the exception of one student, the participants thought that BCTs should be included in the SLT training as students would benefit from using one common language to describe techniques used in SLT sessions and BCTs can be applied to all areas of SLT, which has also been shown in the literature.

Chapter 5: General Discussion

This thesis aimed to examine which BCT types are present in SSD intervention literature and real-world videos of clinical intervention sessions, determining whether SLTs and student SLTs can be trained to identify BCTs in videoed interactions. The views of SLTs and SLT students on BCTs in SSD intervention and SLT student training were also explored. Pivotal to the study were two BCT training workshops developed to target specifically BCTs relevant to SSD interventions. The first and initial BCT training workshop conducted with SLTs and SLT students in Stage 2 showed rather low BCT coding accuracy results, which led to revising and simplifying the BCT training workshop for Stage 3. Results of Stage 2 did not show group differences between SLTs and SLT students so only SLT students participated in Stage 3. Overall, this study was to the knowledge of the author the first of its kind, as participants had to code BCTs item per item from a real-world SSD intervention video (assessment video), which assured that coding accuracy has been assessed in detail (every single instance a BCT type occurring within an utterance of the video). In comparison, earlier studies only detected different BCT types occurring within an intervention without an explicit item per item identification in intervention videos (e.g., Wood et al., 2016). Moreover, an additional survey given to all participants of the BCT training workshop investigated SLTs' and SLT students view on the usefulness of the BCTTv1 (Michie et al., 2013b) for SSD interventions and SLT student training.

The objective of this study has been addressed by three primary research aims, of which the results provide useful insights. The first dealt with the identification of BCT types in three effective SSD interventions for German-speaking children and an example of a real-world SSD intervention session in Stage 1 (Chapter 2). Seventeen BCT types have been identified from SSD literature, using the BCTTv1 as foundation for identifying BCTs. These 17 BCT types have then formed the SSD BCT list which has again been used as base to detect BCTs item per item in the real-world example SSD intervention video. This way, BCT types occurring in both SSD intervention literature and an intervention video could be identified which gave an insight into which BCT types are important for SSD interventions both in theoretical and practical contexts. In addition, the analyses gave a valuable insight into the frequency and use of BCT types within SSD intervention (Chapter 2).

Second, the study has investigated whether SLTs and SLT students can learn how to identify BCTs after completing a bespoke BCT training workshop, dealing specifically with SSD interventions, in Stage 2 (Chapter 3). Participants' coding accuracy results across all BCT types were lower than expected and a group difference between results of SLTs and SLT students was not found. These results were used as rationale to revise and simplify the BCT training workshop in terms of the number of BCTs included, coding requirements, coding assessment tool, content and time. The simplified BCT training workshop was conducted in Stage 3 with students only, as results of Stage 2 indicated that there was no difference in coding accuracy of SLT students and SLTs. Finally, Stage 3 (Chapter 4) showed that the simplified BCT training increased coding accuracy from participants compared to the initial BCT training of Stage 2. This has been shown by the results of the baseline coding task and the assessment coding task.

Third, participants' view on the use and application of BCTs for SSD intervention and the student SLT training has been investigated in Stage 2 and Stage 3. Results from Stage 2 indicated that SLTs and SLT students advocate the use of the BCTTv1 in the context of SSD interventions and SLT students' training (Chapter 3). In Stage 3 (Chapter 4), only SLT students participated. The opinion of SLT students on the application and usefulness of BCTs for SSD interventions and SLT student training has been collected again to consider the big picture of BCTs and SSD interventions and students' training (Chapter 4). Findings from the BCT survey in Stage 3 are in line with those of Stage 2, as the vast majority support the use of the BCTTv1 in the context of SSD intervention and SLT students training.

5.1 BCTs in SSD Interventions

Previously, BCTs have not been explicitly defined within SSD interventions with children. However, as SSD interventions are complex behaviour change interventions, it is obvious that SLTs use BCTs in their interventions (Law, 2019; Stringer & Toft, 2016a). This study showed that it is possible to identify BCTs from already established SSD interventions as it found which BCT types occurred in SSD intervention literature and a real-world SSD intervention video (assessment video). In addition, the frequency of the occurrence of these BCTs within this real-world SSD intervention video were investigated in Chapter 1. In addition, by asking SLTs and SLT students on their view of the most useful BCT types for SSD intervention and the most commonly used ones in SSD interventions in Chapter 2 and Chapter 3, the practical opinion of using the BCTTv1 (Michie et al., 2013b) in SSD interventions has also been considered. Thus, evidence was triangulated across SSD intervention literature, a real-world SSD intervention video (assessment video) and the views of SLTs and SLT students to provide robust findings on BCTs in the context of SSD interventions.

Overall, 17 BCT types (section 2.3.1) from the BCTTv1 including 93 BCTs (Michie et al., 2013b) could be identified in the intervention literature from three evidence-based SSD interventions for German-speaking children (Fox-Boyer, 2014b; Jahn, 2000, 2007; Weiner, 1981). These results were in line with the hypothesis that only a small number of BCTs from the BCTTv1 occur in SSD interventions. Also, most but not all BCTs, more precisely 14 from the 17 BCTs (section 2.3.2), have then also been identified in the real-world SSD intervention video (assessment video). This showed that the majority of BCTs found in SSD literature also occurred in the real-world SSD intervention video (assessment video), which was a representative video of a SSD intervention session between a child and SLT. Therefore, SSD intervention literature and a real-world SSD intervention setting have both been included to identify and determine BCTs from theoretical (literature) and practical (real-world video) point of views.

Six BCT types, namely 1.1. *Goal setting (behaviour)*, 1.4. *Action planning*, 4.1. *Instruction on how to perform the behaviour*, 6.1. *Demonstration of the behaviour,* 7.1. *Prompts/cues* and 8.1. *Behavioural practice/rehearsal*, have been found in literature from all three SSD interventions, whereas all other BCTs were detected in literature from either one or two interventions. Five of these BCTs also overlap with the most frequently occurring BCT types from the assessment video, as 1.4. *Action planning*, 4.1. *Instruction on how to perform the behaviour*, 6.1. *Demonstration of the behaviour,* 7.1. *Prompts/cues* and 8.1. *Behavioural practice/rehearsal* have also been found to be the most used BCTs in the SSD assessment video from both stages of the current study (Stage 2 and Stage 3). Together with the BCT types 2.2. *Feedback on behaviour* and 10.4. *Social reward* these seven BCT types have been identified as the most frequent used ones in the assessment video in Stage 2. It was found that some BCT types were used more often than others in the assessment video, and the frequency of occurrence varied greatly throughout the video.

One main finding of the identification of BCTs from SSD intervention literature and the assessment video was that the seven BCT types, which were used the most often, can all be found in the SSD intervention P.O.P.T. (Fox-Boyer, 2014b). Moreover, these seven most occurring BCTs match also nicely with SLT students' and SLTs' view on which BCTs are the most helpful and the most common ones in SSD interventions, as exactly these seven BCTs were reported by participants of Stage 2. In contrast, the three BCT types 2.6. *Biofeedback*, 8.6. *Generalisation of target behaviour* and 14.8. *Reward alternative behaviour* which were found in literature rather than the assessment video, have also been rated as low relevance and importance for SSD interventions. Hence, the findings on the least used BCT types from the assessment video are also in line with participants' opinion. It has to be noted that only the seven most occurring, most helpful and most commonly used BCT types were included in

Stage 3, for which results of Stage 2 built the rationale. Thus, the results discussed above are based on Stage 2.

The finding that the seven most occurring BCTs of the assessment video are also reported as the most useful and most commonly used ones in SSD interventions (by BCT training workshop participants of Stage 2), raises the question why these BCT types are strongly represented and reported to be essential in SSD interventions. First, stages of SSD interventions need to be considered. Furlong et al. (2021) refer to a therapy structure with three stages, (1) 'Warm-Up', (2) 'Therapy segment' and (3) 'Cool-Down' (Furlong et al., 2021, p.589), whereas Horton (2004) uses more stages within a therapy session. Both have one stage in common: the one in which the therapy task takes place and gets rehearsed. The assessment video recorded one task within a SSD session which represents the part in which the task is being conducted with the child, including explaining the task, demonstrating and rehearsing it, as this is a representative example of a SSD intervention task. Therefore, it has to be considered that the very beginning or end of a therapy session may include and require different BCT types than the stage in which the task is being introduced and rehearsed. This matches the frequency of BCT type occurrences, as the ones used for demonstrating and practising a task were used the most.

Comparing the seven most used BCTs in the assessment video to therapy session examples of SSD interventions in manuals (Fox-Boyer, 2014b; Jahn, 2000, 2007) as well as in the literature (Furlong et al., 2021; Kim et al., 2012), both indicate that these BCTs — 1.4. *Action planning*, 2.2. *Feedback on behaviour*, 4.1. *Instruction on how to perform the behaviour*, 6.1. *Demonstration of the behaviour*, 8.1. *Behavioural practice/rehearsal*, 7.1. *Prompts/cues* and 10.4. *Social reward* — are techniques used in SSD interventions. In contrast, BCT 8.6. *Generalisation of target behaviour,* it is suggested, is mostly used when a child is already able to produce a behaviour/sound in a certain situation. Thus, this BCT is, as also indicated by the current results, assumed to be used only if the desired behaviour is possible. Hence, if a new behaviour is being practised, this BCT will probably not be used. Another reason why certain BCT types may be used more often than others in this specific assessment video might have to do with other active ingredients. As discussed in depth (section 1.3), SSD interventions are complex interventions, and this implies that many interacting components are involved. Thus, some BCTs could be used or omitted because of other active components, such as the complexity of the child's difficulty or the way the intervention is being delivered. However, these suggestions do not concern the seven most occurring BCTs but, rather, the other seven which were used less often and rated as less meaningful for SSD interventions (1.1. *Goal setting (behaviour)*, 1.3. *Goal setting (outcome)*, 1.6. *Discrepancy between current behaviour and* *goal*, 3.1. *Social support (unspecified)*, 10.2. *Material reward (behaviour)*, 10.3. *Non-specific reward* and 12.5. *Adding objects to the environment*), or the BCTs which did not occur at all in the assessment video (2.6. *Biofeedback*, 8.6. *Generalisation of the behaviour*, 14.8. *Reward alternative behaviour*).

The current study has shown that it is possible to identify BCTs in already established SSD interventions by using the BCTTv1 and that SLTs, as well as students, advocate the use of the BCTTv1 in terms of describing techniques explicitly and coherently. Even though it was not in the remit of this study to determine *all* BCT types relevant for SSD interventions and their frequency of occurrence, some BCT types have been found, whereas other have not been found at all as the BCT types used seem to depend on factors such as the structure of the therapy session or the delivered content (e.g., the BCT 1.4. *Action planning* is probably being used more often at the beginning of a therapy session). In addition, some BCT types occurred more often compared to other BCT types in the real-world SSD intervention video, and some BCT types seem to be more important than others for a certain therapy task and/or situation. The use of BCT types in SSD interventions seems to vary and depend on other layers of complexity such as the child's SSD difficulty or the stage of therapy (e.g., beginning, middle, end; receptive task or productive task). These factors represent only some components which determine that SSD interventions can be defined as complex interventions.

None of the BCT types found in the established SSD interventions were named explicitly in the SSD intervention literature or manuals but rather were communicated inconsistently using examples or related expressions. This finding shows that, to date, the SLT profession does not use a consistent and transparent terminology when describing techniques used in SSD interventions. Nevertheless, the example in this study of identifying BCTs in SSD interventions shows that it has been possible to determine active ingredients in terms of techniques used in SSD interventions by using the BCTTv1 and that BCTs therefore contribute to the important step of identifying active ingredients in complex interventions. Thus, results of Stage 1 of this study support the application of the BCTTv1 to other complex interventions in the field of SLT to identify the explicit techniques used to deliver content and to describe these techniques coherently with a common terminology.

In addition to the results of Stage 1, 100% of all participants (N=29) across Stage 2 and Stage 3 agreed that the use of BCTs helps to label the therapist's actions more explicitly. This finding reinforces the conclusion from this research that BCTs can have a positive impact on SSD interventions and that training SLT students in the use of BCTs can improve explicitness. Again, when asked a more general question whether BCTs are useful or not useful for SSD interventions, the vast majority of participants mentioned that BCTs enable them to describe techniques used in SSD interventions explicitly. Moreover, when asked why BCTs should be taught in SLT students' training, almost all participants again mentioned BCTs' explicitness. These results convey clear proof that BCTs provide a terminology which can precisely describe techniques used in SSD interventions. The literature is also in line with these findings, and supports the use of BCTs in all fields using complex interventions (Beresford et al., 2018; Michie et al., 2013b; Wood et al., 2015). Thus, as can be seen from the responses from participants of the BCT survey, BCTs have the power to report explicitly how therapy content is delivered in SSD interventions. Answers from the BCT survey from both stages show that participants stress that this is especially helpful at the stage of studying SLT. Previous studies report that students are uncertain about how to 'do therapy' even if explicitly taught, and feel unprepared in terms of techniques of "how intervention content is being delivered" (Horton et al., 2004). Observation in terms of clinical internships and using video-enhanced observation (VEO) are key methods for teaching SLT students how to transfer theoretical knowledge into clinical practice (Bundesministerium für Gesundheit und Frauen, 2016). However, the application of theoretical knowledge into clinical practice is not straightforward due to the fact that SLT interventions are complex interventions and the transfer from knowledge into clinical situations needs practice. Thus, even if observing SLTs and practising in therapy sessions, newly qualified SLTs often feel uncertain about what to do in therapy (Horton et al., 2004). Therefore, the application and use of BCTs may help students to understand how SSD interventions are being delivered and consequently seem to represent a promising support for students.

It is of great importance to identify the active components of SSD interventions so that their effectiveness can be tested to investigate what works. We need to know exactly what is going on in (SSD) interventions, to test what works (e.g., Craig et al., 2008; Law, 2019; Turkstra et al., 2016). The BCTTv1 enables researchers and practitioners to identify active components of SSD interventions explicitly, report interventions coherently and then test which of these techniques work in the intervention. However, before testing active ingredients such as BCTs in SSD interventions, one first has to be able to understand the concept of BCTs, how to identify them and how to describe and use them deliberately, individually or in combinations. Research has shown that knowledge of the BCTTv1 alone is not sufficient to apply it correctly (Matthews et al., 2020; Wood et al., 2015, 2016). For this reason, a BCT training workshop for SLTs and SLT students was developed in Stage 2 and, in response to the coding results, revised in Stage 3.

Summarised results show that techniques used in SSD interventions to deliver intervention content can be identified by using the BCTTv1. Moreover, this project focused on whether practitioners and students could be trained to identify BCTs accurately and could see the use and importance of BCTs to their practice. Thus, the BCT training of SLTs and SLT students in the application and use of the BCTTv1 was the next logical step towards identifying BCTs accurately in SSD interventions — and, consequently, determine the training's effectiveness.

5.2 BCT Training

The first BCT training workshop aimed to investigate whether SLT students and SLTs can learn how to identify BCTs in a real-world SSD intervention video, the assessment video. At the end of the BCT training workshop participants' coding accuracy was assessed and they were asked to identify every BCT instance of a BCT type once within an utterance of the assessment video. Thus, the training and its assessment focused strongly on coding accuracy to see whether the training had an effect on participants' BCT coding ability. However, the coding accuracy of participants was lower than expected, with participants detecting less than 50% of the BCTs present in the assessment video. It was for this reason that the BCT training workshop was revised and simplified. The revised BCT training workshop was established again in Stage 3 to see whether the changes and adaptations would increase participants' coding accuracy. Stage 2 results served as rationale for changing five components (reducing number of BCTs included, changing coding requirements, revising the assessment template, include fewer training videos but more discussions on coding results and providing more time for assessment video coding task) for the BCT training workshop in Stage 3. Thus, only the seven most occurring BCTs from Stage 2 were included in the BCT training workshop of Stage 3.

Overall, students completing the revised BCT training workshop of Stage 3 showed significantly higher coding accuracy compared to participants completing the initial BCT workshop of Stage 2. Comparing the coding accuracy of the two BCT trainings, it was found that BCTs which occurred less often in the assessment video were identified better by participants in Stage 2. In contrast, the opposite was shown in Stage 3, as BCTs which occurred more often were identified more accurately than the ones occurring less. Literature also suggests that coding accuracy will be better for BCTs that occur more frequently (Wood et al., 2015), which can be seen in the revised BCT training of Stage 3, but not for the initial BCT training of Stage 2. However, the reason for this is likely that there was low coding accuracy overall in Stage 2, which is supported by the results that participants of the revised BCT training in Stage 3 learned how to code BCTs more reliably compared to Stage 2 participants. In addition, reasonable suggestions for why certain BCTs occurring e.g., once were identified better in Stage 2, such as the involvement of materials/objects which are visible in the video and the BCTs therefore easier to identify, have been made (section 3.4.1 and section 4.4.2). For example, the BCT 10.3. *Material reward (behaviour)* requires material, which can be seen in the video.

However, as mentioned before, results from Stage 2 and Stage 3 did not only differ in terms of which BCTs were identified better but also in the overall coding accuracy, as participants in Stage 3 achieved significantly better coding accuracy. The baseline coding task showed significantly better coding accuracy of students after the BCT training workshop compared with during the pre-workshop coding task. However, it has to be noted that students already showed a surprisingly high overall BCT identification rate in the coding task before the BCT training workshop. The seven BCT types included in Stage 3 are highly relevant to SSD interventions, as seen from the identification of BCT types in SSD interventions from the literature and a real-world video (section 2.3), as well as from the BCT survey results (4.2.2.1). It is suggested that students derived the meaning of some of the BCT type labels based on their previous experience of these terms, as some are used frequently in SLT training (e.g., “demonstration”, “instruction”, “feedback”). Thus, some BCT type meanings may seem to be self-explanatory. However, the baseline coding results pre-BCT training showed great variation in the individual overall BCT identification rates. Thus, the BCT training serves to iron out these differences so all students are working from the same base from then on. As the baseline coding results post-BCT training showed a significant rise in coding accuracy, it is clear that the BCT training had a significant impact on students’ coding accuracy.

In addition, participants’ coding accuracy of the assessment coding task was also significantly better in Stage 3 than in Stage 2. Moreover, coding accuracy for six out of seven BCT types of the baseline coding increased in Stage 3. The BCT 1.4. *Action planning* was identified better before the training in Stage 3 than after the training. This may indicate that the description and example included in the BCT SSD was not sufficient enough. Michie et al (2013) and Wood et al. (2015) also report that explanations for some BCTs still need to be improved and described more precisely. Nevertheless, the BCT training workshop results of Stage 3 clearly supported participants in identifying BCTs reliably in an SSD intervention context.

Reasons for the higher coding accuracy after the BCT training in Stage 3 may be linked to the changes to the BCT training workshop which were made between Stage 2 and Stage 3. The BCT training in Stage 2 enabled optimisation of BCT training effectiveness based on findings and detected issues which seemed to impact the coding accuracy of participants. First, the number of BCTs included in the BCT training was reduced from 17 to 7 BCT types to support students to focus on seven BCT types only rather than having too many. This way it was possible to keep things relatively simple in terms of BCT types and explain, compare and discuss when each of the seven BCT types occurred in different situations. By only including seven BCT types, it was possible to focus on the quality of the BCT training workshop and go thematically into depth, rather than focus on quantity by covering a large number of BCT types. Also, fewer training videos were included, which allowed more time to discuss the included ones in more detail. Changes were also made to the template used to assess participants' BCT coding accuracy at the end of the BCT training workshop. Instructions on how to code the assessment video (e.g., every single BCT type regardless of how often it occurs within an utterance) were communicated clearly and a revised template was provided for the coding task in Stage 3. Overall, keeping the content relatively simple and clear seemed to contribute to the BCT training workshop's success in Stage 3 and should be considered when applying a BCT training workshop to clinical practice or training.

The BCT training workshop developed in this project supported and helped students to reliably identify and code BCTs in clinical interactions and intervention contexts. SLTs' and students' views on whether BCTs should be taught in the training for SLTs were invited. Overall, considering survey responses of both stages, 82.14% of SLTs and SLT students (N=23/28; one SLT needed to be excluded as this question was not answered) said they were in favour of including BCTs in the training of SLT students. When looking at the two groups separately, 88.88% of SLTs (N=8/9; Stage 2 SLTs with one SLT excluded due to missing answer) and 78.95% (N=15/19; Stage 2 students (N=11) and Stage 3 students (N=8)) see the value of this training for clinical practice and think the BCT training should be included in SLT training programmes. The main reason given for this decision can be linked back to why BCTs are useful in SSD intervention, as it is the same: explicitness. According to the majority of participants, BCTs enable the techniques used in SSD interventions to be labelled and described explicitly. As previously stressed, this suggestion is strongly supported by literature (Rees et al., 2016; Stringer & Toft, 2016a).

5.3 Application and Importance of using BCTs in SLT

The BCTTv1 has already been used in different fields of SLT, such as dysphagia (Toft & Stringer, 2017) and parent-led language interventions (Barnett, 2022). Results of this study show that BCTs can be used in the context of SSD interventions and have the power to contribute positively to the field in terms of reporting and identifying techniques used in SLT interventions. However, the context BCTs are used in needs to be considered to determine whether BCTs can be useful and if so, how they can be used to support students, SLT practitioners or researchers in the field of SLT.

This study has shown that it is possible to identify BCTs retrospectively from already established complex interventions. Thus, results of this study support the application of using the BCTTv1 (Michie et al., 2013b) to identify techniques in other complex SLT interventions.

Identifying techniques used in complex interventions can support SLT students and SLTs when analysing how intervention content is being delivered in terms of what is done in a therapy session to implement the content of an intervention. This study has shown that SSD intervention manuals can be coded retrospectively, as conducted for the SSD interventions P.O.P.T. (Fox-Boyer, 2014b), Metaphon (Jahn, 2000, 2007) and Minimal Pair (Weiner, 1981). The addition of BCTs to intervention manuals could clarify which techniques are used in the intervention. This would then support SLT students as well as SLTs when implementing the intervention content. In addition, the objectivity in implementing intervention content can be supported, as SLTs using the intervention may then apply the same techniques, even if their precise use and implementation could be flexible in terms of how often specific BCT types are being used. Speech and language assessment and diagnostic tools often include information on how to react to responses during the assessment process with children to ensure objectivity during the implementation process. Even though SLTs delivering complex interventions need flexibility and need to tailor the intervention individually for each child, explicitly reported BCTs can support, for example, newly qualified SLTs in how to implement the intervention. This was also reported by participants of the BCT survey and can therefore be supported by results of the current study.

However, we need to take care not to reduce therapy and change to a set of steps in terms of BCTs to be applied, as complex interventions involve many parts and levels (Beresford et al., 2018). Considering SSD interventions, children, parents/caregivers, therapists, the child’s difficulty, the funding of the therapy, the setting of the therapy sessions are just some of the interacting parts and levels. Each one of these brings factors to the therapy session which influence the therapy process and possibly its outcome. Complex interventions are not necessarily complex because of the number of elements and active ingredients of an intervention itself, but because of the complex dimensions which the delivering (e.g., therapist) or receiving (e.g., child) party is in. The explicit use of BCTs may help parents/caregivers understand how therapy or a task is being delivered and may also support transparency for stakeholders and people/institutions funding therapy sessions. However, many other factors influence the therapy outcome. For example, each therapist brings his/her/their own personal style as well as objective and subjective influences to a therapy session. Guidelines and the principle of EBP are considered when planning therapy sessions. However, the principles of EBP can differ individually due to each therapist's expertise, their experience and knowledge. Thus, when considering only one of the interacting components, the "therapist", differences and individualities can be detected. Hand-in-hand with the individual expertise and experience of individual therapists, each therapist develops an interpersonal style over time. The wording a therapist uses, the attitudes a therapist has towards certain topics and the way he/she/they act in certain situations are individual. Even if therapists may act similarly in some situations, there may be others which are different. Capturing interpersonal style and describing it in detail presents difficulties when reporting complex interventions.

The therapist is one component of a complex intervention. At present, therapy content is sometimes described well, even though a consistent terminology is often missing. Furthermore, BCTs and the BCTTv1 present a coherent taxonomy to describe how the intervention content is being delivered. Thus, what to do (intervention content) and how to do it (BCTs), can be described. However, for example, the individuality in terms of interpersonal style of each therapist and relationship between therapist and client may not be so easily captured. Hardcastle (2016) argues that the current BCTTv1 includes content-related BCTs but neglects the interpersonal style of the person delivering the intervention, which also influences behaviour change of the person receiving the intervention. In other words, relational techniques which also enhance behaviour change are not included in the BCTTv1 and the role that the interpersonal style of therapists play in interventions has not been sufficiently considered, although this also impacts the effectiveness of a complex intervention (Hardcastle, 2016). Dixon and Johnston (2010) mention competencies such as "ability to engage client" (p.9), "ability to manage expectations" (p.8) and the "ability to foster and maintain a good intervention alliance" (p.8) as abilities which are needed as foundation to deliver behaviour change interventions. Relational techniques and interpersonal style used in complex interventions also need to be considered, as these are a part of complex interventions, due to the complexity of complex interventions, also contribute to their effectiveness. Thus, future research should also consider the role of interpersonal style and relational techniques used to promote change in e.g., the child as this aspect is missing currently. However, before doing so, ways of incorporating it would require some thought and interpersonal style and relational techniques would need to be recognised in the BCTTv1 as these also present another piece of the complex intervention jigsaw (Hagger & Hardcastle, 2014).

Besides missing relational techniques, literature mentions that the BCTTv1 offers a coherent terminology for students (Rees et al., 2016), which was also mentioned by a few participants of the BCT survey (13.79%, N=4/29). The use of a coherent terminology also supports clinical practice as practitioners and students can use a common language to talk about what exactly happens in SSD interventions, and how intervention is being delivered. The BCT training therefore also contributes to supporting SLTs and students to use a common terminology to describe therapy techniques. However, literature also describes that the BCTTv1 can still be improved in terms of descriptions and examples of BCTs included, as some descriptions are hard to understand or to apply to therapy context (Corker et al., 2023; Wood et al., 2016). In addition, as the BCTTv1 has been developed primarily for the public health sector, additional BCTs may need to be included to represent the wide range of techniques used in therapy to implement intervention content (Barnett, 2022; Corker et al., 2023).

Among all participants of both stages of the current study, 89.66% (N=26/29) stated that BCTs' explicitness is useful for SSD interventions. Thus, results from this study and the literature suggest that the explicit description BCTs offer for describing exactly how content is being delivered in complex interventions has the potential to support students when learning "how to do therapy" (Horton et al., 2004, p.382) (e.g., Rees et al., 2016). Thus, BCTs seem to be useful when analysing and discussing BCTs used as components responsible for change in well-defined therapy tasks with students or SLTs. However, it has to be considered that applying the BCT training is time-consuming and one participant reported that coding BCTs in complex interventions was complicated. Using the BCTTv1 in a clinical context, it may be possible to focus on the concept and content of the BCTTv1 and the BCT types relevant for each SLT area, rather than assessing coding accuracy item by item by using an intervention video coding task. In contrast, using the BCTTv1 in a teaching context with SLT students and assessing coding accuracy might be useful to see whether students fully understand the concept and application of BCTs. According to participants of this study, identifying and coding BCTs in an intervention video also seems to contribute to the understanding of how therapy is being done, which would also be supported by including an assessment task at the end of the BCT training workshop for students.

As discussed in Chapter 1, SLT interventions are complex interventions due to many interacting components. The level of complexity and layers of SLT interventions depend, for example, on the difficulty of the child/patient, the therapist's experience, beliefs and expertise and other external factors such as the funding of the therapy. Considering all these influences and numerous internal and external factors of complex interventions (Beresford et al., 2018), BCTs only represent a small part of the entire therapy process which contributes to bring about change for the child/patient in an intervention. Therefore, when using BCTs it is important to bear in mind that they represent only a small active ingredient in an intervention. In addition, as many more components are involved in a therapy process, it is not possible to reduce SLT interventions to a set of e.g., BCTs and steps which need to be applied to achieve change in the child/patient.

However, defined active ingredients help to understand how single elements of an intervention work (Law, Roulstone, et al., 2015). These are therefore fundamental to investigate what is effective, and using the BCTTv1 supports this by providing a coherent and consistent terminology, also in the context of research. Not only does the BCTTv1 support the explicit description of techniques used in studies investigating complex interventions, but also the replication of studies investigating the effectiveness of complex interventions. Thus, using the BCTTv1 in a SLT research context enables the reporting and describing of complex interventions precisely with a common and coherent terminology. Rather than only describing the content of an intervention, techniques used to deliver and implement the intervention content are also described. Recently, a group of researchers published an article which underlines the need of having a clear taxonomy which describes the explicit techniques used in complex SLT interventions (Frizelle et al., 2023).

A common and explicit terminology across SLT areas could be supported and established by implementing the BCT training workshop among SLTs, students and SLT researchers. Training in how to use the BCTTv1 is important, as reported by literature (Wood et al., 2015, 2016), because knowledge of the BCTTv1 by itself does not mean one can use it accurately. This study showed that it is possible to train participants to identify and code BCTs reliably in the context of complex interventions. Identifying BCTs in already established complex interventions contributes to the understanding of how intervention content is being delivered. This can support students but also SLTs in implementing therapy content. The BCT training workshop showed that it is possible for participants to learn how to identify and code BCTs reliably. SLTs and SLT students see the value of the BCT training workshop for clinical practice and SLT training as BCTs support being explicit about how intervention content is delivered and “how therapy is being done”.

5.4 Strengths, Limitations and Future Directions

This study has strength in its development and testing of a BCT training workshop, which has the potential to be integrated in the training curriculum for SLT students and offered as a workshop for SLTs in clinical practice. Second, to the knowledge of the author, it is the first study to have assessed BCTs item by item in a SSD intervention session video.

The analysis of the BCT training has shown that participants were able to transfer and apply theoretically acquired knowledge on the BCTTv1 into practice by coding BCTs accurately in SSD intervention interactions. This enabled participants to reliably identify techniques used in a complex intervention and describe techniques used in SLT interventions more explicitly as well as reflecting upon their own practice in greater depth. In all fields of SLT, interactions are a vital core component which makes observing interactional clinical situations a key technique in SLT training (Bundesministerium für Gesundheit und Frauen, 2016). Whether a unit of BCT training with an item by item BCT coding task and this level of coding accuracy is useful may depend on the SLT context. For example, as video-enhanced observation (VEO) is used frequently in teaching settings (Seedhouse, 2022), students and SLT lecturers could benefit from having an explicit and consistent terminology to describe techniques occurring in SLT interactional sessions. In addition, SLT researchers might also benefit from describing intervention techniques by using the BCTTv1 as a common terminology in order to replicate studies more concisely (Frizelle et al., 2023). In contrast, if a SLT is working in a clinical setting, it is debatable whether BCT training would need the current level of detail, including an item by item coding assessment. However, knowledge of the BCTTv1 could also support clinicians in reflecting on their own clinical practice and exchanging techniques used in therapy sessions with colleagues. Thus, BCT training has the potential to be useful but the context of the training, the training needs of participants, its purpose and focus needs to be considered and participants, depending on whether these are SLT students, clinical SLTs or SLT researchers, will no doubt benefit differently from more or less detail in the training. Therefore, training should be resource-oriented and carefully designed and tailored to the needs of participants, to include only relevant information. BCT types taught in the training may be dependent on the SLT field and interventions used within the training. As with the identification of BCTs in Stage 1 of this study, BCTs should also be identified in other SLT interventions, to then decide which BCT types are useful to include in the BCT training. A general decision on which BCT types are important and why this is hard to decide, could be investigated and supported by future research.

This study shows that the developed BCT training workshop enables students to identify and code BCTs accurately in a complex intervention. The sample size of workshop participants was rather small. However, results were quite consistent across individual participants, which suggests that results would hold in a larger sample.

The study has been conducted in Austria, where German is the main language. In Germany, German is also the main language. Thus, the two countries Austria and Germany share the same main language, which means that SLT interventions developed work for German-speaking patients regardless of the country (e.g., Austria or Germany). Of course, there are some language-specific differences for the two countries (e.g., use of different words for one thing), but these are rather small and do not impact the use of an intervention approach. Assessments developed in Germany sometimes consider these language-specific differences and have amended their vocabulary for Austrian German (Fox-Boyer, 2014), so they can be used in the Austrian SLT clinical practice (e.g. bag is called “Sackerl” in Austria, whereas in Germany it’s called “Tüte”). The context of the study has always been an Austrian context, but as we speak German in Austria, it has been “for German-speaking children”.

Yet there is no research on the use of BCTs across cultural contexts. Thus, it is unclear whether different BCTs are used different or similar in certain cultural contexts. However, as the structures of SLT sessions in terms of beginning, middle and end of a therapy session are similar across cultures (e.g., Furlong et al., 2021; Horton et al., 2004) it is also suggested that BCTs in general are used throughout different cultural contexts, even though the use of specific BCT types may vary. However, it is suggested that BCTs can be considered as language-independent because techniques used to deliver intervention content are likely to be similar across countries and languages and results from this study can also be viewed as a guide for the application of BCTs in other countries and languages. Future research might focus on replicating the study in different cultural contexts to see whether results such as BCT types used would be similar or different.

In the BCT training workshop, a potential halo effect could have arisen as MD, who conducted the workshops, had a positive attitude towards BCTs which would have been very difficult to hide. In general, the halo describes an “inclination, when making an estimate or rating of one characteristic of a person, to be influenced by another characteristic or by a general impression of that person” (Nicolosi et al., 2004, p. 143). In this research context, as the trainer of the BCT workshop had a positive attitude towards BCTs, participants might have been impacted by this when rating the importance of BCTs (Feeley, 2002). Some students knew MD from previous lectures and clinical supervision, which may also have had an influence on how participants evaluated the workshop. This effect could be avoided in a larger and future research project by having a person conducting the workshop who does not is not biased regarding the importance of BCTs in SLT, which was not possible within the scope and resources of this study. A reflexive diary could have been added to the process in order to show the reflexivity in the research process (Nadin & Cassell, 2006). However, even though the reflective thoughts linked to the research practice were not written down in a diary when giving the workshops, MD was aware of her opinion of BCTs in SLT and reflected on these. Words and the way the content was delivered were chosen carefully in order to mitigate this as much as possible.

Wood et al. (2015) reported that participants' coding confidence should also be assessed in BCT training studies, as an increase in coder confidence is seen as an important objective of BCT trainings. However, Wood et al. (2015) and Matthews et al. (2020) found that high coding confidence does not indicate competent and accurate coding results. Thus, a participant can report feeling confident in coding interventions using the BCTTv1 (Michie et al., 2013b) but their coding results can show low coding accuracy. This study has not assessed coding confidence of students and SLTs, which would have given an additional valuable insight to compare results to available findings (Matthews et al., 2020; Wood et al., 2015) findings. Thus, to investigate the link between coding competence and confidence, future studies may include a measurement of participants' coding confidence.

Now that this research has demonstrated that BCT training improves participants' abilities to identify BCTs in SSD interventions, a further study could actually focus on intervention description and reporting SLT interventions using the BCTTv1. Findings of Wood et al. (2016) on the effect of BCTs on intervention descriptions have been mixed, although some studies indicated that the use and application of the BCTTv1 supports intervention descriptions, as is also suggested by most researchers (e.g., Craig et al., 2008). Thus, results on whether participants completing this BCT training can describe SSD interventions more precisely, would contribute to endorsing (or otherwise) the use of the BCTTv1 for reporting SSD interventions.

In addition, the current study did not investigate which BCT types occurred in which stages of SLT intervention sessions — for example, the beginning, middle or end of a SSD session. A further study could look at the BCT types in certain stages of SLT sessions as this may help to teach SLT students how to introduce, plan, deliver and implement therapy tasks by using certain BCT types for certain stages.

The effectiveness of BCTs and sets of BCTs has to be tested for SSD interventions, as for many other complex interventions (e.g., Armitage et al., 2021; Michie et al., 2018; Schroé et al., 2020). Yet, we do not know which BCTs or sets of BCTs are effective in SSD interventions. However, as the seven most occurring and most useful BCTs have also been found in one evidence-based SSD intervention, this could give an indication that these BCTs may contribute to effectively changing the behaviour of the child in SSD interventions. Nevertheless, no studies to test the effectiveness of BCTs in SSD interventions have yet been conducted.
The current study could be used as foundation for further studies, as BCTs have been identified from SSD interventions, and a BCT training for SLTs and SLT students has been developed.

Therapists or students included in an intervention study to test individual or sets of BCTs need to be trained in the BCTTV1, which could be done by using the BCT training developed in this study.

At heart of every SLT are children and patients and the support of their speech, language, swallowing, hearing or overall communication skills. SLTs are always working in the field of complex interventions, as many incorporating and interacting components are involved in the therapy of a child/patient. Thus, as discussed earlier, the need of identifying the active ingredients of these complex interventions is a given if we are going to test these in terms of their effectiveness. This then contributes to delivering the most effective and tailored therapy support to children/patients with speech, language and communication needs (SLCN). We need to know what it is that makes an intervention work to support children/patients and parents/caregivers effectively. Therefore, it is essential to identify active ingredients such as techniques used, and to label these explicitly and coherently. The BCTTv1 provides such a tool. Applying and using the BCTTv1 for complex interventions may support SLT students, SLTs and researchers. SLT students may benefit, as BCTs seem to help SLT students to understand what is included in 'doing the therapy task' and enables them to label techniques used explicitly. The explicitness of BCTs has also been valued by SLTs, as even though practitioners may not need BCTs to see how to do the therapy task, BCTs may support them to reflect on the techniques used in the SSD intervention. As shown in a recent study, BCTs can also be used to provide guidance on how to support child language development for parents/caregivers (Barnett, 2022). In addition, research can benefit from having a common terminology and applying the BCTTv1 to identify active ingredients in terms of therapy techniques used in complex interventions.

5.5 Recommendations for Research, Policy and Practice

There are increasing calls — from research, policy and practice — to report complex behavioural interventions more precisely (Duncan et al., 2020). Researchers, politicians and parents/carers have different motives for wanting to know how an intervention is being delivered, which active components are included and, above all, why and how the intervention works. Currently, no coherent taxonomy has been used in the field of SLT to identify and describe active components of SLT interventions, including SSD interventions. Results of this study have shown that the BCTTv1 (Michie et al., 2013b) provides a powerful tool to tease out active ingredients in terms of techniques from SSD interventions. It was reported by participants that the use and application of the BCTTv1 also supports SLTs to explicitly report what is being done in an intervention. The data from this study combined with current literature and studies therefore stresses that the BCTTv1 can be used to report, implement, evaluate and teach active ingredients of SSD interventions coherently. This has a different but beneficial impact on research, policy and practice.

First, as stressed several times throughout this study, it is necessary that active ingredients are described precisely to test the effectiveness of interventions. This is true for interventions developed in the past as well as the ones which will be developed in future. Already established interventions can – for example – be coded retrospectively by using BCTs (Stringer & Toft, 2016a), whereas frameworks from behaviour change such as the BCW (Michie, Stralen, et al., 2011) and COM-B model (Michie, Atkins, et al., 2014), can be considered right from the start when developing a new intervention. The great advantage for research is evident in the writing of systematic reviews, among other things. Presently, researchers are still struggling with the fact that interventions are described inaccurately or too superficially (Craig et al., 2008; Skivington et al., 2021) and cannot be included in systematic reviews due to the lack of information (Law et al., 2017). Using a coherent terminology such as the BCTTv1 to report the key ingredients of SSD interventions coherently, would greatly support the process and results of systematic reviews. In the field of SSD interventions, this problem has been evident since at least 2003, when Law et al. (2003) wrote the first Cochrane review in the field of speech therapy. In addition, using the BCTTv1 to identify active ingredients of SSD interventions also enables researchers to test the effectiveness of these components to see which ones are responsible for behavioural change. The motto ‘we need to know exactly what is going on here to know why it works’ should determine the path. The current study contributes to resolving this difficulty, as it has shown that identifying active ingredients in terms of BCTs is possible retrospectively in SSD interventions. Thus, results of this study suggest that the BCTTv1 is applied to further complex interventions to support the identification of therapy techniques.

Second, policy is responsible for public health problems. Difficulties in speech, language and communication can be seen as public health problems as the three criteria (1) must place a large burden which increases on society, (2) the burden is distributed unequally and (3) evidence showing that preventive actions could significantly reduce the burden, apply (Marks et al., 2011; Robert Koch Institute, 2016). Currently, ways in which children with SLCN can access SLT services vary greatly across countries (Law, 2019). It is important to provide easy and adequate therapy access for people and families with SLCN. At the same time, it is vital to investigate which therapy interventions (complex interventions) work. This means, if policy-makers support and fund research projects investigating effective components of SSD interventions, the difficulties of children can be targeted more specifically, which may lead to greater therapy progress and efficiency of SLT practice will be increased. In turn, this will lead to better SLT provision for children with SSD.

In addition, as EBP principles are the state of the art, state insurance companies are interested in what works, as they pay for SLT services. Even though using the concept of EBP does not imply solely using external evidence (research evidence), it has to be considered for each individual child/patient. In addition, BCTs have been investigated in parent-led interventions (Barnett, 2022) and may also find an application in the preventive sector by supporting children with speech and language delays. Thus, it is strongly suggested that policy supports the use and application of BCTs in SSD interventions and general SLT, as benefits from the use can also be expected at a political level in the long run. If BCTs can be investigated in a more detailed way in the context of SLT interventions, it may show that using BCTs can support parents and caregivers effectively in enhancing children's speech, language and communication skills. Parental support may then contribute positively to a child's speech, language and communication development and therefore reduce the number of children who need long-term therapy, which again reduces costs.

Third, using the BCTTv1 in clinical practice and in SLT training offers great advantages for practitioners and SLT students. As results of this study show, the BCTTv1 supports explicitly saying what is being done in a SSD intervention and provides a common language to speak about techniques, which are seen as the active components of complex interventions. Thus, as also outlined by colleagues (Rees et al., 2016; Stringer & Toft, 2016a) the BCTTv1 enables practitioners and SLT students — as well as colleagues across other health science disciplines such as occupational therapy or physiotherapy — to exchange information about therapies used with children/patients and draw from the same language. In this way, the terminology used to describe techniques would be coherent with everyone talking about the same thing. This finding can also be linked to the international level, as the example from the COST Action showed by indicating the use of mixed terms and expressions for DLD intervention in the practitioner survey. If a coherent terminology is not only used across the field of health science, but also across countries, the exchange about techniques used in SSD interventions — moreover, in all SLT interventions — will be easier and high-yield for all people involved. Another example of the contribution the use of the BCTTv1 could make to support transparency in SSD interventions would be a section in therapy manuals which outlines which BCTs are used within the intervention. For therapy manuals already published, this could be done by coding the intervention retrospectively, whereas newly developed interventions can plan such an addition right away. This could support practitioners in implementing the intervention and students in understanding "how to do therapy'" (Horton et al., 2004, p.382).

As previously found (Matthews et al., 2020), being aware of the techniques used in SSD intervention sessions may also support SLTs and SLT students in self-reflection regarding their own actions in therapy sessions and may increase confidence in 'doing therapy'.

5.6 Conclusion

This study explored the presence of BCTs in SSD intervention literature and in a real-world SSD intervention video session. Subsequently, the effectiveness of a BCT training workshop was investigated in Stage 2, followed by adaptations and changes to the BCT training workshop in Stage 3. First, 17 of 93 BCTs from the BCTTv1 (Michie et al., 2013b) were found to be present in the SSD intervention manuals and studies from P.O.P.T. (Fox-Boyer, 2014b), Metaphon (Jahn, 2000, 2007) and Minimal Pair (Weiner, 1981) for German-speaking children. These 17 BCTs formed the BCT SSD list, which was then used as a foundation to identify BCTs in a real-world SSD intervention video. It was found that 14 of the 17 BCTs included in literature were also found in the real-world SSD intervention video. Next, a BCT training workshop was conducted with SLT students and SLTs to see whether they could learn how to code BCTs in an SSD intervention video accurately. Results have shown that participants could code BCTs; however, coding accuracy was below 50% for all BCT types and therefore lower than expected. No group differences of coding accuracy results between SLTs and SLT students were found. Results of Stage 2 were then used as the foundation for revising the BCT training workshop and shaping the adaptations and changes, such as reducing the number of BCTs included or having only SLT students as participants. Finally, the BCT training workshop of Stage 3 indicated that students' coding accuracy had improved significantly compared to before completion of the BCT training workshop in Stage 3, which was assessed by using a pre-and post-baseline coding task. In addition, results also revealed that participants of Stage 3 achieved significantly higher coding accuracy compared to participants in Stage 2. Results of this study suggest that it is feasible and of potential benefit to include BCT training in the curriculum of SLT students as well as providing BCT training workshops for SLT practitioners.

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Appendix A Cost Action IS1406 Practitioner Survey (Section 3)

cost
EUROPEAN COOPERATION
IN SCIENCE AND TECHNOLOGY

COST Action IS1406 English Version

SECTION 3: Theoretical considerations

SECTION 3: Theoretical considerations

This section of the survey focuses on the way that you make decisions when planning and carrying out intervention, and the theories that underpin those decisions. The options were suggested by members of Action IS1406 and we do not expect them all to be relevant to everyone responding to the survey.

* 1. In general, when making decisions about interventions, how often do you consider the theory behind them?

Never
Sometimes
Often
Alsways

* 2. Indicate, in terms of your overall workload (time devoted), the proportion of time you devote to working with children of each of these ages, irrespective of their condition or disorder:

	Under 3 years old	3 to 5 years old	6 to 12 years old	13 to 18 years old
If you do not work with a certain group, indicate 0%				

In section 2 above, we asked you to think of a **one typical child** with LI from your usual caseload for whom you have provided intervention in the last 2-3 months. This could be **direct intervention, where you have** worked with the child yourself **or indirect intervention** such as developing an intervention programme to be delivered by a parent/teacher/assistant, advising parents or training educators to work with the child.

For all of the following questions we ask you to answer them**again with this particular child in mind.**

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* 3a. Name the main intervention approach (ranging from child-centred, to hybrid, to clinician-centred), you used for his/her language difficulty?

3b. Why did you choose this intervention approach?

4. Continue to think about this child. Review each of the following statements about the factors that influenced your decision-making when you chose the intervention for him/her. For each statement, select a point that most closely reflects how often this factor influences your decision-making.

	Not at all	Rarely	Sometimes	Always
The scores the child receives on a standardised formal assessment of language	○	○	○	○
Variability of the activities in an intervention session	○	○	○	○
How well the intervention will suit the child's profile of needs	○	○	○	○
The parent(s)'/child's preferences about intervention	○	○	○	○
Assessments and information about the child's learning and memory profile	○	○	○	○
My understanding of the reasons for the child's language problems	○	○	○	○
What I learn from watching the parent/carer and child interacting with each other	○	○	○	○
The number of intervention sessions	○	○	○	○
My familiarity with and training in the intervention	○	○	○	○

	Not at all	Rarely	Sometimes	Always
Variability of the materials available for a specific goal (a word, a rule)	◯	◯	◯	◯
Duration of an intervention session	◯	◯	◯	◯
Whether I think that the intervention will work for this child	◯	◯	◯	◯
My knowledge of how a particular intervention works to change a language difficulty	◯	◯	◯	◯
The scientific evidence supporting the intervention	◯	◯	◯	◯
My ability to provide the intervention in the place where I work	◯	◯	◯	◯
Frequency of intervention sessions (twice/ once a week, once a month…)	◯	◯	◯	◯
Financial constraints	◯	◯	◯	◯
Expertise and opinion of my colleagues about intervention	◯	◯	◯	◯
What I learned from watching the child playing/with his/her friends	◯	◯	◯	◯
The results/findings of my analysis of the child's language sample	◯	◯	◯	◯
Type of feedback usually used with this particular intervention (e.g., verification, corrective, try again, elaborative)	◯	◯	◯	◯
How soon after the child's response you provide feedback	◯	◯	◯	◯
Time frame available to deliver the intervention (over two months, six months, school-term etc)	◯	◯	◯	◯

	Not at all	Rarely	Sometimes	Always
Qualitative examination of the child's errors and responses on a standardised assessment of language	◯	◯	◯	◯

5. Again, **for this particular child,** please indicate whether you have used or are using the following strategies or approaches in your intervention. For each statement, select a point that most closely reflects how often you use the strategy or approach in intervention with that child. Again the options were suggested by members of Action IS1406 and we do not expect them all to be relevant to everyone responding to the survey. If you are not familiar with the term (it may not be used in your country, for example) just tick the box saying "Don't know". **If you wish to know more about some of these techniques/strategies, please find descriptions of these below.**

	Don't Know	Never	Occasionally	Often	Always
Behaviour modification approaches	◯	◯	◯	◯	◯
Sensori-motor approaches	◯	◯	◯	◯	◯
Linguistic modelling/facilitation to support implicit learning of language	◯	◯	◯	◯	◯
Explicit teaching	◯	◯	◯	◯	◯
Strategies to develop understanding of social situations	◯	◯	◯	◯	◯
Milieu teaching approaches	◯	◯	◯	◯	◯
Comprehension monitoring	◯	◯	◯	◯	◯
Scaffolding in intervention	◯	◯	◯	◯	◯
Enhancement of the frequency and quality of content in the input to the child	◯	◯	◯	◯	◯
Cueing hierarchies	◯	◯	◯	◯	◯
Strengthening of phonological/semantic/syntactic/ morphological/ pragmatic representations	◯	◯	◯	◯	◯
Development of social skills	◯	◯	◯	◯	◯
Teaching the child to use compensatory strategies	◯	◯	◯	◯	◯
Oro-motor approaches	◯	◯	◯	◯	◯

	Don't Know	Never	Occasionally	Often	Always
Embedding of intervention and changes in the environment in an ecological approach	○	○	○	○	○
Development of conversational skills	○	○	○	○	○
Development of meta-pragmatic awareness	○	○	○	○	○
Phonological contrast approaches	○	○	○	○	○
Training of parent-child interaction	○	○	○	○	○
Interaction based therapy (i.e. not involving parent training in parent-child interaction)	○	○	○	○	○
Metalinguistic approaches	○	○	○	○	○
Working memory intervention	○	○	○	○	○
Specific illustrative materials to teach language rules (e.g., pictures, movies)	○	○	○	○	○
Drilling	○	○	○	○	○
Reinforcement schedules	○	○	○	○	○
Focused stimulation	○	○	○	○	○
Conversational recast intervention	○	○	○	○	○
Other (please specify)	○	○	○	○	○

If selected **'Other'**, please specify

TECHNIQUES/STRATEGIES IN INTERVENTION

Milieu teaching: Incorporates operant principles, such as reinforcement and shaping, in semi-natural settings using different techniques. Common principles include arranging the environment (e.g. so that the things the child wants can be seen but are out of reach) and responsive interaction (recognising and responding to what the child does verbally or non-verbally). Milieu teaching involves conversation-based contexts (where the adult's actions are contingent on the child's and follow the child's interests and initiations in order to provide modelling and prompting).

Comprehension monitoring: Is an approach to supporting children with language comprehension difficulties. It aims to help the child to recognise when they have not understood completely and to learn how to do something about this. For example, the child might learn to ask for something to be repeated or said more slowly.

Scaffolding: This describes the process of giving a child structured assistance/help during the intervention and learning interaction, in order to help the child to reach the desired goal. The adult will adjust the amount of help according to the child's needs and the particular learning goal.

Cueing hierarchies: These may be used across different interventions. They involve the clinician providing a series of cues to prompt the child to produce the targeted sound/word/phrase/sentence. The cues will usually (though not always) be arranged based on providing the least to most help the child needs to produce the target (e.g. in sentence production, when the child produces an incorrect form ('he kick the ball'), the clinician's first prompt could be a sentence completion clue ('he..?'), followed by a forced choice ('he kick the ball or he kicked the ball?'), then if the child still does not produce correctly, the practitioner provides a model for the child to imitate.

Focused stimulation: In this approach, the clinician will provide many models of the target forms in a meaningful communicative context (e.g. play, book reading). The interaction will be arranged so that there are many obligatory contexts for the forms that are being targeted in the intervention.

Conversational recasts: Where the child says something and the practitioner responds by expanding what the child says into a different type or more elaborate sentence (e.g. child says 'teddy bed' and the clinician responds with 'oh, teddy is in the bed' or 'is teddy in the bed?').

* 6. **Overall, in your practice**, is your language intervention influenced by any of the theories listed below? (If you wish to know more about these theories please click on this link: https://tinyurl.com/yclz8y5u). For each statement, select a point that most closely reflects how the theory influences your intervention. It is possible that more than one, or perhaps none, of the theories are relevant or related to your day-to-day work, or even that they are not well known in your context. The purpose of this question is to describe whether these "academic" ways of thinking relate to practical interventions.

DON'T KNOW, I am not familiar or do not know what this theory is about. My intervention is**NEVER** influenced by this theory, My intervention is **OCCASIONALLY** influenced by this theory, My intervention is **OFTEN** influenced by this theory, My intervention is **ALWAYS** influenced by this theory.

	Don't know	Never	Occasionally	Often	Always
Behaviourist (Skinner)	○	○	○	○	○
Nativist/Generative grammar (Chomsky; Wexler)	○	○	○	○	○
Information Processing Theories (Bates; MacWhinney; Saffran et al.)	○	○	○	○	○
Cognitive constructivist (Piaget)	○	○	○	○	○
Socio-cognitive (Vygotsky)	○	○	○	○	○
Constructivist and Usage-based (Goldberg/Tomasello)/ Emergentist (Aslin et al; MacWhinney; Ellman; Hollich et al)	○	○	○	○	○
Social-interactionist/socio-pragmatic (Ninio; Bruner; Nelson; Clark)	○	○	○	○	○

Appendix B Examples of the COM-B model domains in the context of SSD interventions

COM-B domain	**COM-B domain definition** (from Michie et al., 2014, p.63)	**General SSD intervention example**
Physical capability	'Physical skill, strength or stamina" (Michie et al., 2014, p.63)	Have the skill to conduct SSD sessions (therapist), if present in session: have the skill to act as co-therapist in SSD session; have the skill to engage in a session (child)
Psychological capability	'Knowledge or psychological skills, strength or stamina to engage in the necessary mental processes' (Michie et al., 2014, p.63)	Understand the impact and necessity on SSD intervention (parent), have mental stamina to conduct (therapist) and participate (child) in a SSD session
Physical opportunity	'Opportunity afforded by the environment involving time, resources, locations, cues, physical 'affordance'' (Michie et al., 2014, p.63)	Have the right material to conduct a SSD session (therapist), being able to come to the clinic (parent and child)
Social opportunity	'Opportunity afforded by interpersonal influences, social cues and cultural norms that influence the way that we think about things, e.g., the words and concepts that make up our language' (Michie et al., 2014, p.63)	Have a team to speak to about SSD session (therapist), know other parents whose children show SSD (parents), know other children attending SLT sessions (child)
Reflective motivation	'Reflective processes involving plans (self-conscious intentions) and evaluations (beliefs about	Feel a sense of satisfaction from carrying out SSD sessions (therapist), notice child progress (parent), look

	what is good and bad)' (Michie et al., 2014, p.63)	forward to SSD session (child)
Automatic motivation	'Automatic processes involving emotional reactions, desires (wants and needs), impulses, inhibitions, drive states and reflex responses' (Michie et al., 2014, p.63)	Looking forward to prospective SSD sessions and develop a routine (therapist), establish a routine in therapy process (parent), develop a routine in therapy process (child, e.g., getting a sticker at the end of the session)

Appendix C Email Correspondence Professor Susan Michie

Sunday, 19.04.2020 21:07

Dear Melanie,

Yes, that is fine to use the logo as long as it is appropriately cited.

I have applied for funding to update v1 but if this is granted the work would not start until next year. In order to bring it into the Behaviour Change Intervention Ontology (see www.humanbehaviourchange.org) we will be improving definitions and adding a couple of techniques but nothing more radical than that

Best wishes

Susan

Ps I hope you come to our online conference in due course

Professor Susan Michie, FAcSS, FMedSci
Director of UCL Centre for Behaviour Change
Department of Clinical, Educational and Health Psychology
University College London
1-19 Torrington Place
London WC1E 7HB

Website: https://tinyurl.com/susan-michie

Email: s.michie@ucl.ac.uk

@UCLBehaveChange

Email: behaviourchange@ucl.ac.uk

Website: www.ucl.ac.uk/behaviour-change

Join CBC mailing list

For information on our online Summer School visit: https://www.ucl.ac.uk/behaviour-change/summer-school

From: Melanie Dornstauder (PGR) <M.Dornstauder2@newcastle.ac.uk>
Sent: 15 April 2020 16:13
To: Michie, Susan <s.michie@ucl.ac.uk>
Subject: BCT Logo Homepage

Dear Professor Michie,

My name is Melanie Dornstauder, I am a SLT and I am doing in Newcastle with James Law. I investigate BCTs in relation to Speech and Language Therapy (children with DLD/SSD). I am based in Vienna, Austria, and actually wanted to ask at the conference, but since plans have changed, I am writing an e-mail and hope this is ok.

I did write a short insight into BCTs for SLTs in German and this gets published in June 2020, in the "logothema" (an Austrian journal – non peer reviewed – for SLTs, it is the journal of the Austrian SLT association – similar to the bulletin of the RCSLT). Is there a possibility, that we use the BCT Logo in the journal? We also advise people to take a look at the homepage and get an insight into the resources you offer.

This actually brings me to my second question. I was wondering, whether the current BCT Taxonomy gets revised. As I am working with the current one, and I am still at the start of my PhD project, I want to ask this, because if a new version would get published I might as well take this into account beforehand.

Thank you also for giving such valuable input on twitter. Especially the taxi-driver tweet was great to give a practical example. Thank you.

I wish you all the best during this time, and hope to be able to take part at other BCT conferences in the future, and in person.

Best wishes,

Melanie Dornstauder

Melanie Dornstauder

Speech and Language Sciences PhD Student

E: m.dornstauder2@newcastle.ac.uk

A: School of Education, Communication and Language Sciences | Newcastle University

King George VI Building | Queen Victoria Road | Newcastle upon Tyne | NE1 7RU

She/her

I may send and reply to emails out of office hours, but do not expect others to do the same.

Newcastle University
Speech & Language Sciences

Appendix D Ethics Committee Vienna (English and German)

TRANSLATION OF ETHICS COMMITTEE VIENNA LETTER:

City of Vienna

Health Service

Ethic Commission of the City of Vienna
Thomas-Klestil-Place 8,
Town Town, 1. Floor, CB 12.103
A – 1030 Vienna
Entrance: Schnirchgasse 12
A- 1030 Vienna
Phone: +43 1 4000-87754
Fax: +43 1 4000-99-87754
ethikkommission@m15.mag.wien.gv.at
www.gesundheitsdient.wien.at

MA 15 – EK/20-280-VK_NZ

Vienna, 28th October 2020

Dear Melanie Dornstauder, BSc MSc
Speech and Language Therapy Dornstauder
Via E-Mail

Dear Ms Dornstauder, BSc MSc!

Addressing your request for the evaluation of the study entitled:

"The effectiveness of behaviour change techniques (BCTs) in interventions for children with developmental language disorders"

from the 23rd of October 2020 we would like to inform you that there is statutory obligation to have a research project assessed by the Ethics Committee for the testing of medical products or medical devices or the application of new medical methods on humans. None of the above-mentioned criteria apply to the project in question, so that our Ethics Committee is not competent (responsible/in charge) according to the Austrian Medicines Act, the Austrian Medical Device Act and the Vienna Hospital Act.

However, we refer to other regulations such as the Declaration of Helsinki, publication guidelines, etc., which require the vote[4] of an ethics committee.

Your sincerely,

Reinhard Undeutsch

Managing director

[4] Vote of an ethics committee meaning ethical approval (in English)

Stadt Wien | Gesundheitsdienst

Ethikkommission der Stadt Wien
Thomas-Klestil-Platz 8,
Town Town, 1. Stock, CB 12.103
A-1030 Wien
Zugang: Schnirchgasse 12,
Stiege 2, CB 12.103
A-1030 Wien
Tel.: +43 1 4000-87754
Fax: +43 1 4000-99-87754
ethikkommission@m15.magwien.gv.at
www.gesundheitsdienst.wien.at

MA 15 - EK/20-280-VK_NZ

Wien, 28. Oktober 2020

Frau Melanie Dornstauder, BSc MSc
Logopädie Dornstauder
per E-Mail

Sehr geehrte Frau Dornstauder, BSc MSc!

Anlässlich Ihres Ansuchens zur Beurteilung der Studie mit dem Titel:

„The effectiveness of behaviour change techniques (BCTs) in interventions for children with developmental language disorders"

vom 23. Oktober 2020 teilen wir Ihnen mit, dass eine gesetzlich vorgeschriebene Verpflichtung zur Beurteilung eines Forschungsprojekts durch die Ethikkommission für die Prüfung von Arzneimitteln oder Medizinprodukten oder die Anwendung neuer medizinischer Methoden am Menschen besteht. Keines der genannten Kriterien trifft auf das gegenständliche Projekt zu, sodass eine Zuständigkeit unserer Ethikkommission gemäß Arzneimittelgesetz, Medizinproduktegesetz und Wiener Krankenanstaltengesetz nicht gegeben ist.

Wir weisen jedoch auf andere Regelungen wie die Deklaration von Helsinki, Publikationsrichtlinien etc. hin, die das Votum einer Ethikkommission fordern.

Mit freundlichen Grüßen
Der Geschäftsführer:

Reinhard Undeutsch

Verkehrsverbindung: U3 – U-Bahn Station Erdberg, Ausgang Nottendorfer Gasse bzw. U-Bahn Station Schlachthausgasse Ausgang Markhofgasse
Straßenbahnlinie 18, Station Schlachthausgasse und lokale Bus-Linien

Appendix E Parent Leaflet (English and German)

This project has been approved by the "Stadt Wien MA15" and will be approved by the Research Ethics Review Panel within the Newcastle University.

Contact

If you have any questions or wish to discuss any of the information further, please feel free to contact me:

Melanie Dornstauder, BSc MSc
Tel.: +43 660 474 5791
Email: office@logopaedie-dornstauder.at or m.dornstauder2@newcastle.ac.uk

Concerns?

If you have any concerns about the project please me at any time or speak to me in a speech and language therapy session:

Melanie Dornstauder, BSc MSc
Tel.: +43 660 474 5791
Email: office@logopaedie-dornstauder.at or

The Training and Application of Behaviour Change Techniques for speech and language therapy students and speech and language therapists in interventions for children with speech sound disorders

Dear parents/carers

As you know, my name is Melanie Dornstauder, and I am a speech and language therapist and the head of "Logopädie Dornstauder" in Vienna, 1220. As part of my ongoing professional development, I am currently doing a PhD in Speech and Language Sciences at Newcastle University. I am carrying out a research project, which is/was supervised by Prof. James Law, Dr. Carol Moxam, Dr. Faye Smith and Dr. Carolyn Letts. I am interested in which techniques speech and language therapists are using in speech sound disorder intervention and how often certain techniques are being used to make a positive change and an impact to the child's speech difficulty. I have written this information leaflet to help you understand why we are doing the above research project and what it will involve. You can then decide if you want your child to take part.

What is this project about?

The aim of the research is to obtain more information about techniques speech and language therapists are using in speech sound disorder sessions. This project also aims to look at a behaviour change technique taxonomy (BCTTv1, Michie et al 2015) to see whether techniques from the taxonomy are used in speech sound disorder therapy and how often. This is important to reflect and identify active ingredients of speech sound disorder intervention to deliver – in the long run – the most effective intervention possible.

Why has my child been chosen?

Your child fits the criteria is set for this study, which are:

- ✓ Monolingual German speaking children
- ✓ Aged 4.6-6.0 years-old
- ✓ Speech sound disorder with similar profile to other participating children
- ✓ No sensory impairments, has not been diagnosed special educational needs

Your child fits these criteria and I am therefore inviting you and your child to take part in the study, which includes that I will record our regular speech sound disorder session in the speech and language therapy session to then use these videos in the workshop and training for speech and language therapists and students in a later stage in 2020-2022.

What will happen to my child if s/he takes part?

All recruited children will participate *indirectly* as videos of our regular speech sound disorder sessions will be recorded and Melanie Dornstauder will use these in a Behaviour Change Technique Training which takes place in two-three workshops for speech and language therapists and speech and language therapists at a later stage. The project will run from 2020-2022 and the videos will be used to identify behaviour change techniques (BCTs) the therapist (in the video Melanie Dornstauder) used during the therapy sessions. BCTs are techniques which are used by speech and language therapists in general when working with children/adults and contain behaviour such as demonstration how to do something or giving feedback to the child on how he/she has completed a task. Hence, these so-called techniques are not new, but not well researched on yet. Therefore, the PhD project focuses on whether BCTs can be identified in therapy session videos by speech and language therapists and students and also on how many and which BCTs are used by speech and language therapists. In general, therapy sequences of 10-15 minutes will be recorded (only one task, not the whole session). The video sessions which I would record with your child are basically the learning material for the BCT workshop for students and other speech and language therapists participating in the project at a later stage. All participating speech and language therapists and students are signing a confidentiality statement are obligated to maintain full confidentiality of the whole project.

Disadvantages/risks?

There are no foreseeable disadvantages or risks if your child takes part. The speech and language therapy session will take part as usual with your child being asked and informed on the video recording. Some children may react a bit distracted at the moment when they notice that the session will be recorded, but behaviours as such will be monitored by Melanie Dornstauder and if the recording does not work for the child for any reason, it will be stopped at any point of the session. Only one part of the session (10-15 minutes) will be recorded, not the whole session. The sessions are as usual designed to be child-friendly and enjoyable.

Melanie Dornstauder will also explain to the children that and why we record our speech and language therapy session and make clear that we do not have to record the session if children do not want this. Child consent will also be obtained with a child assent form by ticking whether they are happy to participate/record the session or not. If they do not want to record the session it will not be done. If during a session they notice that they do not want to get recorded that is fine, and the recording will be stopped and the video not beeing used.

Benefits?

There are no immediate benefits for those children participating in the project and therefore making the recording of video sessions possible. However, if parents wish, they get the recorded video sessions from Melanie Dornstauder on as USB stick and can have it for themselves/at home. The recording of the sessions gives Melanie Dornstauder the possibility to identify behaviour change techniques and use the videos in the behaviour change techniques training for the workshops of other speech and language therapists and speech and language therapy students.

What will happen to the results of the research project?

The results of the study will be used to inform other speech and language therapists as well as nursery educators, teachers and doctors about techniques used in speech and language therapy, especially in speech sound disorder intervention. It helps professionals to describe the content of interventions more clearly and reproduce research studies more easily.

The results will be written up in the PhD dissertation of Melanie Dornstauder and might be presented at conferences and published in (inter-)national journals.

Will my child's taking part in this project be kept confidential?

Yes, in general. Forenames may occur within the video and therefore other speech and language therapists and students participating in the workshops will know the forename your child. Additionally, everyone participating in the workshops obtains full confidentiality and has to fill out a pending confidentiality form before participating. Participants will know that your child has a speech sound disorder, and the age of the child will be said. Every other information is also kept confidential. Surnames will be removed from any materials and be replaced by an ID code. Additionally, individuals will not be identified or identifiable in any reports or publications that result from the research.

The video recordings are for the purpose of analysis and documentation only and will be stored on a password protected and encrypted external hard-drive and in a software named Video Enhanced Observation (VEO) which is in line with current data protection guidelines in the UK and Austria (see https://veo.co.uk/security/). The software VEO is specifically designed to be used by specialists (e.g. therapists and educators) and stores sensible data well. Additionally, all written and video information will be kept in a locked filing cabinet in my office. All electronic data such as the video recordings will be encrypted and password protected. The participants of the workshops (students and speech and language therapists) will be able to see the videos in the video enhanced observation software for the duration of the workshop (approx. 3-4 days of participation). After the workshop, no one other than supervisors of this project and supervisors of the project and Melanie Dornstauder. All data will be destroyed as soon as my PhD dissertation has been submitted and related publications are in press.

Does my child have to take part?

No, you can decide whether your child takes part or not. If you are happy for your child to take part in the study by giving consent to record regular a speech sound disorder intervention session, you still have the **right to withdraw** from the study **at any time** without giving any reasons. There will be no negative consequences if you withdraw your consent.

What do I do next if I am happy for my child to take part?

Keep this information leaflet for reference. Complete and return a signed **consent form** in the regular therapy session of your child to Melanie Dornstauder.
I will confirm the recording of a regular video session at the beginning of our speech and language therapy appointment, so you and your child will of course know at which of our appointments we will be recording a therapy sequence. The consent form is attached to this leaflet.

Many thanks for reading this!

Dieses Projekt wurde bei der Stadt Wien MA15 und bei der zuständigen Ethikstelle der Newcastle University (Antwort erwartet).

Kontakt

Wenn Sie Fragen zum Projekt oder zum Ablauf haben, kontaktieren Sie mich bitte gerne:

Melanie Dornstauder, BSc MSc
Tel.: +43 660 474 5791
Email: office@logopaedie-dornstauder.at or m.dornstauder2@newcastle.ac.uk

Sorgen?

Wenn Sie Sorgen bzgl. des Projektes haben, sprechen Sie gerne nach einer logopädischen Therapieeinheit mit mir darüber. Vielen herzlichen Dank.

Melanie Dornstauder, BSc MSc
Tel.: +43 660 474 5791
Email: office@logopaedie-dornstauder.at or

Newcastle University

Das Training und die Anwendung von Techniken zur Verhaltensänderung für Logopädie Studierenden und LogopädInnen in der Behandlung von Kindern mit Aussprachestörungen

Liebe Eltern/Erziehungsberechtigte,

wie Sie wissen, heiße ich Melanie Dornstauder und bin Logopädin und Leiterin der Praxis Logopädie Dornstauder in Wien 1220. Im Rahmen meiner beruflichen Weiterentwicklung mache ich derzeit ein PhD in Speech and Language Sciences an der Newcastle University. Ich führe ein Forschungsprojekt durch, das von Prof. James Law, Dr. Carol Moxam, Dr. Faye Smith und Dr. Carolyn Letts betreut wird/wurde. Ich interessiere mich dafür, welche Techniken Logopäden bei der Behandlung von Aussprachestörungen einsetzen und wie oft bestimmte Techniken eingesetzt werden, um eine positive Veränderung und einen positiven Einfluss auf die Sprachschwierigkeiten des Kindes zu erreichen. Ich habe diese Informationsbroschüre verfasst, damit Sie verstehen, warum wir das oben genannte Forschungsprojekt durchführen und was es beinhaltet. Sie können dann entscheiden, ob Sie Ihr Kind daran teilnehmen lassen wollen.

Worum geht es bei diesem Projekt?

Ziel des Forschungsprojekts ist es, mehr Informationen über die Techniken zu erhalten, die LogopädInnen bei der Behandlung von Aussprachestörungen einsetzen. Im Rahmen dieses Projekts soll anhand der Verwendung der Taxonomie für Techniken zur Verhaltensänderung (BCTTv1, Michie et al. 2015) untersucht werden, ob und wie oft Techniken aus dieser Taxonomie in der Therapie von Aussprachestörungen eingesetzt werden. Dies ist wichtig, um die aktiven Bestandteile der Intervention bei Aussprachestörungen zu reflektieren und zu identifizieren, um - langfristig gesehen - die effektivste Intervention entwickeln zu können.

Warum ist mein Kind ausgewählt worden?

Ihr Kind erfüllt die Kriterien, die für diese Studie festgelegt wurden:

- ✓ Einsprachig deutschsprachige Kinder
- ✓ Im Alter von 4,6-6,0 Jahren

- ✓ Sprachklangstörung mit ähnlichem Profil wie die anderen teilnehmenden Kinder
- ✓ Keine sensorischen Beeinträchtigungen, es wurde kein sonderpädagogischer Förderbedarf diagnostiziert

Da ihr Kind diese Kriterien erfüllt, lade ich Sie und ihr Kind ein, an der Studie teilzunehmen. Falls Sie einer Teilnahme zustimmen, würde dies bedeuten, dass ich unsere logopädischen Therapieeinheiten aufnehme, um diese Videos dann später (2020-2022) im BCT Workshop, den ich für LogopädInnen und Studierende leite und abhalte, zu verwenden.

Was passiert mit meinem Kind, wenn es teilnimmt?

Alle rekrutierten Kinder nehmen *indirekt* teil, da Videos von unseren regulären logopädischen Einheiten der Aussprachestörungstherapie aufgezeichnet werden. Melanie Dornstauder wird diese Videos in einem Behaviour Change Technique Training verwenden, das in zwei bis drei Workshops für LogopädInnen und Studierenden stattfindet. Das Projekt läuft von 2020 bis 2022 und die Videos werden verwendet, um Verhaltensänderungstechniken (BCTs) zu identifizieren, die die Therapeutin (im Video Melanie Dornstauder) während der Therapiesitzungen anwendet. BCTs sind Techniken, die von LogopädInnen im Allgemeinen bei der Arbeit mit Kindern/Erwachsenen eingesetzt werden und Verhaltensweisen beinhalten, wie z. B. die Demonstration, wie etwas zu tun ist, oder Feedback geben (an das Kind), wie es eine Aufgabe erledigt hat. Diese sogenannten Techniken sind also nicht neu, aber noch nicht gut erforscht. Daher konzentriert sich das Dissertationsprojekt auf die Frage, ob BCTs in Videos von Therapieeinheiten zu Aussprachestörungen vorkommen und von LogopädInnen und Studierenden identifiziert werden können. Ebenso wird analysiert, wie viele und welche BCTs von LogopädInnen verwendet werden. Im Allgemeinen werden 10-15 Minuten von Therapiesequenzen aufgezeichnet (nur eine Aufgabe, nicht die gesamte Sitzung). Die Videositzungen, die ich mit Ihrem Kind aufnehme, sind im Grunde das Lernmaterial für den BCT-Workshop für Studierende und andere LogopädInnen, die später an dem Projekt teilnehmen. Alle teilnehmenden LogopädInnen und Studierenden unterschreiben eine Verschwiegenheitserklärung und verpflichten sich, das gesamte Projekt vertraulich zu behandeln.

Nachteile/Risiken?

Es gibt keine vorhersehbaren Nachteile oder Risiken, wenn Ihr Kind am Projekt teilnimmt. Die logopädische Sitzung findet wie gewohnt statt, wobei Ihr Kind gefragt wird, ob wir die Einheit und unsere Übung aufnehmen dürfen. Ebenso erkläre ich dem Kind zuvor, wofür das Video gebraucht wird. Manche Kinder reagieren vielleicht etwas schüchtern oder auch überdreht, wenn sie bemerken, dass die Sitzung aufgezeichnet wird, aber das Verhalten als solches wird von Melanie Dornstauder beobachtet, und wenn die Aufzeichnung aus irgendeinem Grund für das Kind nicht funktioniert, wird sie abgebrochen. Es wird nur ein Teil der Sitzung (10-15 Minuten) aufgezeichnet, nicht die gesamte Sitzung. Die Sitzungen sind wie immer kindgerecht und unterhaltsam gestaltet.

Vorteile?

Es gibt keine unmittelbaren Vorteile für die Kinder, die an dem Projekt teilnehmen und dadurch die Aufzeichnung der Videositzungen möglich machen. Wenn die Eltern es jedoch wünschen, erhalten sie die aufgezeichneten Videositzungen von Melanie Dornstauder auf einem USB-Stick und können sie für sich selbst/zu Hause haben. Die Aufzeichnung der Sitzungen gibt Melanie Dornstauder die Möglichkeit, Techniken zur Verhaltensänderung zu identifizieren und die Videos in der Schulung von Verhaltensänderungstechniken für die Workshops anderer LogopädInnen und Studierenden zu verwenden.

Was wird mit den Ergebnissen des Forschungsprojektes geschehen?

Die Ergebnisse der Studie werden verwendet, um andere Logopäden und Sprachtherapeuten sowie Erzieher, Lehrer und Ärzte über Techniken zu informieren, die in der Logopädie, insbesondere bei der Behandlung von Sprachstörungen, eingesetzt werden. Sie hilft den Fachleuten, den Inhalt von Interventionen klarer zu beschreiben und Forschungsstudien leichter zu reproduzieren. Die Ergebnisse werden in die Dissertation von Melanie Dornstauder einfließen und könnten auf Konferenzen vorgestellt und in (inter-)nationalen Fachzeitschriften veröffentlicht werden.

Wird die Teilnahme meines Kindes an diesem Projekt vertraulich behandelt?

Ja. Im Video können Vornamen vorkommen, so dass andere LogopädInnen und Studierende, die an den Workshops teilnehmen, den Vornamen Ihres Kindes kennen werden. Allerdings unterliegt jede/r TeilnehmerIn an den Workshops voller Verschwiegenheit und muss vor der Teilnahme ein Formular ausfüllen. Die TeilnehmerInnen werden aufgrund es Videos wissen, dass Ihr Kind eine Aussprachestörung hat, und das Alter des Kindes erfahren (aus fachlichen Gründen). Alle anderen Informationen werden ebenfalls vertraulich behandelt und nicht bekanntgegeben. Die Nachnamen werden aus allen Materialien entfernt und durch einen ID-Code ersetzt. Darüber hinaus werden die Personen in den Berichten oder Veröffentlichungen, die aus der Forschung resultieren, nicht identifiziert oder identifizierbar sein.

Die Videoaufnahmen dienen ausschließlich der Analyse und Dokumentation von BCTs zu Lehrzwecken und werden auf einer passwortgeschützten und verschlüsselten externen Festplatte und in einer Software namens Video Enhanced Observation (VEO) gespeichert, die den aktuellen Datenschutzrichtlinien im Vereinigten Königreich und in Österreich entspricht (siehe https://veo.co.uk/security/). Die Software VEO wurde speziell für die Verwendung durch SpezialistInnen (z.B. TherapeutInnen und PädagogInnen) entwickelt und speichert sensible Daten gut. Zusätzlich werden alle schriftlichen und Videoinformationen in einem verschlossenen Aktenschrank in meinem Büro aufbewahrt. Alle elektronischen Daten, wie z.B. die Videoaufzeichnungen, werden verschlüsselt und mit einem Passwort geschützt. Die Teilnehmer der Workshops (Studierende und LogopädInnen) können die Videos in der videogestützten Beobachtungssoftware für die Dauer des Workshops (ca. 3-4 Tage der Teilnahme) sehen. Nach dem Workshop hat niemand außer den Betreuerinnen dieses Projekts und Melanie Dornstauder Zugang zu den Videoaufnahmen. Auch alle anderen Originaldaten, wie z.B. Informationen über Ihr Kind, sind nur den Projektbetreuern und Melanie Dornstauder zugänglich. Alle Daten werden vernichtet, sobald meine Dissertation eingereicht ist und die entsprechenden Publikationen im Druck sind.

Muss mein Kind teilnehmen?

Nein, Sie können selbst entscheiden, ob Ihr Kind teilnimmt oder nicht. Wenn Sie damit einverstanden sind, dass Ihr Kind an der Studie teilnimmt, indem Sie der Videoaufnahme unserer Logopädie Einheiten zustimmen, haben Sie dennoch das Recht, jederzeit ohne Angabe von Gründen von der Studie zurückzutreten. Es wird keine negativen Folgen haben, wenn Sie Ihre Zustimmung zurückziehen.

Wie gehe ich weiter vor, wenn ich mit der Teilnahme meines Kindes einverstanden bin?

Bewahren Sie diese Informationsbroschüre zum Nachschlagen auf. Füllen Sie eine Einverständniserklärung aus und geben Sie diese unterschrieben in der regulären Therapiesitzung Ihres Kindes an Melanie Dornstauder zurück. Ich bestätige die Aufnahme des Videos zu Beginn unserer logopädischen Einheit, so dass Sie und Ihr Kind natürlich wissen, bei welchem unserer Termine wir eine Therapiesequenz aufnehmen werden. Die Einverständniserklärung ist diesem Merkblatt beigefügt.

Vielen herzlichen Dank, dass Sie dies gelesen haben!

Appendix F Information Sheet Children (English and German)

Information Sheet Children
Video recording of speech and language therapy session

Title of Research Project: The Training and Application of Behaviour Change Techniques for speech and language therapy students and speech and language therapists in interventions for children with speech sound disorders

My name is Melanie (Dornstauder) and as you already know I'm a speech and language therapist.

We've been working several hours together to help you with some sounds, do you remember? I'm doing a special job at the moment to find out which techniques work best for children and to see which ones I am using very often. I'm going to work with a couple of children and want to ask you whether you are happy to participate in the project. I would like to make video recording of our therapy sessions. The recordings will then be used in a training for other speech and language therapists and speech and language therapy students, to see how we have been practising and which techniques we used a lot, or not so often. We are working on the same tasks as usually and will play a game at the end. This is what we will do:

Listen to some words, identify certain sounds and practise to say the sounds.

  

 

I need to record our video sessions and games on my digital recorder so me and my colleagues can then look at what we did and how we did it.

Just so you know: It doesn’t matter if you can’t say sounds or words properly. I just want to look at what speech and language therapists are doing exactly. You can say “no” or “stop” if it gets too hard at all times.

<u>Informationsblatt Kinder</u>
Videoaufnahmen von Logopädie Einheiten

Titel des Projekts: Dass Training und die Anwendung von Techniken zur Verhaltensänderung für Logopädie Studierenden und LogopädInnen in der Behandlung von Kindern mit Ausspracheströungen

Mein Name ist Melanie Dornstauder und wie du bereits weißt, bin ich Logopädin.

Wir haben schon einige Stunden zusammengearbeitet, um dir bei einigen Lauten zu helfen, erinnerst du dich? Ich arbeite im Moment an einem speziellen Projekt, um herauszufinden, welche Techniken bei Kindern am besten funktionieren und welche ich besonders häufig anwende. Ich werde mit ein paar Kindern arbeiten und möchte dich fragen, ob du an dem Projekt teilnehmen möchtest. Ich möchte Videoaufnahmen von unseren Therapiesitzungen machen. Die Aufnahmen sollen dann in einer Fortbildung für andere LogopädInnen und Studierenden verwendet werden, um zu sehen, wie wir geübt haben und welche Techniken wir häufig oder weniger häufig angewendet haben. Wir arbeiten an denselben Aufgaben wie sonst auch und werden am Ende ein Spiel spielen. Das werden wir tun:

Wir werden uns Wörter anhören und ganz gut hinhören, welche Laute (Geräusche) vorkommen und diese dann gut üben (um sie richtig auszusprechen).

  

 

Ich muss unsere Videositzungen und Spiele auf meiner Kamera aufzeichnen, damit meine KollegInnen und ich uns anschauen können, was wir gemacht haben und wie wir es gemacht haben.

Nur damit du es weißt: Es spielt keine Rolle, ob Sie Laute oder Wörter nicht richtig aussprechen können. Ich möchte mir nur ansehen, was die Logopädin (also ich) genau macht. Du kannst jederzeit "Nein" oder "Stopp" sagen, wenn es dir zu schwer wird.

Appendix G Consent Form Parents (English and German)

The Training and Application of Behaviour Change Techniques for speech and language therapy students and speech and language therapists in interventions for children with speech sound disorders

Parents' Consent Form

I have read and understood the information leaflet explaining the project of Melanie Dornstauder and have had the opportunity to ask questions about the project.

Please circle 'agree' or 'do not agree' as appropriate in the following:

1. I agree / do not agree

   that speech sound disorder therapy sessions from my child attending speech and language therapy in the clinic "Logopädie Dornstauder" are being video recorded.

   My child's name: ______________________________ ☐ male ☐ female ☐ divers

   child's name

   born: ____________________

   child's DoB

2. I agree / do not agree that Melanie Dornstauder uses the video recordings of the sessions in the BCT training of speech and language therapists and speech and language therapy students in her PhD workshops taking place 2020-2022.

3. I agree / do not agree that my child's forename is being recorded and used in the video. Therefore, participants will know the forename of my child.

Please initial the boxes below if you are happy for your child to take part in the project

I understand that participation is voluntary and that I am free to withdraw my consent and my child at any time without giving any reason and without there being any negative consequences. ☐

I understand that the information gained about my child on this project will be kept secure, strictly confidential, and anonymised. Second Names will be removed from any materials and individuals will not be identified or identifiable in any reports that result from the research. I give permission for Melanie Dornstauder and her supervisors to have access to this information. Forenames of my child will be used and may appear in the video. ☐

I understand that the video will be recorded in a regular speech and language therapy session for speech sound disorders and nothing will be conducted/applied differently to any other ☐

speech and language therapy session of my child.

I understand that Melanie Dornstauder has approached me and my child as my child matches the inclusion criteria of having a speech sound disorder, is monolingual and has no other known disability as already discussed at the first speech and language therapy appointment in the clinic “Logopädie Dornstauder” and during the recent procedure. ☐

___________________	______________________________________	_______________________
Date	Print Name (Parent/Carer)	Signature (Parent/Carer)
_________________	______________________________________	_______________________
Date	Print Name (Name of person taking consent if different from researcher)	Signature
_________________	______________________________________	_______________________
Date	Print Name (Researcher)	Signature (Researcher)

Please return the Parents’ Consent Form to Melanie Dornstauder after the therapy session of your child.

Einverständniserklärung der Eltern

Ich habe die Informationsbroschüre zum Projekt von Melanie Dornstauder gelesen und verstanden und hatte die Möglichkeit, Fragen zum Projekt zu stellen.

Bitte kreuzen Sie bei den folgenden Punkten "stimme zu" oder "stimme nicht zu" an:

3. Ich stimme zu/stimme nicht zu,

   dass die Therapiesitzungen meines Kindes, das die Praxis Logopädie Dornstauder besucht, auf Video aufgezeichnet werden.

   Name meine Kindes: ________________________________ ☐ m ☐ w ☐ d

   Name des Kindes

   Geboren am: ______________________

   Geburtsdatum des Kindes

4. Ich bin damit einverstanden / nicht einverstanden, dass Melanie Dornstauder die Videoaufzeichnungen der Sitzungen im BCT-Training von LogopädInnen und Logopädie Studierenden in ihren 2020-2022 stattfindenden PhD-Workshops verwendet.

3. Ich bin damit einverstanden / nicht einverstanden, dass der Vorname meines Kindes aufgenommen und im Video verwendet wird.

Bitte kreuzen Sie die Kästchen unten an, wenn Sie damit einverstanden sind, dass Ihr Kind an dem Projekt teilnimmt

Mir ist bekannt, dass die Teilnahme freiwillig ist und dass ich meine Zustimmung und die meines Kindes jederzeit ohne Angabe von Gründen und ohne negative Folgen zurückziehen kann. ☐

Mir ist bekannt, dass die im Rahmen dieses Projekts über mein Kind gewonnenen Informationen sicher, streng vertraulich und anonymisiert behandelt werden. Nachnamen werden aus allen Materialien entfernt, und Einzelpersonen werden in Berichten, die aus der Forschung resultieren, nicht identifiziert oder identifizierbar sein. Ich erteile Melanie Dornstauder und ihren Supervisorinnen die Erlaubnis, Zugang zu diesen Informationen zu erhalten. Die Vornamen meines Kindes werden verwendet und können auf dem Video erscheinen. ☐

Mir ist bekannt, dass das Video in einer regulären logopädischen Sitzung zur Behandlung von Sprachklangstörungen aufgenommen wird und dass nichts anders als bei anderen logopädischen Sitzungen meines Kindes durchgeführt/angewendet wird. ☐

Mir ist bekannt, dass Melanie Dornstauder auf mich und mein Kind bzgl. des Forschungsprojektes zugekommen ist, da mein Kind die Einschlusskriterien erfüllt, da ☐

eine Aussprachestörung vorliegt, das Kind einsprachig ist und keine weiteren bekannten Entwicklungsprobleme hat, wie bereits beim ersten logopädischen Termin in der Praxis "Logopädie Dornstauder" und bei der letzten Terminen besprochen.

____________________	______________________________________	________________________
Datum	Blockbuchstaben Name (Eltern/Erziehungsberechtigte)	Unterschrift

__________________	______________________________________	________________________
Datum	Blockbuchstaben Name (Forscherin)	Unterschrift

Bitte geben Sie die Einverständniserklärung der Eltern nach der Therapiesitzung Ihres Kindes an Melanie Dornstauder zurück.

Appendix H Consent Form Children (English and German)

Children Assent Form

Newcastle University
Melanie Dornstauder PGR

Title of Research Project: The Training and Application of Behaviour Change Techniques for speech and language therapy students and speech and language therapists in interventions for children with speech sound disorders

This project has been explained to this child by

____

Name of child ____

I would like to take part in this project	**I would not like to take part in this project**

(tick as appropriate)

Thank you!

Melanie Dornstauder

<u>Einverständniserklärung Kinder</u>

Universität Newcastle
Melanie Dornstauder PGR

Titel des Forschungsprojekts: Das Training und die Anwendung von Techniken zur Verhaltensänderung für Logopädie Studenten und LogopädInnen in Interventionen für Kinder mit Ausprachestörungen

Dieses Projekt wurde dem Kind von ____ erklärt.

Name des Kindes ____

Ich möchte an diesem Projekt teilnehmen	**Ich möchte <u>nicht</u> an diesem Projekt teilnehmen**

(Zutreffendes ankreuzen)

Vielen lieben Dank!

Melanie Dornstauder

Appendix I SSD BCT list: BCTs and examples identified in SSD intervention literature (Minimal Pair, Metaphon and P.O.P.T.)

BCT type	Examples – BCTs identified in SSD intervention literature
1.1. Goal setting (behaviour)	'Objective of the game is to get me to pick up all 5 pictures of the boat. **Everytime you say boat**, I will pick one up. When I have all 5, you may paste a star on your paper." (Weiner, 1981, p.98; Minimal Pair)
1.3. Goal setting (outcome)	'Wenn das Kind **die angebotenen Laute zu ca. 80% korrekt auditiv differenzieren und bestenfalls auch produzieren kann**, wird zur nächsten Ebene übergegangen.' (Jahn, 2007, p.58; Metaphon) translation*: 'When the child is able to* ***correctly auditory differentiate the sounds offered to approx. 80% and at best also produce them****, we move on to the next level.'* (translated from Jahn, 2007, p.58; Metaphon)
1.4. Action planning	'**We are going to play a game.** The objective of the game is to get me to pick up all 5 pictures of the boat. Everytime you say boat, I will pick one up. When I have all 5, you may paste a star on your paper.' (Weiner, 1981, p.98; Minimal Pair)
1.6. Discrepancy between current behaviour and goal	'**You keep saying *bow*. If you want me to pick up the *boat* pictures you must say the /t/ sound at the end**. Listen, boat, boat, boat. You try it. Okay, let's begin again.' (Weiner, 1981, p.98; Minimal Pair)
2.2. Feedback on behaviour	'**Auch bei korrekter Realisierung sollte Feedback gegeben werden**: „Richtig, Da hört man den Holzhacker: Koffer. Das heißt ja nicht Toffer, Goffer oder Doffer, stimmt's?" – Dabei zeigt sie [die Therapeutin] auf die jeweiligen Lautsymbole.' (Fox-Boyer, 2014b, p.51; P.O.P.T.) translation*: '****Feedback should also be given if the realisation is correct****: "Right, there you hear the wood chopper:* ***Koffer*** *('suitcase'). That's not Toffer, Goffer or Doffer, is it?" - She [the therapist] thereby points to the sound symbols.'* (translated from Fox-Boyer, 2014b, p.51; P.O.P.T.)
2.6. Biofeedback	‚Bei der Vorverlagerung (…) ist es sinnvoll, die Unterschiede zwischen ‚vorn' und ‚hinten' zunächst auf der Zunge und am Gaumen zu verdeutlichen (**taktil-kinästhetische Wahrnehmung**). Therapeut und Kind **tippen**

	sich gegenseitig mit einem feuchten Watteträger auf den vorderen und hinteren Teil der Zunge bzw. des Gaumens. Als Antwort werden z.B. Klebepunkte vorn bzw. hinten auf eine gemalte Zunge geklebt.‘ (Jahn, 2007, p.57; Metaphon) translation*: ‘When fronting (...) it is useful to first clarify the differences between 'front' and 'back' on the tongue and palate* ***(tactile-kinaesthetic perception). Therapist and child tap each other on the front and back of the tongue or palate with a moist cotton swab.*** *In response, e.g., adhesive dots are stuck on the front or back of a painted tongue.’* (translated from Jahn, 2007, p.57; Metaphon
3.1. Social support (unspecified)	‚Gelingt dies nicht, erklärt sie noch einmal die produktiven Besonderheiten des Lautes und **ermutigt das Kind erneut** zur Imitation.‘ (Fox-Boyer, 2014b, P.O.P.T., p.40) translation*: ‘If this is not successful, she again explains the productive features of the sound and* ***encourages the child to imitate again****'.* (translated from Fox-Boyer, 2014b, P.O.P.T., p.40)
4.1. Instruction on how to perform the behaviour	‚Alles ausgewählten Laute werden mit Lautsymbolen belegt (…) und es wird **ausführlich und repetitiv erklärt,** vorgemacht, **gezeigt, wie sich der Laut anfühlt, wo und wie er produziert wird, wie der Mund/die Zunge dabei aussieht, was er/sie dabei tut und vor allem wie der Laut klingt**.‘ (Fox-Boyer, 2014b, p.33; P.O.P.T.) translation*: ‘All selected sounds are assigned to sound symbols (...) and* ***it is explained in detail and repetitively,*** *demonstrated,* ***shown how the sound feels, where and how it is produced, what the mouth/tongue looks like, what it does and above all how the sound sounds****.’* (translated from Fox-Boyer, 2014b, p.33; P.O.P.T.)
6.1. Demonstration of the behaviour	‚Alles ausgewählten Laute werden mit Lautsymbolen belegt (…) und es wird ausführlich und repetitiv erklärt, **vorgemacht, gezeigt, wie sich der Laut anfühlt, wo und wie er produziert wird, wie der Mund/die Zunge dabei aussieht, was er/sie dabei tut und vor allem wie der Laut klingt**.‘ (Fox-Boyer, 2014b, p.33; P.O.P.T.) translation*: ‘All selected sounds are assigned to sound symbols (...) and it is explained in detail and repetitively,* ***demonstrated, shown***

	***how the sound feels, where and how it is produced, what the mouth/tongue looks like, what it does and above all how the sound sounds**.'* (translated from Fox-Boyer, 2014b, p.33; P.O.P.T.)
7.1. Prompts/cues	'Stimuli: 5 **pictures** of boat, 5 **pictures** of bow' (Weiner, 1981, p.98; Minimal Pair)
8.1. Behavioural practice/rehearsal	'In allen Phasen ist es besonders wichtig, dass die Spiele einen hochfrequenten Input oder ein hochfrequentes Üben zulassen.' (Fox-Boyer, 2014b, p.28; P.O.P.T.) translation*: 'At all stages, it is particularly important that the games allow for high-frequency input or practice.'* (translated from Fox-Boyer, 2014b, p.28; P.O.P.T.)
8.6. Generalisation of target behaviour	'Die erarbeiteten Minimalpaare werden zunächst in **feste Satzmuster** eingebaut, z.B. „Lege ‚Traube' in die Dose". **Anschließend werden freiere Satzmuster**, ggf. mit anderen Minimalpaaren, produziert. (Jahn, 2007, p. 64; Metaphon) translation*: 'The developed **minimal pairs are first built into fixed sentence patterns**, e.g., "Put 'grape' in the can". Afterwards, **freer sentence patterns are produced**, if necessary with other minimal pairs.* (translated from Jahn, 2007, p. 64; Metaphon)
10.2. Material reward (behaviour)	'In addition to verbal reinforcements, children were given a **small toy** for every four stars earned.' (Weiner, 1981, p.98; Minimal Pair)
10.3. Non-specific reward	‚Bei dieser Methode ist entscheidend, dass dem Kind ein Anreiz gegeben wird, das Wort mit dem Ziellaut, im Beispiel das Wort ‚Fee', möglichst oft zu produzieren. Dies gelingt z.B. dadurch, dass eine bestimmte Anzahl von **‚Zaubersteinen'** (**Murmeln**) **in den Beutel gelegt werden darf, sobald das Kind ‚Fee'** sagt. Als **Motivation kann anschließend Murmelbahn gespielt werden**. (Jahn, 2007, p.50; Metaphon) translation*: In this method, it is crucial that the child is given an incentive to produce the word with the target sound, in the example the word 'fairy', as often as possible. This is achieved, for example, by allowing a **certain number of 'magic stones' (marbles) to be placed in the bag as soon as the child says 'fairy'. As a motivation, a marble run can be played afterwards**.'* (translated from Jahn, 2007, p.50; Metaphon)
10.4. Social reward	‚Probiert ein Kind zu diesem Zeitpunkt bereits freiwillige Laute aus, so sollte jeder Versuch

	gelobt und positiv verstärkt werden.‘ (Fox-Boyer, 2014b, p.47; P.O.P.T.) translation: *‘If a child is already trying voluntary sounds at this stage, each attempt should be praised and positively reinforced.’* (translated from Fox-Boyer, 2014b, p.47; P.O.P.T.)
12.5. Adding objects to the environment	‚Bei der Vorverlagerung (…) ist es sinnvoll, die Unterschiede zwischen ‚vorn‘ und ‚hinten‘ zunächst auf der Zunge und am Gaumen zu verdeutlichen (taktil-kinästhetische Wahrnehmung). Therapeut und Kind tippen sich gegenseitig mit einem **feuchten Watteträger** auf den vorderen und hinteren Teil der Zunge bzw. des Gaumens. Als Antwort werden z.B. **Klebepunkte** vorn bzw. hinten auf eine gemalte Zunge geklebt.‘ (Jahn, 2007, p.57; Metaphon) translation: *‚When fronting (...) it is useful to first clarify the differences between 'front' and 'back' on the tongue and palate (tactile-kinesthetic perception). Therapist and child tap each other on the front and back of the tongue or palate with a **moist cotton swab.** In response, e.g., **adhesive dots** are stuck on the front or back of a painted tongue.’* (translated from Jahn, 2007, p.57; Metaphon)
14.8. Reward alternative behaviour	‘**Correct productions were those that resulted on elimination of the process rather than in correct production of the target word.** That is, in the case of deletion of final consonants, production of any final consonant was regarded as a correct production and was appropriately reinforced — e.g., for stopping, any other initial fricative was reinforced and for fronting, any velar stop was reinforced.’ (Weiner, 1981, p.98; Minimal Pair)

Appendix J Thank You Letter Parents (English and German)

Thank-You Letter for parents/carers of children

Vienna,
Date

Research project: The Training and Application of Behaviour Change Techniques for speech and language therapy students and speech and language therapists in interventions for children with speech sound disorders

Dear parents/carers of ______________________________________
(child's name)

Thank you very much for allowing your child to take part in this research project.

We have now recorded one speech sound disorder session. This video will now be used in the BCT training workshop for speech and language therapists and students. If you wish to receive a copy of the video, please let me know.

If you have any questions following this letter please feel free to contact me.

Kind regards,

Melanie Dornstauder, BSc MSc
Tel.: +43 660 474 5791
Email: office@logopaedie-dornstauder.at or m.dornstauder2@newcastle.ac.uk

Dankesbrief für Eltern/Betreuer von Kindern

Wien, Datum

Forschungsprojekt: Das Training und die Anwendung von Verhaltensänderungstechniken für Logopädie Studierende und LogopädInnen in Interventionen für Kinder mit Aussprachestörungen

Liebe Eltern/Erziehungsberechtigte von ___________________________________

(Name des Kindes)

vielen Dank, dass Sie Ihrem Kind erlaubt haben, an diesem Forschungsprojekt teilzunehmen.

Wir haben nun eine Sitzung zur Sprachklangstörung aufgezeichnet. Dieses Video wird nun im BCT-Trainingsworkshop für Sprachtherapeuten und Studenten verwendet werden. Wenn Sie eine Kopie des Videos erhalten möchten, lassen Sie es mich bitte wissen.

Sollten Sie nach diesem Schreiben noch Fragen haben, können Sie sich gerne an mich wenden.

Mit freundlichen Grüßen,

Melanie Dornstauder, BSc MSc
Tel.: +43 660 474 5791
Email: office@logopaedie-dornstauder.at or m.dornstauder2@newcastle.ac.uk

Appendix K Phonological Awareness Task Assessment Video

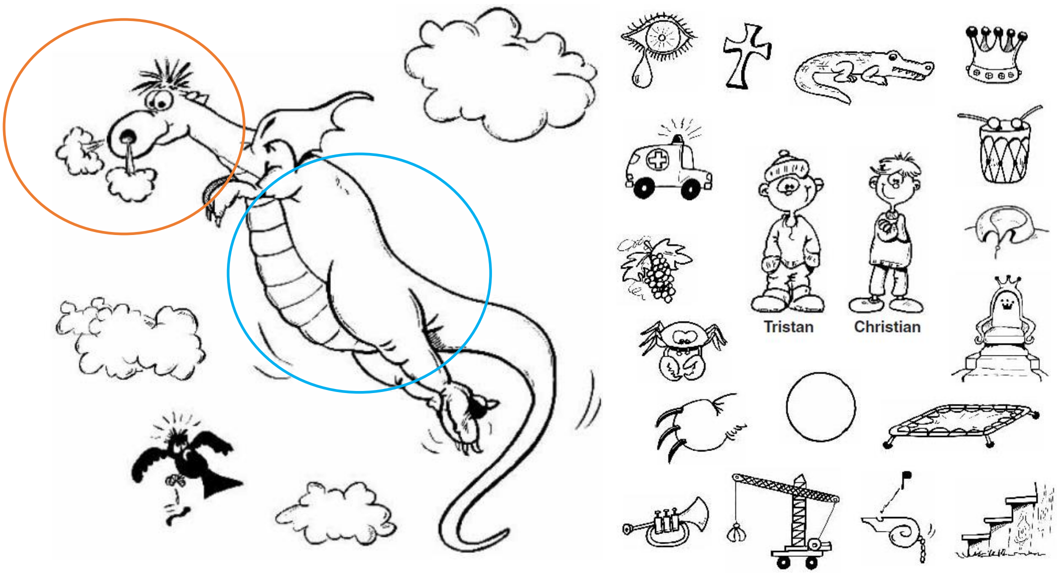

Figure 38: Phonological awareness task from reference video (dragon and consonant cluster

orange=put the card there if the word has a /tr/ at the beginning of the word

blue=put the card here if the word has a /tr/ in the middle of the word

Appendix L Certificate of BCTTv1 Online Training

B C T
Taxonomy v1

Online Training

CERTIFICATE OF COMPLETION

This is to certify that the holder of this certificate has:

Completed full online training at: www.bct-taxonomy.com and has achieved coding competence in use of BCTTv1 to specify the content of complex behaviour change interventions

Certified by:

The BCTTv1 Project Team

and the UCL Centre for Behaviour Change

For further training opportunities, see www.ucl.ac.uk/behaviour-change

C B C
UCL Centre for Behaviour Change

Appendix M Work Experience Survey SLTs (Stage 2; English and German)

Behaviour Change Techniques in speech and language therapy for children with speech sound disorder

Workshop 31st of March – 14th April 2021, Melanie Dornstauder

Some personal information about participating Speech and Language Therapists

This short survey aims to collect some basic information about you, your qualification and your work setting to tailor the workshop beneficial for all participants. In addition, this data will be used anonymously to explore and analyse data collected within the workshop. By filling out and returning the questionnaire you obtain consent. The participation in the workshop is only possible when returning the questionnaire.

1. Gender:

m ☐

w ☐

d ☐

2. Age

20-30☐

31-40☐

41-50☐

51-60☐

60+☐

3. The country you work in (please specifiy)

……………………………………………………..

4. What is the title of your job?

☐Speech and Language Therapist
☐Special Educator
☐Psychologist
☐Linguist
☐Teacher
☐Pedagogue
☐Medical Doctor

☐Other (please specify) ……………………………….
5. Level of "professional" qualification

☐Non-university: Diploma

☐University: Undergraduate/ Bachelor degree

☐University: Masters degree

☐University: Dr. (PhD)

☐University: Other (e.g., Diploma) …………………………………….

6. Country of graduation

………………………………………………………….

7. Years of experience with children with speech sound disorder

………………………………………………………….

8. How many children with speech sound disorder do you have in your work setting in SLT weekly?

1-5☐

6-10☐

11-15☐

16-20☐

21-25☐

26-30☐

31-35☐

More than 35 ☐

9. Are you aware of concepts/therapy interventions which you use for working with children who show speech sound disorders? If so, which?

………

………

………

10. What is your native language?

…………………………………………………………………

11. How old are children with speech sound disorder you work with? (please tick all that apply)

☐0-3;11 Jahre
☐4-6;11 Jahre
☐7-11;11 Jahre
☐12-16;11 Jahre
☐16+ Jahre

12. Where do you work (please tick all that apply)

☐Hospital
☐ Rehabilitation centres
☐“Wahllogopäden” SLT without direct insurance contract (private SLT, self-employed)
☐“Kassenlogopäden“ SLT with direct insurance contract (self-employed)
☐Nursery/kindergarten (mainstream)
☐ Nursery/kindergarten (special)
☐ School (mainstream)
☐ School (special)
☐ day care centre
☐ Health clinic/centre
☐Other (please specify) …………………………………….

13. How is your work place being funded?

☐publicly
☐privately

Behaviour Change Techniques in der logopädischen Therapie von Aussprachestörungen

Workshop 31.03.2021 – 14.04.2021, Melanie Dornstauder

Erhebung Persönlicher Informationen teilnehmender Logopäden/innen

Hier werden grundlegende Informationen über Sie, Ihre Qualifikationen und ihr Arbeitsumfeld erhoben, um den Workshop für alle Teilnehmer*innen optimal gestalten zu können. Ebenso werden diese Daten, **ausschließlich in anonymisierter Form**, zur Erläuterung und Bearbeitung der Stichprobe (Gruppe) bei der Auswertung der Daten berücksichtigt. Mit dem Ausfüllen und Zurücksenden dieses Fragebogens erklären Sie sich hiermit einverstanden. Die Teilnahme am Workshop ist aufgrund des Forschungsprocederes nur mit ausgefülltem Fragebogen möglich.

1. Geschlecht:

m ☐

w ☐

d ☐

2. Alter

20-30☐

31-40☐

41-50☐

51-60☐

60+☐

3. In welchem Land sind Sie tätig?

………………………………………………………..

4. Wie lautet Ihre Berufsbezeichnung? (Kombinationen bitte ankreuzen – wenn nicht vorhanden: Bei andere bitte anführen)

☐Logopäde/in
☐Sonderpädagoge/in, Sonderheilpädagoge/in, Sprachheilpädagoge/in
☐Psychologe/in
☐Linguist/in

☐Lehrer/in
☐Pädagoge/in (elementar-/Kleinkind-)
☐Arzt/Ärztin
☐Andere (bitte anführen) ……………………………….

5. Level der beruflichen Qualifikation

☐nicht-universitärer Abschluss (z.B. Schule für Logopädie, Akademie, nicht-universitäres Diplom)

☐Fachhochschule/ Universität: Bachelorabschluss

☐Fachhochschule/ Universität: Masterabschluss

☐Universität: Doktorat/ Promotion

☐Universität: andere Abschlüsse: ……………………………………

6. In welchem Land wurde der berufliche Abschluss erworben?

…………………………………………………………

7. Seit wie vielen Jahren seit Ihrem Berufsabschluss sind Sie mit Kindern mit Aussprachestörungen tätig?

…………………………………………………………

8. Wie viele Kinder mit Aussprachestörungen haben Sie letzte Woche therapiert?

1-5☐

6-10☐

11-15☐

16-20☐

21-25☐

26-30☐

31-35☐

Mehr als 35 ☐

9. Welche Therapiekonzepte/Therapieprogramme wenden Sie in der Therapie von Kindern mit Aussprachestörungen an?

……

………………………………………………………………………………………………………

………………………………………………………………………………………………………

10. Was ist Ihre Muttersprache?

………………………………………………………………………………………………………

11. Welcher Altersgruppe(n) gehören Kinder, die aufgrund der **Aussprachestörung** bei Ihnen in Therapie sind, an? (Bitte **alle** zutreffenden Auswahlmöglichkeiten ankreuzen)

☐0-3;11 Jahre
☐4;0-6;11 Jahre
☐7;0-11;11 Jahre
☐12;0-16;11 Jahre
☐16;0+ Jahre

12. Wo arbeiten Sie? (Bitte **alle** zutreffenden Auswahlmöglichkeiten ankreuzen)

☐Krankenhaus
☐Rehaklinik
☐Wahllogopädin (freier Praxis, selbstständige Logopädin)
☐Kassenlogopädin (freier Praxis, selbstständige Logopädin)
☐Kindergarten (Regelkindergarten)
☐Kindergarten (Förderkindergarten)
☐Volksschule (Regelschule)
☐Volksschule (SPZ)
☐Tagesklinik
☐Gesundheitszentrum
☐Andere (bitte anführen) …………………………………….

13. Wie finanziert sich Ihre Arbeitsstelle? (Bitte **alle** zutreffenden Auswahlmöglichkeiten ankreuzen)

☐privat (z.B. freie Praxis, Wahllogopäd*in: selbstständige Logopäd*in, Angestellte Logopäd*in in einer freien Wahlpraxis, Privatkrankenhaus, etc.)

☐öffentlich (z.B. gemeinnützige Organisation, Bildungsbereich, Zentrum für Entwicklungsförderung, Kassenlogopäd*in, staatliches Krankenhaus, etc.)

Appendix N BCT Survey (Stage 2; English and German)

BCT Fragebogen

BCT Survey

1) Wie hilfreich empfinden Sie die Anwendung von BCTs in der (logopädischen) Therapie von Kindern mit Aussprachestörungen im Allgemeinen?

1) How useful do you consider the application of BCTs in (speech and language) therapy of children with speech sound disorder in general?

☐sehr hilfreich (1) **(very useful)**

☐eher hilfreich (2) **(rather useful)**

☐eher nicht hilfreich (3) **(rather not useful)**

☐ nicht hilfreich (4) **(not useful)**

Nennen Sie 5 Gründe für Ihre Auswahl (fügen Sie bei Bedarf gerne weitere dazu):

Indicate 5 reasons for your choice (add more if needed):

1.
2.
3.
4.
5.

2a) Bewerten Sie die 17 BCTs für die Therapie von Kindern mit Aussprachestörungen in der **Spalte 2a)** der Tabelle 1 von **1= sehr hilfreich, 2= eher hilfreich, 3= eher nicht hilfreich bis 4= nicht hilfreich.**

2a) Rate the 17 BCTs for speech and language therapy of children with speech sound disorder in column 2a) of Table 1 from 1= very useful, 2= rather useful, 3=rather not useful to 4= not useful.

2b) Erstellen Sie in der **Spalte 2b)** der Tabelle 1 ein **Ranking** der 17 BCTs, wobei Ihre gewählte Reihenfolge Ihre persönliche Meinung bzgl. der „am hilfreichsten" BCTs wiederspiegelt – jedoch diese nicht bedeuten muss, dass das z.B. 17. BCT gar nicht hilfreich ist!

2b) Create a ranking of the 17 BCTs in column 2b), in which the chosen order reflects your personal opinion on how helpful the certain BCTs are. Note that the order does not indicate that the BCT mentioned in position 17. is not helpful at all!

BCT	2a) 1= sehr hilfreich, 2= eher hilfreich, 3=eher nicht hilfreich, 4=nicht hilfreich **1= very helpful, 2= rather helpful, 3= rather not helpful, 4= not helpful**	2b) Ranking 1 -17
1.1.Goal setting (behaviour)		
1.3.Goal setting (outcome)		
1.4.Action planning		
1.6. Discrepancy between current behaviour and goal		
2.2.Feedback on behaviour		
2.6. Biofeedback		
3.1. Social support (unspecified)		
4.1. Instruction on how to perform the behaviour		
6.1. Demonstration of the behaviour		
7.1. Prompts/cues		
8.1. Behavioural practice/rehearsal		
8.6. Generalisation of target behaviour		

10.2. Material reward (behaviour)		
10.3. Non-specific reward		
10.4. Social reward		
12.5. Adding objects to the environment		
14.8. Reward alternative behaviour		

3) Welche **5 BCTs** aus der Liste der 17 identifizierten BCTs für die **Therapie bei Kindern mit Aussprachestörungen** finden Ihrer Meinung nach in logopädischen Interventionen und im logopädischen Berufsalltag am häufigsten Anwendung?

3) Out of the 17 identified BCTs for therapy intervention with children with speech sound disorder, which 5 BCTs do you think are the most commonly used ones in SLT daily practice?

1.
2.
3.
4.
5.

4) Welche der 17 BCTs für die Therapie bei Kindern mit Aussprachestörungen könnten Ihres Erachtens nach auch in der Therapie von Kindern mit **Sprachentwicklungsstörungen** zur Anwendung kommen? Kreuzen Sie die entsprechenden BCTs an.

4) In your opinion, which of the 17 BCTs for speech sound disorder therapy could also be used in developmental language disorder therapy? Please tick the appropriate ones in the box.

BCT	Kreuzen Sie an **Tick the box**
1.1.Goal setting (behaviour)	

1.3.Goal setting (outcome)	
1.4.Action planning	
1.6. Discrepancy between current behaviour and goal	
2.2.Feedback on behaviour	
2.6. Biofeedback	
3.1. Social support (unspecified)	
4.1. Instruction on how to perform the behaviour	
6.1. Demonstration of the behaviour	
7.1. Prompts/cues	
8.1. Behavioural practice/rehearsal	
8.6. Generalisation of target behaviour	
10.2. Material reward (behaviour)	
10.3. Non-specific reward	
10.4. Social reward	
12.5. Adding objects to the environment	
14.8. Reward alternative behaviour	

5) Hat Ihnen das BCT Training bei der Analyse der Videos von den Therapiesequenzen geholfen, das Handeln und die Techniken der Therapeutin zu „besser“ zu erfassen und zu benennen, als vor dem BCT-Training?

5) Did the BCT Training and the video analysis of the therapy sequences help you to capture and name the actions and techniques of the therapist easier (“better”) than before the training?

☐ Ja Yes☐

☐ Nein No☐

Worauf haben Sie beim Analysieren der Videos vor dem BCT-Training und worauf haben Sie nach dem BCT Training geachtet?

When analysing the videos before receiving the BCT training, what did you look at/pay attention to?

VORHER **BEFORE**
NACHHER **AFTER**

6) Ordnen Sie zu, ob es sich bei den untenstehenden Angaben entweder um eine Methode oder eine Technik handelt.

6) Please assign whether the terms below are methods or techniques.

Angaben des Frameworks Terms of the Framework	logopädische Methode oder BCT SLT method or BCT
Corrective Feedback	
Einsatz von Spiegel	
Inputspezifizierung	
Ziele gemeinsam festlegen	

Erklärung/Verbildlichung der betroffenen Laute	
Vorzeigen	
Feedback geben	
Belohnungssystem	
Lob	
Kontrastierung	
Wiederholung	
Drill	
Vereinbarung mit dem Kind treffen (z.B über Wiederholungszahl)	
Verwendung Materialien	
Klare Anweisungen	

7) Fänden Sie das Lehren von BCTs für alle Fachbereiche des Logopädie - Phoniatrie - Audiologie Studiums sinnvoll?

7) Would you say that teaching BCTs in speech and language therapy studies would be useful?

☐ Ja Yes ☐

☐ Nein No ☐

Begründen Sie Ihre Antwort:

Please justify your answer:

Appendix O Confidentiality Agreement Participants (English and German)

Confidentiality agreement

from____
_ (first and last name of participant in block letters, hereinafter abbreviated to "participant") in relation to the following study (hereinafter abbreviated to "project"): "The effectiveness of behavior change techniques (BCTs) in interventions for children with developmental language disorders/speech sound disorders" and the related workshop: Behaviour Change Techniques and Speech Therapy - BCTs in interventions for children with pronunciation disorders/speech developmental disorders.

(expected) duration of the project 2022/2023 - workshop 2021/22

Project or study lead Melanie Dornstauder, MSc, BSc (hereafter referred to as "project lead" for short). On **XXX** (Date), I was informed by the project lead that I, as a participant, am subject to confidentiality and am obligated to maintain this confidentiality and to protect data secrecy.

Therefore, I hereby expressly undertake not to disclose any personal data or personal information about the persons interviewed/investigated within the framework of the project, in whole or in part, to third parties for the duration of the project in question and also after its termination.

I am aware that my duty of confidentiality extends not only to third party secrets, but also to all facts that are entrusted to me or become known to me in the course of or in connection with my participation; in particular, names and the personal affairs of the persons participating in the project as well as the affairs of the project. My duty of confidentiality exists in principle towards everyone, so also towards family members, other participants and also towards persons who have already gained knowledge of the fact in question.

I am aware that persons who are not entrusted with tasks within the framework of the project may not be granted access to any documents and other information (e.g., not even to persons related to my profession and/or other speech therapists, internship supervisors, etc.). I am also not allowed to take documents and information without the explicit permission of the project lead - not even as a copy - or store them on private media or give them to third parties. I am prohibited from collecting, processing - i.e. storing, changing, transmitting, blocking, deleting - or even using personal data without authorization. I am aware that only those data may be processed that are necessary for the specific participation.

I have been informed that my duty of confidentiality and my obligation to maintain data secrecy continue to apply even after the project or my participation has ended. All documents and any copies made of them as well as stored data must be returned to the project management immediately upon request, at the latest, however, after the end of the project or my participation. Any publication or other use of data from the project is prohibited. Furthermore, I have been informed that violations of data secrecy may be prosecuted. I have been given a copy of this declaration.

____

Place, date Signature of participant

Verschwiegenheitserklärung

von____

(Vor- und Nachname von Teilnehmer*in in Blockbuchstaben, im Folgenden kurz „**Teilnehmer*in**") in Bezug auf die folgende Studie (im folgenden kurz „**Projekt**"): „The effectiveness of behaviour change techniques (BCTs) in interventions for children with developmental language disorders/speech sound disorders" und dem damit in Zusammenhang stehenden **Workshop**: Behaviour Change Techniques und Logopädie – BCTs in Interventionen für Kinder mit Aussprachestörungen/Sprachentwicklungsstörungen

(voraussichtliche) Dauer des Projekts 2022/2023 – Workshop 2021/22

Projekt- bzw. Studienleitung Melanie Dornstauder, MSc, BSc (im Folgenden kurz „**Projektleitung**").

Ich wurde am **XXXXX (DATUM)** von der Projektleitung darüber aufgeklärt, dass ich als Teilnehmer*in der Verschwiegenheit unterliege und zu deren Wahrung sowie zum Schutz des Datengeheimnisses verpflichtet bin.

Hiermit verpflichte ich mich daher ausdrücklich, während der Dauer des gegenständlichen Projekts und auch nach dessen Beendigung keinerlei personenbezogene Daten oder persönliche Informationen über die im Rahmen des Projekts befragten/untersuchten Personen ganz oder teilweise an Dritte weiter zu geben.

Mir ist bekannt, dass sich meine Verschwiegenheitspflicht nicht nur auf fremde Geheimnisse erstreckt, sondern auch auf alle Tatsachen, die mir in Ausübung oder in Zusammenhang mit meiner Teilnahme anvertraut oder bekannt werden; insbesondere Namen und die persönlichen Angelegenheiten der an dem Projekt teilnehmenden Personen sowie die Angelegenheiten des Projekts. Meine Verschwiegenheitspflicht besteht grundsätzlich gegenüber jedermann, so auch gegenüber Familienangehörigen, anderen Teilnehmer*innen und auch gegenüber Personen, die von der betreffenden Tatsache bereits Kenntnis erlangt haben.

Mir ist bekannt, dass Personen, die nicht mit Aufgaben im Rahmen des Projekts betraut sind, kein Einblick in jegliche Unterlagen und sonstige Informationen gewährt werden darf (z.B. auch nicht an berufsverwandte Personen und/oder andere Logopäd*innen, Praktikumsanleiter*innen etc.). Auch darf ich Unterlagen und Informationen ohne ausdrückliche Erlaubnis der Projektleitung keinesfalls an mich nehmen – auch nicht in Abschrift oder Kopie – oder auf privaten Medien speichern bzw. an Dritte herausgeben. Es ist mir untersagt, unbefugt personenbezogene Daten zu erheben, zu verarbeiten – das heißt: zu speichern, verändern, übermitteln, sperren, löschen – oder überhaupt zu nutzen. Mir ist bekannt, dass nur diejenigen Daten verarbeitet werden dürfen, die für die konkrete Teilnahme erforderlich sind.

Ich wurde darüber aufgeklärt, dass meine Verschwiegenheitspflicht und meine Pflicht, das Datengeheimnis zu wahren, auch nach Beendigung des Projekts bzw. meiner Teilnahme fortbestehen. Sämtliche Unterlagen und evtl. davon angefertigte Kopien sowie gespeicherte Daten sind auf Aufforderung der Projektleitung, spätestens jedoch nach Ende des Projekts bzw. meiner Teilnahme dieser unverzüglich zurückzugeben. Jegliche Veröffentlichung oder sonstige Verwertung von Daten aus dem Projekt ist mir untersagt.

Darüber hinaus wurde ich darüber aufgeklärt, dass Verstöße gegen die Wahrung des Datengeheimnisses gerichtlich geahndet werden können.

Eine Kopie dieser Erklärung ist mir ausgehändigt worden/habe ich.

Ort, Datum   Unterschrift Teilnehmer*in

Appendix P Logothema Article and Call for Participation

WISSEN

Behaviour Change Techniques und Logopädie

Eine neue Methode im Fokus

Melanie Dornstauder

Melanie Dornstauder, BSc, MSc
hat ihr Logopädie-Phoniatrie-Audiologie Studium 2010 an der FH Campus Wien abgeschlossen. Sie studierte 2011-2014 berufsbegleitend an der University of Sheffield (UK), an der sie ein Masterstudium mit dem Schwerpunkt „Kindersprache" (Master of Science in Speech Difficulties) abschloss. Von 2016-2019 war sie als hauptberuflich Lehrende an der FH Campus Wien mit dem Schwerpunkt Forschung und Entwicklung tätig und nahm am internationalen Forschungsprojekt COST Action IS1406 teil. Seit 2019 ist sie als nebenberuflich Lehrende tätig und begann ihr Doktoratsstudium (PhD) in Speech and Language Sciences an der Newcastle University (UK). Sie arbeitet seit 2012 als freiberufliche Logopädin in 1220 Wien und gründete die Praxis Logopädie Dornstauder. Zuvor war sie im Allgemeinen Krankenhaus Wien (AKH) und bei der St. Nikolausstiftung als Logopädin tätig. Ihr großes Anliegen ist es, Forschung und Praxis im Sinne der evidenzbasierten Praxis in der Logopädie zu vereinen.

Im logopädischen Prozess kommen unterschiedliche Methoden, Techniken, Strategien und Programme zur Anwendung. Diese Begriffe werden häufig synonym verwendet und beinhalten meist Handlungs- und Vorgehensweisen für logopädische Interventionen. Die Ziele logopädischer Therapie können sehr unterschiedlich sein und reichen von der Verbesserung der aktuellen Situation unserer Patient_innen bis zur Erhaltung der physiologischen Fähigkeiten. Eines haben effektive logopädische Interventionen gemeinsam: Es findet eine Veränderung statt. Abhängig vom Kontext ist diese Veränderung meist als eine positive zu betrachten. Logopädische Interventionen werden aufgrund der vielen, sich gegenseitig beeinflussenden Komponenten als komplexe Interventionen angesehen (Craig et al., 2019). Da kein Kind, kein Patient und keine Patientin dem bzw. der anderen gleicht, sind bei der Anwendung von Therapieinterventionen viele Faktoren und Komponenten zu bedenken. Pauschallösungen und allgemein gültige Rezepte gibt es in der logopädischen Therapie kaum. Aber welche einzelnen Handlungsweisen verstecken sich in logopädischen Methoden, Techniken, Strategien und Programmen? Welche Handlungen setzen wir, um (positive) Veränderungen bei unseren Patient_innen herbeizuführen/ zu unterstützen? Und lassen sich die Handlungsweisen als aktive Komponenten der logopädischen Intervention einheitlich benennen und beschreiben? Es gibt viele offene Fragen bezüglich des „WAS" (bezogen auf Handlungsweisen - Was machen wir?), gefolgt von den Fragen nach dem wo, wann, warum, wer und „WIE" (bezogen auf die Umsetzung der Handlungsweisen - Wie setzen wir diese um?) (Marks et al., 2018). Wenn wir wissen wollen wie und warum logopädische Therapie wirkt (Wirkungsbedingungen), ist es wichtig, einheitlich und nachvollziehbar zu benennen, was wir tun. Grundlegend ist, die aktiven Anteile bzw. Komponenten der Therapie zu identifizieren und sich bewusst zu werden, was angewandt wird, um eine (positive) Veränderung herbeizuführen. Diese Details dann zu benennen und in weiterer Folge zu testen ist notwendig, um zu wissen, wie logopädische Interventionen funktionieren.

Präzises Beschreiben der Methoden

Die Profession Logopädie hat in den vergangenen Jahrzehnten eine bedeutende Entwicklung betreffend evidenzbasierter Praxis erlebt. Wirksamkeitsnachweise für logopädische Therapieansätze nehmen zu und die Erforschung dieser schreitet voran, auch wenn dies in unserem Bereich - aus mehreren Gründen - keine allzu leichte Aufgabe darstellt (z.B. Heterogenität und Komplexität der einzelnen Fälle, Anzahl der Forschungsstellen im Bereich der Logopädie). Dies zeigt sich auch in der Forschung, da vorhandene Studien sich oft stark in ihrer Forschungsmethode, Beschreibung und Durchführung unterscheiden, sodass einige aufgrund der fehlenden Vergleichbarkeit z.B. nicht in systematische Reviews inkludiert werden können (siehe Cochrane Review, Law et al.). Das präzise Beschreiben von Handlungsweisen (aktiven Komponenten) in verhaltensändernden Therapieinterventionen wird von mehreren Seiten aus zahlreichen Gründen befürwortet, wie zum Beispiel in den CONSORT Guidelines (Michie et al., 2013; Moher et al., 2003; Weinert, 2002). Aus der Perspektive der Forschung zum Beispiel, um Studien replizierbar zu machen und weitere Wirksamkeitsbelege generieren zu können, die sich wiederum auf die Praxis - die Behandlung unserer Patient_innen - auswirken. Darüber hinaus kann das Identifizieren und einheitliche Benennen von Handlungsweisen in der Praxis zu weiterer Transparenz bezüglich der Umsetzung von Therapieinhalten beitragen, eine Unterstützung für angehende Logopäd_innen sein, als auch als einheitliche Sprache der Vernetzung mit Kolleg_innen aller Disziplinen dienen.

Verhaltensändernde Techniken - Behaviour Change Techniques (BCTs)

Aus den genannten Gründen wurde am University College London (UCL) von Michie et al. (2013) aus dem Fachbereich der Psychologie (Center for Behaviour Change) eine Taxonomie names „Behaviour Change Technique Taxonomy Version 1 (BCTTv1)" mit Techniken zur Verhaltensänderung in einem mehrstufigen Verfahren erstellt. In der englischen als auch deutschen Fachliteratur werden diese verhaltensändernden Techniken „Behaviour Change Techniques" genannt, und mit „BCTs" abgekürzt. Aus Gründen der besseren Lesbarkeit und der einheitlichen Terminologie wird der Begriff auch im Deutschen mit „BCT" bzw. „BCTs" verwendet und abgekürzt. Eine BCT ist die „kleinste identifizierbare und replizierbare Komponente einer Intervention, die das Potential für die Änderung von Verhalten hat" (Michie et al., 2015). Die Taxonomie beinhaltet 93 BCTs, welche in 16 Kategorien eingeteilt wurden (z.B. „1. Ziele und Planung", „2. Verhalten beobachten und Feedback geben", „3. Soziale Unterstützung"). BCTs können sowohl einzeln als auch - wie in logopädischen Interventionen häufig der Fall - kombiniert verwendet werden. Die BCTTv1 ist nur eine von vielen Taxonomien, die für uns als Logopäd_innen von Nutzen sein können. Da diese jedoch spezifisch auf die verhaltensändernden Techniken in einer Intervention abzielt und der Fokus nicht auf der Beschreibung von Inhalten und Intensität (Dauer, Häufigkeit) liegt, kann sie helfen die aktiven Komponenten transparent zu beschreiben und die Handlungsweisen des logopädischen Prozesses zu definieren (Stringer & Toft, 2016a). Bislang wurden BCTs mehrheitlich im Bereich der Public Health und in der Gesundheitspsychologie (z.B. Strategien zur Förderung des regelmäßigen Händewaschens, Reduktion von Alkoholkonsum) angewandt (Michie et al., 2005). Zuletzt wurden BCTs und ein Modell zur Änderung von Verhaltensweisen (COM-B Model; Michie et al., 2014) im Zusammenhang mit der Verbreitung des Covid-19 diskutiert (Michie, 2020a; Michie et al., 2020b). Seit 2016 wird die Verwendung von BCTs für logopädische Interventionen erforscht (Toft & Stringer, 2017), da diese für alle verhaltensändernden Interventionen anwendbar sind (Law, 2019). Die Verwendung der Taxonomie in zahlreichen Interventionen und Forschungsprojekten verhalf, z.B. in der Psychologie, Physiotherapie, Ergotherapie und auch in Pilotprojekten in der Logopädie (Atkinson, in Arbeit; Michie et al., 2018; Toft & Stringer, 2017), bereits mehrmals zu einer einheitlichen und präzisen Beschreibung der Handlungsweisen (aktiven Komponenten). So findet man sowohl Studien, die bereits beim Planen und Entwickeln der Intervention mit BCTs und demnach den aktiven Komponenten und Handlungsweisen beschrieben wurden, als auch Interventionen, die im Nachhinein mit den BCTs codiert wurden.

BCTs und logopädische Interventionen – von Sprachentwicklungsstörungen bis zu Dysphagien

Einige Therapieinterventionen im Bereich der Sprachentwicklungsstörungen beschreiben den Therapieinhalt, die Therapieintensität und einzelne Techniken und Strategien - die aktiven Komponenten der Intervention - präzise und beziehen sich indirekt auf BCTs. Bei anderen fehlen Beschreibungen dieser Art (Toft & Stringer, 2017). Die ersten Versuche, in Interventionen für Sprachentwicklungsstörungen zu identifizieren, wurden an der Newcastle University (UK) unternommen (Atkinson, in Arbeit; Atkinson & Stringer, 2016; Spalding & Stringer, 2016). Während einer „Summerschool" wurden 2016 Therapieeinheiten beobachtet und gefilmt und mittels „video-enhanced observation (VEO)" von mehreren BCT-zertifizierten Logopäd_innen analysiert und vorhandene BCTs codiert. Vor kurzem wurden dann weitere Therapieeinheiten von Sarah Atkinson im Zuge ihres PhDs beobachtet und analysiert und die Ergebnisse – die identifizierten BCTs – mit den teilnehmenden Logopäd_innen besprochen. Vorläufige Ergebnisse der Videoanalysen, Beobachtungen und Diskussionen zeigen, dass bestimmte BCTs in logopädischen Interventionen für Sprachentwicklungsstörungen einerseits gehäuft auftreten (z.B. 2.2 Rückmeldung zum Verhalten, 8.1 Üben und Wiederholen und 10.4 Soziale Belohnung) und andererseits, dass diese „nicht bewusst" als Technik oder Methode angeführt werden. Aufgrund der unbewussten Anwendung werden viele Handlungsweisen demnach auch nicht als BCTs erkannt, benannt und beschrieben und bleiben so intransparent. Ebenso wurden weitere, logopädiespezifische BCTs erstellt, da man beobachtet hat, dass nicht alle BCTs, die in der logopädischen Intervention für Sprachentwicklungsstörungen vorkamen, auch in der derzeit bestehenden Taxonomie BCTTv1 zu finden sind (z.B. Prompte Selbstevaluierung der Äußerung, Verfolgung der Aufgabenvervollständigung). BCTs kamen auch in anderen logopädischen Bereichen bereits zur Anwendung. So veröffentlichten Toft & Stringer (2017) einen Review, welcher sich mit dem Beschreiben und Anwenden von Dysphagie-Interventionen auseinandersetzt, und kommen ebenso zu dem Ergebnis, dass BCTs bei der Anwendung von Dysphagie-Interventionen bereits seit jeher verwendet werden (z.B. Logemann's Beschreibung von „assistance" und „cheerleading", die in der BCTTv1 unter den Punkten „4.1 Anleitungen zum Ausführen eines Verhaltens" und „10.4 Soziale Belohnung" zu finden sind), jedoch nicht als solche benannt und beschrieben werden. Demnach zeigt sich allgemein, dass wir verhaltensändernde Techniken - BCTs - in der Logopädie bereits verwenden, jedoch nicht als solche bezeichnen, identifizieren und wissentlich beachten (Stringer & Toft, 2016a; Stringer & Toft, 2016b).

Perspektive Praxis – #forschenwir

BCTs sind folglich Handlungsweisen, die wir in der Praxis verwenden, jedoch nicht identifizieren und so bezeichnen. Daher ist es wichtig, den Fokus nun auf die Praxis zu legen und zu erforschen, welche BCTs wir verwenden und wie wir diese einsetzen, und ob sie wirksam sind. Deswegen führt der Weg nun von der Praxis in die Forschung. Im Setting und Geschehen der logopädischen Therapie, kann erkannt werden, welche BCTs innerhalb der unterschiedlichsten Therapieeinheiten in welcher Intensität und Abfolge/ in welchem Muster angewendet werden. Hierfür wurden bereits Therapieeinheiten mittels Videoaufnahmen aufgezeichnet und analysiert (Atkinson, in Arbeit). Ein weiterer Schritt besteht darin, zu untersuchen, ob und welche BCTs in der logopädischen Therapie effektiv und wirksam sind. Im Zuge meines PhDs an der Newcastle University (UK) widme ich mich den BCTs in der logopädischen Therapie von Sprachentwicklungsstörungen (=SES BCTs bzw. DLD BCTs). Der grobe Ablauf der Studie und Möglichkeiten zur Teilnahme am Projekt werden folgend kurz beschrieben: Derzeit wird ein BCT-Trainingsprogramm für Logopäd_innen und Logopädie-Studierende entwickelt. Teilnehmende Logopäd_innen und Studierende werden in zwei Gruppen eingeteilt, und es wird zunächst eine BCT-Trainingsgruppe, die das BCT-Training »

» zu Beginn durchlaufen wird, und eine Kontrollgruppe, die das BCT-Training auf Wunsch gerne nach Durchführung der Studie erhält, geben. Die BCT-Trainingsgruppe führt anschließend Therapieeinheiten unter Berücksichtigung der Anwendung von randomisierten, einzelnen BCTs und/ oder Sets von mehreren BCTs (vorherig ermittelte Ergebnisse des Projektes werden dies zeigen) durch, wohingegen die Kontrollgruppe die Therapieeinheiten wie gewohnt durchführt. Die Profile der Kinder werden sorgfältig und in den wichtigsten Parametern übereinstimmend ausgewählt. Bei diesem Projekt kann jede Logopädin und jeder Logopäde teilnehmen, die oder der Kinder mit Sprachentwicklungsstörungen in Österreich therapiert. Die Teilnahme von freiberuflichen und angestellten Kolleg_innen wird unterstützt und ist von großem Interesse für dieses Projekt, da unsere praktische Arbeit eine wichtige Säule dieser Studie darstellt. Die Termine für das Trainingsprogramm 2021 werden demnächst festgelegt. Wenn Sie schon jetzt neugierig geworden sind, laden Sie sich die BCTTv1 herunter und machen Sie sich ein Bild von den einzelnen Kategorien. Jede BCT ist mit einer detaillierten Beschreibung und einem Beispiel versehen. Das Team des UCL hat zudem eine App für Smartphones und Tablets entwickelt, die man im App-Store unter „BCT Taxonomy" findet. Ein kostenloses Online-Training zur Verwendung der BCTTv1 und die Taxonomie selbst finden Sie unter www.bct-taxonomy.com (ebenso finden Sie eine deutschsprachige Version von Göhner et al. (2016) über Online-Suchmaschinen). Es ist interessant, sich die einzelnen BCTs durchzudenken, und dann die eigenen Therapieeinheiten zu reflektieren und sich zu überlegen, welche BCTs man bereits selbst in der logopädischen Therapie anwendet.

Die bewusste Anwendung der BCTTv1 kann helfen, die aktiven Komponenten in logopädischen Interventionen zu identifizieren, transparent und einheitlich zu benennen und zu beschreiben, sowie zu verstehen, was getan wird, um eine Veränderung im Verhalten herbeizuführen und den Zustand der Patient_innen positiv zu unterstützen. Ebenso helfen BCTs sich genau zu überlegen, welches Verhalten man mit dem Gegenüber verändern möchte, woran man arbeiten „möchte" (z.B. Herstellen eines triangulären Blickkontaktes), Ziele zu definieren und sich zu überlegen welche BCTs eingesetzt werden, um diese Ziele zu erreichen. Die Taxonomie könnte Studierenden ermöglichen, Handlungsweisen transparenter zu erkennen, zu benennen und zu verstehen und daher die Therapieplanung und praktische Umsetzung zu unterstützen. Bei der Entwicklung neuer Therapieinterventionen können BCTs eine interdisziplinäre und einheitliche Sprache bieten. Die Forschung, Logopäd_innen und weiterführend das Wichtigste in unserem Beruf - unsere Patient_innen und deren Versorgung - können profitieren, da Studien mit einer Beschreibung der aktiven Komponenten anhand von BCTs besser replizierbar wären und das Testen von Wirkungsnachweisen erleichtert werden könnte. Unter dem Motto #forschenwir bitte ich Sie herzlich, sich für diese Studie anzumelden (via E-Mail an md@logopaedie-dornstauder.at) und zusammen mit Kolleg_innen und mir an diesem Projekt zu forschen, denn die Details der logopädischen Therapie zu erfassen ist wesentlich, um zu verstehen, wie logopädische Interventionen wirken. •

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Appendix Q Single Answers BCT Survey (Stage 2)

BCT survey, 3.3.3.1: Ten Reasons why BCTs are useful for SSD interventions, each mentioned once:

1. Arbeitsgenauigkeit gesteigert

translation: working accuracy increased

2. Verschiedene Kanäle werden angesprochen: auditiv, visuell, Eigenwahrnehmung

translation: different channels are addressed: auditory, visual, self-perception

3. Theoretischer Zugang zu BCTs (war spannend)

translation: theoretical approach to BCTs (was exciting)

4. Mögliche Quantifizierung

translation: possible quantification

5. Durch das Feedback können die Kinder feststellen wo sie stehen

translation: feedback allows the children to see where they stand

6. klarere Strukturierung einer Therapieeinheit

translation: clearer structuring of a therapy session

7. Im Nachhinein sieht man welche BCTs für welches Kind hilfreich sind

translation: in retrospect you can see which BCTs are helpful for which child

8. einfach anwendbar

translation: easy to apply

9. Auf alle Störungsbilder anwendbar

translation: applicable to all disorders

10.praxisnah

translation: practical

Five reason why BCTs are not useful for SSD intervention, mentioned once:

1. Man kann nie ganz sicher sein, ob alle das gleiche darunter verstehen.

translation: You can never be quite sure whether everyone understands the same thing by it.

2. Nachteil: Es fehlen Kodierungen für einige Verhalten, die sehr wichtig sind, die aber nicht immer direkt auf das Zielverhalten bezogen sind. Da die Allianz/Beziehung zum Kind aber sehr wichtig ist, sind sie trotzdem höchst relevant. Wichtig, dass diese nicht verloren gehen, weil man sich ‚nur' auf die bisher genannten BCTs konzentriert.

translation: Disadvantage: There is a lack of coding for some behaviours that are very important but not always directly related to the target behaviour. However, as the alliance/relationship with the child is very important, they are still highly relevant. Important not to lose these by focusing 'only' on the BCTs mentioned so far.

3. Ich persönlich interessiere mich nicht für sehr kleinteilig analysiertes Verhalten, obwohl ich natürlich den Sinn dahinter im Zuge einer Forschung total sehe.

translation: I personally am not interested in very small-scale analysed behaviour, although of course I totally see the point behind it in the course of a research.

4. zeitaufwändig

translation: time-consuming

5. Ich habe nicht das Gefühl, dass es mich zu einer ‚besseren' oder effizienteren oder spannenderen Therapeutin macht, zu wissen, welches BCT es war, als ich in einer Situation ‚mach mal /r/' gesagt habe.

translation: I don't feel that knowing which BCT it was when I said 'do /r/' in a situation makes me a 'better' or more efficient or more exciting therapist.

Appendix R SSD BCT List

These 7 BCTs are the ones we use in the subsequent workshop.

Diese 7 BCTs sind diejenigen, die wir nun im folgenden Workshop verwenden.

BCT SSD list 2021/2022

1.4. Action planning
2.2. Feedback on behaviour
4.1. Instruction on how to perform the behaviour
6.1. Demonstration of the behaviour
7.1. Prompts/cues
8.1. Behavioural practice/rehearsal
10.4. Social reward

Appendix S Work Experience Survey Students Stage 3 (English and German)

Behaviour Change Techniques in speech and language therapy for children with speech sound disorder

Workshop 17.12.2021 & 07.-08.01.2022, Melanie Dornstauder

Some personal information about participating Speech and Language Therapy Students, Workshop Stage 3

This short survey aims to collect some basic information about you, your qualification and your previous work setting. This data will be used anonymously to explore and analyse data collected within the workshop. By filling out and returning the questionnaire you obtain consent.

1. Gender:

 m ☐

 w ☐

 d ☐

2. Age

 20-30☐

 31-40☐

 41-50☐

 51-60☐

 60+☐

3. a. Level of previous professional qualification

 ☐Higher school certificate (German: Matura/Abitur)

 ☐Non-university: Diploma

 ☐University: Undergraduate/ Bachelor degree

 ☐University: Masters degree

 ☐University: Dr. (PhD)

 ☐University: Other (e.g., Diploma) ………………………………………

3. b. If you have already completed another professional education/university degree, in which field did you complete this? (please write the name of the field below)

……………………………………………………………………………………………………

4. a. Do you have one or more people in your private surrounding who is working in the health and/or social field?

Yes ☐

No ☐

4. b. If 4. a. is YES: The person is:

Former legal gurdian ☐

Grandparents ☐

Siblings ☐

Life partner ☐

other: ………………………… ☐

5. How many sessions of children with speech sound disorder could you observe (shadow?) in your internships already?

1-5☐

6-10☐

11-15☐

16-20☐

21-25☐

26-30☐

31-35☐

36-41☐

More than 41 ☐

6. How many children sessions with speech sound disorder could you carry out under guidance of a SLT in your internships already?

1-5☐

6-10☐

11-15☐

16-20☐

21-25☐

26-30☐

31-35☐

36-41☐

More than 41 ☐

7. How old are children with speech sound disorder you could observe or work with in your internship? (please tick all that apply)

☐0-3;11 Jahre
☐4-6;11 Jahre
☐7-11;11 Jahre
☐12-16;11 Jahre
☐17+ Jahre

8. Which concepts/therapy interventions for working with children who show speech sound disorders could you observe in your internships?

………

………

………

Behaviour Change Techniques in der logopädischen Therapie von Ausspracheströrungen

Workshop 17.12.2021 & 07.-08.01.2022, Melanie Dornstauder

Erhebung Persönlicher Informationen teilnehmender Student*innen aus dem Logopädie-Phoniatrie-Audiologie Studiengang

Hier werden grundlegende Informationen über Sie, Ihre Qualifikationen und ihr bisheriges Arbeitsumfeld erhoben. Diese Daten werden, **ausschließlich in anonymisierter Form**, zur Erläuterung und Bearbeitung der Stichprobe (Gruppe) bei der Auswertung der Daten berücksichtigt. Mit dem Ausfüllen und Zurücksenden dieses Fragebogens erklären Sie sich hiermit einverstanden.

1. Geschlecht:

m ☐

w ☐

d ☐

2. Alter

20-30☐

31-40☐

41-50☐

51-60☐

60+☐

3. a. Level der bisherigen beruflichen Qualifikation

☐anderer nicht-universitärer Abschluss (z.B. Akademie, nicht-universitäres Diplom)

☐Fachhochschule/ Universität: Bachelorabschluss

☐Fachhochschule/ Universität: Masterabschluss

☐Universität: Doktorat/ Promotion

☐Universität: andere Abschlüsse: ……………………………………….

3. b. Falls Sie bereits eine Berufsausbildung/ein Studium abgeschlossen haben, in welchem Bereich ist dies der Fall? (Name der Ausbildung/des Studiums bitte anführen)

…………………………………………………………………………………………………

4. a. Haben Sie in Ihrem näheren, engen familiären oder partnerschaftlichen Umfeld eine oder mehrere Personen, die einen Beruf im Gesundheits – und/oder Sozialwesen ausüben?

Ja ☐

Nein☐

4. b. Wenn 4. a. JA: Die Person ist:

(ehem.) Erziehungsberechtigte/r ☐

Großeltern ☐

Geschwister ☐

Lebenspartner*in ☐

Andere: ………………………… ☐

5. Wie viele Therapieeinheiten mit Kindern mit Ausspracheströungen haben Sie in den bisherigen Praktika bereits <u>gesehen</u>?

1-5☐

6-10☐

11-15☐

16-20☐

21-25☐

26-30☐

31-35☐

36-41☐

Mehr als 41 ☐

6. Wie viele Kinder mit Ausspracheströungen haben Sie bereits <u>unter Anleitung therapiert</u>?

1-5☐

6-10☐

11-15☐

16-20☐

21-25☐

26-30☐

31-35☐

36-41☐

Mehr als 41 ☐

7. Welcher Altersgruppe(n) gehören Kinder, die Sie bereits in Therapieeinheiten gesehen oder unter Anleitung therapiert haben an? (Bitte **alle** zutreffenden Auswahlmöglichkeiten ankreuzen)

☐0-3;11 Jahre
☐4;0-6;11 Jahre
☐7;0-11;11 Jahre

☐12;0-16;11 Jahre
☐17;0+ Jahre

8. Welche Therapiekonzepte/Therapieprogramme haben Sie in der Therapie von Kindern mit Aussprachestörungen bereits in der Anwendung in ihren Praktika gesehen?

……………………………………………………………………………………………………

……………………………………………………………………………………………………

……………………………………………………………………………………………………

Appendix T BCT Survey Stage 3 (English and German)

BCT Fragebogen

BCT Survey

1a) Wie hilfreich empfinden Sie die Anwendung von BCTs in der (logopädischen) Therapie von Kindern mit Ausspracheströrungen im Allgemeinen?

1a) How useful do you consider the application of BCTs in (speech and language) therapy of children with speech sound disorder in general?

☐sehr hilfreich (1) **(very useful)**

☐eher hilfreich (2) **(rather useful)**

☐eher nicht hilfreich (3) **(rather not useful)**

☐ nicht hilfreich (4) **(not useful)**

1b) Nennen Sie 5 Gründe für Ihre Auswahl (fügen Sie bei Bedarf gerne weitere dazu):

1b) Indicate 5 reasons for your choice (add more if needed):

1.
2.
3.
4.
5.

2a) Bewerten Sie die 7 BCTs für die Therapie von Kindern mit Aussprachestörungen in der **Spalte 2a)** der Tabelle 1 von **1= sehr hilfreich, 2= eher hilfreich, 3= eher nicht hilfreich bis 4= nicht hilfreich.**

2a) Rate the 7 BCTs for speech and language therapy of children with speech sound disorder in column 2a) of Table 1 from 1= very useful, 2= rather useful, 3=rather not useful to 4= not useful.

2b) Erstellen Sie in der **Spalte 2b)** der Tabelle 1 ein **Ranking** der 7 BCTs, wobei Ihre gewählte Reihenfolge Ihre persönliche Meinung bzgl. der „am hilfreichsten" BCTs wiederspiegelt – jedoch diese nicht bedeuten muss, dass das z.B. 7. BCT gar nicht hilfreich ist!

2b) Create a ranking of the 7 BCTs in column 2b), in which the chosen order reflects your personal opinion on how helpful the certain BCTs are. Note that the order does not indicate that the BCT mentioned in position 7. is not helpful at all!

BCT	2a) 1= sehr hilfreich, 2= eher hilfreich, 3=eher nicht hilfreich, 4=nicht hilfreich **1= very helpful, 2= rather helpful, 3= rather not helpful, 4= not helpful**	2b) Ranking 1 -7
1.4.Action planning		
2.2.Feedback on behaviour		
4.1. Instruction on how to perform the behaviour		
6.1. Demonstration of the behaviour		
7.1. Prompts/cues		
8.1. Behavioural practice/rehearsal		
10.4. Social reward		

3) Welche **5 BCTs** aus der Liste der 7 identifizierten BCTs für die **Therapie bei Kindern mit Aussprachestörungen** finden Ihrer Meinung nach in logopädischen Interventionen und im logopädischen Berufsalltag am häufigsten Anwendung?

3) Out of the 7 identified BCTs for therapy intervention with children with speech sound disorder, which 5 BCTs do you think are the most commonly used ones in SLT daily practice?

1.
2.
3.
4.
5.

<u>4) Welche der 7 BCTs für die Therapie bei Kindern mit Aussprachestörungen könnten Ihres Erachtens nach auch in der Therapie von Kindern mit **Sprachentwicklungsstörungen** zur Anwendung kommen? Kreuzen Sie die entsprechenden BCTs an.</u>

<u>**4) In your opinion, which of the 7 BCTs for speech sound disorder therapy could also be used in developmental language disorder therapy? Please tick the appropriate ones in the box.**</u>

BCT	Kreuzen Sie an **Tick the box**
1.4.Action planning	
2.2.Feedback on behaviour	
4.1. Instruction on how to perform the behaviour	
6.1. Demonstration of the behaviour	
7.1. Prompts/cues	
8.1. Behavioural practice/rehearsal	
10.4. Social reward	

<u>5a) Hat Ihnen das BCT Training bei der Analyse der Videos von den Therapiesequenzen geholfen, das Handeln und die Techniken der Therapeutin zu „besser“ zu erfassen und zu benennen, als vor dem BCT-Training?</u>

<u>**5a) Did the BCT Training and the video analysis of the therapy sequences help you to capture and name the actions and techniques of the therapist easier (“better”) than before the training?**</u>

☐ Ja	Yes☐
☐ Nein	No☐

5b) Worauf haben Sie beim Analysieren der Videos vor dem BCT-Training und worauf haben Sie nach dem BCT Training geachtet?

5b) When analysing the videos before receiving the BCT training, what did you look at/pay attention to?

VORHER **BEFORE**
NACHHER **AFTER**

6) Ordnen Sie zu, ob es sich bei den untenstehenden Angaben entweder um eine Methode oder eine Technik handelt.

6) Please assign whether the terms below are methods or techniques.

Angaben des Frameworks Terms of the Framework	logopädische Methode oder BCT SLT method or BCT
Corrective Feedback	
Einsatz von Spiegel	
Inputspezifizierung	
Ziele gemeinsam festlegen	
Erklärung/Verbildlichung der betroffenen Laute	
Vorzeigen	
Feedback geben	
Belohnungssystem	

Lob	
Kontrastierung	
Wiederholung	
Drill	
Vereinbarung mit dem Kind treffen (z.B über Wiederholungszahl)	
Verwendung Materialien	
Klare Anweisungen	

7a) Fänden Sie das Lehren von BCTs für alle Fachbereiche des Logopädie - Phoniatrie - Audiologie Studiums sinnvoll?

7a) Would you say that teaching BCTs in speech and language therapy studies would be useful?

☐ Ja Yes ☐

☐ Nein No ☐

7b) Begründen Sie Ihre Antwort:

7b) Please justify your answer:

Appendix U Single Answers BCT Survey (Stage 3)

BCT survey, 4.2.4.1: Nine Reasons why BCTs are useful for SSD interventions, each mentioned once:

1. Man beschäftigt sich mit dem Mehrwert, den man durch seine Aussage vermittelt oder eben nicht.

translation: one deals with the added value that one conveys through one's statement or not.

2. Qualitätskontrolle

translation: quality control

3. Unterscheidung zwischen Methode und BCT

translation: differentiation between method and BCT

4. Evidenzbasiertes Therapieren

translation: evidence-based therapy

5. Jedes einzelne ist wichtig für die logopädische Therapie

translation: each one is important for SLT

6. Erleichtern die Zielsetzung (z.B. Instruction on behaviour)

translation: facilitate goal setting (e.g., instruction on behaviour)

7. Man kann durch die BCTs besser argumentieren wofür was in der Therapie gut ist

translation: through BCTs one can better argue what is good for in therapy

8. Man kann sich mit den BCTs eine Art Richtlinie erschaffen in der Kommunikation mit den Kindern

translation: with the BCTs one can create a kind of guideline in the communication with the children.

9. Machen logopädische Arbeit quantifizierbar

translation: make speech therapy work quantifiable

One reason why BCTs are not useful for SSD intervention, mentioned once:

1. Ich habe eher hilfreich angekreut, da das Kodieren einer Therapieeinheit auch viel Zeit beanspruchen kann, besonders wenn man noch nicht darin geübt ist. Es ist anfangs auch herausfordernd die verschiedenen Ansichtsweisen hinter den BCTs richtig zu verstehen und zuzuordnen.

translation: I ticked rather helpful because coding a therapy session can also take a lot of time, especially if you are not yet practised at it. It is also challenging at first to correctly understand and assign the different views behind the BCTs.