THE FUTURE OF LEARNING: IMPLEMENTATION OF SOLE IN A SAUDI PRIMARY SCHOOL

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Abstract

Over the last three decades, increased attention has been given to different forms of computer supported collaborative learning within the classroom. One such example is Self-Organised Learning Environments (SOLEs), in which students are supposed to work collaboratively using the Internet to answer a question with minimum teacher intervention. A number of empirical studies have indicated the effectiveness of using SOLE to improve learners' academic performance when working in small cooperative groups. However, there have been no previous studies conducted in Saudi Arabia or even the Arab world in general, where SOLE is considered to be a new teaching and learning approach. This study is therefore a pioneer in the education field in Saudi Arabia that attempts to improve the traditional patterns of teaching in Saudi primary schools through introducing a new method and exploiting new sources of learning and specifically the Internet. The study also seeks to highlight the barriers in the face of introducing and implementing such methods to draw the attention of policymakers in Saudi Arabia in order to avoid them.

The current study has adopted an action research approach as a methodology through exposing a group of 28 primary school children in Riyadh city in Saudi Arabia to 10 SOLEs sessions over a period of 14 weeks. During these sessions, the participants' activities were observed and their perceptions were surveyed. More specifically, students' academic and social behaviour were observed and their opinions about learning within SOLE and how it compares to traditional classroom experience were surveyed. In addition, the parents of these children, their classroom teacher, the school head teacher and 17 other teachers from the same school were either surveyed or interviewed to explore opinions about SOLEs, perceptions of the participating pupils about SOLEs experience, and the challenges that might face introducing SOLEs into Saudi schools.

The findings indicate that engaging in SOLEs benefited students academically and socially. However, teamwork faced challenges as the students were internally dissatisfied with the role of an individual, equity and involvement in the group and they could not manage their interactions. Based on this, it is argued that more time seems required to achieve adequate social skills by students coming from traditional environment classrooms such as in Saudi Arabia, but teacher intervention might save time in this respect through facilitating group work and speeding up the acquisition of collaborative skills. Moreover, the results of this study revealed a number of challenges for integrating digital-technology-based learning such as SOLEs in Saudi schools. These challenges are the lack of students' skills in working in a collaborative learning setting, the lack of resources (computers and Internet connection) and technical support and the lack of school time due to dense curriculum and high teacher workload. In addition, there is a deficiency in teacher training and specifically about how to integrate innovation teaching approaches in current curriculum effectively.

The study concludes with a discussion of the implications for researchers, practitioners and educational policy, and recommendations for further research. Despite the challenges, the study concurs with the value of the SOLEs approach as a realistic and effective method to help the Ministry of Education in Saudi Arabia to achieve the 2030 Kingdom's vision.

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Chapter 1. Introduction

1.1 My background as a teacher and researcher

As a Saudi national, I received my primary, middle and secondary school education in Saudi Arabia and specifically in Al Dammam District in the end of 1980s and through 1990s. Then, I completed my Bachelor's Degree in Mathematics in, what is now called, Price Nourah University, Riyadh, in 2001. This was followed in 2002 by a one-year postgraduate Diploma in teacher education at the same university. I started my career as a math teacher in 2003 in Saudi schools moving from one area to another across Riyadh, Eastern and Northern districts. Following this in September 2015, I moved to the UK to complete my MA and PhD studies in Education at Newcastle University.

Looking back at my learning experience as a student, I still remember myself passively sitting in the classroom listening to a teacher, who was lecturing all the time. During those years, I was required to memorise information given by the teacher and should keep them in my head through continuous revisions until the day of the exam. Success in exams was mainly about how much information I could remember and write down. The image of this little girl listening passively during classes and trying very hard to memorise information by heart kept coming back to my head even a decade later when I became a teacher. Such not very positive and tiring experiences as a learner pushed me to try to change students' experiences when I started to become the controller in the classroom as a teacher. I tried to involve students more in learning through engaging them in collaborative activities, during which they can share answers with peers and express their opinions. However, despite my serious attempts to create a more collaborative learning environment and my personal effort to take every chance to improve myself as a teacher, the exam-oriented educational polices in the country (see Section 1.4.2) put limits to my endeavours and led me to replicate the same classroom environment I was trying to avoid. The teacher training I received during those years did not make the situation better because it focused on training teachers on how to follow the instructions rather than how to improve students' experiences.

When I entered the classroom for the first time as a teacher in 2003, I noticed the presence of a projector screen, which I was told I could use to present the teaching content. This was an interesting departure from how I was taught and thus I started transferring the paper textbook materials into PowerPoint slides to use on the projector screen. Later on in 2009, Smart Boards were introduced into Saudi classrooms and we were asked to use them in our lessons. I, similar to other teachers, had to make great efforts to teach myself how to use this new technology in an effective way. Although I received training, this focused on the use of Smart Boards in general and wasn't on the specific tools I could use in a math lesson. Such training did not really encourage many teachers to use the Smart Boards. Even those who managed to use this technology, myself included, had soon to abandon it because of the lack of technical support and maintenance.

In addition to projectors and Smart Boards, the schools where I worked over 17 years, similar to most schools in Saudi Arabia, had access to some computers. These computers were expected to be used by teachers and students for educational purposes. However, these devices were kept untouched because we, as teachers, did not know how to use them in our classrooms or what addition they can offer. So, despite the presence of useful technology under our hands, we did not utilise it to improve students' learning experiences. This has instigated my curiosity to know how such technology, particularly computers, can be used effectively in our classrooms. This is indeed my aim from this research; the current study is a piece of action research that seeks to investigate the application and effectiveness of a new learning approach, namely Self-Organised Learning Environments (SOLEs), which allows teachers to use available technologies to enrich Saudi students' learning experience.

1.2 My motivation

My motivation for this study can be divided into two parts. While the first is related to conducting a study in Saudi schools, the second is concerned with specifically using SOLE as an approach to be tested in Saudi Arabia. Starting with the first, as a student and teacher in

Saudi schools, my main motivation is the current situation in the schools of Saudi Arabia and my desire to improve it. Based on my experience in Saudi schools as a student three decades ago and as a teacher since 2003, what I experienced as a student did not differ much from what my students currently are going through in their learning journey; lecturing is still the main teaching method and memorization is how students should approach learning. In those classrooms, the teacher's attention is focused on controlling students and the class environment to have a chance to deliver the curriculum for tests or examinations rather than giving students enough time to ask questions during class with little concern about transferable skills or extracurricular activities. There are few opportunities for learners to think deeply, reflect or investigate ideas through projects and research especially in public primary schools in Saudi Arabia.

My teaching experience for the past 17 years and my readings while I am doing postgraduate studies in the United Kingdom have shaped my perspective on how to enhance education in Saudi schools. Through my experience as a teacher, I have had the chance to look at the situation of education in the country. What has struck me most, as already mentioned above, is that despite the availability of technological tools such as computers or smart boards in Saudi schools, these are not put into use in learning and teaching. Based on my experience, I believe that this might be due to the absence of a clear strategic framework and pedagogy that allow teachers to incorporate these technological tools into their sessions. This framework should include elements such as technical support staff, training for teachers on how to use technology effectively in the classroom, collaboration among teachers, support provided by head teachers in addressing teachers' computer-related technical concerns, and resource availability.

Moreover, a large body of research in the international context (e.g. Smeets, 2005, Plowman et al., 2008, Chen, 2014, Al Kandari and Al Qattan, 2020) has stressed the importance of technology integration at primary schools through learning approaches such as enquiry-based

learning, collaborative learning and network-based learning to improve students' skills, support student participation and interaction and provide opportunities for knowledge construction.

The Ministry of Education (MoE) in Saudi Arabia has introduced many projects to develop education and technology integration (see Section 1.5.3). The focus is to change the philosophy of education from teacher-based instruction to student-centred instruction. This is a shift from the traditional way of teaching and learning to more sophisticated approaches that can engage students better and give them opportunities to be responsible for their own learning. The intention is also to equip students with educational skills such as research skills, cooperation, social skills and problem solving, which are fundamental for the 21st century.

However, despite the efforts made to reform the Saudi education system in this direction, the situation has not changed; as indicated by MoE (2020) in Saudi Arabia, the gap is widening between what is provided through education and what is required in the job market in the country. MoE (2020) has stressed that school education should not only focus on providing basic knowledge, but it should strive to equip students with educational skills such as critical thinking, problem solving and decision making and social skills such as leadership, communication and collaboration.

Furthermore, as for my motivation to use SOLE, this is actually linked to my postgraduate study experience in the UK. Coming to the UK and doing an MA in the field of education enlightened me about learning theories and added a different dimension to my teaching experience. My focus during the MA programme, and even here in my PhD thesis, has been on students in their primary years in school and what they need to be more successful and lifelong learners through, for example, integrating technology in their learning. In the early

classes of my Master's degree, I attended a module named ‘Future of Learning’ led by Sugata Mitra, the founder of SOLE. This module, among others (especially the school placement class), inspired me to think of a variety of creative tools and methods to teach students in a more interactive learning style than is often seen in my culture. SOLE is one of these innovative methods.

Linking my interest and focus during my study experience to the research at hand, the shortcomings in the education system in Saudi Arabia highlighted above, as also asserted by some educators and researchers (e.g., Algarni and Male, 2014, Alturki, 2016, Almulla, 2017, Vision 2030, 2020), can be addressed by introducing new approaches that can enhance students’ educational experience and skills. Such approaches need to take into consideration the availability of technological tools in Saudi schools and the lack of effective use of these tools.

Conducting action research study on SOLE is motivated by my belief that this pedagogical approach has the potential to work effectively in Saudi Arabia. To clarify further, I found that the SOLE approach is compatible with my ambition to introduce a new method of education that has features of collaborative and enquiry-based learning that can improve students’ educational and social skills. This approach can, at the same time, make use of technology, specifically the internet, to develop students’ research skills. The following section provides more background information about the current study.

1.3 Background of the study

As mentioned above, to develop the practice in Saudi Arabia schools, I investigate in this study the application and effectiveness of SOLE in primary schools in Saudi Arabia. This section describes how the SOLE approach works and its underlying assumptions.

In a SOLE session, which lasts between 30 and 90 minutes, students are asked to choose their own groups and sit together in front of a computer connected to the Internet. Students are given a 'big question' to research and answer and then, they are expected to present what they have learned at the end of the session. The core idea of SOLE is to create the optimal conditions in which students can collaborate to teach themselves within a more traditional school setting, while using the Internet connection with minimal teachers' intervention (Mitra, 2015).

It is believed that the SOLE approach provides spaces in which spontaneous creativity and unexpected learning can occur (Mitra, 2005, Dangwal and Kapur, 2009, Mitra, 2014). These researchers believe that learning is triggered by students' innate sense of wonder and engagement in child-driven learning that is mostly controlled by themselves. Further, SOLE is a curiosity-driven and collaborative enterprise that seeks to engage children's interest in important questions and support children in exploring ideas and sharing discoveries (Dangwal and Kapur, 2009). In addition, this approach is believed to provide students with new skills such as critical thinking and problem solving, communication, collaboration and technology literacy (Mitra, 2014).

The SOLE approach was developed from the 'Hole-in-the-Wall' experiment (i.e., the unsupervised use of the Internet by a group of children) carried out by Mitra between 1999 and 2006 (Mitra, 2003, Mitra, 2005, Dangwal et al., 2006), which had interesting and highly controversial results (Sowey, 2013). The experiment involved the installation of computers connected to the Internet within a wall, operating in English, in Kalkaji, a suburb of New Delhi, India and then repeated in villages across India. The children's interactions with the computers were monitored by the researchers. They found that groups of street children

learned to use computers and the Internet by themselves, with little or no knowledge of English and never having seen a computer before. It was assumed that the learning was a result of collaboration, peer tutoring and random exploration driven by the children's innate sense of wonder (Dangwal and Kapur, 2008).

Upon the completion of lengthy research, Mitra (2005) suggests that children can achieve educational objectives without direct intervention from adults (Minimally Invasive Education) with the use of the Internet. He believes that children's desire to learn, along with their curiosity and peer interaction, drives them to explore the environment in order to satisfy their inquisitiveness. Dangwal and Kapur (2008) clarify this stating that "as children explore their environment, they relate their new experience to their previous experience and thereby new learning takes place" (pp. 339-340). The findings of Mitra's studies conducted between 1999 and 2006 support this conclusion that the 'Hole-in-the-Wall' experiment was successful because it elicited the children's interest and curiosity by introducing computers, which were considered novel to them. The children felt happy and excited during the experiment and showed a desire to learn.

In 2009, Mitra and Crawley (2014) applied the 'Hole-in-the-Wall' approach in a UK school. It was named Self-Organised Learning Environments (SOLEs). In addition, similar research studies have been conducted across the world to test the SOLE approach (Mitra and Quiroga, 2012; Rix and McElwee, 2016; Vega, 2018; Ma, 2018). These studies reached the same conclusion stating that SOLE succeeded in improving students' academic performance to some extent and positively influencing students' social and learning behaviour. In addition, students perceived SOLE activities as an interesting and beneficial way of learning.

The SOLE approach has been perceived as innovative and an idea worth spreading by TED conference. In the spring of 2013, Prof Sugata Mitra was awarded the TED Prize (a million-dollar prize) for showing that in adult unaided environments children can teach each other many things using computers. This prize was used by Mitra to establish and run SOLE centres, known as the 'School in the Cloud', in the UK and India (Mitra, 2015). These centres encourage pupils to take responsibility for their learning through working collaboratively to answer exciting questions using the internet. Further, in a strategy to encourage learners' curiosity called 'the Granny Cloud', pupils can network with e-mediators known as 'grannies' through a Skype video conferencing (Clark and Hall, 2011; Mitra, 2015).

Nevertheless, whilst some research has been carried out on the SOLE approach, it is still in need of further investigation to uncover its effects and the feasibility of introducing it into schools. Previous SOLE research has focused on comparing the performance of SOLE students against standard learning outcomes expected to be achieved by school students at a specific level. There is however a lack of research investigating the processes through which SOLE could improve students' academic skills such as information seeking, problem solving, critical thinking and social skills such as motivation and engagement, confidence, self-organisation and collaboration. The current study aims to bridge this research gap through exposing a group of primary school children in Saudi Arabia to SOLE.

1.4 The current study

As stated above, the aim of this research is to investigate the applicability and effectiveness of SOLE in improving students' academic and social performance at a primary school in Saudi Arabia. The following are the objectives of this research.

1. Investigating the effectiveness of SOLE on the academic and social behaviour of Saudi primary school children.

2. Exploring the perceptions of Saudi primary school children towards SOLE.
3. Identifying the challenges that might encounter introducing SOLE into Saudi primary schools.

To achieve this, the following questions will guide the research process.

1. How does SOLE affect the learning process and products of children who are accustomed to a traditional approach?
2. How do students perceive SOLE in comparison with a traditional classroom environment?
3. What are the challenges of introducing SOLE in Saudi Arabia schools?

It should be understood that the learning processes investigated here refer to how children behave when they are exposed to SOLE sessions. This includes their behaviour in relation to information seeking and collaboration as well as how they work within a new environment such as SOLEs and their level of motivation and engagement. In addition, the product is taken in this thesis to mean the academic and social development of children who are exposed to SOLE sessions.

To answer these questions, I conducted a piece of action research and collected data through multiple methods. Students' academic and social behaviour were observed (classroom observation and field notes) and their opinions about SOLE and how it compares to traditional classroom experience were surveyed (through Pupil View Templates (PVT), 'What Is Happening In this Class' (WIHIC) Questionnaire, and 'SOLE and Traditional Classroom' Comparison (STCC) Questionnaire. In addition, questionnaires were filled in by parents and teachers and interviews were completed by the classroom teacher and head teacher to collect data about opinions about SOLE, perceptions of the participating pupils' SOLE experience and the challenges that might face introducing SOLE into Saudi schools.

The following section introduces the context where this study is conducted.

1.5 Research context

This section presents the context of the current study and aims to familiarise the reader with the nature of the educational system in Saudi Arabia. More specifically, it gives a brief history about the educational system in Saudi Arabia and the teaching practice in Saudi schools. It also describes the educational initiatives that have been launched in the country to improve education and the constraints that have been identified in the face of education development.

1.5.1 A brief history of the education system in Saudi Arabia

General education in Saudi Arabia is mandatory for children aged 6 to 15 and optional before and after that age (Alturki, 2016). The education is divided into three levels: Primary (6–12 years old students), intermediate (13–15 years old students) and Secondary school (16–18 years old students). Because religious beliefs and cultural traditional values have a powerful influence on the Saudi Arabia education system, only single-sex schools exist in the country. Instruction in these schools is provided by the same gender teachers, apart from the nursery, reception and, recently, lower primary school stages at which instruction is delivered only by female teachers. Both genders follow the same curricula and take the same annual examinations.

Saudi primary schools, the setting of this research, are divided into a lower primary stage (Years 1, 2 and 3) and higher primary stage (Years 4, 5 and 6). At the lower primary stage, there is one classroom teacher who is responsible for teaching all the subjects and monitoring academic and social development of students. At the higher primary stage, on the other hand, subjects are taught by different teachers, but one of these teachers is assigned as the classroom teacher responsible for monitoring academic and social development of students.

The assessment system in Saudi schools varies according to the school stage. In primary schools, we, as teachers, are required to use automatic progression to gather and interpret evidence to make judgments about students' learning. In these schools, there is a performance scale checklist form that we are required to fill based on our observations of the skills exhibited by pupils. However, in Saudi intermediate and secondary schools, assessment relies on a comprehensive exam at the end of each semester. The academic calendar in Saudi Arabia is divided into two semesters and each semester has eighteen weeks. Based on the examination results, students move to the next grade. If the student fails to acquire certain skills or to answer 50% of the exam questions, s/he has to sit the supplementary exam at the end of the school year as a final chance to pass the grade.

Prior to 1925, education in Saudi Arabia was in the form known as "Kuttab" where students go to their teachers' houses or the community mosques to memorize Qur'an and learn basic reading, writing, arithmetic and morals. The method of instruction relied mainly on lecturing and memorization. In 1925, King Abdulaziz, the founder of Saudi Arabia, established the first formally organized educational centres in the country with the assistance of educational experts from other countries such as Egypt. These centres were equipped with qualified teachers from other Arab countries and they borrowed curricula used in other countries. This form of education was the foundation of the Saudi education system, but it was accessible only by wealthy people. At the time of the establishment of the Ministry of Education (MoE) in 1953, the quality and quantity of education was very limited due to the high illiteracy rate and the country's insufficient funds (Ali, 2009).

Oil discovery in Saudi Arabia in the 1950s has revolutionised all public sectors in the country including education (Ali, 2009). The priority of the educational authorities in Saudi Arabia was to spread education throughout the country and make education accessible and available

to all Saudi citizens throughout the country (Alghamdi and Al-Salouli, 2013). In the last two decades, the government has shifted their focus to improve the quality of education; the government through MoE has invested more in educational facilities, technologies and development and modernisation of curriculum. Educational authorities have started to pay more attention to raising the standard of educational institutions from childhood to higher learning to meet the needs of the job market and social development plans. In addition, the MoE has funded many projects to reform education to meet the changing requirements of the job market (Almulla, 2018). According to Alaqeel (2013), these projects focus on areas such as educational curricula development, teacher training, educational environment and classroom activities improvement (See section 1.5.3 below for more information about these projects).

1.5.2 Teaching practice in public schools

Starting from year 2 at primary school in Saudi Arabia, there are specialised teachers to teach different subjects such as language, science, math and religion. In addition, different from the teaching practice in developed countries such as the UK, where the teacher has the freedom in how and when to cover specific curriculum elements (GOV.UK, 2015), we, as teachers in Saudi Arabia, are expected to strictly follow what is prescribed by the MoE in terms of the curriculum and the teaching approach (Alqahtani et al., 2016). Although the curriculum is borrowed from international contexts, some modifications on these are introduced in order to be suitable for the Saudi context and the needs and goals of the country. As for our teaching approach, it relies mainly on lecturing and memorization teaching methods and this has indeed been highlighted in previous research in the country (e.g. Almuntasheri et al., 2016; Almulla, 2018). The teacher is perceived as a bank of information that should transfer the knowledge and the facts from the textbooks and is considered the authoritative character who dominates the learning process. Consequently, the learners are typically considered passive recipients and are required to receive these facts and memorise them for the sake of the final

exam. The teaching-to-test approach might restrict teachers to focusing on ensuring that large classes of children achieve the learning objectives outlined in the National Curriculum.

Ordinarily, most learners in Saudi schools sit in parallel rows facing either the teacher or the whiteboard, receiving information and working individually. We, as teachers, spend most of our teaching times in front of the class lecturing, using projectors, or writing on the board while learners passively listen to them (Almulla, 2017). The conversation between students is prohibited and they talk only when we ask them a question; otherwise, they might be punished. The proposed questions during the lesson are usually closed questions to check the students' understanding of the content delivered or to recall knowledge that is already known (Alotaibi, 2014; Almulla, 2017). This traditional teaching style focuses on memorisation and neglects the use of higher-order skills, critical thinking and problem solving (Alotaibi, 2014).

Based on my personal teaching experience and as stressed in a study by Almulla (2017), Saudi teachers' have the perception that policymakers in the MoE are concerned about the number of students who pass the national exam. Schools consequently devote more effort and attention to the quantity rather than the quality of education, especially under pressure from severe competition to achieve national plans and targets such as the number of graduates. This results in a more directive teaching approach aiming at delivering particular attainment goals.

Under such situation, our main focus, as teachers, is to lead students to achieve high grades rather than improve their performance and the acquisition of skills as also discussed in Almullah (2018). Students are awarded a grade at the end of each year based on their examination results and the condition for moving to the next educational stage is to pass the exams (Alotaibi, 2019). In short, it seems that for most Saudi teachers and parents, the aim of education is merely helping children to pass examinations.

It is important to mention that this teaching practice has been criticized by many educational researchers as being outdated (e.g., Algarny and Male, 2014; Rico and Ertmer, 2014; Alsuhaymi and Alzebidi, 2019). For example, more than a decade ago, Bruner (1966) simplified the concept of teaching as follows:

> "To instruct someone… is not a matter of getting him to commit results to mind. Rather, it is to teach him to participate in the process that makes possible the establishment of knowledge. We teach a subject not to produce little living libraries on that subject, but rather to get a student to think mathematically for himself, to consider matters as a historian does, to take part in the process of knowledge-getting. Knowing is a process not a product". (Bruner, 1966, p.72)

Breakstone et al. (2018) emphasize that it is crucial that teachers are clear about this concept because it greatly affects what they actually do in the classroom. However, unfortunately, we as Saudi teachers, particularly working at primary schools, still consider ourselves as indoctrinators rather than educators. It appears that we focus on ensuring that large classes of children achieve the learning objectives outlined in the National Curriculum and consider students as 'receivers' and expect them to memorise information to pass exams. This approach can be described as one-size-fits-all as it does not take individual needs into consideration. It also neglects philosophical, social and psychological foundations of education, as well as future requirements such as communication skills, critical thinking, problem solving, creative thinking, self-learning and lifelong learning (Golen, 1982; Alsuhaymi and Alzebidi, 2019).

In addition to the outdated view of teaching, research has demonstrated that Saudi teachers have insufficient knowledge and training to integrate technology properly in their classrooms. Indeed, I can personally admit that this is the case with most teachers particularly in relation

to the use of the Internet. For example, Alsswey et al. (2020) found that teachers in Saudi Arabia believe that the Internet helps them in preparing instructional delivery and classroom materials (i.e., creating lesson plans and using digital resources...) and in communicating with peers, students and their parents. They did not seem to be aware of any Internet uses that could enrich students' learning.

Indeed, this lack of knowledge and training led to poor integration of technology in the classroom especially during the lockdown caused by Covid-19 pandemic, which had a negative impact on the educational process. As schools had to transfer all their teaching online, the MoE provided teachers and students with a virtual platform through which they could communicate. However, what was publicly reported and discussed was that students did not engage in this process, although both teachers and students did not have problems with access to computers and the Internet as these were available nationwide. The cause of this failure might be because the teaching practice remained the same (i.e. the teachers as knowledge transformers and the students as receivers).

To sum up so far and based on my personal experience, it seems that we, as Saudi teachers, have an outdated view of what teaching is. We still rely on lecturing as our main method to teach and we expect students to memorise information to be successful. In addition, we do not have sufficient knowledge about how to integrate technology effectively in our lessons. This necessitates introducing new teaching approaches that rectify our perception of what teaching is and helps us to integrate technology effectively in the classroom.

1.5.3 Educational initiatives before 2016

Over its history since 1953, the MoE has launched many initiatives to improve education in the country. However, more comprehensive reforms have been implemented since 2013, particularly after the Educational decision-makers and curriculum planners in the MoE

realised that the curriculum did not meet individuals' and national needs (MoE, 2020). Educational researchers also thought that the curriculum did not educate young Saudis with marketable skills and a capacity for innovation and entrepreneurship (Al-Abdulkareem and Hentschke, 2014). Hence, new initiatives have been proposed by the MoE to encourage school and curriculum reform by designing a curriculum that emphasized critical-thinking and problem-solving approaches in teaching (MoE, 2020).

One early initiative launched in the same year of the MoE's announcement was introducing a new national curriculum. This curriculum was influenced by the American education system, which is characterized by extensive use of technology and based on constructivist theory (Al-Abdulkareem and Hentschke, 2014). As asserted by Al-Abdulkareem and Hentschke (2014), different from the old curriculum and textbooks which were characterised by a traditionalist-teaching methodology (teacher-directed) and on pedagogies that encourage memorization, the new curriculum was intended to support constructivist pedagogy. This new curriculum emphasised student-centred learning and encouraged students to collaborate, think critically, argue, and discuss concepts that had been previously treated strictly as a series of facts (Al-Abdulkareem and Hentschke, 2014).

In line with the curriculum reform, the MoE in Saudi Arabia conducted several initiatives to improve the assessment system in schools (Alotabi, 2014). In addition to the previously available summative method of assessment (end of year examinations), the MoE insisted to implement formative assessment in order to measure students' learning more effectively. This new method of assessment allowed the teacher to assess students' performance during lessons and gave the student the chance to reflect on and monitor their own progress through for example keeping a diary book that the teacher can access. In addition, this type of assessment

made it possible for teachers to measure students' abilities, skills and knowledge and provide constructive feedback on students' performances during the academic semester.

Furthermore, the MoE made active efforts to improve the professional development of teachers. It started to provide training courses for pre-service teachers' in teachers' colleges and the schools of education at universities. This was in addition to training courses for in-service teachers in different educational training centres all over the country by the Department of Professional Development (Alotaibi, 2019). Continuous development of educational systems and regulations are used to keep pace with the rapid developments in educational activities. These courses aimed to develop teachers in different aspects of their career relating to the assessment of students' performance, teaching skills, classroom management and the use of technology mainly for instructional preparation and delivery.

A further initiative by the MoE relates to activating technologies in education. The Saudi government has made huge investments in reforming and improving education using modern technologies (Almutairi, 2019). During the evolution of education in Saudi Arabia, the MoE invested in the technological infrastructure in the vast majority of schools by establishing Learning Resources Centres (LRCs), which usually contain computers, smart boards and recently the Internet (Alenezi, 2016). The MoE also launched the national education portal 'AinVirtual Gate' to provide a self-learning platform for students to improve learning outcomes. In addition, a barcode was added to textbooks to provide easy access to digital content and enrichment-related materials for the lesson. This wonderful addition in textbooks linked educational digital content to the textbook, which was hoped to contribute to enhancing students' self-learning processes and supporting students' parents in understanding the scientific content of their children's education.

However, unfortunately, the reform efforts described above were not successful (Alturki, 2016). As a teacher in Saudi schools between 2003 and 2015, I did not notice any difference in the teachers' or school's practice. Indeed, conducting a review of a large number of empirical studies in Saudi schools, Almulla (2018) found that 'teaching to test' remained the common practice in those schools and the learning was largely based on memorisation and repetition of information. This is also what was reported by Almuntasheri et al's (2016) study, which found that the system was predominantly teacher-centred and students remained passive listeners in the educational process. This resulted in poor performance by Saudi students in TIMSS and other global exams, when compared to students from other countries, especially in mathematics, science, and other 21st century skills (Soliman, 2019). In addition, although technologies were introduced into schools as per the initiative described above, as reported by Alenezi's (2016) study, computers were not exploited and remained neglected, particularly in primary schools. However, new initiatives have been introduced under the umbrella of Vision 2030 and these will be discussed in the following section.

1.5.4 Education and Saudi Arabia's Vision 2030

In 2016, Crown Prince Muhammad Bin Salman announced a long-term plan for Saudi Arabia called 'Saudi Vision 2030' (Vision 2030, 2020). The vision focuses on reducing the country's dependence on oil, diversifying the economy and developing and upgrading public service sectors such as tourism, education, health, recreation, infrastructure and entertainment. In relation to education, the MoE has established strategies in response to the Saudi's vision to develop this sector. The strategies are as follows:

- Developing philosophy, policy and goals of curricula, means of development, mechanism activation and connecting all these means with the programs of teacher preparation and his professional development.

- Developing teaching methods that focus on the learner not on the teacher, and concentrate on inculcating skills, developing personality, improving confidence and promoting spirit of creativity.
- Developing attractive, preferred and stimulating school environment and connecting it with supportive and integrated services systems.
- Providing comprehensive education and appropriate support for all categories of persons with disabilities.
- Providing pre-primary education (kindergarten) opportunities, expanding it and activating its link with the education system. (MoE, 2020, para. 1)

To support achieving the ambitions and objectives of Saudi Arabia's Vision 2030, the National Transformation Programme 2020 was launched. It aims to develop governmental work and establish strategic objectives and identify the initiatives necessary to achieve the vision.

The National Transformation Programme 2020 worked with the MoE to identify the challenges facing education and to prepare an educational transformation plan. Based on this, they identified some challenges, and these are presented in Figure 1 below as in the original source (MoE, 2020).

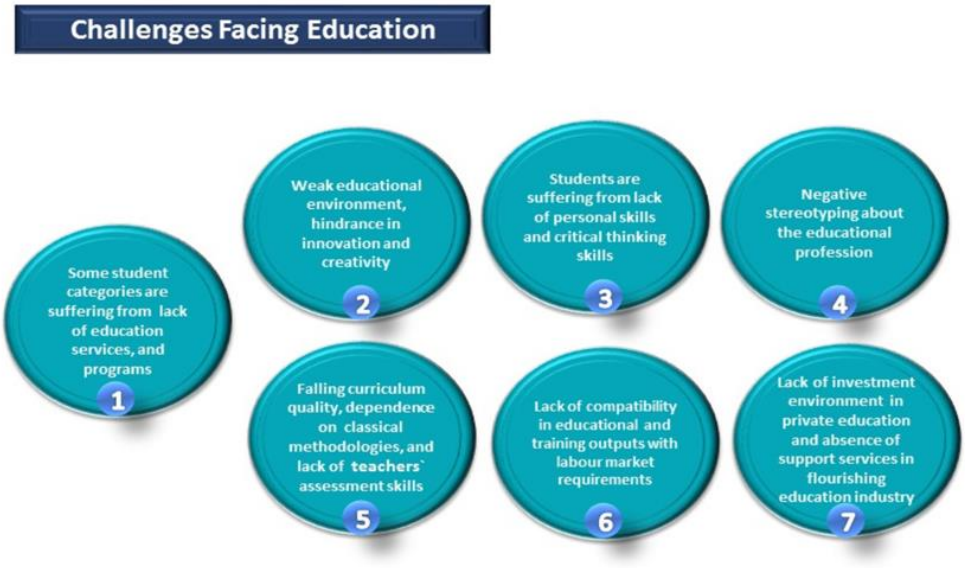

Figure 1.1: Challenges facing education in Saudi Arabia according to the National Transformation Programme 2020 (Source: MoE, 2020, Section 1.6, Figure 4)

Some strategies have been advanced in the aim of overcoming these challenges by 2030. One of these strategies is shifting to digital education to support teacher and student progress and to prepare students for their future work environments. This strategy involves presenting all learning materials in digital format through mobile devices that provide up-to-date content in real time. This is in addition to creating personalized digital learning programs and platforms aiming at meeting the individual needs of each student. This strategy also seeks to replace printed exams by online assessments. In relation to this, the MoE introduced a new initiative called 'Future Gate' to promote digital learning and "change the whole setting" in schools (MoE, 2020). It handed out iPads to students and teachers in schools and encouraged more technology-enabled teaching and learning. This step seems promising, but based on my experience, I think it might not succeed until appropriate teacher training is provided. This should focus on how teachers can use such technology effectively in their classes. In other words, introducing such technology requires a change or at least modification of the teaching method and without realising how to use the technology effectively, the teacher might not shift to start using it.

An initial report about the progress of these initiatives was scheduled to be published by the MoE in 2020 (MoE, 2020), but due to Covid 19 pandemic, this was not done. This has made it difficult to obtain any information about the possible outcome of the strategies advanced in this regard.

1.5.5 Constraints on education development in Saudi Arabia

The educational initiatives mentioned above before Vision 2030 did not achieve what they aimed to as discussed in 1.5.3. Many researchers (e.g., Alhareth and Al Dighrir, 2014; Alnahadi, 2014; Almuntasheri et al's, 2016) attributed this to a couple of reasons. These are 1) constraints of the Saudi public schools and 2) constraints of the teacher professional

development programmes. Discussing these here seems necessary in order to clarify the possible challenges that might face the introduction of any educational initiative such as the one under investigation in this study (i.e., SOLE). These two constraints will be discussed in turn below.

1.5.5.1 Constraints of the Saudi public schools.

The education system in Saudi Arabia is highly centralised and strictly governed by the MoE. The MoE controls all public education institutions in the country, with a very limited autonomy and authority given to schools. It is responsible for the national educational policy-making decision processes and the implementation of the government's education policy. This is in addition to its responsibility for the construction of buildings, provision of school equipment, allocation of national education budget, recruitment of teaching staff, design and execution of in-service training programmes and timetabling and monitoring schools (MoE, 2020). Moreover, the MoE does not only set the aims and objectives of the national curriculum, but also provides the specific syllabus and textbooks that schools should adopt (MoE, 2020). In addition, the assessment system and students' progression are regulated by the MoE (Alotaibi, 2019).

Although this high centralisation of the educational system has provided some stability and continuity, as asserted by Nather (2014), it has led to constraints on classroom practices and pedagogical approaches and, thus, on educational development. For example, the mandatory curriculum, syllabus and textbooks as well as teaching approaches led us, as teachers, to focus mainly on the mastery of content, which undermines the role of the teachers' creativity and negatively affects students' development. To clarify, a textbook for each grade contains as many lessons as teaching weeks and we must complete the curriculum on time irrespective of whether the lessons' objectives have been achieved. At a strict time (45 minutes), we are

expected to complete the materials prescribed for each lesson and check the homework from the previous lesson. Consequently, such an approach might lead us to ignore individual differences and learning styles of students. This is indeed what happened with me personally although I am teaching a subject (i.e math) that requires great attention to individual differences because there are noticeable variations in students' abilities. In addition, this intensity and rigidness might leave us with no consideration for remedial, supplementary enriching activities as truly highlighted by Nather (2014). All this might put obstacles on the educational development of students.

Furthermore, the rigidness and intensity of the curriculum has created barriers for teaching innovation. The shortage of time for teachers has prevented them from applying and experimenting with new teaching methods, especially those that require technology use, because of the time-consuming nature of most new approaches' tasks and activities. Personally, the time and the workload led me so many times to avoid asking students to work collaboratively although I realise based on my experience that they learn more when they do so. The time factor appeared in many studies that hinder the achievement of the Ministry's goals. Previous studies (e.g., Almulla, 2017; Alghamdi, 2019) have consistently reported that Saudi teachers complain that the available class time and workload is the major discouraging factor to experiment alternative methods of teaching. In addition, a study by Al-Wassia et al. (2015) has revealed that it is the time factor that disallows teachers to use formative assessment practices that could empower students and make teachers more aware of their students' needs.

Furthermore, the centralisation of the education system has also put constraints on the support that teachers might need in the classroom. To explain further, when teachers require any kind of support to do their teaching duties, such as technical support, they do not know how to

obtain it. This is because there is no clear policy and mechanism that teachers could follow to achieve this (Alssissi, 2017; Schwab et al, 2020). For example, Schwab et al. (2020) found out that Saudi teachers have difficulties in requesting support and they have to rely on themselves to provide anything they might need. In another study, Alghamdi (2019) revealed that Saudi teachers were unable to secure technical support for the technology used in their classrooms. Both studies demonstrated that these issues clogged teachers' efforts to use technology innovation and led them to jump back to their traditional teaching methods as these did not require much support.

1.5.5.2 Teacher professional development programmes in Saudi Arabia

Another constraint that is discussed in the literature (e.g., Alturki, 2016, Almutairi, 2019) as a factor hindering the success of MoE initiatives is the deficiency of teacher development programmes. There is a gap between the theoretical content provided in teacher training sessions and the real situation in Saudi classrooms. Alturky (2016) reported that professional development focuses more on the theoretical delivery of information than training teachers in practice. These programmes deal with informing teachers how to follow instructions rather than build their own strategies to achieve educational objectives or equip them with the necessary skills to manage their classroom time and perform their tasks effectively (Alghamdi, 2019). I have indeed experienced the result of this unsatisfactory training; this was through my experience in observing other teachers' classes as I noticed that teachers rely on ready-made plans and guidelines to deliver content and do not prepare their own lesson plans. Such programmes, therefore, do not equip teachers with the necessary skills to be creative on how they perform their job in terms of educating or assessing students. This might consequently have a negative impact on students' learning and the success of any educational initiative.

Another deficiency in the professional development programmes is that they do not take teachers' needs into consideration. Algamedi (2018) asserts that the planning and design of the teacher training workshop does not involve teachers, which might make the training short of satisfying teachers' needs and lack relevance to classroom practice. According to Algarni and Male (2014), the teaching approaches in the country remain far from being able to prepare students for the 21st century. More specifically, teachers' beliefs and experiences about transmitting knowledge teaching methods need to change because they do not help learners to construct knowledge in their own way (Algarni and Male, 2014). This means that there is a need to change the school culture in relation to teaching and learning towards creative new approaches that focus more on students learning and move them from being passive recipients of information to being critical thinkers and lifelong learners.

Moreover, for continued reform in education, research strongly suggests that training courses should focus more to promote teacher thinking skills which would allow them to transfer these skills to their students in school (Alturky, 2016; Nather, 2014). Although the MoE has provided teachers with various teaching courses in different aspects relating to teaching and learning, these courses did not seem sufficient; teachers still need a vast amount of change and training in learning how to teach critical thinking skills, problem solving skills and other 21st Century skills. This seems necessary especially in light of the fact that the teachers themselves were not exposed to such skills in their own education, which was teacher-directed, passive and did not stress reflection and critical thinking. Therefore, the current professional development programmes seem to be blind about these needs and involving teachers in the design process of these programmes seems necessary.

Another area that is lacking from the professional development programme is training related to technology integration. Although the MoE has spent massively on technology integration, a

large body of literature supports the idea that the lack of teacher training is the main reason for not using technology effectively in the classroom (Albugami and Ahmed, 2015, Alghamdi and Higgins, 2018, Alsswey et al., 2020). Albugami and Ahmed (2015) highlights that 'there is still a real gap between the availability of ICT technology in Saudi schools and methods of implementation' (p.37). The professional development training on technology use is for instructional preparation of instructional delivery, but not for technology as a learning tool (Alsswey et al., 2020). In addition, the training provided by the MoE is usually generic and not specifically geared to particular technology integration. Hence, inadequate preparation to use technology is one of the reasons that teachers do not systematically use computers in their classes. Teachers need to be given opportunities to practice using technology during their teacher training programs so that they can see ways in which technology can be used to augment their classroom activities.

To conclude, it is widely believed that the failures in the education system in Saudi Arabia can be addressed by introducing new approaches that can enhance students' educational experience and skills and maximize their attainments (Algarni and Male, 2014; alturky, 2016; Nether, 2014; Almulla, 2017; Vision 2030, 2020). Through the research at hand, I attempted to introduce an approach which is thought to meet these goals; more specifically, this approach is SOLE. This is an innovative pedagogy focusing on improving children's educational experience and skills such as using the Internet to research by working in groups. In an action research study, I introduced this approach into a class of students in a primary school in Saudi Arabia to identify (1) students' perspectives regarding whether they enjoy SOLE in addition to how they perceive this approach in relation to their other learning experiences, (2) whether SOLE can help them improve academically and socially and (3) the potential of activating an effective use of the available educational resources.

1.6 Structure of the thesis

This thesis consists of six chapters. It is organised as follow:

Chapter One has provided the motivation of the study, its background in SOLE approach to learning, the research aim, objectives and questions. The rest of the chapter was devoted to the presentation of the research context.

Chapter Two is the literature review, and it aims to examine the current knowledge in the field of SOLE knowledge and practice and identify potential gaps in SOLE research. It starts with a discussion of the main learning theories that are relevant to the topic of this investigation (a discussion of Constructivist and Connectivism theories of learning). This is followed by a section on similarities that SOLE bear to these major theories of learning. The chapter continues with an analysis of the SOLE application in the classroom, foundational ideas of SOLE and previous empirical studies on SOLE.

Chapter Three covers the methodology and research design. It restates the research questions and evaluates the major research paradigms. The research design is then explained and justified. The data collection and analysis procedures are also described. The chapter also includes a discussion and consideration of the sampling techniques, validity and reliability procedures and research ethics.

Chapter Four presents the research findings and the process of interpreting the information begins.

Chapter Five is a discussion of the findings presented in the previous chapter in order to identify important findings and link them to concepts from the literature review. The chapter also discusses the theoretical and practical implications for the integration of SOLE in schools generally and in Saudi Arabia particularly.

Chapter Six concludes this study. It summarises the key findings. This is followed by a discussion of the limitations of the study. It also presents recommendations for future research on the use of SOLE.

Chapter 2. Literature Review

2.1 Introduction

This chapter discusses the concepts and literature related to the educational approach under investigation in this thesis, namely Self-Organised Learning Environments (SOLEs). It starts in Section 2.2 with a discussion of the general major learning theories underpinning SOLE approach. More specifically, it reviews the philosophical foundation of Constructivism and Connectivism theories and discusses how SOLE is situated in these theories. Section 2.3 examines the essential elements of SOLE in terms of their underpinning ideas, practices and associated research. This specific section deals with SOLE application in the classroom (2.3.1) and the foundations of SOLE (2.3.2), which include collaborative learning, enquiry-based learning, big question, Internet as a research tool and minimal teacher intervention (teacher as a facilitator). The theoretical and empirical literature about each of these features will be discussed and linked to the Saudi context. Then, the expected impact of SOLE on children as discussed in previous research will be presented in Section 2.3.3. Section 2.3.4 critically reviews the findings of previous empirical studies conducted on SOLE. The chapter is concluded with a highlight of the gaps existing in previous research that the current study seeks to address.

2.2 Constructivism and Connectivism

In previous decades, there has been an increase in the number of innovative teaching methods in education which are built on assumptions rooted in student-centred approaches (Bransford et al., 2000). With the advances in technologies, these approaches have called for open learning environments and for linking teaching, learning and technology. Jonassen and Land (2012) argue that the view of learning has changed from the simple traditional transmissive or

submissive processes (which remain popular) to a view of learning that is intentional, active, conscious and more social, conversational, and constructive. How this is conceptualised will be discussed in relation to two main theories, Constructivism and Connectivism that are relevant to the rise of SOLE.

2.2.1 Constructivism

Constructivism could be considered one of the most prominent learning theories utilised within traditional and non-traditional educational fields or more broadly an educational philosophy that encompasses other theories (Leonard, 2002). The historical roots of Constructivism theory go back to the school of psychology founded by Dewey (1859–1952). According to Dewey, children learn better when they interact with their environment and have the opportunities that enable them to link current knowledge to prior experiences and knowledge (Dewey, 1963). Piaget (1896– 1980) also elaborated on this, stating that learning can occur without being planned or organized by teachers or schools (Piaget, 1952, 1968, 2003). Piaget's theory was that children develop intellectually without being taught. This was based on his awareness that children effectively think differently than adults, and that their cognitive evolution requires designing rich toolkits and environments rather than force-feeding knowledge (Piaget, 1952, 1968, 2003).

In line with Piaget's ideas, in her earlier work, Montessori (1870 – 1952) developed a method of education that was based on self-directed activity and communication (Montessori, 1976). By giving children freedom to initiate their learning through free choice, she believed they would act spontaneously for optimal development and use their senses to explore and manipulate materials in their immediate environment. The teacher role, therefore, is to offer age-appropriate activities to guide the process and observe children's innate psychological development. This belief that children can learn on their own is also supported by the Discovery Learning theory advanced by Bruner (1983), who was also interested in

constructivist theory; his theoretical framework is based on the stand that students can learn concepts more effectively when they reach them by discovery, attempt to make them part of their knowledge system in accordance with their context and organise them in a way that is consistent with their own life experiences.

Adding a new dimension to constructivist learning theory and practice, Lev Vygotsky (1896–1934) introduced the social aspect of learning (Vygotsky, 1978). He argued that the basic mechanism of cognitive growth is communicative in nature and learning is a constant reinterpretation of meaning. He emphasizes the social context and on the construction of knowledge following interaction and collaboration between students, their peers and the context. This interaction and collaboration construct has become fundamental in social constructivist theory and named as the Zone of Proximal Development (ZPD) by Vygotsky, (1978). Vygotsky defined the concept of the ZPD as "the distance between the actual development level as determined by independent problem solving and the level of potential development as determined through problem solving under adult guidance or in collaboration with more capable peers" (Vygotsky, 1978, p.86).

A further development within the constructivist theories of learning is the revolutionary proposal of Papert's (1928–2016), who called for and investigated the idea of teaching children through computers (Papert, 1990). Papert built his view of learning upon the work of Piaget in constructivist theories and he proposed that children can construct knowledge by themselves with a minimal teaching intervention. Computers are believed to assist children in completing this task. Papert (1999) developed a programming language application and asked a group of children to work on. He observed that children, when placed in an appropriate environment and given the right tools, could learn and construct knowledge on their own

without the intervention of the teacher. His ground-breaking work has led to the widespread use of computer and information technology in constructivist environments.

Having reviewed the historical developments of constructivism, it is essential to elaborate here to clarify what this theory indicates and involves. Fosnot (2013, p.1) states that constructivism theory "describes knowledge not as truths to be transmitted or discovered but as emergent, developmental, non-objective, viable constructed explanations by humans engaged in Meaning-making in cultural and social communities of discourse". Other researchers such as Rahimi and Ebrahimi (2011) assert that within this theory, the knowledge constructed by learners is not inert, but rather usable in new and different situations. Anderson and Shattuck (2012) also clarify that this theory places students at the centre of learning and encourages them to take active control over learning processes by constructing their own understanding and knowledge of the world (both individual and social), through experiencing things and reflecting on these experiences in an unguided or minimally-guided environment.

Constructivist learning environments emphasize how individuals actively construct knowledge and understand it in social contexts. Gauvain and Parke (2010) argue that involvement with others creates opportunities for students to evaluate and refine their understanding as they are exposed to the thinking of others and as they participate in creating shared understanding, termed as 'intersubjectivity' by Nyikos and Hashimoto (1997, p. 508). In other words, constructivism relies on collaboration, reflection, interaction between learners, who involve in social negotiation to reconcile competing and conflicting perspectives and beliefs, leading to a shared understanding.

Constructivists hypothesise that students learn most when they discover or construct essential information for themselves not just simply presented to them. This is because students will

give different meanings to the same things as they each have an individual experience that is different from others (Land and Jonassen, 2012). This might indicate that it is unfeasible and undesirable to learn every topic through the constructivist approach as there are lessons that would benefit from traditional approaches. This is particularly relevant to some domains such as math education where learners mainly have to rely on available data or examples to create hypotheses or conjectures to solve a problem. Asking higher order questions in a situation like this would likely confuse students, especially if they do not already have the proper knowledge base. For example, mathematical objects and relations are abstract, so they generally do not allow learners to make conjectures based on prior knowledge or everyday experience (Baroody et al., 2013).

Clarifying the teacher role within constructivism, Fosnot (2012) claims that the instructional approach of this theory is radically different from the direct instructional approach. She explains that "the traditional hierarchy of teacher as the autocratic knower, and learner as the unknowing, controlled subject student and practicing what the teacher knows, begins to dissipate as teachers assume more of a facilitator's role and learners take on more ownership of ideas" (Fosnot, 2012, p.1).

The constructivist approach has faced strong criticism from academics such as Kirschner, Sweller and Clark (2006), who classified this approach as minimally guided. These authors define minimally guided instruction as a learning context in which 'learners, rather than being presented with essential information, must discover or construct essential information for themselves', but they conversely define direct guidance instruction as 'providing information that fully explains the concepts and procedures that students are required to learn' (Kirschner et al. 2006, p.1). Kirschner et al. argue that the constructivist views of learning are accurate, however, using minimally guided instruction does not lead to effective or efficient learning.

This is because, according to these scholars, students can work independently without instructional guidance only when they have the required knowledge to guide them.

Moreover, from these authors' perspective, the failure of minimally guided instruction lies in ignoring the structures that constitute 'human cognitive architecture' which produces cognitive overload and, thus, impedes productivity. They argue that such instructional approaches require more cognitive capacity in working memory, leaving (too) little capacity to store novel information in long-term memory. They claim that students in this approach, particularly in the case of novice learners, often become frustrated by feeling lost and their confusion can lead to misconceptions in learning.

However, it is important to clarify that, contrary to what Kirschner et al. claim, most of the constructive theory approaches mentioned indeed include providing guidance to students to a sufficient extent and is followed by corrective feedback on set tasks (Tobias and Duffy, 2009). Moreover, Kirschner et al.'s criticism does not fully explain what other kinds of guidance is needed and when and, more importantly, how much instruction should be provided to students during the lesson (Rymarz, 2012). In her rejection to Kirschner et al.'s claim, Schmidt et al. (2007) illustrate that:

> "Human cognitive architecture, and in particular the limitations of working memory capacity at the individual level…, is an important reason to assign learning tasks to groups rather than to individuals. It is believed that the more complex the task (i.e., the higher the intrinsic cognitive load), the more efficient it will become for individuals to cooperate with other individuals in a fashion that this load is shared" (Schmidt et al., 2007, p.94).

In their critique, Kirschner et al. emphasise that based on empirical evidence from previous studies, the learners need a more direct instruction in order to build a solid foundation before

being presented to any kind of minimally guided methods which, in their view, are unlikely to generate effective learning. Obviously, as held by Kirschner et al., the direct instructional guidance approach, as the name indicates, differs from the constructive approach. While both approaches aim to help students to acquire effective knowledge, the differences between them are associated with the roles of students and teachers. In direct instructional guidance, knowledge is well-defined and organised, and students (passive role) assimilate it with their prior knowledge (Rymarz, 2012). However, in the minimally guided approach, students gain knowledge initially through questioning, researching and using critical thinking to solve problems (active role) (Rymarz, 2012). In addition, while teachers are content experts in the former approach, they are facilitators in the latter approach (Rymarz, 2012).

To elaborate further on the role of the teacher, in the direct instructional approach this is restricted to transferring knowledge to the students' minds in the light of specific and fixed criteria for the educational product at each stage of the process. This teacher-centred method of teaching also assumes that all students have the same level of background knowledge in the subject matter and are able to absorb the material at the same pace. In addition, the education outcome in such an approach is measured linearly in the sense that all learners are expected to achieve all educational and behavioural goals in the same way (Wraga, 2017). The learning process, hence, is evaluated according to educational objectives to verify the individual achievement of each learner. To clarify further, the current learning system across the international context focuses on covering a certain amount of knowledge from the national curriculum set by education authorities at each schooling stage. Across the world, students are tested for their acquisition of knowledge and related skills in formal exams (Berliner, 2011; Serdyukov, 2016). This leads educators in schools to be exam-oriented and therefore direct instruction approaches are adopted.

This teacher role in direct instructional approaches is also criticised as it ignores or diminishes the importance of students' engagement and motivation (Kuhn, 2007, Gregory and Kaufeldt, 2015). This is exactly the shortcoming that the constructive approach has come to address. This framework encourages the students to take primary responsibility for their own learning via their participation and make connections that are meaningful to their lives and experiences instead of memorizing content knowledge (Kuhn, 2007, Gregory and Kaufeldt, 2015). The teachers' role in this approach is focused on assisting learners working in groups to discover, enjoy, interact and expand their understanding through introducing them to the concept and then motivating them to depend on themselves to expand their knowledge of that specific concept (Kuhn, 2007, Gregory and Kaufeldt, 2015).

Based on this discussion of the teacher role, it seems that direct instruction (teacher-centred) and minimally guided (student-centred) approaches can complement each other rather than contrast with each other. This is indeed supported by the preposition of Sfard's (1998). To clarify, Sfard (1998) emphasizes that there are two predominant ways of learning, which can be captured as Acquisition Metaphor and Participation Metaphor and these are complementary and should be used together in classrooms. These two metaphors have different views of the goal of learning, learning, student, teacher, knowledge and knowing. These different views are summarised in the following figure (adapted from Sfard, 1998, p.7).

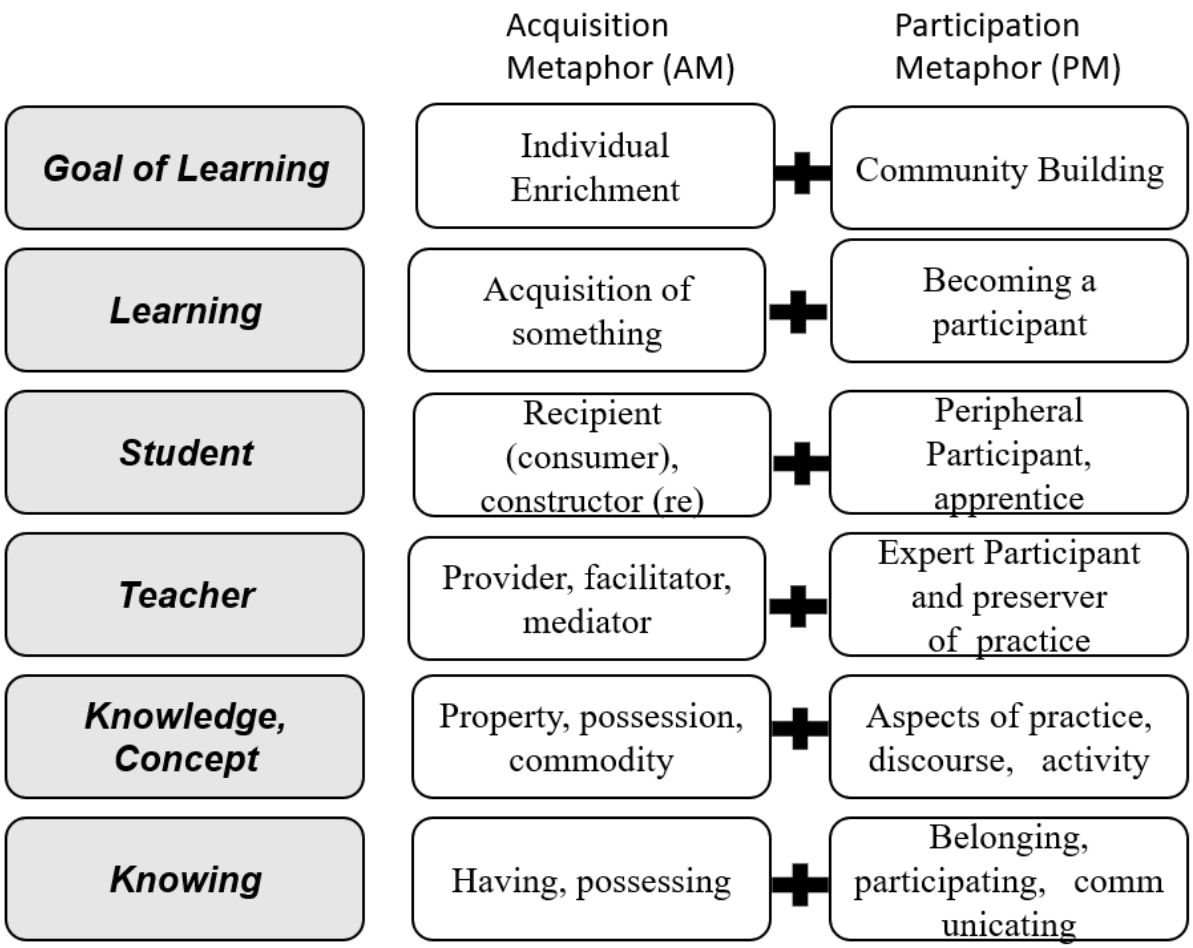

Figure 2.1: Acquisition and participation metaphors' views on leaning

According to Sfard, while the Acquisition Metaphor (AM) indicates that learning is about acquiring, possessing, and transferring the knowledge by an individual, the Participation Metaphor (PM) focuses on learning through participation within a social setting. Sfard asserts that each of them is essential to learning and that each metaphor has its place in education. In addition, these metaphors have their own distinct and separate features, which at the same time, complements and augments the other to the point that the removal of one might limit the effectiveness of the other. To put it in Sfard's words,

> "The relative advantages of each of the two metaphors make it difficult to give up either of them: Each has something to offer that the other cannot provide. Moreover, relinquishing either the AM or the PM may have grave consequences, whereas metaphorical pluralism embraces a promise of a better research and a more satisfactory practice. The basic tension between seemingly conflicting metaphors is

> our protection against theoretical excesses and is a source of power". (Sfard, 1998, p.10)

Therefore, teachers do not need to follow one approach or the other as combining them seems important. As stressed by Sfard here, these approaches complement each other and following both would lead to better learning outcomes.

To conclude, although constructivist approaches may be effective in most social and science modules, it might not be applicable in some other subjects such as math, which requires students to rely on available data or examples to create hypotheses or conjectures to solve a problem. However, good teaching combines, rather than contrasts, direct teaching and constructivist teaching and knowing (Sfard, 1998). As asserted by many researchers including Kuhn (2007), what is worth considering here is the method of application to instruction when using various strategies for teaching. Abundantly clear "this does not accrue by serendipity or accident…the excellent teacher must be vigilant to what is working and what is not working in the classroom" (Hattie, 2012:p.17). Nevertheless, it is worth noting here, as also stressed by some scholars such English and Kitsantas (2013), that shifting from teacher-centred to student-centred approaches might not be straightforward especially in traditional classroom environments where both students and teachers have deeply ingrained habits they have developed through their experiences. Pressed further, although exam results are important as an indication of students' progress, as stressed by Fu and Hwang (2018), the construction of students' personalities (self-monitoring, self-evaluation, self-teaching, self-confidence) is just as, or even more, important. Such skills are given importance in a more recent learning theory that makes use of technological developments, specifically the Internet, i.e. Connectivisim, which will be the focus of the next section.

2.2.2 Connectivism

Connectivism or distributed learning is considered as a new learning theory of the digital age (Siemens, 2005; Downes, 2005; Louriero and Bettnecourt, 2010; Mattar, 2018). This theory is used to explain the impact of Internet technology on people's lives, how they learn and share information across the Web and amongst themselves (Transue, 2013). In his theory, Siemens (2005, p.5) considered that learning is 'actionable knowledge' that is obtained outside of ourselves (for example, in databases, organization, or social media). He also proposes that knowledge is distributed among people and things and not possessed by one individual and it can only be obtained through communication with these human and non-human sources. These sources can be represented by a network of 'nodes', each node representing each source of knowledge. Procedural knowledge is represented by two basic elements, the first of which is knowledge itself, which varies from tacit knowledge (knowing how) to explicit knowledge (knowing what) and which includes interest in the soft knowledge of experiences, interactions, and the like. The second element is work, that is, to perform tasks in an appropriate manner. Therefore, Siemens concludes that Connectivism is the integration of principles explored by chaos, network, and complexity and self-organization theories.

Although some scholars classified connectivism under the constructivist umbrella and being a model of learning rather than a theory (Kerr, 2007; Kop and Hill, 2018; Clarà and Barberà, 2014), some think it is the development of previous theories of learning such as behaviourism, cognitivism and constructivism (Siemens, 2005; Anderson and Don, 2011, 2012; Mattar, 2018). Siemens (2005) argue that most learning theories assume that learning occurs inside a person and fail to "address learning that occurs outside of people (i.e., learning that is stored and manipulated by technology)" (Siemens, 2005, p.5). Thus, connectivism emerged to make the constructivist approach more flexible and to stretch it to include learning that lies outside the learner and this refers to knowledge and expertise residing in the social networks. Moreover, connectivism has infused constructivist principles as learners are expected to

function as self-motivated, self-directed, interactive and collaborative participants in their learning experiences.

One of the main arguments of connectivism advocates is that internalising knowledge is less important than knowing where to find knowledge (outside ourselves) to support our actions in certain situations. It focuses on the skills needed to access relevant information and robust learning and to synthesize and recognize connections and patterns between this and existing learning especially with the immediacy of huge amounts of information, ideas and other people afforded by digital technologies. In support of this, Mattar (2018) argues that while knowledge can be forgotten when the learner does not need it anymore, the learning continues to rest outside the person stored and manipulated by external artifices. With technology, knowledge can be retrieved and activated again whenever needed.

In addition, the key feature of connectivism is that the central role of relationships and networks are primary rather than supplemental sources (Downes, 2012). The learners themselves become mentors, teachers, and model learners for one another, sharing best practices and strategies for effective learning; they also start to make use of their sense making (metacognition skills- thinking how to think), patterning (knowledge recognition), wayfinding (identifying their goals and mission through those networks and community involvement) and realizing the emergent knowledge (ontology-learning to be) (Gerstein, 2014). The teacher, on the other hand, provides some guidance, information and answers to critical queries from the students. In this respect, Siemens (2005) suggest that "educators must assume dual roles: as experts with advanced knowledge of a domain and guides who foster and encourage learner exploration" (p. 17). In such an environment, teacher-student relationships shift from expert-disciple towards peer-based collaborative learning.

From the preceding explanations and as argued by Blair (2018), constructivism and connectivism are similar in that both hold the learner as the centre of the education experience and consider that learners are not passive participants and that they construct knowledge in some way.

2.2.3 From constructivism and connectivism to SOLEs

The constructivist approach has led to the rise of various methods that are based on its principles such as discovery learning (Bruner, 1983), problem-based learning (Barrows and Tamblyn, 1980) and experiential learning (Fry and Kolb, 1979). More recently, SOLE (see e.g. Mitra, 1999; Mitra and Crawley, 2014) as a constructivist approach to learning has been advanced. This approach shares some principles and features with constructivism and connectivism. This section elucidates how the SOLE approach has appeared, bearing similarities with both theories.

As introduced in Chapter One (Section 1.2), SOLE is a student-centred approach to learning where students construct knowledge (both individually and socially) by using an Internet-connected computer with minimal teacher intervention. The learners are encouraged to negotiate a solution in groups from different perspectives for deeper understanding and social knowledge construction.

Theoretically, it seemed that the philosophy of SOLE finds its roots in constructivism and connectivism learning theories. The relevance of each of these perspectives becomes apparent when the pupil constructs knowledge by collaborating with other pupils or by using networked technologies collecting information in an unstructured or unorganised setting with minimal guidance. In SOLE, the learner is exposed to diversity of experiences and ideas, which they try to interpret and construct meaning for using what they already know about

them (constructivism). At the same time, in SOLE sessions, learners seek information and knowledge that already exists on the Internet (connectivism).

Students engage in individual and social activities such as discussions and argumentation to answer the big questions for deeper understanding and social knowledge construction (the knowledge resides in the mind of the learner). At the same time, they use the Internet for searching for useful knowledge in order to answer the big questions (Knowledge resides in non-human objects). Thus, the SOLE approach takes into consideration what already exists in the learner's mind (constructivism) and puts emphasis on the importance of how information and ideas are iteratively found in the digital technologies and assessed and how learners meaningfully connect what is needed when it is needed (connectivism).

Moreover, one of the areas of resemblance between SOLE and connectivism is the self-organisation feature. Self-organisation is defined as the emergence of pattern and order in a system by internal processes, rather than external constraints or forces, in response to unpredictable and ever-changing stimuli (Moussaïd et al., 2009). SOLE is defined as a self-organising system that consists of a set of interconnected parts (group members), each of which is unpredictable (how learners behave in a SOLE setting and why they behave in a certain way) and produces spontaneous order in an apparently chaotic situation (freedom) (Mitra, 2009). In line with this, Siemens (2005) postulates that connectivism is the integration of principles explored by chaos, network, and complexity and self-organization theories. In addition, another point of resemblance between SOLE and connectivism is that their advocates insist that the knowledge is distributed across a network of connections through the Internet and that this knowledge rapidly changes. Also, with huge databases of knowledge, where to find knowledge may be more important than answering how or what that

knowledge encompasses. Through the journey in these databases, the learner can acquire the viewpoint and diversity of opinion to learn to make critical decisions.

The following section elaborates on the SOLE approach and the relevant literature since this approach to learning is the focus of the current study.

2.3 SOLEs

As a relatively new approach to learning, investigations on SOLE are promising yet limited. Further, the experimental data are rather controversial, and there is no general agreement about SOLEs' impact. The subsequent subsections will discuss the SOLE model in more detail. In 2.3.1, how SOLE can be applied in the classroom is outlined. This is followed by a discussion of the foundations of SOLE in 2.3.2. Then, the expected impact of SOLE on children is discussed in 2.3.3. After that, previous empirical studies conducted on SOLE are reviewed in 2.3.4. Finally, since no studies on SOLE have been conducted in the study context, Saudi Arabia, previous relevant research that has focused on collaborative learning or enquiry-based leaning and done in this specific context is discussed in 2.3.5.

2.3.1 Application in the classroom

There are a range of levels at which teachers could integrate the SOLE approach across many disciplines and subjects. It is advisable to trial this approach whether as part of a topic especially at the first instance or for the whole topic once a teacher is confident enough (Mitra et al., 2010). Some teachers consider SOLE as a tool for introducing and generating interest in a new topic, as well as broadening students' understanding of a familiar topic. Successful implementation will likely differ from school to school which depends on the extent of the teachers understanding of his/her role in this innovative method and his/her good choice of the question given in addition to the extent of the preparation of the place.

The SOLE classroom design is especially important. This learning space furniture should be rearranged to enable groups of 3-5 children to interact with a computer connected to the Internet and allows for ease of movement around (Mitra, 2015). Computer numbers should be limited to promote collaboration and they should be fitted with large screens for ease of sharing and accountability (Mitra et al., 2016).

During a SOLE session, children are given a question and asked to research the answer. They form their own groups, have the freedom to talk with members within any groups and to move around, change groups and share information at any time. Sometimes a student is nominated by the others to take the role of students' manager, to sort out any disputes and keep noise to manageable levels. It is only the students' manager who can interact with the teacher. Noise levels can vary, and chaos is permitted. At the end of a given time period, usually between 30 and 45 minutes, each group is asked to present their findings and reflect on what went well and what they could do differently next time (Mitra and Crawley, 2014). Teacher intervention is limited as no explanation or instruction is offered. Teachers may help by providing open and supportive questions and very importantly, instructive feedback.

2.3.2 Foundations of SOLEs

The SOLE approach is founded on ideas related to collaborative learning and enquiry-based learning and combines these in an approach that poses big questions requiring students to use the Internet to find answers for, under a minimal teacher intervention. Thus, the following subsections will review and discuss the theoretical and empirical literature about collaborative learning, enquiry-based learning, Internet as a research tool and minimal teacher intervention (teacher as a facilitator). It is important to bear in mind that some of these elements are amenable depending on how SOLE is executed and, thus, they should not be considered

fundamentals; they are discussed here on the basis that they are commonly associated with SOLE in the relevant literature (e.g., Mitra, 2014 b; Burn et al., 2020).

2.3.2.1 Collaborative Learning

The SOLE approach adopts the principles of Collaborative Learning (CL) to promote participation, collaboration and dialogue building among students. CL is an educational approach whereby students are encouraged or required to work together to accomplish shared learning goals. To accomplish the group's goal, students need to talk with one another and provide help, support and encouragement. CL is meant to be a constructive process, in which students establish knowledge through exploratory, collaborative exchange of ideas and problem-solving skills. It is a practice based on group work and peer interaction, highly dependent on positive interdependence and individual accountability, thus shifting the initiative for the learning process from teachers to students (Topping et al., 2017). Overall, it's about encouraging students to understand that they are active owners of their learning and building a sense of autonomous learning.

Moreover, one recent focus in CL literature has been the incorporation of computer-supported collaborative learning to improve teaching and learning with the help of modern information and communication technology (Andriessen et al., 2013). The role of the technology here is critical as a tool to support experimentation, manipulation, idea generation and sharing of information (Andriessen et al., 2013). Based on this, the SOLE session is dedicated to group work, dialogue and discussion, which help the learners in summarising concepts, comparing viewpoints and solving problems on a networked device with the space to move, discuss and cooperate, both within the learning space and beyond (Mitra and Crawley, 2014; Paradowski, 2015).

Numerous benefits have been associated with CL. For example, Laal and Ghodsi (2012) emphasise that CL "results in higher achievement and greater productivity, more caring, supportive, and committed relationships; and greater psychological health, social competence, and self-esteem" (p.489). In the analysis of 90 articles from 2007 to 2016, Fu and Hwang (2018) found that learning collaboratively with a device help "learners make progress from social interaction with a variety of information, and with peers and experts with diverse perspectives, from which they construct meaningful knowledge, make reflections, and obtain advanced epistemology by developing evaluative standards and explanatory models for judging information and knowledge" (p.141).

Some of the widely discussed factors in the effectiveness of CL are group composition and interactions between group members. Previous research has revealed that the effects of CL are largely dependent on the cohesiveness of the group and their ability to share responsibility for the learning process (Slavin, 2015). According to Slavin (1995), the only way the team can succeed is to ensure that all team members have learned, so the team members' activities focus on explaining concepts to one another, helping one another practice and encouraging one another to achieve. However, this seems to be connected to the size of the group. For example, Burke (2011) demonstrates that with increasing group size, there is a decrease in the amount of interaction among group members and a few participants are likely to dominate, whereas others may remain passive. Conversely, in small groups, structuring group members' discussion is easier and makes students active speakers in discussions. According to Bertucci et al. (2010), the smaller size of groups makes students not only more positively active but also more responsible, independent and accountable.

In addition to the above-mentioned factors, previous research has also indicated that intervention duration could influence the learning results and behaviours in collaborative

learning activities. One previous study that reported findings on all these factors is Sung et al (2017). Sung and his group conducted a meta-analysis study which included 48 peer-reviewed journal articles and doctoral dissertations written over a 15-year period (2000-2015) involving 5,294 participants in collaborative learning supported by a device. This study revealed that the most essential elements for effective CL are the learning scenarios, mechanism of encouraging interaction and reward methods. It also reveals that groups of four students or more produce better effects than two- or three-member groups irrespective of whether they are in homogeneous or heterogeneous group compositions. Further, unstructured teaching methods with no competitions were found to be more effective. Another interesting finding of this study was that long-term interventions did not show significant effects; shorter than one-month interventions revealed more illustrious effects than those between one and six months. Besides, six months or longer interventions also did not show significant effects.

However, the findings about the ineffectiveness of long-term intervention from Sung et al. (2017) are inconclusive for two main reasons. One reason provided by Sung et al. is that in longer interventions students may lose the sense of novelty in the devices and thus lose interest in the routine scenarios. Another possible reason for this might be the absence of innovative teaching methods enabling the teacher to maintain students' engagement. This is combined with other challenges such as support for hardware maintenance, software supplementation, and curriculum design during a long-term programme, which prevents teachers from continuing to support the usage of devices in the classroom.

Nevertheless, some scholars have pointed out at negative aspects in the CL environment that might affect students' learning. For example, Kling (1991) asserts that in CL environments sometimes students perceive discussions as confusing, less productive and more time-consuming. Indeed, in two recent studies conducted in the UK on fourth grade school children

(i.e., Mercier et al, 2014) and in Sweden on year 6, 7 and 8 students (10-13 years old) (i.e., Frykedal and Samuelsson, 2016), the authors reported some concerns stated by students themselves on CL. These were slower workers holding the group back, team members conducting distracting and irrelevant conversations, and individuals with dominant personalities taking over. In addition, in a review of previous CL studies in Finnish schools, Järvelä et al. (2015) found that the use of computers in CL led to lower participation, full of contradictions, competition, more conflict, less group cohesiveness, and less satisfaction.

The concerns raised against CL in the previous paragraph have been discussed by some scholars (e.g., Cohen, 1994; Topping et al., 2017) and ways for dealing with them have been proposed. Both Cohen (1994) and Topping et al. (2017) suggest that preparing students to address the current skills-gap for modern professional interactions is an essential piece of education and it could address the negative aspects of CL. More specifically, Cohen (1994) highlights the need for deliberate instruction on some specific skills for effective CL, such as the ability to negotiate, compromise, reconsider, explain and listen and the skill to manage competitions and conflicts. This is echoed by Topping et al. (2017), who assert that grouping students and asking them to work together on a task without preparing them on collaborative learning does not ensure quality cooperation or learning. Developing such soft skills at an early age will go a long way in helping pupils become effective communicators as they approach adulthood and, more importantly, it is essential in giving all students a voice and transforming the group into a team (Topping et al., 2017). It is crucial to encourage a mindfulness of the actions that go hand in hand with listening and taking part of the dialogue, such as eye contact, offering empathy, and letting others finish especially if the student lacks social skills.

2.3.2.2 Enquiry-Based Learning

Mitra (2010, p.3) proposes that "Self-Organised Learning Environments' refers to the adaptation of a school space to facilitate Enquiry-Based Learning". In the SOLE session the teacher encourages their students to work collaboratively to answer a 'big question' using devices with Internet access. This corresponds with the definition of Enquiry-Based Learning (EBL)[1] by Harada and Yoshina (2004) as a pedagogical approach that uses questioning to engage students actively in their own learning. Also, Bhattacharyya et al. (2009) explain that EBL is a student-initiated exploration process where the learning depends on the students' responsibility to investigate how, why or what and analyse data, draw conclusions, and report findings. Other scholars explain Enquiry as based on student's curiosity about learning such as Wells (2000, p.10). He maintains that "Inquiry is as much about being open to wondering and puzzlement and trying to construct and test explanations of the phenomena that evoked those feelings".

EBL is a prevalent method of teaching and learning among constructivist and connectivist educators. They believe that real learning only happens when children construct their own knowledge by interacting with the presented material (exploring then reflecting) and substantively dialoguing and considering partner's views (Anderson and Shattuck, 2012). In authentic EBL activities, students learn in individual and social activities such as experiments, discussions and argumentation through interacting with their prior knowledge and new information, collecting data, interpreting evidence and drawing conclusions to present them (Al-Kathiri, 2014). Thus, by using this approach in SOLE, it is hoped that this method

[1] Enquiry' is also spelled as 'Inquiry' in some sources (e.g. Well, 2001), but both spellings refer to the same learning approach interchangeably. 'Enquiry' will be used throughout this thesis for consistency.

provides intellectual stimulus and encourages children to achieve more and develop long-life learning skills.

There are various strategies for applying EBL to the diverse subjects in the classrooms. For example, Wells (2001) constructed a model for implementing EBL in the classroom. The process of his model begins with the teacher launching a question that is interesting to explore and to grasp students' attention. In the following two steps, students research and interpret the question by working together in groups to gather related information from different sources to evaluate it. Students then present their findings to the classroom and receive feedback (see Figure 2.2).

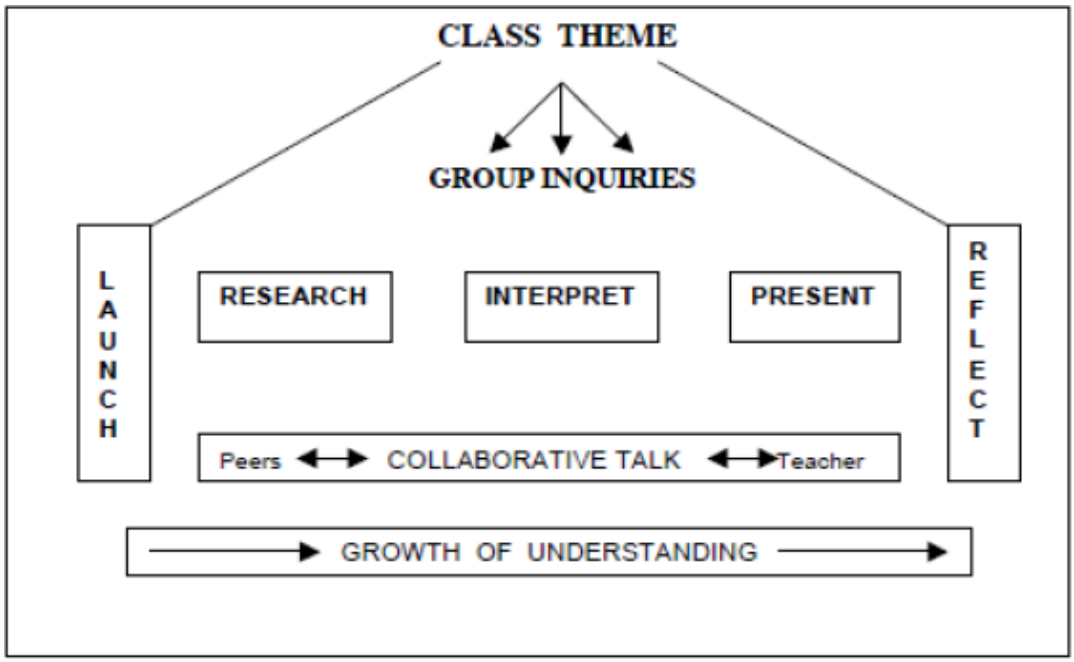

Figure 2.2: Model of an inquiry approach to curriculum (Well, 2001).

The results of a considerable amount of research conducted in different domains, mostly in science subjects, support the greater effectiveness of EBL over the traditional approaches (e.g., Chu, 2009; Chu et al, 2011). Educators using EBL have explored opportunities offered, such as using computers and accessing information through the Internet, to promote significant learning among students. For example, Chu (2009) investigated the effect of EBL

in a primary school in relation to eight dimensions of skills, abilities, and knowledge: subject knowledge, information literacy, IT skills, presentation skills, research skills, reading comprehension, writing ability and social and communication skills. Student enjoyment was also explored in the study. Over a period of 6 months, students were given two topics to search where they could use any database or search engine to collect the information they needed with the help of the librarian and to present their findings for each topic. The subject teachers then marked the project work of these students and the researcher compared these grades with the grades of previous year project work completed by traditional classroom students (marked by the teachers). The study also conducted surveys and interviews with students (N1 =141), parents (N2 =27) and teachers (N3 =11). The results showed that the project grades (as assessed by the subject teacher) for the participants in this experiment were significantly higher than those of students in the traditional classroom. Additionally, according to the judgment of the teachers and the results of the surveys and interviews, the students made noticeable improvements in the eight dimensions of learning, independence and self-confidence. In addition, the students reported that they enjoyed doing the projects and found the tasks challenging.

A further published study done by Chu et al (2011), in the same experiment as in Chu (2009), focused on the development of primary students' information literacy and IT skills. The study also revealed improvements in these aspects. However, in both studies, obviously, the students were extremely highly guided and achieved this result because of the considerable support from what they called as a collaborative teaching approach which included 11 teachers in different subject areas and the school librarian. The IT teacher taught students various IT skills and the librarian provided students with relevant materials as well as training in how to use these materials effectively. The role of the subject teacher, on the other hand,

was to design the content and the process of the intervention and, further, to grade the students' improvement.

Another important issue that is relevant to both EBL and SOLE is the guidance provided to students during sessions. Lazonder and Harmsen (2016) defined the guidance as a series of scaffolding principles and guidelines to support sense making, process management and articulation and reflection. Scaffolding has been defined as a "process that enables a child or novice to solve a problem, carry out a task or achieve a goal which would be beyond his unassisted efforts" (Wood et al. 1976, p. 90). The guidance within EBL in the SOLE session appears to be directive and non-directive (SOLE Toolkit). The Toolkit directs practitioners to give students the questions formulated beforehand to suit the curriculum to investigate using the Internet (directive). However, the Toolkit also asks practitioners not to instruct students on how to answer the question (non-directive).

Although there might be some agreement on the effectiveness of EBL, this depends on whether students receive guidance during the enquiry or not although the amount and type of that guidance are still debatable issues. Alfieri et al.'s (2011) meta-analysis of 164 studies revealed that across domains and settings, EBL with minimal or no guidance is less effective than explicit instruction, but a reasonable degree of guidance is more effective than traditional methods. This is consistent with what Kirschner et al. (2006) claimed about the effectiveness of minimal guidance approaches (see Section 1.2.1 above).

However, different from the studies cited above (i.e., Alfieri et al., 2011; Kirschner et al., 2006), the findings of a study conducted by Baroody et al. (2013) suggest that with computer-assisted learning, there is no need for highly guided and explicit practice when applying EBL. Baroody et al.'s (2013) study involved 64 first graders (6-7 years old) in the USA assigned to

computer-assisted structured discovery. After 9 months of student observation, the authors concluded that "computer-assisted instruction is a feasible means of helping first graders [...] via minimally guided or essentially unguided implicit pattern detection rule" (Baroody et al., 2013, p.565).

Baroody et al.'s (2013) findings are indeed supported by the results of a meta-analysis conducted by Lazonder and Harmsen (2016) on the effectiveness of guidance. Lazonder and Harmsen (2016) included 72 studies in the aim of comparing the effectiveness of different types of guidance for different age categories. Lazonder and Harmsen (2016) clarify that providing extensive scaffolding and guidance "inevitably challenges the inherent nature of the inquiry process, and the present findings indicate that less specific forms of guidance lead to comparable learning activities and outcomes as more specific guidance" (p.706). Another key finding in their study is that EBL methods are effective in the majority of studies. However, as pointed out by Lazonder and Harmsen (2016), the effectiveness in the included studies was mainly measured by assessing students' knowledge acquisition; the learning activities (actions learners perform during an inquiry) and performance success (the quality of the products they create during that inquiry) were ignored. This means that the evidence provided in this direction is not sufficiently convincing.

Based on this review of the effectiveness of type and amount of guidance, it seems that the evidence provided in previous empirical studies was either contradictory (Alfieri et al., 2011; Baroody et al.'s, 2013) or not sufficiently convincing (Lazonder and Harmsen, 2016). In such a situation, it does not seem clear whether the minimal guidance along the lines recommended by SOLE is truly an effective approach or not. Hence, this issue will be taken further in this research to investigate whether such an approach to guidance is sufficient and provide students with what they need to perform their learning task effectively.

The next section discusses the concept of ‘big question’ that SOLE sessions start with.

2.3.2.3 Big Question

The SOLE session starts with a question related to a research topic that the teacher asks students who work on finding an answer for it using web-based resources and this is named ‘big question’. Crafting the big question might be considered the most challenging piece of the SOLE process. According to the SOLE Toolkit provided by Mitra (2014b), big question should also be challenging and interesting to motivate learners' imaginations and curiosity and encourage deep and long conversations and the use of reason and critical thinking. Thus, the big question should be challenging. In an empirical work by Mitra (2014b), he found that the children will rather work in groups to increase their chances of succeeding if they perceive a task as difficult or impossible. In support of this, in a review of previously conducted research, Cohen (1994) revealed that if the task is challenging "ill-structured problems", students will experience the process of group work itself as highly rewarding. In addition, the big question should be thought-provoking in the sense that it should encourage students to research for any missing or further required information, generate possible solutions and make the decision as to which one is best (Mitra and Crawley, 2014).

Questions that teachers ask to students can be open-ended or close in nature, but the former is preferred in collaborative settings (Houen et al., 2016). Houen illustrates that open-ended questions, if sufficiently challenging, can promote complex thinking and rich conversations because they have many possible responses; such questions might improve cognitive outcomes. Close questions, on the other hand, use the recall of fact which can constrain the thinking and restrict response by limiting the interaction to one word (yes or no) or short

responses. In collaborative settings, teachers are advised to ask questions that have more than one answer or can be solved in a number of ways (open-ended) (Wiener, 1986; Houen, 2016).

Open-ended and specifically ‘why’ questions, according to the SOLE Kit, encourage pupils to justify and make explicit their own reasons for their views and enhance students’ collaboration. Evidence on the effectiveness of such questions comes from Mercer (2002), who studied classroom interaction and teachers’ uses of questions for several years. According to Mercer (2002), these questions are rewarding because they have positive effects including “organising interchanges of ideas and mutual support amongst pupils and generally encouraging pupils to take a more active, vocal role in classroom events” (p.8). Mercer (2002) conducted his research in primary schools in the aim of developing a practical programme of 'Talk Lessons' for children aged 8-11 and raising children's awareness of how they talk together and how language can be used in joint activity for reasoning and problem-solving with computer-based activities support. He found that the ‘why?’ helps not just in learners’ intellectual development, but also in encouraging them to think collectively and work jointly in problem-solving activities.

In his book, McGregor (2007) illustrates that to stimulate or encourage pupils' thinking development and understanding through social interactions, teachers should use higher-level and thought-provoking questions that are beyond the level of recall or translation. This can provide learners with the opportunity to “explain, justify, clarify, reason and generally think about ideas with peers” (McGregor, 2007, p.295). McGregor postulates that questions should be open in nature, can be worked on collaboratively, maintain progression and sequencing and encourage criticality and creativity in thinking. Commenting on the nature of questions, Houen et al (2016) asserts that “the format fosters an interactional space for ‘wondering’ - playing with thoughts, ideas and opinions rather than being required to recite facts” (p.75).

However, although questions stimulating higher-thinking problems are recommended, ensuring the appropriate level of question difficulty is necessary to avoid cognitive strain (Wiener, 1986; Hung, 2013). Westwood (2011) corroborates that exposing students to difficult questions might lead to inappropriate problems creating considerable cognitive overload and confusion and this will negatively affect students' motivation and learning. To overcome this problem of question difficulty, the teacher could monitor students' reaction to the question and reformulate the question design to make it appropriate to students' cognitive ability (Houen et al., 2016).

To sum up, the design of big questions should follow a number of criteria. They should be challenging and interesting to motivate learners. In addition, they are preferred to be open-ended and specifically 'why' questions. This is because such questions provoke students' interests and encourage them to think more deeply and work collaboratively to find an answer. Moreover, the level of difficulty of the big question should be controlled to avoid cognitively overloading students and adversely affecting their motivation.

2.3.2.4 Internet as a research tool

The Internet is a key element of SOLE practice. Internet revelation and the advancements in technology have led to rapid changes in learning and teaching not just in education institutions and schools but also in education learning theory. Since the Internet emerged about three decades ago, educators have been interested in the potential learning benefits driven initially by the advent of massive amounts of information available at one's fingertips through the Internet, making resources more readily located and acquired. They suppose that the network creates effective and efficient education available to everyone everywhere.

Early research focused on the instruction programme or tutorials that allow the individual learner to work through a sequence of instructional or drill-and-practice activities, providing an opportunity for learners to perfect their responses with immediate feedback (Dalgarno et al., 2012). In the 1990s, the design of interactive learning programmes developed (e.g., Jasper Woodbury series) to promote knowledge construction and articulation (Cognition and Vanderbilt, 1992). This programme allows students to participate in activities to solve the problem either individually, in small groups, or as a whole class. Such an environment provides learners with multiple opportunities for problem solving, reasoning, communication and making connections to other areas such as science, social studies, literature and history. More recently the range of instructional online learning platforms available has expanded (e.g. Mathletics) which integrate valuable information with built-in assessments and interactive activities that help both students and teachers track progress.

In the past two decades, increasingly more classrooms around the world have started incorporating computers and the Internet (Land and Jonassen, 2012). However, against the general belief in the need for making more use of such technology in the classroom, a report issued by the OECD Programme for International Student Assessment (PISA) (OECD, 2015) revealed surprising findings about how the use of this technology reflects on students' test scores. The report shows that students in countries where computers and the Internet are used more in classrooms did not achieve higher in reading, math and science international tests. To the contrary, higher achievers in those tests were located in countries where lower levels of computer and Internet use were allowed in schools. This report, the findings of which downgrades the use of this technology in classrooms, has received wide media reporting and, at the same time, rejection by educators (Schmid and Petko, 2019). Although the report sounds completely negative towards computer and internet use in the classroom, as stated by Andreas Schleicher, the Director for Education and skills in OECD, "the findings of the report

should not be used as an excuse not to use technology, but as a spur to finding a more effective approach" (Coughlan, 2015, Para.4). In addition, one main criticism against this report is that it focused on comparing the level of computer use in the classroom and students' test scores, overlooking the fact that computer use in the classroom is not merely meant to improve test scores; equipping students with the skills needed to thrive in the 21st century is as or even more important.

In line with Schleicher's statement in the previous paragraph, advances in digital and online technologies and their availability to students inside and outside schools have indeed encouraged educators such as Mitra, the inventor of SOLE (Mitra and Rana, 2001; Mitra, 2010), to introduce new learning methods to utilise such innovation in schools. The incorporation of technology in SOLE sessions encourages self-learning (life-long learning) (Siraj-Blatchford, 2006) which helps students gain the confidence needed to learn efficiently (Hayes and Whitebread, 2006). This incorporation, on the other hand, gives opportunity to the Internet being assimilated in the curriculum and pedagogy (Paradowski, 2015). Mitra and Quiroga (2012) believe that by providing students with the Internet and giving them an opportunity for teamwork, they naturally acquire more technological literacy and greater confidence using new technologies.

Research on how students use the digital environment in their information search process has been of interest to many scholars. For example, Holliday and Li (2004) conducted a study to explore the information seeking behaviours of 35 high school students in the USA. Holliday and Li gave the students a topic and asked them to search for information. Through inspecting students' written journals during the research process and data collected through focus-group and individual interviews, the researchers came up with results about students' actions and feelings during their information seeking research process. The findings showed that the

Internet's readily available information has potentially changed students' conceptions of the research process to be easy. The authors suggested that the students were quite capable of using technology to gather information, but they were less skilled at critical thinking to choose the information. For example, the students settled for the first piece of information related to the topic and they collected ideas from a limited number of readings to form their own conclusions. Holliday and Li also mentioned that the participants experienced more uncertainty and frustration in the searching stage.

In another similar study conducted in the USA, Kuhlthau et al. (2008) used a sample of 574 students from grades 6 to 12 (10-18 years old) for three years and explored their information seeking behaviour. In this study, the school librarian and classroom teacher implemented guided collaborative inquiry, which formed the pedagogical framework for the instruction on selected curriculum topics. The students were encouraged to use a broad range of information sources including electronic sources and databases. Questionnaires exploring the students' feelings during the study revealed that students tended to conceive information as something easily available and felt frustrated when the process was not as seamless as they expected. It was also found that the gathering and formulation of information were the most challenging stages for their participants. The authors illustrate that a possible explanation for this might be the lack of the students' experiences in how to evaluate the quality of information, how to recognise what information is or is not relevant to the question at hand, and how to synthesize information from multiple sources into a coherent piece of work. The study also demonstrated that not all of the students proceeded at the same pace through the process and some of them needed more time to practice and develop their thinking and searching skills.

In a third study using a sample of 52 elementary year 3 (7-8 years old) students in Canada, Nesset (2008, 2013), collected data about students' information seeking behaviour through

observations, students' journals, interviews, pre- and post-questionnaires and self-evaluation sheets. Different from Holliday and Li (2004) and Kuhlthau et al. (2008), Nesset (2008, 2013) prepared students by providing sufficient information about the topic through texts, presentations or teacher explanation. The study revealed that although the pupils were prepared before they started the research stage, they encountered some problems when they searched for information in printed or web-based materials, but they seemed to overcome some of the problems and improve their information seeking skills by the end of the study. According to Nesset (2013), during presentations and discussions, children became more aware of conflicting ideas and this led them to be more focused in their search for information and findings presentations. The study also reported that the lack of appropriate websites for children was one of the challenges that faced her participants.

To conclude this section, advocates of using the Internet for learning believe that it encourages self-learning, which leads students to obtain life-long knowledge and skills (Mattar, 2018). The Internet has opened windows into up-to-date and diverse sources of knowledge. Although this diversity of sources might be an obstacle for students, who might at first lack the information seeking skills such as evaluating and synthesising information (Holliday and Li, 2004; Kuhlthau et al, 2008), with some guidance students can overcome these problems (Nesset, 2013). When exposed to such a learning approach, students become able to find the information they need when they need it, which is a more valuable skill than internalising knowledge as argued by connectivists (Siemens, 2005). In addition, it is assumed that using the Internet in learning would make students more confident of using technologies and equip them with skills they need to thrive in the 21st century.

2.3.2.5 Minimal teacher intervention

One important preposition in SOLE is that the role of the teacher in the classroom should be minimal as children can be responsible for their own learning given that the material resources are available to them (Mitra, 2006, 2010, 2015). To put it in Mitra's words, he states that "If given appropriate access, connectivity and content, groups of children can learn to operate and use computers and the Internet to achieve a specified set of the objectives of primary education, with none or minimal intervention from adults" (Mitra, 2015, p.263). This preposition has instigated fierce debates as many scholars have questioned the effectiveness of such an approach to learning in light of the teacher's absence or minimal intervention (Dolan et al, 2013; Stanfield, 2015). This will be elaborated on further below.

Mitra (2015) holds this position of minimal teacher intervention because he believes that effective teachers should always aim to encourage curiosity and wonder-driven learning and then step back as much as possible. To clarify the main preposition of SOLE in this respect, it is proposed that the teacher should act as a facilitator through formulating and asking big questions and giving feedback to students on their findings, but s/he should act as an observer or non-existent while the students are organising themselves and doing their research (Mitra, 2014a). The points at which the teacher can/should intervene according to SOLE are clarified in Figure 2.3.

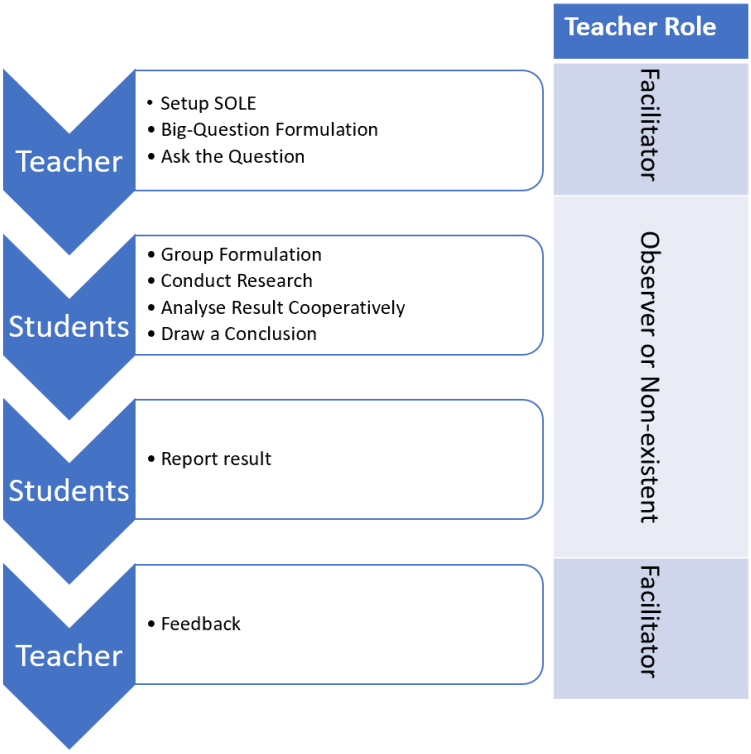

Figure 2.3: The role of the teacher during the SOLE session as adapted from SOLE Toolkit (2014b)

Indeed, Mitra asserts that beside choosing a challenging and thought-provoking big question, the teacher should provide feedback at the end of the SOLE session that supports learners in all aspects. Students will gain the knowledge and skill they need through receiving instructive feedback but with none or minimal intervention from the teacher during the researching phase in this process. Based on this, it can be said that the role of the teacher in SOLE sessions, as in constructivism and connectivism learning approaches, is a combination between directive and non-directive roles. The directive role refers to giving students the questions formulated by the teacher and giving them feedback when they have presented their findings. The non-directive role, on the other hand, means that the teacher does not instruct students on how to answer the question, but s/he acts as an observer. Thus, similar to the role of the teacher under the connectivism, the role of the teacher changes to being more of a 'curator' who creates spaces in which knowledge can be created, explored and connected (Vega et al., 2020).

In fact, it seems that the role of the teacher in the SOLE environment can be positioned in the context of education through Complexity Theory. Mason (2008, p.2) elucidates that the "Complexity theory's notion of emergence implies that, given a significant degree of complexity in a particular environment, or critical mass, new properties and behaviours emerge that are not contained in the essence of the constituent elements, nor can be predicted from a knowledge of initial conditions". The student's unexpected and random behaviours in the SOLE sessions result from the lack of external control. The minimal teacher intervention could cause the emergence of unpredictable complex phenomena such as chaos and self-organising behaviours.

Mitra and SOLE advocates believe that the absence or minimal intervention of the teacher enables students to work in a learning environment that is free of boundaries and in which they have a choice. In their view, such an environment would empower students and give them voice, combined with choices, to influence their own path to mastery driven by their interests, and often self-initiation. This would also give students opportunities to take meaningful action and see the results of their decisions (Mitra and Dangwal, 2010). Moreover, the students' ability to make a decision, away from the teacher's authoritative presence, encourages them to take initiatives, which enhances their cognitive ability to take control, increase motivation, ensure that students are engaged and respond to their activities (Dolan et al, 2013).

Nevertheless, some scholars oppose the minimal teacher intervention preposition as they believe that the authentic classroom context is more complex than it is viewed in SOLE and that SOLE promises with regards to students' outcomes can only be fulfilled with the support of the teacher. This support is concerned with what the teacher provides to students academically, socially and emotionally. In terms of the academic support, after analysing

Mitra work, Paradowski (2015) strongly argued for the need of a knowledgeable facilitator to help learners in information prioritisation, the organisation and structuring of their experience and linking their findings with the wider learning context. In addition, according to Paradowski (2015), successful online information seeking requires prior digital literacy training such as the skills necessary to identify and evaluate the most credible information, how search engines work, how to assess the reliability of the information they find online, and how to improve their search skills. What is more, Sowey (2013) and Harmer (2014) point out that the absence of the teacher in SOLE can result in lack of instruction, facilitation evaluation and even social exclusion and isolation during the process. These arguments against the minimal teacher intervention in SOLE approach are in line with the ideas of some scholars such as Kirschner et al. (2006), who argue that teachers in enquiry-based learning in general should at first provide some guidance and knowledge to students to prepare them to work independently (see Section 2.2.1 above).

As for the social support provided by teacher to students, as discussed in Section 2.3.2.1 above, many scholars (e.g. Gillies and Boyle, 2010; Järvelä et al., 2015; Frykedal and Samuelsson, 2016; Niemi, 2019; Alahmadi, 2020; Al Kandari and Al Qattan, 2020) believe that it is important to expressly teach novice learner CL skills before applying any collaborative approaches. These skills include negotiation, compromising to resolve conflicts, positively contributing to groups, explanation, listening and jointly solving problems and comprehending texts. This view coincides with the findings of educational research regarding the importance of the teacher's role in structuring and scaffolding these social skills. One such researcher is Niemi and Kiilakoski (2019), who conducted a design-based research study involving 23 pupils in the third graders (7-8 years old) in Finland. The aim of Niemi and Kiilakoski was to examine positive and negative experiences for students in a multidisciplinary learning module. This module, similar to the SOLE procedure, combined

between different subjects and the students were asked in groups to search for knowledge and express their findings through multiple ways such as 3D-modelling or handicraft. By analysing 80 photographs, 23 picture books and 23 interviews, the study found negative experiences that are related to learning how to work in a group and perform the tasks at hand. The authors concluded that “social participation does not occur by itself and the guidance by a teacher is needed to ensure that everyone can participate" (Niemi and Kiilakoski, 2019, p.9).

Moreover, contrary to what Mirta (2014) asserts, these scholars mentioned in the previous paragraph believe that establishing and sharing clear procedures with students relating to collaborative skills early in sessions will set the structure for positive interactions and aspirations later in the sessions. For instance, Frykedal and Samuelsson (2016) carried out a study in primary and secondary Swedish schools to investigate why some students accommodate but others resist when participating in group work as a mode of learning in schools. Based on quite a long period of observation time (225 hours) by the two authors in classrooms of students from school Years 6, 7, and 8 (10-15 years old) followed by 25 semi-structured interviews, they concluded that to increase group solidarity in the classroom, team skills should be explicitly taught. Further, Ferguson-Patrick (2018) argues that relationships among group members may require mediation or facilitation by an external source as conflicts or power differences might arise.

Along the same lines, Järvelä et al. (2015) warn about the negative effects of teachers’ elimination. These authors argue that working on single-user-designed devices, such as personal computers, need even more skilled students to resolve conflicts and give the individual accountability. They point out that a group of students using one shared display, if not prepared, might experience lower levels of participation and motivation, less group

cohesiveness and satisfaction and more conflict and contradictions. This is because such an environment allows for one child to control while the others only observe the experience.

Moving to the emotional support provided to students, although the SOLE approach does not state explicitly that no emotional support should be provided to students, the minimal intervention advised even at times of conflict among students creates a distance between the teacher and students preventing emotional support provision to a great extent. Creating an emotionally supportive classroom environment, as illustrated by Pianta and Hamre (2009), can take place by caring, being sensitive to students' needs and showing regard for students' perspectives. However, as argued by Reich-Stiebert and Eyssel (2016), distancing teachers from the classroom might affect teacher–student interpersonal relationships negatively. To clarify, distancing the teacher means being passive and leaving the child feeling disheartened, frustrated or helpless, which could lead students to feel that their feelings are being ignored by the teacher. This not only affects the teacher-students relationship, but also contradicts what the concept of 'a good teacher' means. A good teacher, as explained by Dozza and Cavrini (2012), is one that has the ability to establish positive and caring interpersonal relationships, which include cooperativeness, helpfulness, concern for others and interest in students' wellbeing. In addition, Shin and Ryan (2017) mentions an important effect of positive student-teacher relationships. This scholar points out that such relationships can be associated with a range of positive student behaviours in the classroom, including increased effort, help seeking and cooperation with peers. The author also argues that this relationship protects students from toxic stress and peer victimization and reduces negative instances of disruptive behaviour. However, it should be noted here that previous research has focused only on the effect of interpersonal relationships on students' feeling and behaviour, with the effect of this relationship on the teacher's psychological health and personal wellbeing being largely ignored (Spilt et al., 2011).

Based on the previous discussion and as argued by many scholars including Heron (1999), who provides a detailed explanation about how teachers should facilitate students' learning, teachers should provide successive levels of temporary support that help students reach higher levels of comprehension and skill acquisition that they would not be able to achieve without assistance. It is necessary that teachers respond as appropriate to reduce the negative emotions (frustration, intimidation and discouragement) and self-perceptions that students may experience when they work in groups or attempt a difficult task. In short, the effective facilitation could be supported by switching between different strands of learning and the facilitator him/herself determines the style depending on students' needs. The supportive strategies might be incrementally removed when they are no longer needed, and the teacher gradually shifts more responsibility over the learning process to the student (Heron, 1999).

This role of the teacher described by Heron (1999) can also be seen as 'orchestration' as discussed by a number of researchers (e.g. Dillenbourg, 2016; Hamre and Pianta et al., 2010). Orchestration is a metaphor depicting the teacher as a conductor who gives instructions to a group of musicians to achieve a desired goal (Viilo et al., 2018). To clarify, as a conductor, the teacher is responsible for designing and creating the learning opportunities/ activities for learners in a way that s/he considers suitable to maximise students' learning (Hamre and Pianta, 2010). In addition, adapting and customizing the practice according to the situation in the classroom is a key part of orchestration; indeed, Dillenbourg (2016, p.486) states that "orchestration is a regulation process similar to adaptive (individualized) instruction: monitoring the situation, deciding what adaptations are necessary and then performing these adaptations". Therefore, this role requires the teacher to regulate students' learning through preparing the activities and the learning environment, managing and monitoring the learning process and adapting the process in a way that is considered more beneficial for students.

In addition to the support given by the teacher to students, some researchers (e.g., Richards and Farrell, 2005, 2010; Farrell, 2013) assert that it is pivotal for teachers to be aware of any critical incidents that take place in the classrooms. A critical incident is defined by Richards and Farrell (2010) as "an unplanned and unanticipated event that occurs during a lesson and that serves to trigger insights about some aspect of teaching and learning" (p. 13). According to Farrell (2013), such incidents can be positive or negative and would lead the teacher to intervene or to change his/her course of action. These incidents are particularly important because they provide the teacher with chances to improve their practice (Richards and Farrell, 2005). This is the case because teachers are expected to reflect on these critical incidents and how they responded. This reflective process will allow teachers to gain insights into how to best deal with certain situations and this would definitely improve their practice in general (Mohammed, 2016).

Furthermore, a significant aspect of the teacher role is maintaining students' engagement and motivation (see Section 2.3.2.3 on the use of big questions to motivate students). In education, student engagement refers to the degree of attention, curiosity, interest, optimism, and passion that students show when they are learning or being taught, which extends to the level of motivation they have to learn and progress in their education (Pink, 2011). The teacher's role in this engagement and motivation comes when designing the learning experiences to drive students' curiosity and capture their interest (Fletcher, 2012). However, some scholars (Sung et al, 2017; Fu and Hwang, 2018) warn that the design of the learning experiences might sometimes lead students to become less engaged and less motivated and lose interest in what they are doing. This is supported by the findings of Sung et al's (2017) meta-analysis, which revealed that longer educational interventions using digital devices were not more effective than shorter ones because students started to lose the sense of novelty of the devices and lose

interest in the routine scenarios. Hence, to avoid the likelihood of such an occurrence, teachers should be creative and innovative in how they increase their students' engagement and motivation.

In relation to students' engagement and motivation, a number of studies have suggested strategies to address this aspect. Providing rewards to students is one of these strategies. Slavin (2015) asserts that research reveals conclusive evidence that rewards are essential for motivation and the effectiveness of team work especially in primary schools. Another strategy suggested to increase students' engagement and motivation is introducing artistic elements to the learning environments. Some research (e.g., Jensen, 2001; Achor, 2010; Coulter and Woods, 2011; Niemi and Kiilakoski, 2019) showed that this technique creates an environment of pleasure, joy and happiness in the classroom, which are, according to Achor (2010), a powerful indicator of engagement and can lead to greater motivation. In addition, Jensen (2001) also found that because arts enhanced concentration and motivation, they led to better achievement. In an attempt to clarify this relationship between arts and motivation, Coulter and Woods (2011) clarifies that the artistic element helps to sustain children's interest because their curiosity is piqued, which has the power to cause motivation and enjoyment.

A third strategy suggested to increase students' engagement and motivation is self- and peer-assessment. In Black et al. (2004) study, it was found that when students participated in self- and peer-assessment, they became more motivated and engaged in learning and this led to significant learning gains. Moreover, the 'Granny Cloud' strategy suggested and followed by Mitra (2015) is believed to have a positive effect on students' motivation and engagement. In this strategy, another person, such as a parent or another teacher, from outside the school or even the country is invited to participate in the SOLE session from distance over the internet. In Mitra's (2015) study, retired teachers in the UK participated in SOLE sessions involving

Indian children and this was found to reflect positively on students' engagement and motivation. According to Leonard (2003), in developing countries children admire and are fascinated with western people especially if they meet them in a friendly and non-threatening environment (i.e., online chat), which could justify the positive effect of 'Granny Cloud' strategy.

To sum up so far, this section has discussed the five main foundational ideas of the SOLE approach. It is clarified that SOLE adopts and combines the collaborative and enquiry-based learning methods. Students in SOLE are required to work together in groups using web-based resources to answer big questions. In this process, the teacher's role is restricted to formulating and presenting this question and giving feedback on students' findings at the end of the session (the advantages and challenges of SOLE approach will be discussed in later sections in this chapter).

Before moving on to review previous empirical work on SOLE, how this approach is thought to impact children will be discussed in the following section.

2.3.3 The expected impact of SOLEs on children

SOLE as a learner-centred approach is student-driven learning that takes place due to 'self-organised, curious, engaged, social, collaborative, Intrinsic motivation and motivated by peer interest, fuelled by adult encouragement and admiration' (Mitra, 2014b, p.5). A curious child is motivated to ask questions, seek answers, and apply those answers to his or her personal experience. SOLE can be thought of as a process where students help uncover information themselves and motivate each other to understand the underlying principles. Dr Mitra believes that SOLE is not about information processing, it is about delving into the realms of deeper learning (Mitra et al., 2010). Further, when students investigate the topic together and

ultimately present their findings to the class, self-confidence increases in their own ideas and ability to contribute to the classroom (Gregersen and Horwitz, 2002).

The advocates of SOLE are eager that this approach becomes a sustainable learning method that attracts students and connects with their needs. This is because, from their perspective, the children have to develop 'agency', that is to be able to show choice and responsibility as well as gain a sense of self and autonomy. In Mitra's words, "SOLE demonstrates just how powerful adults can be when they give small groups of children the tools and the agency to guide their own learning and then get out of the way" (Mitra, 2015, p.374).

Furthermore, SOLE is believed to increase children's motivation in learning (Mitra, 2015). Previous literature on motivation considers the concepts of autonomy, mastery and purpose fundamental to intrinsic motivation (Pink, 2011). Pink draws a distinction between motivation that is driven by external goals that are associated with rewards and punishments and motivation that is driven by internal goals to learn. Bjerede (2018) clarifies this as follows:

> "[S]tudents who are motivated to learn are more likely to focus on understanding, are more likely to learn deeply, are more likely to go above and beyond in an assignment and are more likely to investigate when they have a question. Students who are motivated to get good grades [or pleasing teachers or parents] are more likely to game the system, do the minimal amount of work necessary, memorize formulas rather than understand where they came from, read book summaries rather than books, and cheat". (Bjerede, 2018, para.8)

Student agency, which is promoted by SOLE, implies that students are intrinsically motivated, which supports that students internalize learning as a goal. This can happen by implementing interesting, challenging and absorbing pedagogical approaches such as Project-Based Learning, Inquiry, Design-Based Learning and others that lead students to sustain

intrinsic motivation and find enjoyment and satisfaction in school. The SOLE approach applies this learner-agency based model, where learners actively construct and even co-create knowledge during the learning process. Students are encouraged to explore topics in detail, free to develop concepts without many restrictions found in traditional classrooms, even if they do not get their way all the time, which triggers a greater investment of interest and motivation.

Although having an impact on the behaviours, skills and knowledge of students is perhaps the core purpose of any teaching approach, being able to measure this impact is just as important for researchers and teachers in order to investigate the effectiveness of this approach. Indeed, different taxonomies to assess learning have been developed by researchers; well-known taxonomies include the Structure of the Observed Learning Outcome (Biggs and Tang. 2011) and Bloom's Taxonomy of Educational Objectives (Bloom and Krathwohl, 1956). However, as argued by Kharrufa et al. (2017), these taxonomies focused on measuring knowledge acquisition at one point of time and did not address the development aspect of this learning process, which is essential in the digital age. Kharrufa et al. (2017), on the other hand, developed the Group Spinner tool to measure students' learning and learning behaviour in a digital environment and tested this tool in a SOLE classroom. This tool takes into consideration not only knowledge acquisition but also the development aspect of the learning process. It focuses on a number of behaviours that can be observed and can indicate the progress of students' learning. More specifically, these behaviours are information seeking, learning outcome, collaboration, context-specific behaviour and motivation and engagement. Based on this, this tool will be adopted in the current study to measure the impact of SOLE and the methodology chapter (Section 3.6.1) elaborates further on the specific components of this tool and how it measures learning and the learning behaviour.

To conclude, this section has identified a number of benefits for the SOLE approach based on the previous literature. It is highlighted that SOLE is proposed by advocates to work as a pedagogical practice more than simply cognitive but also emotional, social and physical development. It comprises greater opportunities for intrapersonal and interpersonal skill development. Children at all levels might benefit from the reinforcement of concepts through peer teaching, communication, and social interaction in SOLE sessions. It is an authentic learning environment that constructs opportunities to synthesize and apply knowledge. Students are given a degree of independence that involves peer-assessing, making judgements and presenting their learning. However, most of the features mentioned above are aspirations that need to be investigated more in depth. Furthermore, it is still necessary to consider how to integrate SOLE in the curriculum to enhance contemporary learning.

The following section reviews the findings of previous empirical studies on the applicability and effectiveness of SOLE in different contexts.

2.3.4 Previous empirical studies on SOLEs

The concept of SOLE was developed from the 'Hole-in-the-Wall' experiment (i.e., the unsupervised use of the Internet by a group of children) carried out by Mitra in 1999- 2006 and which resulted in several publications (i.e. Mitra and Rana, 2001; Mitra , 2003; Inamdar , 2004; Dangwal et al., 2006; Mitra et al., 2005; Dangwal and Kapur, 2008). The 'Hole-in-the-Wall' was first conducted in 1999 in Kalkaji, a suburb of New Delhi, India and then repeated in 26 locations all over India. These studies involved providing street children with unconditional access to computers operating in English, which were made available in public out-of-school settings (within a wall and later a kiosk). The children's interaction with the computers was monitored by the researchers. The earliest 'Hole-in-the-Wall' studies (i.e. Mitra and Rana, 2001; Mitra, 2003) found that, within a few days, street children learned to use computers, play games, create documents and paint pictures by themselves although those

children received no instruction or guidance, had little or no knowledge of English and never had seen a computer before. In other words, it appeared that in unsupervised and unguided access, children could learn to use computers and the Internet by themselves, irrespective of their social, cultural or economic backgrounds. It was assumed in these studies that the learning was a result of collaboration, peer tutoring and random exploration driven by the children's innate sense of wonder and curiosity.

The 'Hole-in-the-Wall' initiative has been concerned initially with bridging the divide in remote and disadvantaged regions by "providing access to education for children in places where good schools do not exist, and good teachers do not want to go" (Mitra and Arora, 2010, p. 703). The promising results of the early 'Hole-in-the-Wall' studies in relation to computer literacy led some researchers to investigate whether such unsupervised group learning in shared public spaces can improve children's knowledge in academic subjects such as 'Computer Science' (Inamdar, 2004), math, English and science (Dangwal, 2005; Inamdar and Kulkarni, 2007) and molecular biology (Mitra and Dangwal, 2010). In these studies, some school children were given access to materials relating to a specific academic subject through a computer station (experimental group) and their performance in exams were compared to that of other school children who did not have access to a computer station (control group). The findings of these studies revealed that the experimental group outperformed or at least achieved the same levels as their peers in the control group.

The 'Hole-in-the-Wall' project has received recognition about the impressive results achieved inside India and internationally. However, after conducting an ethnography on two failing 'Hole-in-the-Wall' projects in the Central Himalaya communities of Almora and Hawalbagh, Arora (2010) raised concerns about the abdication of responsibility and lack of sustainability especially with an adult or teacher absenteeism. Based on these concerns, Mitra and Dangwal

(2010) introduced the idea of including a 'mediator' who is unknowledgeable about the academic subject but whose responsibility is to supervise children and encourage them to do the task of researching. Mitra and Dangwal believe that the presence of the mediator, who minimally intervenes to encourage but never teaches, could resolve the concerning issue relating to the absence of an adult. The academic subject their study focused on was molecular biology and the children used in the study were 10–14 years old Tamil-speaking children living in an Indian disadvantaged area. In this study, the authors tested the children's knowledge prior to and posted a 75-day 'Minimally Invasive Education' intervention. The post-test scores showed a 51% increase in results from the pre-test results. The study also found that what these children achieved was comparable with the performance of children receiving education in privileged private and public schools in the nation's capital. That these children could learn sophisticated materials without the help of a teacher and their performance was comparable to students in teacher-led classrooms was impressive.

Following the promising findings of the 'Hole-in-the-Wall' experiment in India primarily outside a school setting, Mitra and Quiroga (2012) tested this idea of 'minimally invasive education', which was named then as 'Self-Organised Learning Environment' (SOLE), in other countries inside schools. This study was carried out in four primary schools in Uruguay on 78 grade five children over three days. The study required the students to do a reading comprehension task beyond their levels in Spanish (their first language) and English (their second language) in a SOLE environment. The main aim of the study was to investigate whether children would read better in groups or individually. The findings demonstrated that students who worked in groups outperformed their peers who worked individually in the reading comprehension task. In addition, children in groups were more enthusiastic to answer complex questions than when they worked individually. Similar findings were reached by

Vega (2018), who conducted her study on fourth-grade children in New York, USA. According to both studies, these findings support SOLEs' thesis about working in groups.

Prior to Mitra and Quiroga (2012), Mitra and a research team started a 3-year project in 2009 to test SOLE in a UK primary school, and this resulted in two publications (i.e. Dolan, Leat, Mazzoli Smith, Mitra, Todd and Wall, 2013; Mirta and Crawley, 2014). This project aimed at investigating the effectiveness of SOLE and its transferability to classrooms. In this aim, Mitra and Crawley (2014) carried out four consecutive experiments. In experiments 1, the researchers gave Year 4 students (8 years old) a set of questions from GCSE Level (16 years old) and asked them to find answers using the Internet within 45 minutes. The children were able to answer these questions in groups during the same session. Moreover, the children were tested three months later, and they could answer the questions individually without the help of the Internet. In addition, the same conditions of experiment 1 were repeated in experiment 2 and 3 but with more difficult questions this time and the same findings were reached. In experiment 4, reading passages with a set of follow-up comprehension questions were given to two groups of Year 4 students and while one group was asked to answer the questions individually, the other was asked to work in groups; both worked in a SOLE environment. It was found that the students in groups performed significantly better in response to more difficult passages and questions. Based on these findings, the authors concluded that students "with the help of the Internet and without supervision, are capable of understanding topics that are traditionally considered many years ahead of their age level capabilities" (Mitra and Crawley, 2014, p.85).

In the other study resulting from this project, Dolan et al. (2013) aim to explore to what extent the SOLE practice can be regarded as transformative and innovative. To this end, they analysed data arising from the project over two years based on teacher notes and students'

opinion questionnaires during SOLE sessions. The data was about the teacher's and students' experiences, views, and work during the implementation of SOLE. It was found that the students were enthused to use the Internet in groups to research answers for more challenging questions and the method was successful in engaging all students in the learning. The pupils enjoyed working on more challenging questions, and this was, according to the authors, due to the non-competitive atmosphere. Flocking behaviour was also noticed where nearly all the students would gather around other groups to inspect significant findings which led to discussions that were carried out after the sessions. The researchers concluded that SOLE constitutes a potentially radical transformative pedagogy, but it is flexible to the extent that it can be used alongside other more traditional approaches. They also postulated that such use of technology with minimal teacher intervention is an innovative approach as it reflects positively on students' social and learning behaviour.

SOLE has also been tested in other levels of education with older students, and the findings seemed impressive. One such study is Rix and McElwee (2016), who investigated the potential of SOLE to increase engagement and learning among 26 low achievement students at Year 8 (12-13 years old) in a secondary school in England. Those students were exposed to two cycles of SOLE sessions (3 sessions each), the focus of which was Geography-related topics. In the second cycle of sessions, a Six Form mediator (a 17-year-old peer) was introduced in order to support students during the learning process through directing them to keep focused on and engaged in the set task. The authors used a range of data collection techniques: Field notes, video-recording of the presentations and interviews.

The findings of this study by Rix and McElwee (2016) demonstrated that the SOLE experience appealed to students as they showed a very good level of engagement and enthusiasm in the first session. However, this engagement and enthusiasm decreased

noticeably in the second and the third sessions, which necessitated introducing a Sixth Form mediator after that. Another finding was that knowledge acquisition occurred in both cycles of the experiment, although after introducing the mediator, the students' understanding, according to the authors, "tended to go beyond what might be expected according to age-appropriate average National Curriculum levels. Some went beyond that to the highest order of thinking, evaluation" (Rix and McElwee, 2016, p.49). Moreover, the students covered all areas of the topic that they would have been expected to cover in a traditional classroom and they even reached some areas that would have been considered beyond expectations in such a stage. Based on this, the authors also argued that the information accessed and processed by the students was more than what they would have been exposed to in a traditional setting.

In Rix and McElwee's (2016) study, a mediator who was an older peer was introduced to provide assistance to students. The authors mentioned that the type of help provided was restricted to some scaffolding to engage students in the task and some emotional support to encourage them to complete the task. Thus, the mediator did not provide any kind of academic support and, according to the author, this did not change the nature of the SOLE experiment, but still it made a significant difference in the performance of students during task completion and their presentations. Therefore, introducing a mediator seems a wise decision to improve students' performance, but the idea of introducing an older student into SOLE sessions in real practice as a mediator might not always be possible; although Rix and McElwee (2016) did not clarify whether having an older peer as a mediator in their study was a suggestion to copy this in real practice or was only for the sake of the experiment, having the teacher taking this position seems a more practical decision. Indeed, other research studies employed the teacher as a mediator as will be seen in Ma's (2018) study discussed below.

Ma (2018) conducted her study in a secondary school in China to investigate how SOLE can be integrated into the curricula for history and maths within a traditional and exam-oriented teaching environment. The study involved a class in the eighth grade (13-14 years old) with 58 students as the SOLE group and another two classes as controls. The three classes were taught by the same history and maths teachers. Over a nine-month period, twenty history and twenty maths SOLE sessions were conducted. Data was collected using classroom observation notes, questionnaires completed by students and students' guardians, semi-structured interviews with teachers and students, after-class diary forms, homework assessments and the results of three examinations. The results revealed that students' scores improved in history but not math exams indicating development in knowledge in history but not in math. In addition, students enjoyed history sessions and only geometrical, but not algebraic, tasks in math sessions. Moreover, although taking the new roles in SOLE sessions was difficult for both students and teachers in early sessions, they were able to adapt to these roles later.

Nevertheless, the strategy of the SOLE approach has not escaped criticism from academics and some practitioners, who viewed it as disruptive and an extreme way of doing things. Similar to minimally guided approaches as termed by Kirschner et al. (2006), SOLE has been criticised for its lack of direct instruction and, therefore, inability to equip students with solid foundations (Harmer, 2014). Sowey (2013) also claimed that a complete reliance on self-organised learning could lead to misconceptions and might be misleading because of the limited abilities of children at certain stages as they cannot differentiate between what is right and wrong or appropriate and inappropriate. These limited abilities of children might give rise to even a more serious problem with SOLE given the nature of information available through the Internet; the Internet is full with unreliable sources of information. This argument by Sowey is indeed supported by the findings of Holliday and Li (2004) and Kuhlthau et al.

(2008) reviewed above in Section 2.2.2.4. However, although SOLE is criticised and many researchers maintain that it cannot replace formal education, there is some agreement on its benefits and therefore there are voices to apply it along with formal education. This can be done along the lines suggested by SOLE advocates themselves (e.g., Dolan et al., 2013), who maintain that although the SOLE approach is a radical transformative change to pedagogy, it can work in harmony with other more traditional dominant approaches.

Whilst some research has been carried out on the SOLE approach; it is still in need of further investigation to uncover its benefits and the feasibility of introducing it into schools. Such further investigations might contribute to constructing the theories underpinning the SOLE project. These investigations should focus on introducing and testing SOLE in other contexts and bridging gaps in SOLE research. Firstly, as for introducing and testing SOLE in other contexts, to date, there are no SOLE studies conducted in Saudi Arabia or even the Arab world (see the next section on relevant work conducted in Saudi Arabia). Doing such research in Saudi Arabia could enhance our understanding of SOLE applicability and effectiveness in the learning of students from different cultural backgrounds and this may suggest how to customise SOLE approach to be suitable for different contexts. This endeavour will be pursued in the current study through exposing a group of primary school children in Saudi Arabia to SOLE.

Secondly, as for bridging gaps in SOLE research, this approach to learning is relatively new, and it is no surprise that gaps exist. One noticeable gap in SOLE research, as highlighted by Dolan et al., (2013) and as the review above has revealed, is related to the fact that previous research has focused on comparing the performance of SOLE students against standard learning outcomes expected to be achieved by school students at a specific level. In doing so, such research has ignored how SOLE could improve students' academic skills such as

information seeking, problem solving, critical thinking and social skills such as motivation and engagement, confidence, self-organisation and collaboration. However, this gap is not restricted to SOLE as research on collaborative learning also has paid little attention to these skills (Fu and Hwang, 2018). Understanding how these skills are developed is necessary, especially in light of the SOLE suggested minimal teacher role in this process. This is something that the current study attempts to pursue.

The following section reviews previous relevant research conducted in Saudi Arabia.

2.3.5 Previous research in Saudi Arabia (the study context)

In relation to the study context, Saudi Arabia, no SOLE studies have been conducted and few studies focused on introducing innovation practice in schools. As mentioned in Section 1.5, the most prevalent teaching approach in Saudi schools is the traditional approach based on lecturing and although technology exists in these schools, it is not integrated in lessons to enhance students' learning. However, motivated by the MoE plans to transform education in Saudi Arabia, there have been few attempts by postgraduate students to investigate introducing and testing new innovative teaching approaches as will be elaborated below.

One of these attempts was made by Almulla (2017). This example of research in Saudi secondary school aimed to examine the perceptions of Saudi secondary school teachers and their students about CL and the challenges and difficulties in implementing CL in the Saudi context. The study involved exposing eight teachers to in-service training on CL and asking them to use this approach in their classrooms. Data were collected about the teachers' and students' attitudes through interviews, the students' academic development through pre and post-tests and the students' social development through classroom observation. The study revealed that students developed academically and socially noticeably and that both students and teachers held positive attitudes towards CL and preferred it to the traditional approach.

Some challenges to introducing CL into Saudi schools are also revealed by the study. The intensity of the curriculum and lack of cooperation skills among students were the main challenges. In line with many researchers in this field, Almulla suggests that there is a need for further research on the CL approach in the Saudi context to better understand how it can be introduced.

In another interesting study carried out by Alsenaidi (2012), the author explored how EBL improves creativity skills of primary school students. The study used an experimental design through testing the creativity skills of students placed in three different classrooms: EBL with a computer classroom, EBL without computers classroom and traditional teaching approach classroom. The three classrooms exposed students to the same topic but delivered or guided by different teachers. Through examination of the observation and interview data, the author found that the EBL with computers classroom group outperformed the other two groups in creativity skills, dialogue and engagement. However, the study revealed that there were some barriers facing EBL with computers such as technical problems and communication problems among students.

The two studies mentioned above (Almulla, 2017; Alsenaidi, 2012) also attempted to investigate the teacher's role when CL or inquiry-based learning is introduced. Although these studies observed that the teachers require more training to take up their roles effectively, they reported that teachers were positive about the new roles when compared to their roles under the traditional approach. For example, Allmula (2017) reported that the teachers in his study perceived their roles in CL as facilitators, task designers and mentors of students' progress more positively than their role as lectures and presenters as in the traditional approach.

This review of studies conducted in Saudi Arabia shows that there is a dearth of research on this area (Almulla, 2018). Relying on the findings of this limited number of studies might not be sufficiently informative to lead to the success of educational initiatives launched by the MoE in Saudi Arabia. This necessitates conducting more empirical studies testing new approaches in Saudi schools that make students' learning the central concern and redefines the roles of teachers. This is an endeavour that will be pursued in the current study through exposing a group of primary school children in Saudi Arabia to SOLE and investigating the applicability and effectiveness of this innovative practice in education.

2.4 Conclusion

This chapter reviewed constructivism and connectivism learning theories, which are based on the belief that learning and teaching should happen in an active and engaging environment. This was followed by a section on the similarities that the theory behind SOLE bears with these major theories of learning. The chapter continued with an analysis of the application of SOLE in the classroom. After this, a discussion of the five main foundational ideas of the SOLE approach was presented. The discussion clarified how SOLE adopts and combines collaborative and enquiry-based learning methods. It further showed how in SOLE students are required to work together in groups using web-based resources to answer big questions. It was also discussed that in this process, the teacher's role is restricted to formulating and presenting these questions and giving feedback on students' findings at the end of the session. Following this, the chapter reviewed SOLE-related empirical research. This literature review also summarised the earlier studies and current trends in research on SOLE, which helped the researcher to identify three research gaps in this field. Based on this, the chapter highlighted the need for conducting more empirical studies testing new approaches in Saudi schools that make students' learning the central concern and redefines the roles of teachers.

In the next chapter, the methodology used in this study will be outlined.

Chapter 3. Research Methodology

3.1 Introduction

This chapter presents and discusses the methodological procedures adopted in this research. It starts with restating the aim, objective and research questions in Section 3.2. Following this, Section 3.3 discusses different philosophical positions and justifies placing the current study within the interpretivist tradition. Then, Section 3.4 discusses and justifies following an action research approach to achieve the study objectives. The next section (3.5) provides information about the sampling strategy and the participants of the study. The data collection techniques used in the current study are discussed, outlined and justified in Section 3.6. The next two sections (3.7 and 3.8) clarify the data collection and data analysis procedures, respectively. Finally, issues related to research rigour and trustworthiness, researcher's positionality and research ethics are discussed in 3.9, 3.10 and 3.11 before concluding the chapter in 3.12.

3.2 Aim, objectives and research questions

As mentioned in Chapter One (section 1.4), the aim of this research is to investigate the applicability and effectiveness of SOLE in improving students' academic and social performance at a primary school in Saudi Arabia. The following are the objectives of this research.

1. Investigating the effectiveness of SOLE on the academic and social behaviour of Saudi primary school children.
2. Exploring the perceptions of Saudi primary school children towards SOLE.
3. Identifying the challenges that might encounter introducing SOLE into Saudi primary schools.

To achieve this, the following questions will guide the research process.

1. How does SOLE affect the learning process and products of children who are accustomed to a traditional approach?
2. How do students perceive SOLE in comparison with a traditional classroom environment?
3. What are the challenges of introducing SOLE in Saudi Arabia schools?

3.3 Philosophical perspective

In order to achieve a successful outcome, this research has to build upon some fundamental philosophies, values, and viewpoints underlying the approach chosen. Because of the nature of research in education, there are different research paradigms that have evolved to determine the criteria according to which one would select and define problems for inquiry. According to Gipps (1994, p. 1) a research paradigm is the "set of interrelated concepts which provide the framework" as to how problems should be understood and addressed.

There are mainly two paradigms commonly applied in the education research setting: the conventional positivist and constructivist interpretivist. The fundamental difference between positivist and interpretivist paradigms "depend on philosophical issues related to the question of ontology (the nature of reality) and epistemology (the nature of knowledge)" Tuli (2011, p. 99).

The next section will examine the positivist and interpretivist approaches based on the ontology and the epistemology philosophy. In doing so, justifications for considering interpretive paradigm as appropriate for this research will be presented.

3.3.1 Positivist paradigm

The positivist researcher in education sees "social science as an organized method for combining deductive logic with precise experimental investigation of individual behaviour in

order to discover and confirm a set of probabilistic causal laws that can be used to predict general patterns of human activity" (Neuman and Kreuger, 2003; Tuli, 2011, p. 99). The basic ontological position of positivism is that there is only one truth, an objective reality that exists apart from personal ideas or thoughts (Scotland, 2012). Epistemologically, the researcher and the researched are independent entities (Scotland, 2012). Therefore, a researcher is assumed to be objective and capable of studying a phenomenon without influencing it or being influenced by it.

Researchers who work from this perspective are looking for correlations and associations among variables that "comprise hypotheses and research questions" (Creswell, 2009, p. 7). Further, such researchers also investigate how variables interact and shape events and try to identify causes which influence outcomes (Creswell, 2009). This may be done through standardized tests, questionnaires, experiments, and descriptions of phenomena using standardized observation tools that are coded quantitatively (Creswell, 2009). Researchers use this method to test and verify a hypothesis to obtain "objective" truth as well as to predict what may happen in a future date (Creswell, 2009). Positivists analyse and evaluate the quantitative findings using statistical criteria and terms such as reliability, validity and quality (Creswell, 2009).

Although the positivist approach is widely used in school setting research (Cohen, 2011), there have been debates about its limitations. Scotland (2012) highlights that because of the complexity in the education setting, it is extremely difficult to control or simplify the variables in educational research. For example, the influence of the contextual variable might be easily ignored by the positivist approach.

The positivist approach is also criticised for being often insufficient and unsuitable in describing human behaviour (Cohen, 2011). That is, positivists seek predictions and generalizations that ignore the intentionality of the individual, and thus do not fully understand actions (Cohen, 2011). Although positivist measurements can provide researchers with an efficient means of grouping and quantifying complex human behaviour (Kim, 2003), these measurements might lead to errors when it comes to understanding the human behaviour (Scotland, 2012).

3.3.2 Interpretive paradigm

Interpretive research or constructivist research, in contrast, seeks to understand phenomena from an individual's views, investigating interaction among participants as well as the "historical and cultural norms that operate in individuals' lives" (Creswell, 2009, p.8). Researchers holding this philosophical position assume that the "knowledge of reality is gained only through social constructions such a language, consciousness, shared meanings, documents, tools, and other artefacts" (Walsham, 2006, p.69). Reality here is perceived by individuals as they make sense of the world but focuses on the complexity of human sense making as the situation emerges.

In this humanistic paradigm approach, the researchers are more likely to accept the complexities of the education schemes and enable them for a deeper understanding of the teachers and students experiences, and of the classrooms, schools and the communities cultures (Cohen, 2011). This understanding, as Cohen explains, involves political, historic, economic, and social aspects that shape the schooling systems, curriculum policies and pedagogies. Further, for those wishing to take on a student-centred pedagogy teaching and learning such as constructivist an interpretive orientation is essential.

The ontological position of interpretive research assumes that reality is individually constructed through social interaction, such as language, shared meanings, and instruments (Creswell, 2009). This type of research allows for obtaining a deep and sympathetic understanding of human thought and the processes of interaction in a social context, such as a school. A key aspect of interpretive research is that the researcher seeks to reach this understanding through constructing knowledge, which in turn takes place through the researcher's social experience and, more importantly, his/her effort in "empowering the participants in research to freely express their views, which they may not have a chance to do with someone outside of the school system" (Tuli, 2011, p. 102). This means that interpretive theory is oriented toward discovery and is, thus, inductive. Reality in this sense is being generated from the data and hence has high validity (Cohen, 2011).

However, Guba and Lincoln (1994) underscore that the reality is subjective and differs from person to person. Thus, the epistemology of this paradigm is inter-subjective knowledge construction. Further, the researcher and the research context "are assumed to be interactively linked so the findings are literally created as the investigation proceeds" (Guba and Lincoln, 1994, p.111). More precisely, Tuli (2011) asserts that knowledge and reality are, interpretively, constructed by people in their interactions with each other and with wider social systems. Hence, they are developed and transmitted in social context. This suggests that reality has no existence prior to the activity of investigation, and reality ceases to exist when we no longer focus on it (Greig-Smith, 1983, p.).

According to Ulin et al. (2005) and Creswell (2009), interpretivists often rely on qualitative data, although this should not be taken as a thumb rule. Such data is collected through personal contact over some period of time between the researcher and the group being studied. The findings in qualitative methodology are usually reported in detailed, rich, and

thick (empathic) description. Collecting such data gives value and importance to the interactions that have taken place in naturally occurring social settings and produce “theorised accounts” that represent participant’s “sociological understandings” (Danby and Farrell, 2004, p. 41). However, while associating interpretivism with qualitative data and positivism with quantitative data is fairly common in research, as stressed by Bryman (2016), this dichotomy only exists at the superficial level. A number of researchers including Creswell (2009), Mertens (2014) and Bryman (2016) postulate that it is how the researcher deals with data that determines whether the adopted paradigm is interpretivism or positivism. For example, a researcher counting a number of a specific type of incidents in a social context to check how they correlate with another type of incidents is a positivist approach. On the other hand, relying on the participants' views in that social context to explain the relationship between these two types of incidents is an interpretivist approach, but the counting of the incidents to provide evidence about their frequency does not change the nature of this approach. This indicates that interpretivism might also make use of quantitative and not just qualitative data (Creswell, 2009). Indeed, Bryman (2016) proposes that even combining qualitative and quantitative data is possible under the interpretivism umbrella. As will be elaborated on and justified in Section 3.3.3, the present study adopts an interpretivist approach combining both qualitative and quantitative data.

The interpretivist approach has some limitations. One of them is the inability to make generalisations (Scotland, 2012). This appears to mean that the outcome of the research cannot be generalised to other settings. However, there is a body of opinion that purports to the contrary, suggesting (given the world is social and individuals engage in this world on the basis of shared understanding) that if the research context represents an area of social life, typical of its ilk, then there is no logical reason to assume that the findings gathered cannot be assumed to be similar in other 'like' settings (Lewis et al., 3003; Larrson, 2009; Suter, 2012).

In addition, according to Suter (2012), the purpose of qualitative researchers is to uncover themes, identifying patterns and drawing conclusions. These conclusions contribute rich insights about the problem studied which may help to be applied in many contexts. More clearly, researchers who use these approaches often find that their research "generalises" to the extent that others can use ideas embedded within the descriptions in some other, often personal, context (Suter, 2012, p. 363). On the other hand, the results from this kind of studies can provide important information for exploratory research.

Up to this point, this chapter has outlined the two paradigms commonly applied in education research settings and has discussed their associated strengths and weaknesses. The following section provides the rationale behind choosing the interpretive paradigm for this study.

3.3.3 The justifications of choice of approach

Before discussing the rationale of choosing the interpretive paradigm, it is worth to note that the researcher is aware that no one research methodology is better or worse than the other as both are proven to be useful in most research endeavours (King et al., 1994). Both positivist and interpretive researchers hold that human behaviour may be patterned and regular. While positivists are concerned with attempts to quantify social phenomena and to collect and analyse numerical data, interpretivists are concerned with understanding the meaning of social phenomena in relation to actions and situations. In addition, interpretivists' approaches enable rich and detailed, or thick descriptions of social phenomena by encouraging participants to speak freely and understand the investigator's quest for insight into a phenomenon that the participant has experienced.

Choosing between these two main research paradigms, positivism and interpretivism, depends on a number of factors. According to Tuli (2011), these factors are the research problem that often dictates a specific research methodology to be used in the enquiry, the research context,

the researcher's personal beliefs and values and researcher's own experiences and training. The rest of this section explains these factors in relation to the current study, but before this it should be restated (as mentioned in the previous section) that this interpretivist study combines both qualitative and quantitative data to find answers to its research questions. The use of quantitative data here does not change the nature of the interpretivist approach and this argument will be incorporated in the discussion below.

In the context of this study, the aim of this research is to investigate the applicability and effectiveness of SOLE in improving students' academic and social performance. Studying the applicability and effectiveness of SOLE requires observing students' engagement and level of motivation. Epistemologically, the students' engagement and motivation are always perceived in a particular way; they have no reality independent of perception and constructed by them in their interactions with each other and with wider social systems, hence, they are developed and transmitted in a social context. Ontologically, the reality in this research is individually constructed through social interaction. Thus, the interpretive paradigm is considered to be the most appropriate option for this research. However, although the exploration of this reality takes place through collecting qualitative data, some counting (resulting in quantitative data) of participants' views is done but this is used to support the qualitative data and its interpretation. As postulated by Creswell (2009), Mertens (2014), Bryman (2016) and many others, such counting keeps the study under the interpretivist umbrella since the reality is based on the researcher's interpretation.

In regard to the researcher's personal beliefs and values, I believe that everyone's perceptions are different given their unique background and experience. Further, all knowledge is subjective and is socially constructed. In terms of the researcher's own experiences and training, the researcher is a math teacher for many years' and, thus, she is able enough to

realise, thanks to her teaching experience, that each classroom is unique and students' reactions to new pedagogies are diverse. Therefore, observing students in real context provides a better understanding about the research. Consequently, the interpretive paradigm is selected to be adopted for this work. Stated differently, as Watling and James (2002) point out, a qualitative researcher "is likely to be searching for understanding rather than facts; for interpretations rather than measurements; for values rather than information." (p. 355). Thus, this study endeavours to know how children react in SOLEs and the students' opinions and views about this new pedagogy consider the participants' attitudes and beliefs to understand the rationale behind their action and behaviour.

3.4 The Research Approach: Action Research

Various methods and techniques have been used within educational research, such as action research, biography, phenomenology, surveys, case studies and simulations (Creswell, 2009; Cohen, 2011). Educational research often seeks to link research to practice testing the effectiveness and applicability of theoretical proposals (Cohen et al., 2018); in doing so, action research has been the most popular technique, particularly relating to the adoption of new innovative pedagogies (Baumfield et al., 2012; Yin, 2013). The section elaborates on this approach and justifies its use in the current study.

In education, action research has gradually gained popularity in researching the introduction of new innovations into lessons in addition to the evaluation, investigation and diagnosis of problems or weaknesses associated with classroom or school life (Stringer et al., 2009; Mills, 2006). Action research may also be used where there are no problems, but the aim is to obtain better insights about a specific situation in order to improve it (Stemberger and Cencic, 2014). Mills (2006) defines action research in school settings as "any systematic inquiry conducted

by teacher researchers, to gather information about the ways that their particular schools operate, how they teach, and how well their students learn" (p. 19).

Moreover, action research is a reflective process which helps teacher-researchers to explore and examine learning interventions in naturalistic contexts and to produce practical knowledge and a new form of understanding (Reason and Bradbury, 2001). According to McNiff and Whitehead (2009, p.17), action research "is about improving practice (both action and research), creating knowledge, and generating living theories of practice". This may help researchers deepen their understanding of the issues to be addressed to improve students' learning and "learn about the craft of teaching" (Mills 2006: p. 6). This is because the data gained from action research are based on the researchers' interpretation of the knowledge generated from his work with the study participants. Therefore, action research falls into the author's interpretive philosophical beliefs.

Nonetheless, action research is not without criticism as it is thought, especially from a positivist viewpoint, to have some shortcomings that are similar to those raised against qualitative research in general. These criticisms and shortcomings are summarised by Burns (2005, p.67). First, action research is small-scale and therefore not generalisable (has low external validity). Second, this type research shows low control of the research environment and therefore cannot contribute to causal theories of teaching and learning. The third point against action research is that it exhibits strong personal involvement on the part of the participants and therefore is overly subjective and anecdotal. Finally, it is thought that the action research report does not conform to a recognisable scientific genre.

However, these criticisms do not underestimate the value of such research especially in educational settings. Baumfield et al. (2012) illustrate the importance of an action approach in

the classroom setting, which incorporates the research into real educational practice and involves working with, for and by people or communities and supports empowerment of people. This makes action research, as asserted by Reason and Bradbury (2001), a democratic, participative type of research and ethical and political process. Further, the result of action research can contribute to changing and improving this practice at the study setting as well as other similar environments (Reason and Bradbury, 2001). In addition to improving practice, it also endeavours to make meaningful contributions to the larger body of knowledge and understanding in the field of education, thus, reducing the gap between research in the educational field and the reality of educational practice (Baumfield et al., 2012).

Furthermore, the process of action research is evolutionary and developmental which allows researchers to evolve through deepening their understanding of the phenomenon studied, developing an action plan and their capacity to reflect and facilitating interactions among participants (Baumfield et al., 2012). Additionally, it helps the researcher to understand the variety of participants' (students) perceptions and how these can influence the implementation of a new learning environment (Baumfield et al., 2012).

The process of action research typically occurs as a spiral of sequential research cycles of planning, action, observation and reflection (Maksimović, 2012). Mills (2006) suggests a diagrammatic model, as shown in Figure 3.1, involving a four-step process: identify an area of focus, collect data, analyse and interpret data and develop an action plan.

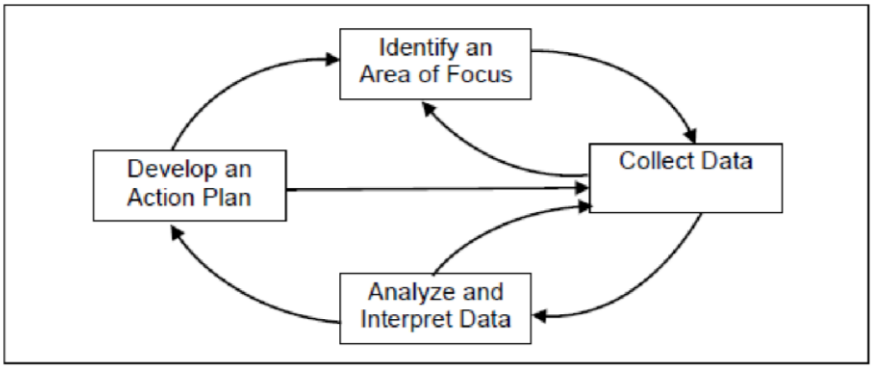

Figure 3.1: The dialectic action research spiral (Mills, 2006: 19)

The first step is identifying an area of focus by reviewing the literature and reflecting to improve the problem identified and then planning the action to fit the context and setting of the study. The second step is to implement the planned action previously determined and collect data. Data collection can take the form of observing students' behaviours and collecting informal data, such as taking field notes. The third step is to analyse and interpret the formerly data collected from the action. The fourth step is to modify and develop the action plan based on the analysis and interpretation. As clear from the Figure above, this process goes in iterative and reciprocal cycles, which means that the researcher might go back from step 2 to re-do step 1 again and the whole process might be repeated more than once.

The cycle discussed above reflect the overall major process of action research. However, in action research, teachers would definitely encounter multiple incidents that they stop at, think about them more carefully, take an action to address them, observe the outcome of taken action and reflect on what has happened in the aim of improving practice (Mills, 2006). This procedure might be repeated again and again during conducting action research forming mini-cycles within the overall major cycle. The cycles that action research would go through might be related to everything that is going on during conducting the study from small to major incident. These incidents would be considered critical when the teacher-researcher decides they should be dealt with while the research is progressing (Mohammed, 2016). Therefore,

while so many incidents might take place during a session, the teacher might stop at some of them because s/he considers them critical to his or her practice.

In the current study, action research is considered to be an appropriate approach to address the research questions in this thesis and, more specifically the process of the dialectic action research spiral proposed by Mills (2006) will be followed. To clarify, this study aims to introduce and develop a new pedagogy (SOLEs), which requires a procedure of testing this new pedagogy in a specific setting, observing how it works, modifying action plans to ensure better outcomes and re-testing the pedagogy in light of the new modifications. Based on this, the model proposed by Mills (2006) seems in line with what this study seeks to achieve and, thus, it will be adopted here in order to produce practical knowledge and a new form of understanding. As for the incidents that will be considered critical and be responded to, this is not a very straightforward step in the current study because of the SOLE foundations proposed by Mitra (2014b); to clarify, as discussed in the Literature Review Chapter (Section 2.3.2.5), in SOLE sessions, the teacher should act as an observer and should not intervene. To follow this rule, the teacher-researcher in the current study tried to limit her intervention in classroom incidents except for those incidents that would probably affect the progress of SOLE sessions. In addition, introducing and developing a new pedagogy should not ignore the views of the students which help in understanding the rationale behind their actions and behaviour. Such views can be best understood through direct contact between the researcher and the students and this makes following an action research approach suitable for this study.

3.5 Research Site and participants

This study was conducted in a primary school in Riyadh, Saudi Arabia. The participants of this study were 28 5th grade students, 26 parents, 17 teachers and 1 head teacher. The

following subsections will describe more fully the research site and the participants of this study.

3.5.1 The school

The current study was conducted in one state, all-girls primary school in Riyadh the capital city of Saudi Arabia. This school was chosen by the planning and development department of the Ministry of education in Saudi. For the purpose of ensuring anonymity, the school's name has been anonymised. This primary school is located in part of the North Riyadh region which is considered a wealthy district. The school has 54 employees consisting of a head teacher, assistant head teacher, three student counsellors, observers, teachers and a school cleaner. There are 18 classes (3 classes for each year from Year one to six). The total number of students in the chosen school in the second term of 2018 was 528 (ages 6-13) and those students, according to the Saudi education system, are divided into mixed-ability classes.

The school, where the research was conducted, is situated in a governmental building and has an unequipped Learning Resorts Centre (LRC). The LRC is an empty hall, which contains tables and electronic whiteboard attached to the PC, used to display only (Figure 3.2). The school also is equipped with some support services such as desktops online connected to MOE for the administration staff but not for the teacher's or student's usage. The school division has a very active Twitter account mainly for presenting school extracurricular activities and news. According to the researcher observation, each classroom is fitted with an overhead projector without a computer, and there is one smartboard located in LRC.

Figure 3.2: The learning resource centre where the current study was conducted

It is worth noting that the computers used for this study were donated to the school by a training company a couple of years ago; those computers (figure 3.3) were not used by the school and they were completely neglected. Although the LRC was not equipped with computers, the school office staff were helpful and provided the researcher with the support needed to prepare the room and throughout the three months of data collection and afterwards.

Figure 3.3: Computers found in the school where the current study was conducted

3.5.2 The students

The participants in the present study came from a year five class (10-11 years old). The school had three same-level classes in total and the choice of the particular class included in the study was based on the school administration's recommendation. All students were literate and all of them were females. Only female students were recruited as research participants because the Saudi educational system is segregated according to gender from primary level

through to higher education (see Section 1.5). The total number of students involved in this study was 28 out of 29 (one excluded after the first session because she had a broken leg and was not able to join the group in LRC which was located on the 2nd floor). Given that very little is known regarding SOLEs, the primary intention was to learn about children's SOLEs experience within the Saudi context. The academic achievement of the students under study ranged from very high to very low and no special education pupils existed within the groups.

The background questionnaire (see Section 3.6.2) showed that most participants owned online-connected devices at home, but they did not bring these devices to school because the education system in Saudi prohibits students from bringing devices to the school for security reasons. Only four of the 26 students who completed the background questionnaire stated that they did not have their own devices, however, they had online access through their family member devices. Eight out of 26 had smartphones, seven had Tablets and seven had both.

The data form background questionnaire also revealed that most of the students used these devices mainly in social media (24 out of 26) and games (26 out of 26). The most accessed social media platforms were Snapchat (17 out of 26) and YouTube (14 out of 26). The only educational website accessed by students was Hulule websites which provided children with full answers for the questions in their textbooks.

3.5.3 The parents

All participating parents had children who also took part in this study. It was crucial to involve the parents' opinions to understand students' behavior during SOLE sessions and to have an idea about how the parents thought about the Internet integrations in the classroom. This was done through giving each child a copy of a questionnaire (see Section 3.6.2) at the end of the study and instructed to give it to their parents and return it the next day to their classroom teacher. Each questionnaire was accompanied by a brochure explaining what

SOLE is and a covering letter elucidating the objectives and importance of the research in addition to a gift pen from Newcastle University to keep (see Figure 3.4). Participants were not requested to write their names on the questionnaire to assure parents that their responses would be anonymous. However, for ease of reference, the children in this study were given pseudonyms.

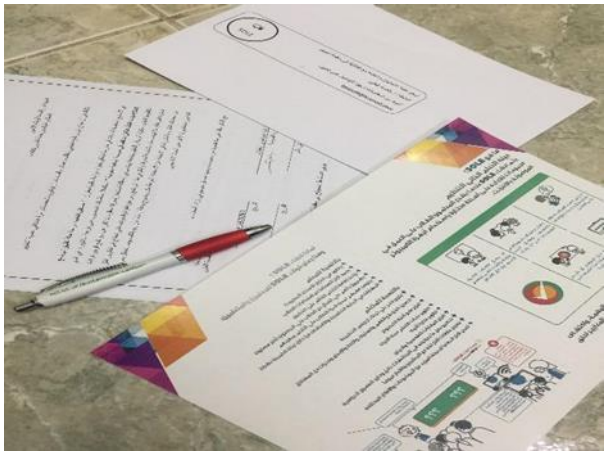

Figure 3.4: Parents questionnaire package

All parents involved in the study had above basic level of education and were literate (see Table 3.1). Additionally, only one parent was under 30 years old and the rest ranged in age between 30 and over 50.

Table 3.1 Parents educational qualification

Educational Qualification for Parent/ Guardian	N
Non	0
Less than high school	2
high school	3
Diploma after high school	1
Bachelor	14
Postgraduate studies	3

3.5.4 The teachers and head teacher

Seventeen out of total 37 teachers in the chosen school completed the questionnaire and one head teacher was interviewed to understand their attitudes and the challenges towards

introducing Internet integration to the curriculum. These teachers teach different subjects, such as Arabic language, English language, religion, science, mathematics, social study and arts. Teachers held bachelor (9) and diploma (6) degrees in their subject area. All teachers had more than ten years of experience except for three teachers who had less than 10 or 5 years of experience. According to the teachers and the administration of the school, the teachers had all attended training courses in different aspects of education, mostly about active learning. However, none of them had ever been trained in using Enquiry Based Learning teaching strategies.

The following section provides more information about the tools used to collect data from these participants.

3.6 Data collection techniques

In order to provide a more comprehensive picture of the issue under investigation, the data collection involved a variety of methods. These were classroom observations, pupil view template (PVT), semi structured interviews and questionnaires. The following four subsections outline the rationale and content of these tools respectively.

3.6.1 Non-verbal observation: Field notes

Observation was used in this action research to help the researcher see what is happening in the classroom and gain direct visual evidence in terms of students' behaviours in SOLE sessions in a natural setting. Thus, classroom observation was a significant data source for this study which helped the researcher to understand SOLE processes and gain rich contextual information to find out what is needed to be done to develop this teaching and learning approach.

It is widely perceived that observation gives the researcher authentic data from naturally occurring social situations (Cohen et al., 2011). Observation can be structured, semi-structured or unstructured (Bryman, 2016). Structured observation involves deciding on what the researcher is looking for in advance and organising this into categories prepared in an observation schedule. Unstructured observation, on the other hand, is exploring what is happening without having a pre-prepared observation schedule. These two types have their own strengths and weaknesses that the researcher should be aware of. While the structured observation keeps the researcher focused during the observation session, it might restrict him/her in terms of what to take notes about and, hence, important details might be missed out. As for the unstructured observation, although it gives the researcher the freedom to observe and take notes of any happening, such a technique might exhaust the researcher and make him/her less focused on important details. Nevertheless, blending both techniques might bring out the strengths and allows for overcoming the weaknesses. This is usually done in a technique called semi-structured observation. According to Cohen et al., (2018, p.543), semi-structured observations "have an agenda of issues but will gather data to illuminate these issues in a far less predetermined or systematic manner". Based on this, the current study adopted the semi-structured observation technique.

In the current study, the researcher followed an observation schedule, but at the same time took notes of other details (e.g. critical incidents) during SOLE sessions that did not fall under the categories of the schedule to achieve the aim of the observation. The observation schedule was prepared based on the "Group Spinner Axes" model proposed by Kharrufa et al. (2017). This model was devised by these researchers to assist teachers with observing and reflecting on their students' behaviours and interactions in collaborative environments that involve the use of technology. Given that SOLE is a collaborative and technology-based approach, the

Group Spinner Axes" model was thought to be suitable to adopt in the observation. This model consists of five axes as follows:

1. Information Seeking: This is related to the level of complexity and critical thinking demonstrated by students during sessions in their information seeking endeavours. This is done through observing students' behaviour in relation to three rubrics, which are A) fact finding, B) balancing information to identify a position and C) scrutinizing and analysing information.
2. Learning Outcome: This is related to the evaluation of what students have gained from the learning sessions. It is done through inspecting the information reached by the students and how they dealt with it following the following rubrics: A) No, or incorrect information, B) facts on one aspect of the answer, C) multiple aspects but no links, D) development of answer and E) applying information to new areas
3. Collaboration: This is concerned with observing students' knowledge sharing behaviour during sessions that students rely on each other rather than on their teacher. It is done through observing the following rubrics: A) sharing resources, B) joint actions, C) mutual planning, D) equal participation, E) communication and F) reaching consensus
4. Context-Specific: Working within SOLE: This is related to observing how students behave in a self-organised learning environment in relation to how they A) take responsibility, B) share knowledge, C) explore resources and D) behave spontaneously
5. Motivation and Engagement: This focuses on evaluating how motivated the students are in a specific learning environment. It is done through observing students' A) attention, B) participation and C) volunteering

The following Figure 3.5 summarises these themes and their rubrics and Appendix A provides the observation schedule used by the researcher based on this.

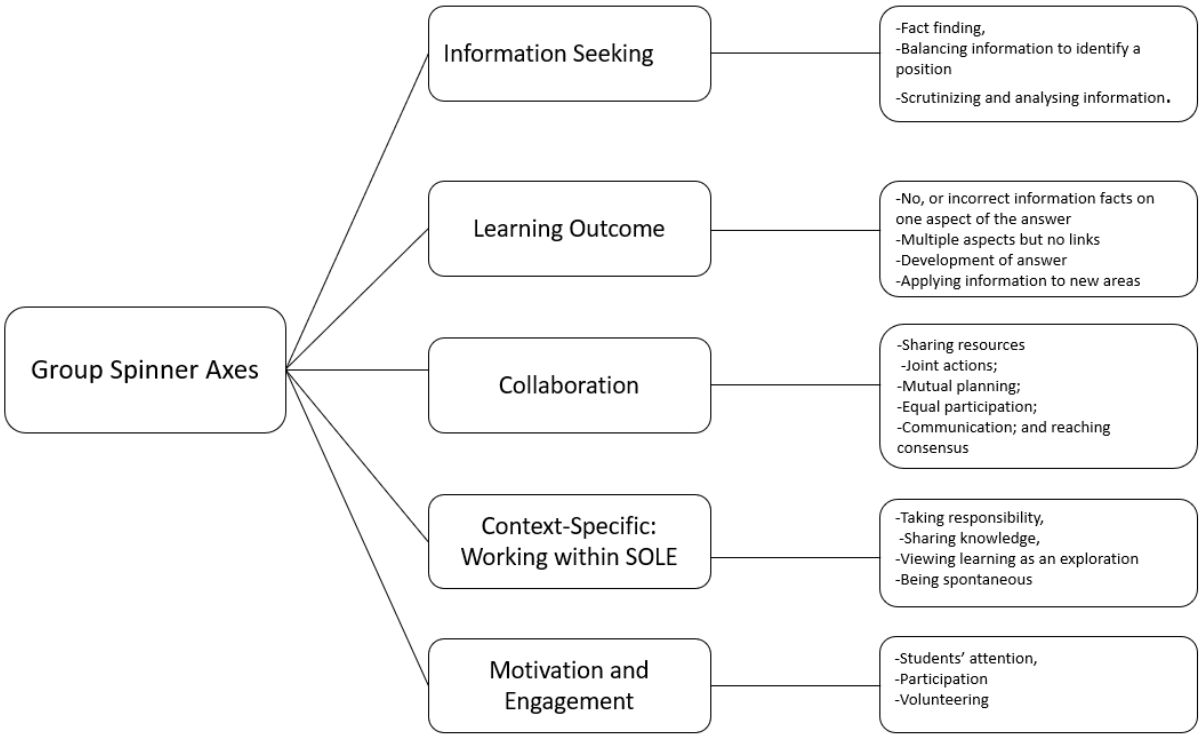

Figure 3.5: Group Spinner Axes model proposed by Kharrufa et al. (2017)

In addition to this schedule, the researcher aimed to observe how the students react in the SOLE process in general and how they formatted their groups. The researcher observed ten different SOLE sessions and took descriptive field-notes both in situ and away from the situation.

One important issue that should be stressed here is related to the role of the teacher in SOLE sessions. The teacher/researcher acts as an observer during the students' research process. Therefore, the teacher/researcher should not intervene when students are looking for an answer for the big questions and give them the chance to solve any problems they encounter. So, the researcher during SOLE sessions kept silent and walked around taking notes and memos or stood somewhere quietly observing the class unless students needed technical help. On random occasions the researcher snapped pictures for the students working without their

notice, so they act in natural manners. These pictures were used as evidence and some time as a reminder for the researcher.

Another important issue is related to a disadvantage of the observation technique that is raised in the previous literature. More specifically, Denscombe (2010) explains that students might behave differently when the observation takes place, which might give a false indicator of their behaviour. However, this can be overcome through building rapport with the students, informing them about the aims of the observation and assuring them that there will be no consequences for any behaviour they exhibit (Denscombe, 2010). Indeed, the researcher in this study spent some time with the students before the sessions to build a good relationship with them. The students were also enlightened about the reason for the observation and the sessions and were encouraged to behave as naturally as possible because anything they do in sessions will not affect them in any way.

3.6.2 Questionnaire

The current study used five different questionnaires, three of which collected data from the 28 students in addition to two questionnaires completed by 26 parents and 17 teachers. This section provides the rationale for using this data collection method and gives details about the specific tools of the study.

Collecting data by questionnaire is very popular in research and commonly used to obtain responses to the same questions from a considerable number of participants (Cohen et al., 2018). According to Cohen et al. (2018, p.471), questionnaire is "useful instrument for collecting survey information, providing structured, often numerical data, being able to be administered without the presence of the researcher, and often being comparatively straightforward to analyse". This means that the questionnaire tool gives the researcher the ability to gather, sample, analyse, and interpret data from a group of people by comparing

between participants' answers and variables (Bell, 2010). Using questionnaires alongside other data collection tools adds breadth and rigour to the research scope.

In the current study, collecting data about the participants' views and perceptions were thought to be best captured through the use of questionnaires. This is because it allows for obtaining such data in a short time and from all of the participants involved in the study. Based on this, five questionnaires were used with the students, parents and teachers. The details of these tools are presented below.

1. Background information questionnaire: This questionnaire (see Appendix B) was completed by 28 students at the start of the study. Given that SOLE is a technology-based (computer and internet) and collaborative approach and that the current study aimed to investigate its effectiveness, it was important to know whether the participants' used technology for learning purposes and their perceptions about collaborative learning. More specifically, through 11 closed-ended questions, the researcher wanted to find out the level of Internet usage at home, what the students use it for and their perception of group work.

2. "What Is Happening In this Class" (WIHIC) questionnaire: This questionnaire (see Appendix C) was completed by 28 students twice in week six and week ten sessions. The purpose of the questionnaire was to explore the students' perception about group work, challenges and procedures of SOLE and their attitudes toward SOLE sessions and activities. The WIHIC questionnaire was originally proposed by Fraser et al. (1996) who were interested in classroom learning environments and believed that "After any change in the educational 'theory' that supports curricula, it is important to know if changes in classroom practices also occur. Similarly, after the introduction of technology, it is also important to know if classroom practices incorporate the wise use of technology" (Fraser et al., 2010, p.106). The

English version of WIHIC, contains seven scales based on student and class characteristics namely student cohesiveness, teacher support, involvement, investigation and task orientation, cooperation and equity. WIHIC also has been repeatedly shown to be a valid and reliable instrument for measuring classroom environments and used at all educational levels in a variety of classrooms, countries and cultures. The adapted questionnaire consisted of two parts, both of which had 38 statements with three-point Likert scale. The first part aimed to investigate students' perception on student cohesiveness, teacher support, involvement, cooperation and equity. The second part was about their attitudes about practices that take place in this class.

WIHIC was provided to the participants in Arabic since this is their first language and they might feel more convenient to read and write using it. The translation was performed by two professional translators and then rechecked by the researcher, who is a native speaker of Arabic and a competent user of English.

3. SOLEs and Traditional Classroom Comparison questionnaire (STCC): This questionnaire (see Appendix D) was completed by 28 students twice in week four and week 11 sessions. It aimed to investigate students' feelings about SOLE experience compared to the traditional classroom. This questionnaire was adopted from Dolan et al. (2013). In this questionnaire, the students were given a set of words, phrases and sentences (i.e. exciting; easier; harder; I learn more; I learn less; I feel more comfortable; scary; I work well with my friend; I sometime argue with my friend; and I can solve problems on my own) and were asked to attach it with the type of education they thought it belonged to (traditional education or SOLE). Before the students completed this questionnaire, the researcher made sure that they understood what traditional classroom and SOLE refer to; it was explained that while traditional classroom

referred to their everyday classes in the school, SOLE meant those sessions delivered by the researcher.

4. The school teachers' questionnaire: This questionnaire (see Appendix E) was completed by 17 teachers in the same school where the study was conducted. The aim was to explore the challenges that might prevent teachers from using the Internet in their teaching. The questionnaire consisted of background questions, 28 closed-ended main questions and one open-ended question to allow the teachers to add any additional information. I designed the 29 main questions in a way to obtain data about the teachers' use of the internet in their classes, the training they received on internet integration in their classes, the challenges of internet integration in their classes and their views of SOLE. This questionnaire was distributed after a workshop was held and brochures about SOLE were given to the teachers which encouraged some to visit SOLE sessions and have a look at students' work.

5. Parents questionnaire: This questionnaire (see Appendix F) was completed by 26 parents of the students involved in the study. I designed the content of this questionnaire in a way to explore parents' perceptions and views about Internet integration in the school curriculum and their perceptions of their children's feelings and experiences during SOLE sessions. In addition to three personal information questions, the questionnaire consisted of five open-ended questions and 16 multiple choice questions.

The contents of the questionnaires were first adapted from previously validated questionnaire tools as indicated above, so the first design was in English. However, given that the participants are native speakers of Arabic, the questionnaires were translated into Arabic by the researcher, who is a native speaker of Arabic and proficient speaker of English. The

researcher paid great attention to the students' questionnaire wording during translation into Arabic due to their age (9-10 years old).

3.6.3 Pupil View Templates (PVTs)

The current study used Pupil View Templates (PVTs) (see Appendix G) to collect data from the 28 students about their feelings and attitudes toward the SOLE procedure. This section provides the rationale for using this data collection method and gives details about the specific tool of the study.

In mid 2000s, Wall and Higgins (2006) developed a practical data collection tool which is particularly suitable for school-aged children to explore pupil view of learning. In Wall and Higgins' (2006) words, the PVT "aims to gather information on pupils' attitudes and beliefs about teaching, curriculum content and school or classroom structures (the process of teaching), but also to elicit their descriptions and reflections on the process of learning" (p.42). The PVT is a visual tool that has been adapted by previous studies to elicit pupil views on learning in multitude of scenarios and in a variety of contexts and age ranges (Wall and Higgins, 2006; Wall, 2008; Wall et al, 2012).

The PVT consists of a cartoon representation depicting the given learning scenario with two empty bubbles. These two bubbles are considered to represent students' thought and speech. In other words, the students are expected to fill in these bubbles with their expectations about the scenario (speech bubble) and their views of the scenario based on the experience they have gone through (thought bubble). This design can help students to stimulate reflection on the processes of thinking in different learning contexts (Wall, 2008). The ethos behind PVTs is that they have the potential to empower learners and provide them with an opportunity to document their thoughts and opinions in a non-threatening method with the sense that their opinion is important and influential.

The PVT technique has a number of attractive features in comparison with other data collection tools. One such feature is its flexibility as children have the opportunity to express their own views and feel at ease to verbalise what they really mean (Gascoine, 2016). In addition, children can add to the PVT through not just adding a comment here or there, but they can also colour and decorate it as they wish (Wall and Higgins, 2006). This gives the potential to empower children and make the learning scenario flexible to the child's perceptions (Wall et al, 2012).

In the current study, a PVT tool was designed to fit the SOLE learning context and follow Wall and Higgins' (2006) suggestions. Figure 3.6 shows the PVT used in this study.

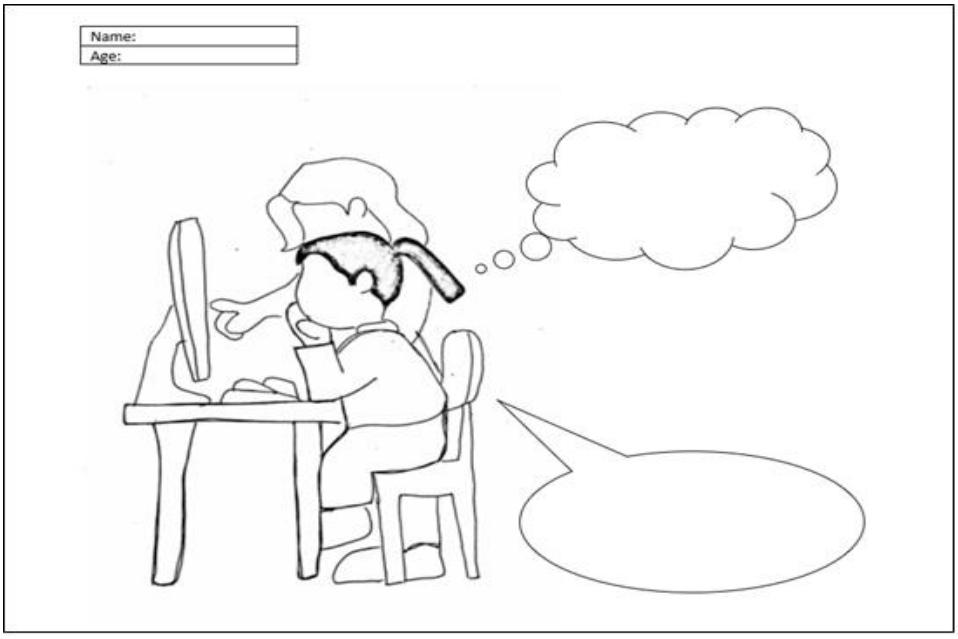

Figure 3.6: The PVT used in the current study

To make sure that the students provided responses in a somewhat consistent manner, they were asked to respond to the question "*what do you think about the way of searching through the Internet in groups?*". This question was thought to direct students to provide responses

that directly relate to the use of the Internet in groups. The students completed this PVT twice during the SOLE programme.

It should also be noted here that some of the students were indeed familiar with the PVTs through their exposure to this kind of cartoon in children comic magazines available in Saudi Arabia. However, to make sure that all students understood this clearly, the researcher explained what PVT meant and what the students were supposed to do and clarified this with examples.

3.6.4 Interviews

The current study, individual face-to-face interviews were conducted with the head teacher and some teachers inside the school. This section provides the rationale for using this data collection method and gives details about the specific tool of the study.

Plas et al. (1996) defines the interview as “an interchange of views between two or more people on a topic of mutual interest, sees the centrality of human interaction for knowledge production, and emphasizes the social situatedness of research data” (p. 14). Bryman (2016) argued that the interview is a method that is widely used in research due to their flexibility in offering to the researcher more freedom to ask questions that help him/her to understand and capture others’ perspectives. In addition, good interviews can yield in-depth and unique information about the perceptions of individuals when they talk freely about their points of view. There are three broad types of interviews, namely, structured, unstructured and semi-structured, all of which can be applied in the form of either one-to-one (individual) or group interviews (Brinkmann, 2014). In structured interviews, the researcher prepares the questions beforehand, but this does not happen in unstructured interviews and the researcher “need to be able to ensure the interview interaction actually does generate relevant data" (Mason, 2010, p.67). In semi-structured interviews, on the other hand, the questions are planned loosely to

give researchers the opportunity to ask follow-up questions according to participant responses to gain a clearer picture and to collect more information from the respondents.

In this study, semi-structured and unstructured interviews were conducted to enrich and understand the context and actual practice of the study. A semi-structured interview was conducted with the head teacher to collect more detailed information about Internet integration in her school and the possible challenges preventing her teachers from utilising digital devices for students learning (see interview questions in Appendix H). Another semi-structured interview was conducted with the classroom teacher of the students who participated in the study. This interview took place after the teacher had discussed the SOLE experience with her students. The rationale of this step was to allow the teacher to find out what is in her students mind and to find out things that the researcher cannot directly observe. Moreover, unstructured interviews were used mainly with school staff in an informal and spontaneous atmosphere without including leading questions to allow them to say what they want. The purpose of these unstructured and informal interviews was to understand why the teachers did not use technology in their classrooms and the barriers that might have prevented them to do so.

To conclude this section, the following Figure 3.7 summarises the data collection tools used in the study:

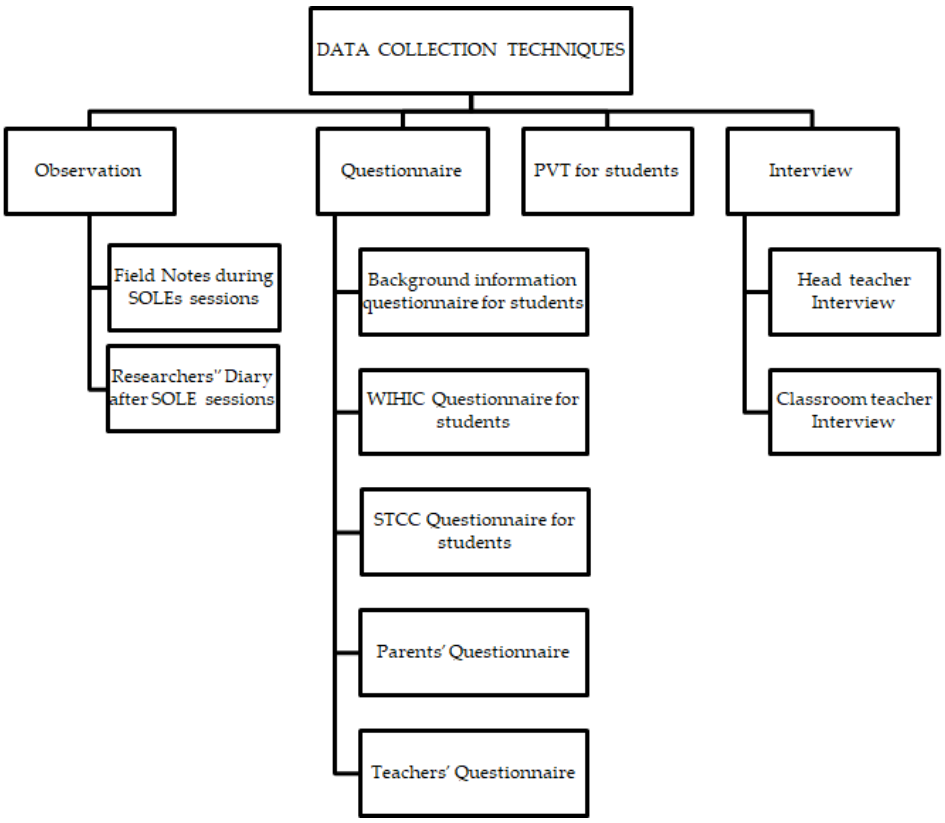

Figure 3.7: The data collection tools used in the study

The following section describes the data collection procedures

3.7 Data collection procedures

3.7.1 Initial plan and changes

After obtaining ethical approval from Newcastle University to carry out the research, I contacted the Ministry of Education (MoE) in Saudi Arabia to gain access to a primary school (see Section 3.11 on ethical considerations). To conduct the SOLE study, I asked the MoE to give me access to a school that has a Learning Resources Centre (LRC), which is usually a big hall containing computers and smart boards. The school that I was given access to had an LRC which was not equipped with computers. However, I found unused computers in the school that were donated by a company in the previous years. Those computers needed also to be installed and connected to the internet, which required from the researcher time, effort and money.

The initial plan for the duration of the study was a full academic semester (14 weeks) during which 14 SOLE sessions could have been conducted. However, some obstacles at the research setting changed this plan by decreasing the duration to 10 weeks and, thus, the number of SOLEs sessions to 10. One of these obstacles was that the LRC was not prepared with computers and internet connection. Hence, LRC preparation took some time. In addition, in week 5 of the study, the school had to evacuate the LRC hall to hold two-week teacher workshops. During these two weeks, no SOLE sessions took place. However, although there was a reduction in SOLE sessions, this had no impact on the quality of the study because a variety of tools and sources were used to collect data for the study and increase its validity.

3.7.2 Deciding on the big questions

As explained in Section 2.3.2.3, the big question is the question that students seek to find an answer for during SOLE sessions and this is an important element of the SOLE approach. In deciding on the questions for the ten SOLE sessions in this study, it was important to choose questions that are challenging enough for these students and at the same time beneficial for them in their academic life. To do this, the researcher had first to look at the Year 5 curriculum since the students were at this level. In addition to this, the researcher held meetings with Year 5 teachers to identify areas that are part of the curriculum but not covered in the classroom previously. In deciding on the big questions, the researcher also consulted the formal SOLE website 'School in the Cloud'[2], which has suggestions about questions that are suitable for Year 5 students. One of suggestions in the SOLE website is that students

[2]https://www.theschoolinthecloud.org/

should be provided with questions tapping into and developing their problem-solving skills. One example in the current study is the big question that was given in Session 9 (i.e., *What are the uses of the Internet?*). This question was presented to the students in English, a language they do not have enough command of that allows them to do the search and find the answer. The rationale behind this was to investigate whether these students would be able to solve this problem through, for example, resorting to translation websites.

It should be noted here that one of the big questions (in Session 2) was designed by the researcher based on her belief that the students do not have knowledge about and that it would benefit them. The big question for this session was *What is the ethical way of obtaining information?* The rationale for this question is that the researcher noticed in the first session that the students copied information from the internet without citing the source. Based on this, the researcher believed that a session on copyright issues could lead the students to deal with the copied materials more ethically. All big questions used in the study are provided in Table 3.2 below along with other details (see Section 3.7.3).

Relevant information to mention here is that before SOLE sessions, the researcher used the designed big questions to search for network information. This helped the researcher in two matters. First, doing this allowed the researcher to judge the suitability of these questions for an internet search. Second, it enlightened the researcher about the information that existed online that might be reached by the students; this in turn helped her to judge students' performance during presentations and give feedback to the students.

3.7.3 Actual data collection

During the spring term of 2018, which lasted for 14 weeks between 21/01/2018 and 24/04/2018, ten SOLE sessions (90 minutes each) were held. As explained above, weeks 1 and 2 were for obtaining permission and setting up the SOLE session location. Also, in weeks

9 and 10, there were no SOLE sessions because the school needed the SOLE session location for teacher workshops. For clarity of presentation, a summary of what happened during the 14 weeks and the ten SOLE sessions is presented in the following table:

Table 3.2: Procedure plan for data collection in the current study (21/1/2018 – 24/4/2018)

Week 1	Week 2	Week 3
- Take permission from the school - View the LRC hall and agree with the school on the changes to be made to the hall.	-Step up the LRC hall (install computers and internet connection) -Talk to the students about the study and SOLEs - Collect students' and their parents' consents. - Collect background information about the students through the **Background Questionnaire**	- SOLE session 1 Big question: Give an example of an animal facing the threat of extinction and explain why? - Collect data through **SOLE session observation**.
Week 4	**Week 5**	**Week 6**
- SOLE session 2 Big question: What is the ethical way of obtaining information? - Collect data through **SOLE session observation** **PVT** - Show students examples on how to present the findings.	- SOLE session 3 Big question: What are the different types of environmental pollution? What are the causes? - Collect data through **SOLE session observation**.	- SOLE session 4 Big question: State at least two solutions for each type of environmental pollution? - Collect data through **SOLE session observation**. **Comparison Questionnaire**
Week 7	**Week 8**	**Week 9**
- SOLE session 5 Big question: How can you use paper stripes (quilling paper) in an artistic way? (students were also provided with quilling paper and asked to work with it). - Collect data through **SOLE session observation**.	- SOLE session 6 Big question: How can you use paper stripes (quilling paper) in an artistic way? (students were also provided with quilling paper and asked to work with it). - Collect data through **SOLE session observation**. **WIHIC Questionnaire**	No SOLE session because of school workshop
Week 10	**Week 11**	**Week 12**
No SOLE session because of school workshop	-SOLE session 7 Big question: Why does sound travel faster in solids than in gases and liquid? - Collect data through **SOLE session observation**.	-SOLE session 8 Big question: Why does sugar dissolve faster in hot water? - Collect data through **SOLE session observation**. **PVT** - Workshop for the teachers (the purpose of this was to introduce SOLE to prepare them to complete the teacher questionnaire)

week 13	week 14	
-SOLE session 9 Big question: What are the uses of the Internet? - Collect data through **SOLE session observation**. **Comparison Questionnaire**	-SOLE session 10 Big question:What would happen to the Earth if all the insects disappeared? - Collect data through **SOLE session observation**. **WIHIC Questionnaire**	

It is worth noting that in the WIHIC and comparison questionnaires (completed by the students), the researcher read the questionnaire content to the students to allow them to understand it clearly and in order to eliminate any misunderstanding that might take place.

Over the ten sessions of this project, 55 groups were formatted. The groups number differ from one session to another depending on the computers available (i.e., groups of seven (2 times) of six (7 times), of five (31 times) and of four (15 times). The teacher did not intervene in group formation at all but used to advise the students to make or join smaller groups.

3.8 Data analysis

According to Cohen et al. (2018), data analysis is the most crucial part of any research. It is a process of inspecting, rearranging, transforming and modelling data to extract useful information (Bryman, 2016). It involves the interpretation of data gathered using analytical and logical reasoning (Bryman, 2016). By revealing the different patterns, themes and relationships from the data, an analyst can provide a good understanding of a research objective. A number of factors can influence the interpretation of data such as the research questions, theoretical framework, through what lens the researcher is looking for this through literature review (Bryman, 2016).

In the present study, both quantitative and qualitative data were obtained. The quantitative data were obtained from the scale statements and close-ended questions in the WIHIC, STCC,

Parents and Teachers questionnaires. Participants' responses were converted into numbers and inserted in an electronic form using a Microsoft Excel spreadsheet. These numbers were then reported in tables in the Findings Chapter to give the reader an indication about the general tendency in the data. In addition, this statistical procedure helped the researcher to identify recurrent themes and compare between participants' opinions, on the one hand, and what was observed in the classroom, on the other.

The study also collected qualitative data through observations, PVTs, classroom teacher and head teacher interviews in addition to parents' and teachers' comments in the questionnaire. For this type of data, a thematic analysis was conducted. Thematic analysis is a method that involves "identifying, analysing and reporting patterns (themes) within data."(Braun and Clarke, 2006, p.6). These themes are patterns of thought that capture the perceptions of research participants and present something important about the data related to the research question on various phenomena. To conduct a thematic analysis, Braun and Clarke, (2006, p.35) suggest six phases that will ensure clarity and rigour in the process. These phases are: 1) Reading the data quickly to be familiar with it; 2) reading the data carefully to identify specific arising ideas and generate codes; 3) grouping these codes together under themes; 4) rechecking themes and ensuring that codes fit properly under themes; 5) defining what each theme refers to and 6) writing up the report.

Themes or patterns within the data collected specifically for the research can be recognised in one of two main ways in thematic analysis: inductively "data-driven way" or deductively "analyst-driven way" (Braun and Clarke, 2006, p.12). The inductive approach involves themes which are driven only by the data itself and no theories or hypotheses are applied at the beginning of the research (Bryman, 2016). In other words, the theory is the outcome and the product of the investigation. By contrast, in the deductive approach, the themes are driven

by the researcher's analytic or theoretical interest in the area (Bryman, 2016). This might mean that the researcher deduces a hypothesis based on an existing theory, and then empirically tests this hypothesis to accept or reject it. To illustrate further, while an inductive analysis seeks to find out the themes and the constituent components (codes) in the data collected, a deductive analysis, conversely, starts with predetermined themes and checks them against the collected data.

The current study used both deductive and inductive approaches in the performed thematic analysis. The deductive approach was mainly used in the analysis of observation data. To clarify, as mentioned in Section 3.6.1, the observation focused on five main themes (i.e., information seeking, learning outcome, collaboration, context-specific: Working within SOLE, and motivation and engagement) with specific rubric for each of these themes based on the "Group Spinner Axes" model proposed by Kharrufa et al. (2017). The observation data were organized under these themes and their rubrics (see Observation Schedule in Appendix A) and reported as sections reflecting these themes in the Findings Chapter.

In respect to the qualitative data generated form PVTs, classroom teacher and head teacher interviews and parents and teacher comments, these were analysed deductively and inductively. The deductive approach was done since there were predetermined themes for the data collected through each of these tools. The predetermined themes according to each tool were as follows:

Table 3.3: The predetermined themes for the data collected through PVTs, classroom teacher and head teacher interviews and parents and teacher comments.

Data collection tool	Themes
PVTs	- Students' perceptions about SOLE in terms of positive or negative - How perceptions developed through the experiment
Head teacher interview	- The challenges that might encounter internet integration in Saudi schools
Classroom teacher interview	Students' perceptions about SOLE
Parents comments in the questionnaire	- Parents' perceptions about internet integration in education - Children' perceptions about SOLE as reported by their parents
Teachers comments in the questionnaire	- The challenges that might encounter internet integration in Saudi schools

However, these themes were broad in the sense that they included other narrower sub-themes that required more of an inductive approach to reveal all the aspects about. In both the deductive and inductive approaches, the stages proposed by Braun and Clarke (2006) for conducting thematic analysis were followed. The data were first read thoroughly, and the recurring patterns were identified and grouped under themes. The table above shows the initial coding scheme that was followed at the start of the analysis, but the further inductive analysis led to modifying this scheme. The following table demonstrates the final coding scheme that the data was organised under:

Table 3.4: Final coding scheme for the qualitative non-observation data in the study

Themes	Sub-themes
Students' perceptions	- Students' general perceptions of SOLE - Students' perceptions of their academic outcomes - Students' perceptions of their social outcomes - Students' perceptions of the classroom procedure and the role of the teacher in SOLEs - Students' perceptions of their own behaviours during group work.
Students' perceptions about SOLE as reported by their parents	- Merits of SOLE - Drawbacks of SOLE
Parents' perceptions about internet integration	- Merits of internet integration - Cautions to be considered
The challenges that might encounter internet integration in Saudi schools	- Student level: group work skills technical difficulties - Teacher level: lack of teacher competence resistance to change and negative attitude - School level: lack of time lack of effective training lack of accessibility lack of technical support lack of administration support

A sample of how data was organised under these themes by data collection tool is included in appendix I. It should be noted that for accuracy and convenience reasons, both inductive and deductive analyses were conducted in Arabic, the original language of the collected data. After this was completed, the themes and some representing quotes were translated into English in order to report in the next chapter.

3.9 Research rigour and trustworthiness

The terms rigour and trustworthiness are about ensuring the research validity and reliability in terms of the appropriateness of the research methods to the raised questions (rigour) and the researcher's honesty regarding the data collection, interpretation and reporting (Bryman, 2016). According to Bryman (2016), rigour and trustworthiness of research means ensuring the extent to which any later research may repeat the process and duplicate the findings. Further, they refer to what extent the research method investigates what it intends to investigate, and the research findings are what they claim to be (Bryman, 2016). In addition, they ensure the ability of the researcher to carry out unbiased research and remain neutral to the phenomenon studied (Nunan, 1992).

Lincoln and Guba (2013) proposed a set of criteria to judge the quality of any interpretive research and to ensure its rigour and trustworthiness. These criteria are credibility, transferability, dependability and confirmability. The following four subsections discuss each of these criteria in turn and show how the current study ensured them.

3.9.1 Credibility

Credibility in qualitative research is parallel to internal validity in quantitative research (Shenton, 2004). It is about ensuring that the findings represent the view participants have of their own reality (Guba and Lincoln, 1994). Guba and Lincoln propose that credibility can be

ensured through a number of procedures including prolonged engagement and persistent observation at site, triangulation and peer debriefing. First, prolonged engagement and persistent observation allows the researcher to understand the behaviours of the involved participants more fully, which is essential to give valid interpretations of what is happening at the research setting. This procedure was part of the current study process. The study was conducted over 14 weeks and during this time, the researcher visited the school and was in direct contact with the participants two to three times every week. This included 20 hours of observations and 8 sessions to complete other data collection tools in addition to many ongoing informal interviews. This might demonstrate the level of the engagement of the researcher in the research setting.

Secondly, triangulation refers to the collection of data through different methods (triangulation of methods) from the same participants or from different types of participants (triangulation of sources) (Shenton, 2004). Using triangulation might ensure that the collected data truly reflects the reality of the investigated phenomenon (Bryman, 2016). Triangulation of sources was adopted in key parts of the current study when this was possible and practical. To illustrate, understanding students' perceptions of SOLE sessions is significantly important in the current study and so is understanding the challenges of SOLE applicability in Saudi schools. For these endeavours, triangulation was adopted. First, data about students' perceptions was collected from the students' themselves, their teachers and their parents. Second, data about the challenges of SOLE applicability was collected from the teachers and the head teacher in addition to the researcher's observation of the research setting.

Thirdly, peer debriefing refers to the discussions between the researcher and peers about the research that is being conducted (Guba and Lincoln, 1994). Such a procedure is thought to lead the researcher to think more and reflect on different details of his or her research, which

increases the research credibility. The researcher in the current study is a PhD student at Newcastle University. The details of this research were discussed in informal and formal gatherings with both students and professional researchers.

3.9.2 Transferability

Another criterion for trustworthiness is transferability, which is developed as parallel to external validity (or generalizability) in quantitative research. Transferability refers to what extent other researchers or readers can check the accuracy of the research findings and transfer it to another context (Shenton, 2004). The aim of this study is not to generalise the findings because the context of action research tends to be very specific and sometimes unique. Hence, I hope these findings may suggest how to customise SOLE approach to be a suitable transfer to schools in other similar situations. This might happen as Larsson (2009) proposed that one way of generalising the result is drawing of specific implications and the contribution of rich insights. I can argue that, if SOLE experience has helped students' academic and social performance improvement in such a highly traditional context as the one investigated here, then such an approach may be effective in other similar traditional educational contexts.

As suggested by Guba and Lincoln (2013), one way that researchers can ensure transferability is through providing a thick description of the research context, setting and participants. In this study I attempted to provide the reader with a rich, thick description of the participants, the time, place, context and culture in which the particular study findings were based. In addition, direct quotations from what was said by the participants are also provided in the findings chapter to clarify and support the interpretations reached by the researcher.

3.9.3 Dependability

The dependability criterion used as parallel to the reliability criterion used in quantitative research, refers to the stability of data over time and over conditions (Guba and Lincoln, 1994). In other words, it aims to ensure the findings of the study are repeatable if the inquiry occurred within the same cohort of participants, coders and context. According to Guba and Lincoln (1994), it is common in qualitative research that different researchers might obtain different findings. This difference in finding might be a consequence of to some extent "methodological decisions by the evaluator or because of maturing reconstructions" (Guba and Lincoln, 1994, p.242). However, since preserving dependability criterion is important in qualitative research, it is proposed by Guba and Lincoln (1994) that the researcher should document and provide a thick description of methodological decisions and interpretations made so that they can be traced by outside reviewers and researchers. In addition, Bryman and Teevan (2005) suggest that developing detailed track record of the data collection process allows the reader to assess the data and demonstrate whether appropriate procedures had been followed and enables future researchers to repeat the work

Following Guba and Lincoln's (1994) and Bryman and Teevan (2005) propositions, the researcher in the current study makes the action research process explicit to enable other researchers to replicate the study. Therefore, a detailed and thick description of the methodological decisions and data collection procedure and interpretation are provided.

In addition to the thick methodology description, Guba and Lincoln (2013) suggested involving another researcher to check the coding of data to make the study more dependable. This is also followed by the current study as an experienced academic was sent a sample of the data along with the conducted coding and the coding scheme. The academic was in agreement with the coding, with the exception of the information seeking theme. Originally, this theme focused on the participants' information seeking behaviour in general. However,

the academic suggested that providing a description of the participants' behaviour in subsequent sessions to show how this behaviour developed over the study. This was indeed a valuable suggestion as showing development over the study period was one of the important themes pursued in this study. Hence, the coding of this theme was changed to reflect development over time.

Furthermore, expert consultation is seen by Guba and Lincoln (2013) as an important procedure to ensure dependability. The expert can be consulted with methodological decisions including the study design, the data collection tools and the data analysis procedure. Given that the researcher in the current study is a PhD student, she is supervised by two experts in the field of education. These experts have been consulted with all the details of the methodology and they also looked at previous drafts of this work.

3.9.4 Confirmability

The fourth criterion to verify trustworthiness is confirmability which is developed as parallel to the objectivity (neutrality) criterion. Confirmability relates to whether the findings are reflective of the participants' views and perspective or a product of the researcher's biases and prejudices (Shenton, 2004). According to Shenton (2004, p.63) "to achieve confirmability, researchers must take steps to demonstrate that findings emerge from the data and not their own predispositions". In order to meet the Confirmability criterion, Guba and Lincoln (2013) proposed some procedures including prolonged engagement, triangulation and the use of an inter-coder. These three procedures were followed in the current study as elaborated in the previous three subsections. The prolonged engagement made the researcher more aware of the participants' perspectives, which minimised subjectivity of the researcher. In addition, the triangulation procedure brought data from different sources and through different methods and this led to the possibility of confirming data from one source or method by data from

another. Finally, the use of the inter-coder helped with confirming that the data analysis was done more objectively than subjectively.

To sum up, the following Table 3.5 summarises the quality and rigour criteria and the procedures followed in this study to ensure them:

Table 3.5: The quality and rigour criteria adopted from Guba and Lincoln (1994) in the current study

The criteria	Objective	Possible provision made by researcher
Credibility	To establish confidence that the results (from the perspective of the participants) are true, credible and believable.	Use prolonged engagement Use persistent observation Use peer debriefing Triangulation
Transferability	To extend the degree to which the results can be generalized or transferred to other contexts or settings.	Data saturation providing the reader with a rich, thick description of the time, place, context and culture in which the particular study findings were based
Dependability	To ensure the findings of this qualitative inquiry are repeatable if the inquiry occurred within the same cohort of participants, coders and context.	Rich methodological description to allow study to be repeated
Confirmability	To extend the confidence that the results would be confirmed or corroborated by other researchers.	Do triangulation Practice reflexivity

All in all, the procedures that were followed in this study are peer debriefing, expert consultation, inter-coder, triangulation and prolonged engagement. These procedures are thought to contribute to the trustworthiness of the study.

3.10 Reflection on researcher's roles and responsibilities

Being clear about the position and role of the researcher in the research being conducted is considered significantly important because this demonstrates the validity of data collection and interpretation and, thus, the whole research. In line with research in other fields of study, within education there are two dominant researcher positions when conducting research in schools, which are outsider and insider (Cohen et al., 2018). While in an outsider position, the researcher does not belong to the community that is being studied, the insider position is held

by a researcher who belongs to the social circle where the research is being conducted (Thomson and Gunter, 2011). Both of these positions have implications on data collection and interpretation. To clarify, because the insider researcher belongs to the community being researched and shares with them culture and experiences, the participants might be more open to deeply discuss the investigated issues and the researcher might find it easiest to interpret the collected data (Mcniff, 2009). However, although this is an advantage, it might lead the research to interpret the data more subjectively based on pre-held assumptions of the community under research (Mcniff, 2009). This might consequently compromise the research validity. On the other hand, an outsider researcher might interpret the data more objectively without relying on previously held assumptions, which might give the research more validity (Thomson and Gunter, 2011). However, the participants might sometimes be reluctant to discuss certain issues with an outsider researcher (Thomson and Gunter, 2011). Further, as an outsider, the researcher might sometimes erroneously interpret participants' data (Cohen et al., 2018). Therefore, as can be seen from this discussion, either of these positions in research has its own advantages and disadvantages.

In the current study, the research plays both roles at the same time: outsider and insider. To illustrate, the researcher in this study is a PhD student at Newcastle University, UK, and she does not work as a teacher at the school where the research is being conducted. This puts her in an outsider position to the research setting and community. However, the researcher is a teacher in another school in the same local area of the research setting, which means that she does belong to a very similar teacher and school community. In addition, the researcher is a Saudi nation, an Arabic speaker and Muslim, which means that she shares the cultural, religious and linguistic background with the community under study. All this gives here also a more insider position at the research setting. Being in both positions at the same time, as also stressed by Cohen et al. (2018), gives the researcher the benefits of both positions and allows

her to avoid their disadvantages. In other words, as an insider, the researcher can elicit data more easily from the participants and she can interpret the data more properly, but at the same time, she can step back to her outsider position to eliminate the effect of pre-held assumptions on data interpretation.

In addition to being in insider and outsider positions, the researcher adopted many different roles at various stages of the research process, including those of planner, leader, catalyser facilitator, teacher designer, listener observer and synthesiser reporter. In other words, the researcher acted as an observer of students' activities to make sure that no student accessed unrelated materials online and to take notes during the research process. In addition, she interviewed the head teacher and the classroom teacher. The participants' parents and the school teachers were also surveyed. At the other end, the researcher conducted the study by herself by setting the venue, proposing the question and giving the feedback to the students about the findings. Further, she analysed the data collected and intends to make the research public by writing and disseminating reports and ideas.

In this study, the researcher was interested in the impact of the SOLE on the behaviours and development of the students and, thus, playing the role of the teacher-researcher was seen as very important for a couple of reasons. First, such a role enables the researcher to involve herself in the daily life in the school setting to gain a greater understanding of its intricacies and complexities. In addition, being involved in research in such a way is important because, as asserted by (Guest and MacQueen, 2008), field research may uncover elements of people's experiences or of group interactions of which we were not previously aware. This role also allows the teacher-researcher to control the process of SOLE more effectively. To illustrate, one of the basics of SOLE is that the teacher does not interfere during the research period and students' discussions and work, but teachers are generally not accustomed to being a spectator

in the class. Thus, they might find it difficult not to interrupt the students' discussion and voice their own opinion on students' work especially if the students' answer is wrong or they ask for help. Indeed, teachers' interference was one of problems that were reported by MA (2018), who asked teachers to lead SOLE sessions. In fact, the teacher can adapt to a mentor role if s/he applied SOLE, as also postulated by MA (2018), but to reach this stand it might take time. The time allocated for this study is limited, though, and, therefore, the researcher decided to take this role so she can focus on the extent of students' development.

3.11 Ethical considerations

No ethical concerns were expected to arise during conducting this research, but similar to other research studies, some issues were taken into consideration to ensure research ethics. As clarified by Bryman (2016), it is of primary importance that ethical issues are considered before conducting research to ensure the integrity of the study. The purpose of considering these issues is to "help keep participants safe from harm, build trust with participants and ensure trustworthy outcomes from the research which will benefit society" (James and Busher, 2012, p.1).

Since the researcher in the current study is a PhD student at Newcastle University, UK, the ethical procedures started with obtaining an ethical approval from the research committee at this university. To obtain this approval, an information sheet and debriefing form explaining the details of the project fully (see appendixes J) and an informed consent document had to be prepared by the researcher. Since in the current study there were different groups of participants (children, teachers and a head teacher) and data was collected from them in different ways, four different versions of informed consent were prepared. The first and second consent letters (see appendixes K) were directed to children and their parents. The

third and fourth letters (see appendixes L) of consent targeted classroom-teacher and the head teacher.

Following this, the researcher contacted the Ministry of Education in Saudi Arabia to ask for permission to conduct the study in a Saudi primary school. Indeed, the planning and development department at this ministry issued a permission letter to facilitate the researcher's task (see appendix M). The next stage involved paying a visit to a primary school in Riyadh, Saudi Arabia, and explaining to the head teacher the details of the project. Finally, the head teacher consented to the project and the study started.

At the start of the study, all participants were informed verbally about the project and given Arabic versions of the information sheet (see appendix N) and consent form. Participants' questions based on this were answered by the researcher. All participants were assured that their identity and any data collected from them would remain confidential and that only non-identifying data will be used in the thesis. It was ensured that all participants understood that their participation was completely voluntary and that they could withdraw from the study at any time without any consequences. Following this, the parents, teachers and head teacher were asked to sign the consent form if they agree to participate. As for the children, the consent from them was obtained verbally instead. Different from adult participants, children were reminded of their right to withdraw without any consequences and their consents to continue were verbally obtained at the start of each SOLE session.

The data obtained from the participants was in hard copy format and the researcher had to transfer some of it into a computer in an electronic format. In both data formats, any identifying information was wiped out and participants were given codes and pseudonyms instead. All data was kept in a secure place that no one, except the researcher could access.

While the hard copy of data was kept in a locked study room, the electronic copy was stored in a password-protected computer.

3.12 Conclusion

This chapter has discussed various aspects related to the process of conducting research, from the philosophical orientation of the study as being interpretivist to the practical aspects of gaining access to the research site, organisational setting and the procedures for data collection and analysis. To conclude, the following Table 3.6 presents the research framework which offers an outline of the overall research design of this study.

Table 3.6: A summary of the methodological details followed in the current study

Research Design	Description of choices
Research Questions	1. How does SOLE affect the learning behaviour and outcomes of children who are accustomed to a traditional approach? 2. How do students perceive SOLE in comparison with a traditional classroom environment? 3. What are the challenges of introducing SOLE in Saudi Arabia schools?
Philosophical orientation	Interpretivism
Research strategy	Action research
Data collection methods and participants	- Observations of 10 SOLE sessions (28 students) - Interviews one head teacher and one classroom teacher - Three different student questionnaires (28 students) - PVTs (28 students) - Parent questionnaire (26 parents) - Teacher questionnaire (17 teachers)
Data analysis techniques	- Simple descriptive quantitative analysis - Qualitative analysis: Deductive and inductive thematic analysis

The next chapter presents the findings of the study.

Chapter 4. Research Findings

4.1 Introduction

As discussed in the previous chapter, the qualitative and quantitative data in this study was obtained through classroom observations (field and researcher note), PVTS for students, questionnaires (for students, parents and teachers) and semi-structured interviews (head teacher and classroom teacher). In order to answer this study's research questions (see Section 3.2), the data collected from different methods was used to present a collective answer.

This chapter starts in Section 4.2 with an overview of the action research cycle. Then, the results are presented in three main sections (4.3, 4.4 and 4.5), each of which is devoted to the findings that address one of the research questions; in Section 4.3, findings relating to how SOLE affected students' learning behaviour and outcome are presented. Section 4.4 reports the findings about how the research participants perceived SOLE. Finally, the findings about the challenges that might face SOLE implementation are given in Section 4.5.

4.2 Overview of the action research cycle

The current study aimed at introducing and developing a new pedagogy (SOLEs) through conducting action research. This involved going through a cycle of testing this new pedagogy in a specific setting, observing how it works, modifying action plans to ensure better outcomes and re-testing the pedagogy in light of the new modifications. However, this does not mean that there was only this one major cycle that the project went through because, as in any other action research, there were mini cycles taking place. These cycles revolved around incidents that happened during the study and these cycles consisted of what actually happened, how I responded and the outcome of my response. Since these cycles were built

around specific incidents, I find it necessary to demonstrate the cycles of this research in terms of these critical incidents as will be shown below.

The current study started with planning for the content of sessions and how the data would be collected. During the sessions, some incidents took place that led me to change the planned course of action. One example of a critical incident in this study took place in session 4 when students started to lose interest. More specifically, I observed that some students started to wander around the classroom or talk with their friends before they completed the task assigned to them. Reflecting upon this, this observation was an occurrence that required my intervention to re-motivate students to make them more focused on and engaged in the task they were doing and to develop the action plan for the study. Indeed, I intervened through introducing some re-motivating strategies: Award system art work sessions and granny cloud (see Section 1.3). The major cycle of this action research is depicted in Figure 4.1 below with specific focus on the critical incident mentioned here and the two phases that resulted:

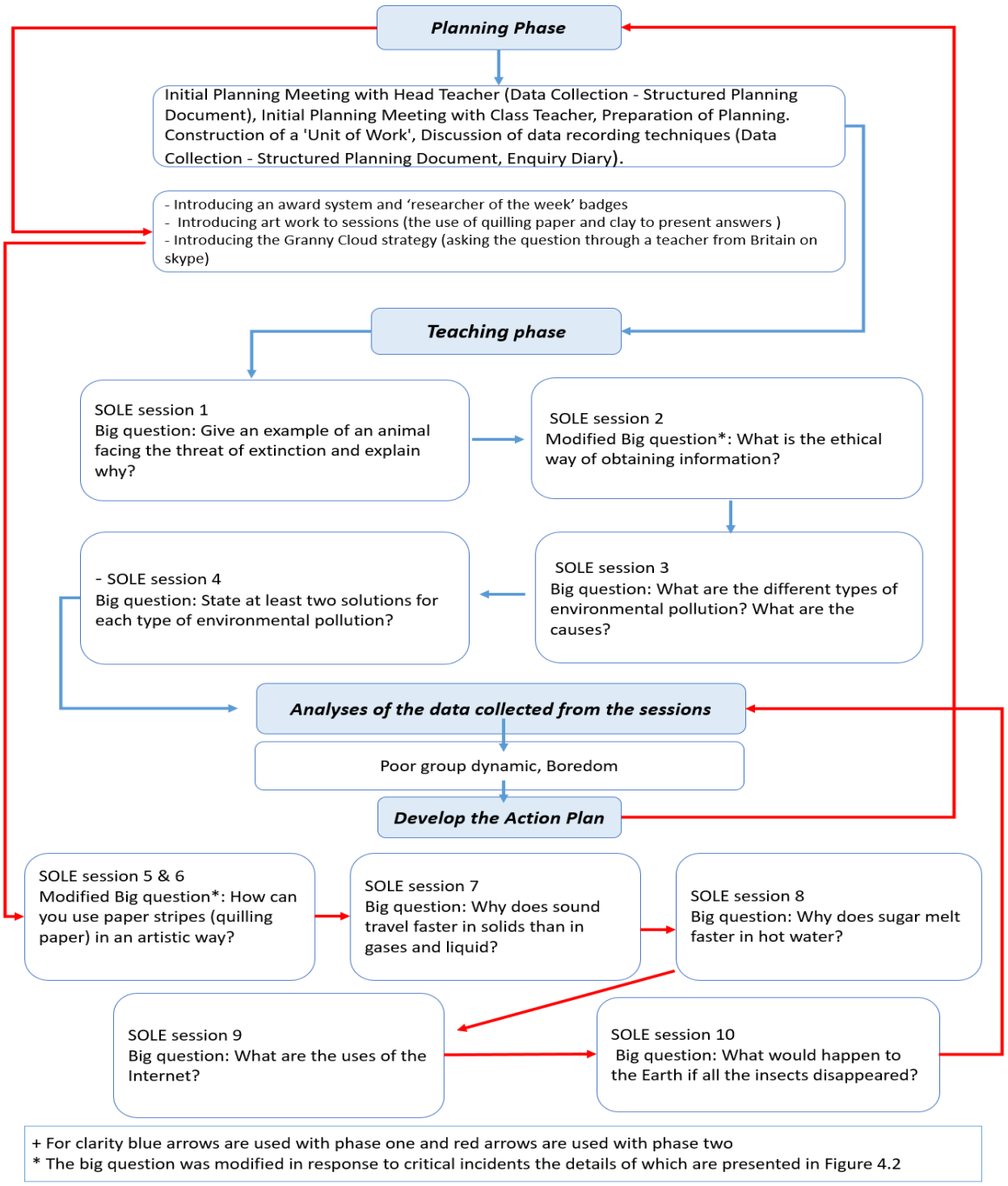

Figure 4.1: An overview of the major cycle of this action research with focus on one critical incident

As explained above, Figure 4.1 shows the major cycle of this action research through one incident that took place during the sessions. As mentioned above, in the current study, there were other incidents that appeared during these sessions. A number of these incidents required a response from me as a teacher and therefore formed mini cycles in this action research. However, it should be noted that there were other incidents that it was thought against SOLE

rules to respond to; these incidents did not form a cycle and, hence, they are not reported here. The critical incidents that formed cycles are summarised along with my response, outcome of response and reflection on the incidents in Figure 4.2. This is done in the aim of providing a more general view of progression of this action research.

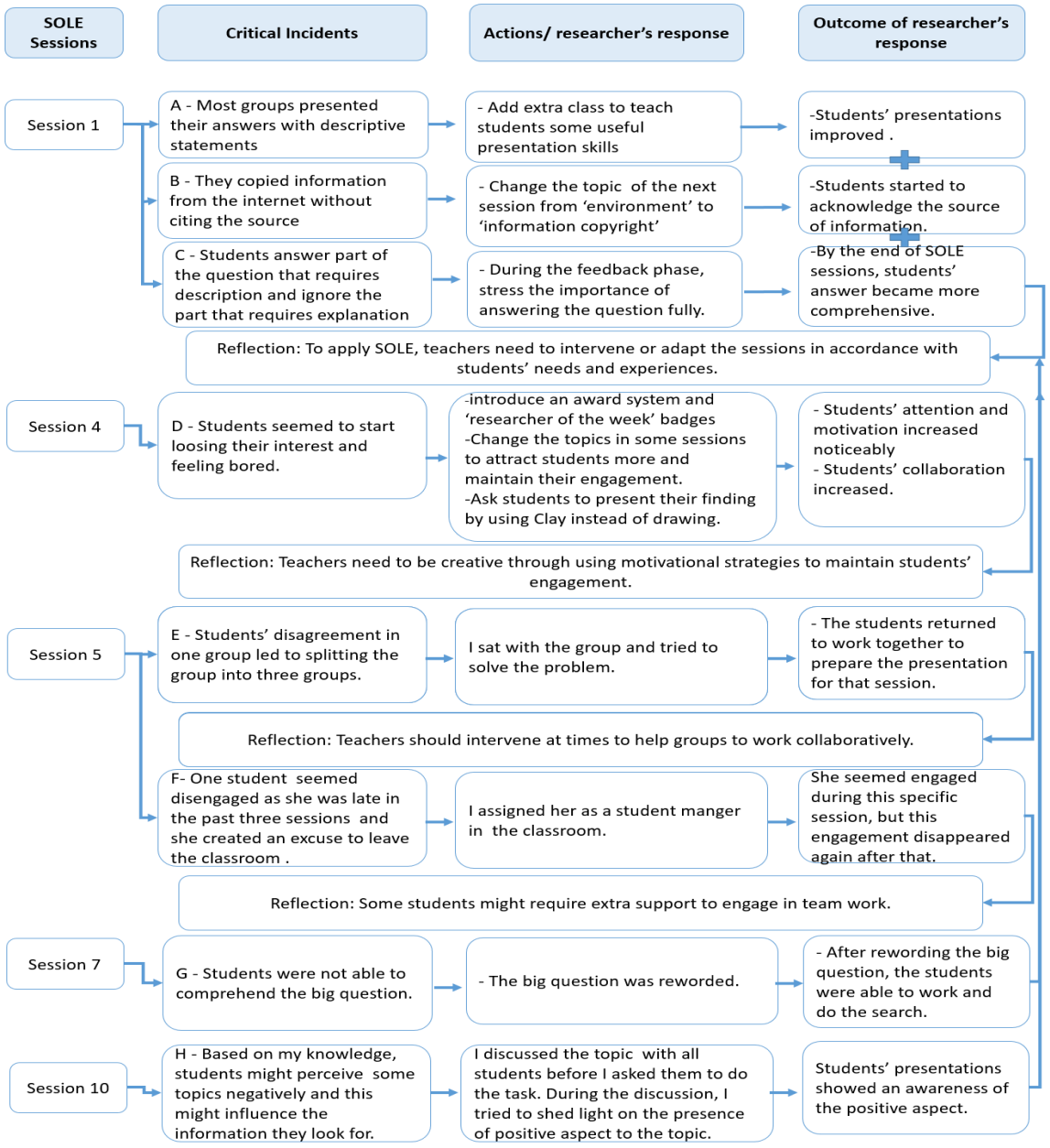

Figure 4.2: An overview of the mini cycles of this action research

These mini cycles presented in Figure 4.2 above are meant to give the reader a sense of the happenings that I felt I had to respond to during the progress of the study. They show the tiny

reactions and decisions I made in light of the bigger decisions to change what I was doing (as shown in Figure 4.1 further above). However, as discussed throughout this thesis, the main focus in this study is to investigate the effect of SOLE approach on students' learning behaviour and outcome and the development of students' abilities to learn through SOLE approach. For this reason, the findings below will be presented in a manner showing how this approach affected students' learning behaviour and outcome and how students' skills and abilities developed rather than through action research cycles, but the research cycles and critical incidents will be returned to in the sections below where their context becomes clearer.

4.3 SOLEs' effects on students' learning behaviour and outcome

This section presents the findings that can provide an answer to the first research question in this study (Q1: *How does SOLE affect the learning process and product of children who are accustomed to a traditional approach?*).

As clarified in the Methodology Chapter (see Section 3.6.1), to understand what is happening during SOLE implementation in this action research, the 'Group Spinner Axes' proposed by Kharrufa et al. (2017) was adopted to get a more holistic view of students' learning behaviour and outcome. The Group Spinner Axes are: 1) Information Seeking; 2) learning outcome, 3) Collaboration; 4) Context-Specific: Working within the culture and context of SOLE; and 5) Motivation and Engagement. The presentation of findings in this section will address these Axes, respectively below.

4.3.1 Information seeking

Despite the short period of this study (10 sessions), some signs of development in students' information seeking skills were detected during observations. As discussed in the

Methodology Chapter (Section 3.6.1), students' behaviour will be understood based on the level of complexity and critical thinking demonstrated by students during sessions in their information seeking endeavours based on Kharrufa et al's (2017) information seeking rubrics (i.e., fact finding, balancing information to identify a position and scrutinizing and analysing).

Based on class observations, in the first few sessions it was observed that students often typed in the whole questions into Google and they got disappointed and frustrated when it did not exhibit an answer (see Figure 4.2, Critical Incident C). Once a basic stance was made, students did not research further. Also, they seemed to lack patience or determination to check the information with an alternate source (second opinion) especially when the given question was sophisticated or consisted of more than one part. In the first session, for example, the question was 'What animals are endangered and why?'; The students immediately typed the whole question in the search engine and looked for examples of extinct animals. Most groups missed to write about the reason for this animal extinction. Throughout the discussion and reflection at the end, the students justified not finding the answer as "there is no information available". My response to this critical incident was that I stressed, during the feedback phase, the importance of answering the question fully by typing each part of it separately. The outcome of this reaction showed that students' search behaviour seemed to change in later sessions although this occurred for some students earlier than for others. For example, in session 3, one student (Adeem) was noticed to use a sub-question in her search for information after her attempt to type the provided question. This question was 'What are the different types of environmental pollution? What are the causes?'. All students including Adeem started with typing the first part of the question and then moved to the second part (What are the causes?) and added "of environmental pollution" to it. However, Adeem returned to the search engine again later in the session and entered three sub questions separately (1. 'What are the causes of water pollution?', 2. 'What are the causes of air

pollution?' and 3. 'What are the causes of soil pollution?'). Such development was not observed in other students' performance until session 7 as they started to use keywords and sub-questions rather than the whole provided question.

Furthermore, students seemed to stop at the first website that provided them with the information they wanted without checking credibility or expand search to other sources. Although in the session feedback I informed the students to consult more sources of information, this did not happen in session 2 and only one student (Adeem) in session 3 seemed to look at different search results and access a number of them in an apparent attempt to rely on a range of sources. This was not seen in the information seeking performance of other students until session 7, and by session 8 all students consulted multiple websites and brought information from them.

A further observation of an incident relating to the development of information seeking took place in session 5. In this session, students were given quilling paper strip sets and were asked to do something useful with them using the internet. All students searched the internet using Arabic language, but the search engine did not come back with relevant results. After this, one group read the English words written on the paper packet and typed them in the search engine, which resulted in some YouTube videos. Following this, other groups copied this behaviour after they checked what that group did. It should be noted here that all students relied on videos to perform the task although their search also revealed some images through Google. Yet, in the session feedback, I encouraged students to also use images.

Indeed, further development relating to this was observed in session 7 and later sessions. Here, students started using images that appear in the search result to obtain information. In session 7 particularly, students were given a question about why sound travel faster in solids

than in gases or liquids. It was observed that they were inspecting the information provided in some images to get answers for the question.

4.3.2 Learning outcome

As explained in Section 3.6.1, the learning outcome axes was measured through the taxonomy proposed by Kharrufa et al (2017) (i.e., No, or incorrect information; facts on one aspect of the answer; multiple aspects but no links; development of answer; and applying information to new areas). In general, the students' outcome after each session showed that students' findings differed from one group to another and from session to session. However, the discussion after the presentation was a much more valuable experience and seemed to spark many more thoughts and areas for further reflection in the students.

In the first two weeks, pupils encountered some difficulty in including adequate information in their presentations. They seemed to be confused about the level of information required to complete the task and thus they built their answers from the most readily available information. How accurate or persuasive was the obtained information did not seem to be a concern for them. In addition, no attempts to critically evaluate, synthesize or analyse information appeared in students' presentations as they seemed to rely on copying the first selection of sources without reading or evaluating the information (see Figure 4.2, Critical Incident B). Most groups presented their answers with descriptive statements (with too much detail sometimes), mainly collecting shallow facts about their questions and not taking an analytical approach (see Figure 4.2, Critical Incident A). In addition, these groups seemed to present information in too simple a way and their answers seemed to address one aspect of the question. To clarify further, most presentations in these two sessions showed the same pieces of information, which indicate that students either copied the same source or copied each other's. In addition, these presentations seemed to focus on one aspect of the question although one of the questions presented obviously included two parts (i.e., Give an example

of an animal facing the threat of extinction and why?). Figure 4.3 is a picture of students' presentations in sessions 1 and 2.

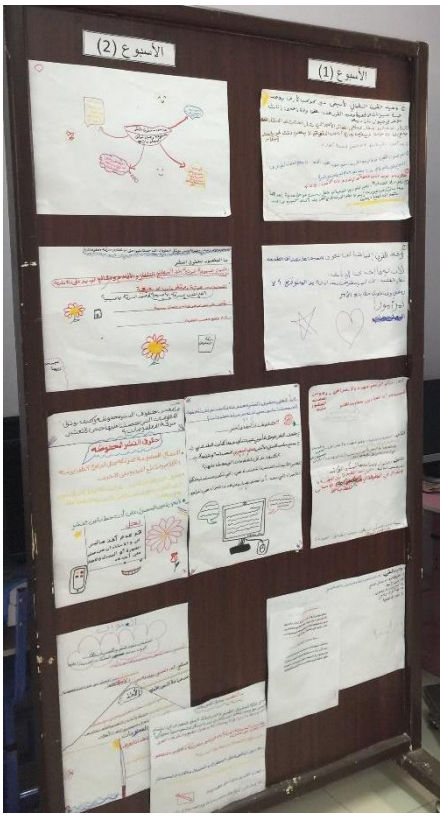

Figure 4.3: Students' presentations in sessions 1 and 2

My reaction to these two incidents involved changing the topic of session 2 from 'environment' to 'copyright' and adding an extra class to teach students some presentation skills. The outcome of my actions started to be noticeable in the next session; the students started to acknowledge the source of information and their presentations improved as will be demonstrated below.

In sessions 3 and 4, a significant unexpected development took place. Students' presentations showed a multi-structural and relational focus (see Figure 4.4). To clarify, the question was about environmental pollution and students mentioned a number of aspects of this question (water, air and soil) and they linked them together by showing the causes behind these types of pollution. However, it should be noted here that the topic of these two sessions was

covered previously for these students as I was told by one of their teachers. It seems that this performance might have been due to students' prior knowledge about the topic. This will be discussed further in the next chapter.

Figure 4.4: Students' presentations in sessions 3 and 4

In sessions 5 and 6, students' performance again seemed to focus on one aspect of the question. In these sessions, as mentioned above students were given quilling paper strip sets and were asked to do something useful with them using the internet. Although quilling paper strips have many uses such as creating objects like bracelets, 3D items and artful pictures, all students used paper strips to create an art picture as their presentations show (see Figure 4.5). This might show the uni-structural focus of students.

Figure 4.5: Students' presentations in sessions 5 and 6

However, in sessions 7 and 8 students' presentations started to exhibit a multi-structural focus. The topics of these sessions were sound and heat respectively; students' presentations focused on multiple aspects of these topics (see Figure 4.6). For example, in session 8, the question was 'Why does sugar dissolve faster in hot water?' almost all groups started their answers by the statement "the heat is one of the melting reasons". Some added the definition of the solubility and the partial sugar compounds. Yet, students did not seem to draw any relation between the different aspects of this topic by for example mentioning that heat gives the molecules energy to move faster causing sugar to dissolve faster.

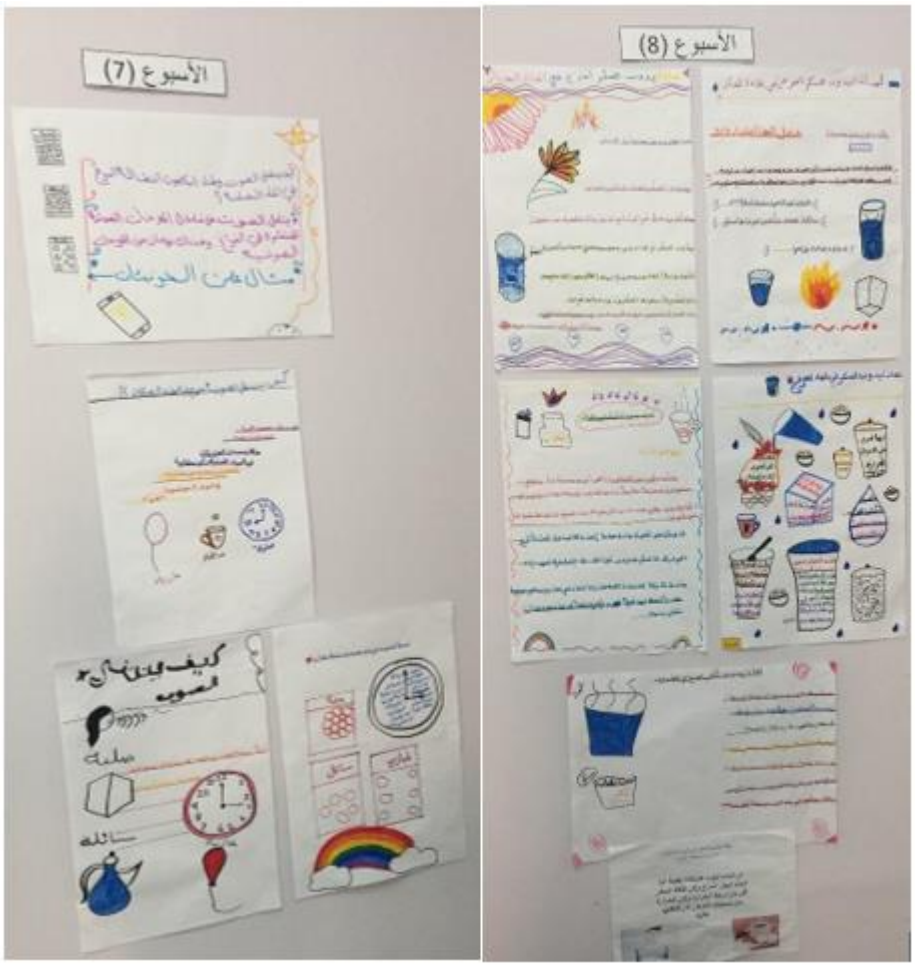

Figure 4.6: Students' presentations in sessions 7 and 8

In session 9, students were asked about the uses of the internet (see Section 4.3.4.1 for more details) and their presentations did not reveal a noticeable development. As figure 4.7 shows, students' presentations listed the different uses of the internet, which might also reveal a multi-structural focus. Yet similar to students' presentations in previous sessions, the relational element was not apparent.

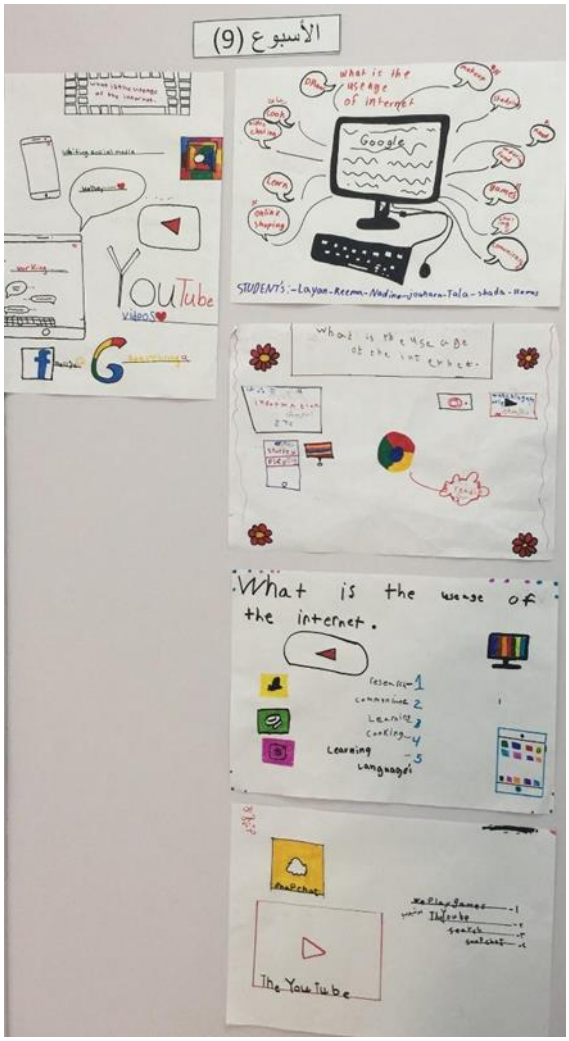

Figure 4.7: Students' presentations in session 9

In session 10, an important development seemed to have taken place as most groups showed an ability to draw a relational focus in their presentations. In this session, students were asked what would happen to Earth if all insects disappeared. Although the presentations did not give a clear answer to the proposed question, they artfully depicted the relation between different components in the life cycle and food chain (see Figure 4.8). However, it should be noted here that an additional procedure was introduced at the start of this session. To clarify, based on my knowledge of the cultural background of the students, I thought that students might perceive a topic related to insects negatively and this might influence the information they look for (see Figure 4.2, critical incident H); they might focus only on the harm insects might cause to human beings. This thought led me to discuss the topic with students before I asked them to do the task. During this discussion, I elicited answers from the students until benefits

of insects were mentioned by some. This action had a successful outcome as students' presentations showed an awareness of the benefits insects have.

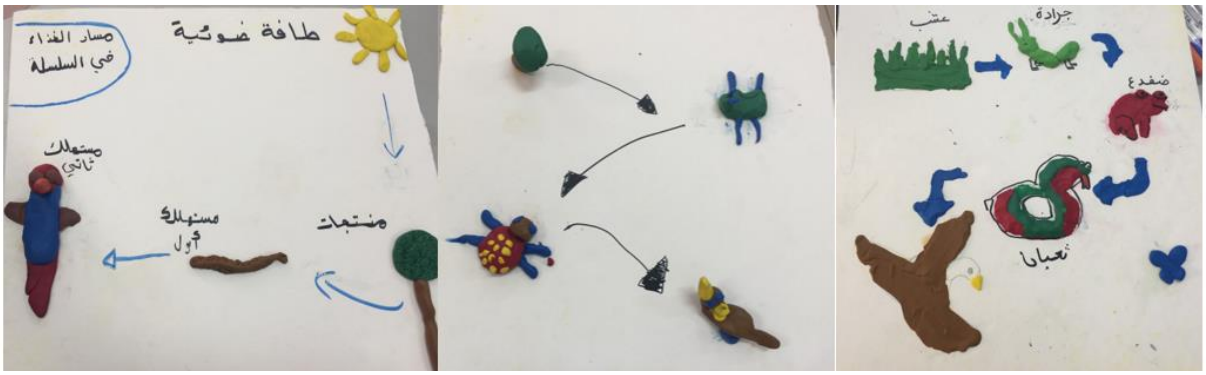

Figure 4.8: Students' presentations in session 10

Another interesting finding documented by the researcher amongst participants was the questions being generated as a result of the projects. The following are some of the questions generated by the students during sessions:

"How does our brain work?"
"How does our brain think in hard situations?"
"How can the heart feel happiness?"
"What is the impact of saying negative words on flowers!?"

Generating such questions illustrate that the students' need to know was growing and their confidence to question was expanding. More importantly, it showed how children started to think critically.

4.3.3 Collaboration

As discussed in the Methodology Chapter (Section 3.6.1), students' collaboration will be understood based on the collaboration elements proposed by Kharrufa et al's (2017) (i.e., sharing resources; joint actions; mutual planning; equal participation; communication; and

reaching consensus). The findings on these elements are presented below respectively. It was found that Groups operated at different group compositions and with different levels of engagement. It emerged from the observation that some of the students were not accustomed to working with other students specifically at the beginning of the study and needed time and opportunities to learn collaborative work strategies. However, it was noticed that this strategy increased significantly toward the end of this research. This was also evident from students', parents' and classroom teacher's views (see Section 4.4.3).

4.3.3.1 Sharing resources

During this study, students seemed to be willing to share resources from the first session. Although the materials needed in the sessions were provided by the researcher to all students, they sometimes did not resort to the researcher but shared things such as pens, papers and the space when needed. An example for this was in the 4th and 7th sessions, when a computer broke down and one group shared theirs. Moreover, it was observed that the pupils also shared the information and the resources (link to the websites) they found most of the time and this also took place in the first session and other sessions afterwards. Nevertheless, there is one occasion where a group concealed their finding from others to be the winner; yet, after I commented on this behaviour in the feedback stage, it never happened again. Overall, students' behaviours from very early on gave indications that collaboration between students was happening.

4.3.3.2 Joint actions

Joint actions appeared within groups from the very first SOLE session in this study. Once the students were given their question to research, they began working in their chosen groups, sat on collaborative benches in front of computer screens in a semicircle and began to research and write about their findings. The joint actions were most apparent during the time of presentation; each member took their turn contributing to the presentation of the findings

nearly from the first session. An exception to this occurred twice in separate occasions in the first and sixth sessions when the members of two groups disagreed with their peers in the same group and withdrew from working together. Yet, in those two occasions, it was observed that the group size (i.e., six or more) was larger than what it used to be in the other sessions (i.e., four)

Joint action was also seen on a larger scale in latter sessions. To clarify, students in the seventh and ninth sessions failed to find answers for the proposed questions. Students started to approach other groups to check what happened with them. Following this, students stopped working and some students from different groups came closer to me and stated that they did not find an answer and asked for help. The general incident appeared to be organised by students together.

4.3.3.3 Mutual planning

In general, whether joint planning happened or not was not something the researcher could observe directly. However, based on students' successful joint action at the group and class levels, it seemed that they had joint planning especially when the number of the group is four. The picture taken for one group in session 4 (Figure 4.9) represents what used to happen within groups in most sessions. To clarify, the picture shows that while one student was working on the computer, another one was writing and two were discussing an issue.

Figure 4.9: A picture of one group in session 4.

Furthermore, on one occasion in session 9, students could not find an answer for the question because it was in English. After they approached the researcher asking for help, who told them to think about it further, they kept standing somewhere in the middle of the class and one student suggested using translation (see Section 4.3.4.3 for more details). After this, all students went back to their groups and started working on the question.

4.3.3.4 Equal participation

The equal participation seemed to have occurred mostly when the group was large (i.e., 6 or 7 students), and this less observed in smaller groups (i.e., 4 or 5 students). To clarify, students formed large groups nine times during the sessions; in most of these occasions some students appeared to be dominant and others were passive. In addition, arguments among members took place to the extent that some students withdrew and on two occasions groups broke down. However, in smaller groups, such incidents were not seen, and students seemed to work well together most of the time. On three occasions only, a student withdrew from a 5-member group and joined another group.

On the other hand, equal participation was clear in the Art and last sessions (see Section 4.3.2); students used clay to present their work, where there is no chance to finish the work during the session without everyone involved. In these two sessions, it was observed that all members in the group had a role during the design of their work and no passive role was observed. It is important to highlight the fact that these sessions were the preferable for the students as they stated in their PVTs, which indicate that children felt that they participated equally and enjoyed the teamwork.

4.3.3.5 Communication

Careful observation of the student groups during the SOLE sessions showed varying levels of discussions taking place and students seemed to rely on their peers for support, especially when my intervention was minimised by the role of SOLE. Moreover, although it appeared that some students were not working hard to answer the questions, most groups by the end of sessions used to finish the task and present interesting and insightful information. This performance might reflect that good communication and teamwork within groups could have taken place.

However, on some occasions barriers to communication seemed to manifest as students withdrew from their groups after an argument or students failed to present, which might indicate a lack of communication. As mentioned above arguments took place in large groups all of the time and among students in groups of five only on three occasions. For example, in the fifth session, one group of six members established a dialogue to regulate their collaborative behaviour; this seemed to result in the students working seriously with their chosen peers. Yet, later on, the same group split during the preparation of the presentation into pairs, but they continued to share the table (see Figure 4.2, Critical Incident E). Each pair of students worked separately, while some students stopped participating. After the

unsuccessful repair attempts by the group manager, my intervention seemed necessary to help the students return to work collectively. Indeed, I sat with this group member and discussed the reason for their behaviour and tried to solve the problem. Following this, the students returned to work together and prepared their presentation together.

Moreover, three different groups could not present as they either did not do the search or did the search but could not reach findings. This failure to present in addition to the poor performance of some groups during presentations were observed to be mostly due to a breakdown of communication between group members. For example, one group of six members in session six did not produce a presentation due to the continuous disagreement between a dominant student and the rest of her group members. This led four students to leave the group and the remaining two students failed to present.

4.3.3.6 Reaching consensus

From the first SOLE session and onward, all groups seemed to reach consensus on the issues being investigated, except in two cases when groups dissolved because of arguments among members. Therefore, the apparent feature was that students reached a joint perspective about the answer to the research question given. It was observed that the process was sometimes driven by a dominant member of the group and the sense of direction provided by her. Based on my observation, the group members who took more leading roles, seemed to have stronger personalities or better computing skills, with the other members conforming. Exceptions to this took place when there were two strong personalities in the group; in such cases, the argument among members ended up in the groups. Moreover, it was perceived that the students rarely agreed to disagree. It seemed that this skill might have been more complex for the students to achieve compared to the previously mentioned skills given the time frame of the project and the impact it managed to generate in the meantime.

4.3.4 Working within the culture and context of SOLEs

The rubrics of this axe as proposed by Kharrufa et al (2017) (see Section 3.6.1) are taking responsibility, sharing knowledge, viewing learning as an exploration and being spontaneous. For children who are accustomed to a traditional approach, it is difficult for them to deal with an extreme change in their learning environment. However, based on the observations, it was found that there were noticeable developments in students' behaviour relating to taking responsibility, knowledge sharing, view of learning and spontaneity over the short period of 10 sessions. The following four subsections report the findings in relation to these aspects respectively.

4.3.4.1 Students take responsibility

In the first few weeks, some students could not settle down with the idea that they should rely on themselves and that I as the teacher would not intervene. Such students kept asking for help from me. However, by the end of this study, it was observed that students asked each other for help and tried to resolve any issues in their groups by themselves. For example, in session 9, students faced a problem as they did not manage to find an answer to the question because it was presented in English. Typing the question in Google gave web pages written in English and thus the students did not understand the content. Although the students resorted to asking me for help in that session, after I had refused to intervene, they managed to resolve the issue by following what was suggested by one of them through using Google Translate.

Moreover, it was found that noticeable developments in students' self-organized behaviour took place over SOLE sessions. For example, in the first session, students spent around ten minutes to organize themselves in their groups. Although out of seeming chaos, they clearly seemed to have a feeling of responsibility for ownership of their learning; they managed to formulate their groups and start to search the big questions without the teacher intervention

from the very first session in this study. In addition, in subsequent sessions, it was noticed that the groups organised themselves much quicker to start search which indicated that they took on more responsibility. The feeling of responsibility was clear in session six and ten, where most of the group members worked collaboratively and everyone in the group was involved and seemed responsible to finish their project.

Furthermore, students' responsibility was apparent when quarrels took place. These happened several times during the sessions and most of the time some of the involved students changed their groups. Such a solution might indicate that the students felt responsible to complete the task and keen to participate in a more suitable environment. The instance mentioned above, the group of six self-organised into smaller groups after the disagreements that occurred between them was interesting because at least it shows they wanted to participate and felt responsible. This is supporting the result that was found in the WIHIC 2, where the children felt unsatisfied about their role in the searching stage which indicates that they desired for participation and had a sense of responsibility toward that.

The development of students' information seeking skills and outcome might be evidence of students taking on the responsibility of choosing the most effective and efficient way to complete their work and look for ways to improve through investigation. By taking over the authority for learning, they seemed to gain the ability and confidence composition and believe that the novelty of messing around would wear off in time. Undoubtedly, there were some occasions when some students did not participate, and they were observed messing around (see section 4.3.1.2). However, these behaviours visibly appeared when students did not engage in their group work. This might indicate that when students become less engaged, they might play around to make themselves busy.

4.3.4.2 Students share knowledge

The groups seemed to enjoy organizing themselves but seemed to struggle with the idea of sharing information initially. In SOLE sessions, the students moved freely between the other groups. They seemed to gather what the other groups found and feed it back into their original group. However, what seemed to go against this was what happened during the 7th session when the award system including coupons and "researcher of the week" badges were introduced to maintain the students' motivation; this seemed to increase students' competitiveness. In this session, the question presented a challenge to all students, but one group managed to find the answer to the big question and they kept the information to themselves and did not share it with others. The other groups eventually found an answer to the question. During the feedback fragment, this behaviour was highlighted, and the students were encouraged to share information with each other. During subsequent sessions, no similar incidents occurred.

4.3.4.3 Learning as a process of exploration (view of the learning process)

The findings reported in this section demonstrate that students' view of learning changed from a process of passively receiving information to a more active process of exploration. As demonstrated in Section 4.3.1, in the first few sessions, it was noted that students often wrote the question verbatim and started the search, but throughout the time students began to think of other ways to look for the answer. This can be clarified by the quilling paper example mentioned in Section 4.3.1, which showed that students changed their strategy of typing the presented question to using certain keywords that helped them to explore the question.

Moreover, it was crucial presenting students with some questions that do not need deep thinking but require some exploration to be answered. For example, in the 9th session, the question was simple and did not need to be considered in depth to get the answer (i.e., 'What are the usages of the internet?'), but it was presented to students in English which posed a

difficulty that needed an exploration to be overcome. When they searched the question, all websites were in English and this led them to ask for help, in which I replied: “I don’t know... think of a solution”. Following this, one student suggested using translation. Other students liked the idea, but they faced another problem which was how to do the translation. They decided to google for the translation method and finally found many sites that helped them translate their ideas to present it. It was interesting to see children exploring sites and think about solutions as a whole.

The searching for further information to explore the proposed questions continued beyond the classroom walls in some sessions. The SOLE experiences appeared to have propelled the students to continue their wonderings. For example, as mentioned above, in sessions 2, 4, and 8, some students brought extra information about the previous session questions. It was interesting to see how SOLE affected students’ desire to know more.

4.3.4.4 Being spontaneous

In the first few weeks, it was observed that the children were moving cautiously and the whole time they were checking how I responded to their moves. If they felt like I was watching them, they hesitated to move or rushed back to their seats and sat steady. This was possibly because in traditional classrooms, students should ask for permission from the classroom teacher before they could move from their places. However, in subsequent sessions, it was observed that students started to be more spontaneous in how they move around. The group change was a free and dynamic process, unlike the usual culture of the classroom. In addition, it was noticed that the students shouted their answers out of excitement, were able to express their emotions and relay their frustrations when challenged and clapped for each other with enthusiasm when presenting the winner group. It was also observed that some students sat on the floor while searching and collaborating and others

worked while standing (see Figure 4.10). To conclude, it was interesting to notice the interactions that took place with students who may not ordinarily work together and the way in which they seemed to settle into exploring the question quite quickly without fear of making errors.

Figure 4.10 students being spontaneous (sessions 7 and 9)

4.3.5 Motivation and engagement

The impact of SOLE procedures on student motivation and engagement was a changing theme throughout the study. In general, most students demonstrated enthusiasm to all SOLE sessions and positive attitude to these new experiences. This conclusion is based on my observations that will be reported below in this section and students', parents' and classroom teacher's views provided in Section 4.4.1. Although the students were motivated to engage in this study, this engagement was variable, naturally enough, from student to student and in different parts of the session. The data extrapolated from the observation support this claim. As mentioned previously in Section 3.6.1, motivation and engagement will be evaluated through observing students' attention, participation and volunteering. Finding about these aspects will be reported below respectively. Other signs of motivation and engagement revealed by the study, but which do not fit under any of these aspects will be dealt with separately.

4.3.5.1 Attention

During the ten observation sessions, it was observed that most of the students were paying attention most of the time, except for a few who exhibited behaviour contrary to this. As the students became more actively involved during the sessions, and as the students engaged in searching, it appeared that their attention increased as a whole. Yet, their attention was most noticeable at two occasions during sessions. First, when the students dashed into the room, they were full of excitement to start the sessions and they distributed themselves into groups and took positions in their group tables waiting for the questions to start researching. It was apparent that the students seemed eager for me to pose the question on the board at the beginning of each session. The second peak was right before the presentation time. This is approximately 5 to 10 minutes before the end of searching time and specifically when I announced the time left for students to complete the task.

The students generally appeared deeply engaged as they actively practised, and their attention seemed to be focused on what they were asked to do during sessions. However, students' attention seemed to be affected by some distractions during sessions. Before presenting these distractions and how they were addressed, they are summarised in Figure 4.11.

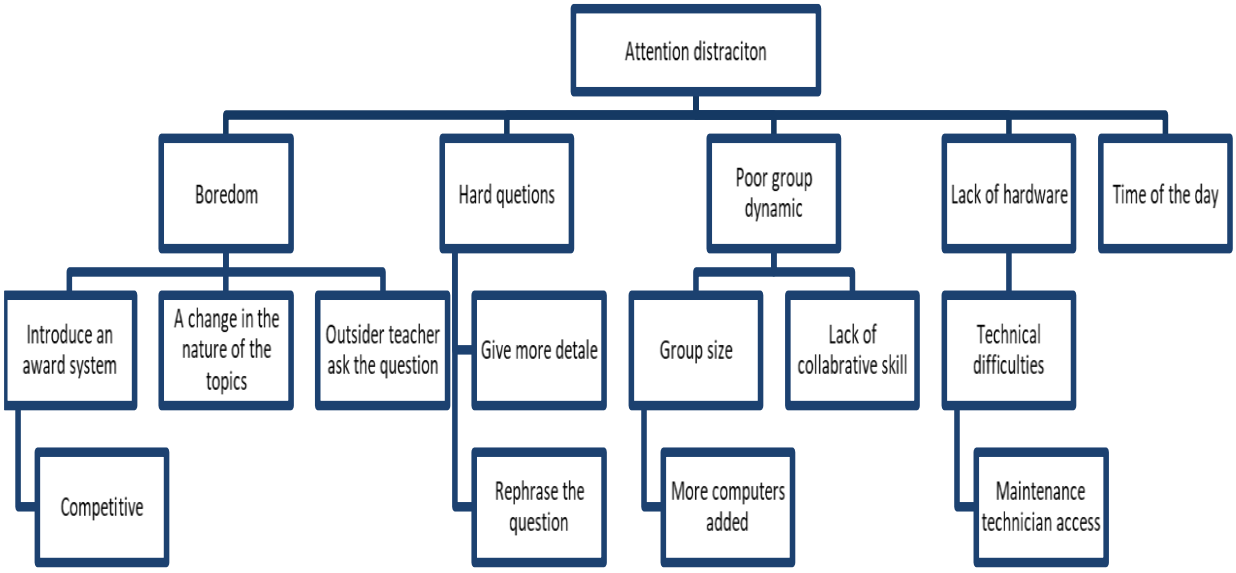

Figure 4.11: Attention distractions and how they were addressed.

To begin with, boredom seemed to occur after the 4th session. This possibly happened because the children seemed to get accustomed to the idea of searching for information, regardless of the lack of full development of their research skills. Hence, children seemed to require an element of creativity in the style of delivery of the session to enhance their attention (see Figure 4.2, Critical Incident D). As an intervention implemented in this study after session 4, an award system and 'researcher of the week' badges were introduced. Children collected coupons towards a final award. A change in the nature of the topics was also made by which art was used as the topic for the 5th and 6th session by the use of quilling paper to present answers. This created a new arousal and drove more learning towards the application of new material. This reflected the development of the children's inquisition and contributed to increasing their engagement and motivation. Another intervention was asking the question through a teacher from Britain (Bridget Stradford) on skype for the 9th session. The challenge in this session developed problem solving skills for the children as they had very basic English to communicate their answers back (see Section 4.3.4.1 for more details). Furthermore, clay was used as the method of presentation in the 10th session instead of presentation by drawing. These several interventions proved effective in appealing to the children and maintaining their interest.

On some occasions, some students were not engaged with their groups. However, the flexibility of SOLE rules (being able to change groups or converse with other groups any time) allowed these students to re-engage with the task. For example, when a student seemed unsure of how to contribute to their group members (appearing as silent and looking somewhere other than the computer screen or other group members), she would start to roam between the other groups and listen to their discussions. Movements like this can be refreshing and stimulating for her. After finding new or interesting information, she would then return to her original group happily and share that finding. This happened on numerous

occasions during my observation period and occurred in various groups. Similarly, if the student did not get along well with others and lose her attention or interest, she could change groups. For example, there was a student who changed groups in the 8th session and she flourished with the new group after a few trials of working with various class members.

Overall, it was observed that for the first half hour of research time, students concentrated on research, and tried to figure out what to say. During the second half of the session the level of focus varied; some students became more engaged, while others seemed to lose focus. It was observed, there were fewer roles for those in big teams and there was no attempt from them to involve or join another smaller group to help. Additionally, in the final research stage, some jobs were left to one or two individuals to complete as they could not all do jobs like editing at one time. This led to periods of inactivity for many of the students.

Attention decreased when there were elements of a poor group dynamic, manifesting in disruptive behaviour and group members not getting along very well with each other. For instance, on the first session, there were fewer computers available, and the students were new to the idea of working with the SOLE system. One group had a disagreement, which may have been due to their large number and the presence of a dominant group member who insisted on controlling the computer search. One of the members then decided not to participate and refused to change groups as suggested by the group manager, but then came around after 15 minutes and joined her original group.

Another example which disturbed the students' attention was when they experienced technical difficulties, such as poor internet connection and computer breakdown; some of these technology problems happened frequently. In the third session, one of the groups showed high levels of engagement, they began with excitement and split the tasks between themselves;

during their search, the computer malfunctioned and as a result they became frustrated. However, what these students did after the incident was interesting. They waited for another group to finish their search and then used their computer. This was interesting to observe as the students, despite the disruption of their attention and search process, they were able to re-establish their attention quite quickly.

The complexity of the question played a major role in maintaining the attention of the students. The inability to navigate through the Internet to answer difficult questions and resulting frustration were apparent in some SOLE sessions. For example, in the 7th session, the students were asked 'Why does sound differ in travel between solids, liquids and gas? Explain your answer'. This question was suggested by their science teacher as it was part of the curriculum but had not been covered yet. During this session, the students struggled with finding an answer (see Figure 4.2, Critical Incident G). After around twenty minutes, many students seemed to have lost interest and started to wander around or show off-task behaviours. They noticeably became frustrated and more chaotic. One of the frustrated students then came up to me and said "why do you give us such difficult questions? My mother gives me questions which once I google, I find the answer for!" (Lubna). As the whole class did not reach a conclusion, I decided to intervene and changed the question to 'Why does sound transfer faster in solids?' based on this, the students regained their motivation and became more focused and attentive. Then one girl screamed "I have found the answer!" (Rema). Following this, all the students gathered around her. It was observed during such occasions that the younger students turned out to be incredibly enthusiastic once they understood the problem.

It was also found that the students' attention decreased noticeably during the time of presentation. The groups in the audience seemed more focused on consolidating their own

findings prior to their turn of presentation rather than listening to the findings of the presenting group. This resulted in them missing on valuable learning points. The award system did not seem to suffice to overcome this problem and, hence, students were asked to engage in self-evaluation and evaluation of others to determine the beneficial presentation themselves. This seemed to maintain everyone's attention towards the end. It also seemed to promote values such as respecting others while presenting.

The students' engagement (paying attention to the task they were doing) was noted by the school principal when she made a surprise visit to the classroom. Unlike usual circumstances, the children were absorbed on their tasks and did not notice the principal when she entered. The principal commented that "the students have become so attracted and engrossed in learning after having an excellent teacher who was able to attract their attention."

Moreover, the time of the day also played a role in the learner ability to concentrate. Observable differences have been noted between early/late classes. In early to mid-morning sessions (6:30 to 10 am), the students seemed more enthusiastic and focused. Yet, in the later sessions (11am) at the end of school day, it was observed that some students' attention seemed to be decreased. This was possibly due to their being tired and hungry and because of the weather that gets hotter starting from late morning.

4.3.5.2 Participation

Active participation by students throughout all sessions was observed, resembling what Figure 4.12 conveys for most of the time. This was true not just during the search time but also during presentation preparation and delivery.

Figure 4.12: Students' active participation during a SOLE session

Group conflicts seemed to rise sometimes, but also to self-resolve within the group as the sessions progressed without the need for intervention of the facilitator (the researcher). I, the teacher-researcher, kept reminding students about the rules of SOLE, relating to changing groups, without intervention to solve the problem as much as possible. In the preparation for the presentation stage, some students appeared to participate less because as one student dictated, another typed, leaving the other students just watching. Yet, all group members participated more during the presentation.

However, some interesting behaviour in relation to participation took place during the sessions and this is worth mentioning here. This was observed when a group member did not wish to participate, which happened for three different students. The first one (Tala) had a dispute with her group members during the 1st and the 3rd sessions, she refused to change her group and disengaged. On both occasions, she just turned her chair back-to-back with her group and sat there doing nothing. This occurred again in the 7th session as she refused the solutions offered by the group manager and she started walking in the classroom and remained doing so until the end of that session. In the 8th session, a dispute happened again because of a dominant group member who refused to share the computer with Tala. The group manager in that session offered her a change of group solution. Tala accepted and from that session onwards she began to flourish and present well. It seems that it took Tala 8

sessions to cope with this new environment where she needs to work in groups with other classmates.

The second student (Shatha) came to me asking for help in tears in the 2nd session. She said "my group won't listen to me. No one is listening to my ideas". She was reminded with the rules of SOLE about changing groups. She approached other groups to join them, but they refused. Shatha returned to her group when other groups did not accept her, but she did not participate in what her group was doing and remained silent for the rest of the session. The following session, she came to class, but she said she was sick and asked to leave. The following sessions, she was in other groups and she seemed to cope well during the remaining 7 sessions. In fact, as a teacher and an observer conducting the study, this encounter was difficult to witness and remain passive about. Further, it was not clear why the other groups rejected Shatha's request to join them.

The third student (Lamis) was the most unique as what happened with her started from the second session and continued until the last one. It is important to note that Lamis' cousin was one of her classmates. In the second session, it was observed that Lamis did not engage well with her group and did not participate well. She approached me and asked to leave because she had a headache. I did not have the power to allow her to leave, so I asked her to stay. She returned to her chair but did not participate at all. In the third session, the same thing happened again. In the 4th session, she attended halfway after the session began and joined one of the groups; she did not participate much during the search, but she participated during the presentation (see Figure 4.2, Critical Incident F). In the 5th session, I assigned her as the group manager in order to increase her motivation; although her engagement was slightly better in this session, ten minutes after the beginning of the session problems started to arise. Group members were observed to argue with each other, and they changed the group and left

Lamis alone with her cousin, who was in the same group in that session. As session 6 was a continuation for session 5, groups remained the same and, hence, Lamis was also alone with her cousin. They seemed to work well together during this session, but they did not produce anything to submit to me. In the 8th session, Lamis and her cousin sat together, and the rest of the group members left them again. The two of them wasted the time of the session playing and when the presentation time was due, both joined a different group to take credit for the work. Lamis was absent in the 9th session, but she worked well in her group in the last session possibly due to her cousin's absence. Although Lamis was observed to disengage most of the session, her views about SOLE were positive (Section 4.4.4). This might indicate her lack of experience in group selection and how to take the responsibility in her action.

4.3.5.3 Volunteering

Another sign of engagement was the students' behaviour in volunteering their time and their effort to participant in order to benefit this study. The students were also willing to try new tasks that were different from what they were used to through their regular class experience. The study took place during the extracurricular activities period, which is considered an opportunity for the students to play. In addition, although that I made it clear that refusing to participate would not affect the students' grades. Despite that, the students were committed to the study with enthusiasm till the end. At the beginning of each session, one motivated student used to volunteer to be the group manager except for the 5th session when I chose Lamis to monitor the progress of all groups and help struggling students by supporting them socially and emotionally. Following this, I changed this student leader every session in order to give other students the chance to experience this role.

It was observed that some students shared their skills voluntarily with other groups. For example, the student, Joude, in the 4th session helped another group when they encountered a

problem with determining the language of search in their computers. Another surprising incident took place in the 8th session when one group voluntarily gave another group their working space to finish their work after their computer crashed. Moreover, the students used to offer help to the researcher by shutting down the equipment after the sessions or rearranging the materials used; this happened on occasions when the SOLE session took place at the end of the school day as there was no need to rush out for the next session.

4.3.5.4 Other signs of motivation and engagement

Based on the findings of the classroom observations the students appeared engaged in the big question and google images and asked each other questions about the meaning. Also, it was noticed that the children were deeply engaged when they were successful in dealing with a challenge presented to them and when they delivered their findings. They demonstrated positive attitudes about the SOLE session, which was evidenced through their clear excitement and confidence; it was apparent that, by the end of this study, all students believed in their own sense of self-efficacy. Confidence and excitement among the students were clearly revealed through their standing, voice, as well as how they answered my questions. In fact, I attempted to feed group competition during the feedback stage particularly through motivating students to try new strategies in how to attract the audience's attention and maintain their interest. In addition, to motivate students further, I used to show them examples of good presentations. In short, in spite of the seeming pandemonium, the classroom was full with enthusiasm and the students appeared to be complacent, comfortable and satisfied.

Engagement persisted beyond the SOLE sessions. By inspection, the 90 minutes of SOLE class quickly came to an end upon the sounding of the bell, which was met with inaudible groans, and most students were reluctant to leave at the end for the subsequent classes. The school's supervisory staff member had to remind them that they needed to leave. Some

students seemed dissatisfied by the fact that the day was over, as they would have been happy to explore the topic further after the discussion. There were occasions when the students continued their search back home and presented their findings about the proposed question the following session. This happened three times during the 1st, 7th and 8th sessions and three different students were involved in this (Joude, Remas and Reem).

Participants' engagement extended to the students' school administrative staff. The deputy head teacher and the secretary of the school reported that they heard about SOLEs' reputation and that it echoed through the school's classrooms. This raised their curiosity, and they attended a presentation during the 10th session and were surprised by the skills and depth of information that the students had acquired.

4.4 Participants' perceptions of SOLEs

This section presents the findings related to the second research question in this study (*Q2. How do students perceive SOLEs?*). Students' perceptions of the SOLE environments are absolutely central to this thesis. In order to understand how students perceived SOLEs, data collected through different tools (i.e., PVT, WIHIC questionnaire, comparison questionnaire, parent's questionnaire and classroom teacher interview) were analysed. The data collection and analysis focused on five themes. These were 1) students' general perceptions of SOLE; 2) students' perceptions of their academic outcomes; 3) students' perceptions of their social outcomes; 4) students' perceptions of the classroom procedure and the role of the teacher in SOLEs; and 5) students' perceptions of their own behaviours during group work. The findings relating to these themes will be reported in the following five sub-sections respectively.

4.4.1 Students' general perceptions of SOLEs

As discussed in RQ1, from the observation, students generally exhibited positive attitudes toward SOLE sessions by participating and volunteering. However, the internal thoughts of students showed mixed attitudes (positive and negative) in the beginning, but this became mostly positive for the majority by the eighth SOLE session. This can be seen in the quotations presented in the following Table (4.1) based on data collected through PVT after session two and then after session eight. This sample was chosen because the responses were more explicit in describing the feelings of youngsters toward this experience.

Table 4.1: Example of the students' general perceptions about SOLE

Students	PVT1	PVT2
Nora	*I thought these sessions were not useful... I used to hate research and I do not know the method of searching. However, I found that it is wonderful and more than that…I like it so much… I know now how to research.*	*I thought it would become harder and boring… on the contrary, after working together I liked the teamwork.*
Layla	*I thought we would work individually, but liked working in a group which I thought we couldn't do on one computer… The question and research were good ideas.*	*I thought it will be so fun and the questions are hard, but it was really fun, and the questions were hard*
Remas	*I thought it's hard, but I found that its easy and I hope we do it again*	*I thought it will be boring but now I wish if we had this session every day*
Nadeen	*I like it however there was chaos and no collaboration in the groups... I hope next time I will do better.*	*I thought the girls will not find enough information and will not work as a team; however, the students find a lot of information and with collaboration the questions and the work become easier… I love SOLE.*
Algwhara	*I thought using the computer was very hard and boring, but I feel happy because I know how to use the computer… this is a good feeling … I like this session*	*I thought I will not change my groups and we will work as a team, but there is no collaboration some time. However, through this experience, I learned how to adapt with others and how to corporate with my friends*
Lubna	*I thought it would be fun and easy, especially with the usage of computers, but it was very hard… it wasn't fun at all because it was competitive … I was thrilled by choosing my groups and my friends… this is strange*	*I thought this experience will become more fun and we will form a wonderful group but all we do is fight … Can you please for next year change the questions to be more childish topics? For example, what are the usages of the phone?* ♥
Joude	*I thought it would be fun to work with my friends, but it wasn't … I don't like group work… it is good experience; I just don't like it*	*I didn't like it at the beginning, but I like it now even though some students are not collaborative*

The statements reflect the overall agreement that the majority of the students liked SOLE sessions. This is also consistent with the results from the questionnaire in response to the statement *'I look forward to SOLE lessons'*. The majority of students agreed with this statement and very few were either not sure or disagreed. These results are summarised in the following table (4.2).

Table 4.2: Students' response to 'I look forward to SOLE lessons' statement

"I look forward to SOLE lessons"	Agree	Not sure	Disagree
WIHIC1	24	3	1
WIHIC2	24	4	0

Furthermore, this was also confirmed by what the parents stated in an open-ended question (i.e., 'what is your daughter's impression of SOLE?') in the questionnaire as 25 of them (total 26) responded positively. For example, one of the parents answered that *"my daughter spoke with love and through her talk I feel that she enjoys this program"* (Remas Mom). Another parent responded that *"She likes it so much…she likes the internet searching idea within a group and learning how to choose the information and how they discuss the finding, but the computers aren't fast*". The responses to this question by the rest of participants were in line with what is stated by these two participants with the exception of one participant whose response was not clear and did not show whether her daughter liked or disliked SOLE. Moreover, in the questionnaire, 24 parents agreed to the statement *'My daughter enjoys participating in this program and always looks forward to it'*, with only two disagreeing to this (Khlthom's and Rewad's parents). Yet, all the parents with no exceptions agreed to the statement "I look forward to my daughter's participation in this program in the coming years".

However, it should be noted that the parents were positive not only towards SOLE but also towards digital environment integration in education. More specifically, all parents held positive attitudes toward the impact of digital environment integration on their children's

education and skills. For example, one parent stated that “the students can access a greater depth and breadth of information on topics that interest them and not just rely on the information provided on the textbooks” (Renad’s mom) and this statement was repeated in different words many times by other parents. In addition, Hayfa’s mom commented that “children can take advantage of the availability of educational material in engaging multimedia formats and help them to become more self-reliant researchers”.

One of the things that greatly impressed me was the parents’ sophisticated understanding of the role and the significance of Internet integration in children’s curriculum. Parents generally seemed concerned about how and how much their children used the Internet at home especially during long summer holidays which children have to stay at home all day because of the very hot weather. Hence, parents seemed to support Internet integration at schools in order to teach students how to use it correctly and appropriately. For example, one parent stated that “Internet integration teaches students how to use it in the beneficial way and allows them to exploit their free time with something beneficial” (Joud’s parent).

In addition, the responses of the classroom teacher during the interview demonstrated that the students really had positive attitudes toward SOLE. For example, she articulated that *“based on my interview with students, I felt that they were generally positive toward SOLE and they enjoyed it”* (Classroom Teacher).

In general, students’ perceptions of SOLE sessions can be considered fairly positive, with the majority of the students and their parents saying that they liked this session and looked forward to it. However, there are a few students and parents who have had a reservation on this experience. The data analysis went further to understand the beliefs underlying these

attitudes. It was found that students, parents and the teacher voiced benefits and concerns relating to SOLE. These will be presented below in the following sections.

4.4.2 Students' perceptions of academic outcomes

When it comes to academic outcomes, data collected shows that the students believed they benefited from using SOLE lessons. Students started to realise the academic benefits of SOLE from the first session onward as the first and second PVT revealed. Most students (21 out of 28) in the first PVT referred to the new knowledge and skills SOLE helped them to gain. For example, Jana commented that *"it was fun… I learned how to use the computer … I gain a lot of new information"*. This was also the view of the student (Lamis), who based on the observation did not seem to be engaged in sessions. She wrote the following *"wonderful experience and fun too… teaches you to exploit your free time in something beneficial outside the school and helps keep your brain active"* (Lamis). Such comments were also found in the second PVT (10 out of 28 students) although the focus in this PVT seemed to be on students' concerns about SOLE.

Furthermore, these benefits were also mentioned by parents in their response to one open-ended question in the questionnaire. Most parents (24 out of 26) described SOLE as 'beneficial'. They seemed to have a positive perception of the SOLE programme. Most of the parents agreed or totally agreed that the SOLE approach might develop their children's problem solving and critical thinking skills. These results are summarised in the following table (4.3).

Table 4.3: Parents' perception of SOLE programme

Item	Totally Agree	Agree	Not Sure	Disagree	Totally Disagree
Developing problem solving skills	13	8	3	0	1
Developing critical thinking skills (selecting information that is directly related to the question)	14	8	2	1	1

They also went further to express why they thought it was beneficial and this was mainly for the knowledge and skills their children acquired during SOLE sessions. For example, one parent said that *"it expands the student's perception and makes students more self-sufficient researchers … Thank you for choosing my daughter"* (Felwa's Mom). Another one also mentioned that *"it helps creative thinking through fun and the questions simulate higher thinking skills"* (Tala's Mom). This was also the view of Jude's Mom, who is an official responsible for education development in Prince Nora University as she stated the following:

> *I would say that I noticed significant improvement in my daughter's skills. She started to rely on herself to reach information and she felt excited to tell others what she found. She also started to know how to determine the source trustworthiness, which is very important because it helps students evaluate the online sources, they come across both in and out of the classroom, making them smarter consumers of information. (Jude's Mom)*

Moreover, the first and second comparison questionnaires also revealed that more students thought that they learned more from SOLE sessions than from traditional classrooms. The following table (4.4) reports the results of students' responses to 'I learned more from SOLE' statement:

Table 4.4: Students' response to 'I learn more from SOLE" statement

I learn More	SOLE	Traditional class
STCC 1	19	10
STCC 2	16	13

However, still a considerable number of students indicated that they learned more from traditional classes and the number increased from the first to the second questionnaire. A possible explanation for this might be that the researcher, in several sessions, focused on procedural knowledge rather than conceptual knowledge as in traditional classes. Another

possible reason is that in the traditional class the teacher provides all the information about the study topic, but in SOLE sessions the students search for this information.

4.4.3 Students' perceptions of social outcomes

When it comes to social outcomes, the data collected showed that the students benefited from using SOLE environments. From all SOLE sessions, groups were operating at different group compositions, with different levels of engagement. It emerged from the observation that some of the students were not accustomed to working with other students, specifically at the beginning of the study and needed time and opportunities to learn collaborative work strategies. However, this situation changed later on during the sessions as students started to cooperate better within groups and these observations were supported by findings from the other methods used in the study. More specifically, the PVT results showed that SOLEs improved students' interpersonal relationships. For example, in the second PVT, more students referred to how SOLEs helped them cooperate better with their group members. What Layan said in the first and second PVT would clarify this further. In PVT1, she said *"I prefer to work by myself because they always fight when we research… I don't enjoy working in groups"*. However, in PVT2, she said *"the session has become more interesting … I have more friends now ... I enjoy the research so much now … I learned a lot ♥"*. Another student (Nora) also commented in PVT2 that *"I like how the students have become more collaborative and helped each other to look for the information. I really like SOLE"*.

These findings from the PVT generally showed that over session students became aware how SOLE developed their interpersonal relationship. Indeed, this finding is supported by STCC questionnaire results and especially students' response to the statement *'I work well with my friends'*. The results' related to this statement are presented in Table 4.5.

Table 4.5: Students' response to 'I work well with my friends' statement

I work well with my friends	SOLE	Traditional class
STCC 1	10	19
STCC 2	23	6

The table shows that in the first STCC questionnaire more students believed that they worked well with their friends in traditional classrooms than in SOLE sessions. However, in the second STCC questionnaire, the majority of students started to believe that they worked well with their friends in SOLE sessions. While it is not clear why students indicated that they worked well with friends in traditional classrooms in the first STCC as students in traditional classrooms sit in rows, they do not work together and conversation is prohibited (they might be punished if they do so), it is possible that they were referring to what they do after the lesson. On the other hand, in SOLE sessions these rows disappear in the group which encourages students to know, talk to and work with each other. Students at first probably struggled to build relations with others during SOLE sessions perhaps as an effect of the traditional classroom environment and based on this they stated that they work well with friends during these sessions. However, by time students developed these skills and this is reflected in the increase of participants who stated that they work well with friends during SOLE sessions.

The development in the interpersonal relationships was also shown when most of the students thought they got help from other students. This was clear in the WIHIC questionnaire when students responded to 'in SOLE class, I got help from other students' statement. The results for this statement are summarised in the following Table 4.6. It can be seen that about a third of students thought they seldom got help and this decreased in the second WIHIC questionnaire to less than a quarter, with the rest of participants believing that they got help sometimes or always.

Table 4.6: Students' response to 'In SOLE session, I get help from other students' statement

In SOLEs, I get help from other students.	Almost Always	Sometimes	Seldom
WIHIC1	2	16	10
WIHIC2	7	15	6

Another social benefit of using SOLE indicated by the classroom teacher was increasing students' confidant and self-esteem. She said, *"what students liked about SOLE is giving the students choice and learning to present their work and have this chance"*. She also added that *"the way that students stood and discussed their ideas were different and it is clear that the student benefited from this program"*. In addition, it was clear from the observation that students' confidence developed noticeably particularly in the presentations. This was supported by parents' comments when they talked about their children's experience. For example, Alguhara's mom stated that *"this practice motivates students and improves self-confidence, and it is much better than just receiving the information"*.

In addition, the majority of the students felt that SOLE sessions helped them with reducing anxiety and stress they feel in regular classes. This was clear from the comparison questionnaire as the students felt more comfortable in SOLE than traditional classes and this number increased throughout the study, as the results in Table 4.7 below indicate.

Table 4.7: Students' perceptions about SOLE session atmosphere

	STCC 1		*STCC 1*	
	SOLE	*Traditional class*	*SOLE*	*Traditional class*
I feel more comfortable	23	*5*	*27*	*1*
Scary	6	22	3	26

This finding was also supported by the observations conducted as some students were observed to be a bit worried and frustrated when they did not find the answer, but this anxiety diminished when they mastered the big question. Further, Khalthom's Mom said that SOLE

sessions provide *"good atmosphere, more information and more self-reliance"*. The parents' perception about SOLE seemed to be encouraging. The results in Table 4.8 suggest that parents were mostly positive about the social benefits their children gain or might gain from the SOLE programme.

Table 4.8: Parents' perceptions about SOLE session atmosphere

Item	Totally Agree	Agree	Not Sure	Disagree	Totally Disagree
Develop a strong self-esteem in making appropriate decisions (selecting the group or changing the group ...)	18	4	0	0	1
Develop peer communication skills	16	8	1	1	0
Ability to work cooperatively within the team	15	7	2	1	0
Developing social skills in dealing with others	15	8	1	0	1
This program encourages students to dialogue and accept the other opinion	17	5	2	1	0
I think with time the program will have positive effects on the behaviour and skills of the student life in and out of school	16	7	0	0	1

A notable area related to the social outcome identified by the children is their enjoyment of learning and the kind of opportunities that SOLE provided them with in creating a stimulating and engaging learning environment. The PVT data showed that most students described SOLE sessions as *"Fantastic", "Interesting", "enthusing", "Different", "fun", "stimulating", "inspiring", "exiting"*. One of the students (Felowa) expanded her feeling by stating that *"I thought that the girls will be bored after a couple of sessions, but to the contrary, this experience became more enjoyable and fun than I expected…The finding was great, and the activities were interesting, and the topics made us curious"*. Similarly, the parents' questionnaires and the classroom teacher's interview confirmed that students enjoyed this experience. For example, one parent stated that SOLE sessions are "*enjoyable and girls*

are excited to participate" (Jude's mom). Additionally, the classroom teacher said that "*the children found that the search for information and presenting it by drawing is fun"*. The result from the comparison questionnaire also supported this as the majority of the children thought SOLE was more exciting, as the following table (4.9) shows:

Table 4.9: Students' perceptions of excitement in SOLE sessions

Exciting	SOLE	Traditional class
STCC 1	25	5
STCC 2	27	2

Furthermore, it was observed that SOLE helped students to improve their communicative skills and conflict-solving skills. Lamis, Shatha and Tala, the individual cases mentioned above, managed to integrate well in the groups in different stages of this study. This might be a sign of development in their communication skills. This conclusion is supported by Algwhara comment in the PVT2*: "This is a good experience. There are no collaborations sometimes but, by time, I learned how to adapt with others and how to cooperate with my friends"*. Additionally, parent's views expressed in the questionnaires were consistent with this statement. One parent, for example, stated:

> *"Through SOLE experience, the students learned to take initiative and responsibility, solve problems, self-organise, articulate effective ways for interaction and communicate ideas… Thank you for this initiative in developing the education … Good bless you". (Rend's Mom)*

Another sign of communication development is students' arguments. The STCC questionnaire revealed that the students argued in SOLE sessions more than conventional classes. This is illustrated in the results presented in Table 4.10 below. The table also shows that the number of students who thought they argued with their friends increased significantly in the second comparison questionnaire.

Table 4.10: Students' perceptions about arguments in lessons

I sometimes argue with my friends	SOLE	Traditional class
STCC 1	12	17
STCC 2	23	6

The table shows that in the first comparison questionnaire more students believed that they argued with their friends in traditional classes (17 out of 28); however, in the second one the number of the students who thought they argued with their friends in traditional classes decreased noticeably (6 out of 28). The opposite trend can be seen for SOLE sessions as those who thought they argued increased from 12 to 23. Although there is no interaction between the students in traditional classes, most students thought they argued in traditional classes. This argument might happen in other informal situations, and not necessarily during the lessons. However, this feeling toward traditional classes changed when they started to take SOLE sessions, which might mean that they started to interact more with each other.

4.4.4 Perceptions regarding classroom procedures and the teacher role

The SOLE sessions from the point of forming and changing groups to findings presentation and the role of the researcher-teacher were perceived by students and parents as unusual, different and new, but also interesting. Tala, contrary to her behaviour during the sessions, wrote in the PVT about SOLE that, *"wonderful ... so sweet ... this something new ... I like it".* Lubna added *"I was thrilled by choosing my groups and my friends… this is strange"*. The parents expressed the whole experience as *"new learning environment where students actively engage… give chance to free move and change the group to help children take control of their learning, this is the first step as lifelong learners"* (Dana's Mom).

On the other hand, few students and parents mentioned that there was some chaos in SOLE lessons. Raghad, for example, commented that *"I like it so much, but it was chaotic…I wish*

we have it again with a more organised group". Also, Alguhara's mum noted that *"the disadvantage of this program…aroused some chaos in the class"*. Rewad's Mom also wrote that *"the disadvantage is the lack of proper ambience (quietness)"*. These comments viewed SOLEs lessons as a noisy, which is understandable because active group learning relies on interactive communication where groups and pairs are talking at the same time.

A recurrent theme that appeared in the PVTs, parents' comments and room teacher's interview was the sense of difficulty expressed toward the big questions used during the SOLE lessons. A considerable number of participants mention this point. Lubna, for example, who was seen during observations as the most complaining student, commented in PVT2 that *"… the question was hard and so boring… can you please try next time to give us more entertaining questions, such as, what are the uses of mobile phones? ♥"*. Her mom added that *"the disadvantages of this programme overweigh the advantage … the proposed topic is not suitable for the students' age … with the presence of boredom except in the several last sessions… best wishes"*. In contrast, the majority of the students in the comparison questionnaire thought that SOLE sessions were easier than traditional lessons, as the results in Table 4.11 indicate. This paradox can be understood due to the nature of the assessments in traditional classes.

Table 4.11: Students' perceptions about the level of difficulty

	STCC 1		STCC 2	
	SOLE	*Traditional class*	*SOLE*	*Traditional class*
Easier	16	13	23	6
Harder	12	17	8	21

Using searching engines to grasp the knowledge was preserved as a beneficial method by both students and their parents. Rend for example commented that *"… this is so good… I like it … I learn a lot and now I use the Internet regularly to search for information".* Almost all the parents support the integration of the Internet in the classroom and see it as an important skill

for modern life. For example, one parent stated that the internet provides students with *"fundamental 21st century skills (research gathering, information synthesizing, utilizing high tech tools, critical thinking"* (Khalthom's Mom). However, some parents voiced cautionary notes about the cyber security and information reliability and accuracy. Layan's dad wrote *"I encourage my daughter to use the net but, within limits and under supervision".* He also added *"the disadvantage of this programme is that the information gathered might be not accurate or reliable"*. Lubna's mom said *"sometimes, I allow using the Internet with fear that she might access unrelated subjects or forbidden websites"*.

One of the important aspects of the SOLE sessions is the researcher-teacher role. Many children commented in their PVT or even in the end of the questionnaire *"I love you teacher"*, but it was not clear why or in what way. The most surprising comment in this regard was made by Lamis, who was disengaged in most sessions: *"The teacher was wonderful and inspiring … I benefit from her encouragement… the teacher practice was wonderful in motivation and this leads me to try and give me positive energy"*. In spite of this, it was apparent from the two WIHIC questionnaires that the children perceived the teacher role as passive, as the results summarised in the following table (4.12) demonstrates.

Table 4.12: Students' perceptions about teacher role

The teacher helps me when I have trouble with the work.	Almost Always	Some-times	Seldom
WIHIC1	2	4	23
WIHIC2	5	6	17

4.4.5 Students' perceptions about their behaviours in group work

As mentioned above, during the observations, it was difficult to capture the details of the group dynamics through the SOLE sessions. Although the students seemed to work as a team most of the time, the internal thoughts revealed a mixed feeling about teamwork.

On the one hand, some children's comments indicated a positive interdependence such as: "*what I like about this session is that we think together"* (Dana). Leen also wrote *"I thought we cannot work in one computer as a group, but we did… we were very cooperative … I wish from the depth of my heart to try this experience again"*. Felowa's mom supports this as she noted that *"my daughter likes this programme so much… she likes the online research and sharing with her friends to find the right answer".* Additionally, most students responded positively in two statements related to this aspect in the questionnaire (i.e., *'I help other class members who are having trouble with their work' and 'in this class, I get help from other students'*), the results of which are presented in the following table (4.13):

Table 4.13: Students' interdependence

WHIC2 (In SOLEs)	Almost Always	Some-times	Seldom
I help other class members who are having trouble with their work.	11	16	1
In this class, I get help from other students.	6	15	7

When it comes to interaction among students, the second STCC questionnaire showed that the majority of the children believe that they cannot solve problems individually in SOLE sessions (see Table 4.14). This might be because of the nature of SOLE sessions (big questions), students were forced to interact and communicate with each other to finish the task.

Table 4.14: Students' responses to 'I can solve problems on my own' statement

I can solve problems on my own	SOLE	Traditional class
STCC 2	8	20

On the other hand, some students, parents and the classroom teacher had a concern about teamwork that cannot be ignored. In fact, the phrase *"there is no collaboration between the group members*" was repeated frequently. A considerable number of students (10 students)

and parents (five parents, three of whom were not parents for any of the 10 students) mentioned this. Leen's dad even suggested that the teacher should choose the group member by herself to maintain harmony on the effectiveness of group learning; he commented: *"we hope to implement the program correctly by choosing the group member based on their homogeneity"*. The classroom teacher also mentioned, after she asked the students about how they perceive SOLEs experience, that *"the children like the idea about working in groups in SOLE sessions, but they find the disagreement among girls during teamwork as annoying"*. In the same context, one student (Adeem) raised a very interesting point to summarize this mixed feeling when she stated *"the truth is that there isn't collaboration, but there are good findings … I like those who support others… then the work will be much better… thank you for everything."*

In addition, it seemed that there is a misunderstanding about the students' roles in the group. This can be seen from the results of the second WIHIC. For example, a noticeable number of students chose 'seldom' in response to the *'I work with other students in this class'* statement. However, the majority responded either 'almost always' or 'sometimes' to the statement 'Students work with me to achieve class goals''. These results are summarised in Table 4.15 below. This contradiction illustrates the internal dissatisfaction with the role of individuals in a group, which indicates that they struggle to work out how to participate in the group work in a way that satisfies their aspirations.

Table 4.15: Students' perceptions of their role in groups

WIHIC2	Almost Always	Some-times	Seldom
I work with other students in this class.	2	17	9
Students work with me to achieve class goals.	10	12	6

The misconception of the individual's role in CL was also evident when students were asked about the equity in participations in SOLE sessions. A considerable number of students responded 'seldom' to two related statements in WIHIC2 (i.e., *'I get the same opportunity to contribute to class discussions as other students'* and *'I get the same opportunity to answer questions as other students'),* as the results in Table 4.16 below indicate.

Table 4.16: Students' perceptions about the equity in participation

WIHIC2	Almost Always	Some-times	Seldom
I get the same opportunity to contribute to class discussions as other students.	4	13	11
I get the same opportunity to answer questions as other students.	4	13	11

When I asked students about their involvement and individual accountability in WIHIC2, a significant number of students thought they gave their opinions during group discussion at least sometime (16 out of 28). Further, the majority thought their ideas and suggestions were used during classroom discussions (22 out of 28). However, the internal dissatisfaction with the role of individuals in the group appeared again when I asked about the personal involvement. This is apparent when students were asked about their involvement in the group as a considerable number of them felt that they were not involved as they should have been. For example, 12 out of 28 chose seldom about the statement *'I give my opinions during group discussions'* and 14 out of 28 chose seldom for the '*I explain my ideas to other students'*, as results in the following Table 4.17 indicate. A possible explanation for this interesting pattern might be that children struggle to work out how to participate in the task or they struggle to manage their interactions. Working in a device which is designed for single users in CL needs even more skilled students to resolve the conflict and give the individual accountability. In addition, perhaps the complexity of working in a large group of four-six may have caused participants to feel somewhat inept socially.

Table 4.17: Students' perceptions about individual participation

INVOLVEMENT in SOLEs	Almost always	Some-times	Seldom
I discuss ideas in class	2	15	11
I give my opinions during group discussions	3	13	12
My ideas and suggestions are used during classroom discussions.	5	17	6
I explain my ideas to other students.	5	9	14
Students discuss with me how to go about solving problems.	6	11	11
I am asked to explain how I solve problems.	10	14	4

4.5 Challenges of SOLEs implementation

This section presents findings related to the third research question in this study (Q3. *what are the challenges of introducing SOLEs in Saudi context?*). In order to understand the challenges of SOLEs integrations in schools from different perspectives, a questionnaire was completed by 17 teachers (participants' schoolteachers) and notes were taken from casual conversations with teachers that focused on their perceptions about their needs and difficulties in technology integration and their suggestions to improve the situation. In addition, a semi-structured interview was conducted with the head teacher to probe her views about these challenges. The data revealed challenges pertaining to students, teachers and schools and these will be presented separately below.

4.5.1 Students' challenges of working in SOLEs

As demonstrated in Section 4.4, a convergence emerged from the research methods that the most noticeable challenge that faced students when working in SOLE was their lack of previous experience with group work. The findings seem to imply that most pupils found it difficult to engage in collaborative work. They were enthusiastic about the idea of SOLEs; however, they clearly lacked the skills needed to participate in SOLEs sessions effectively.

Another apparent obstacle was technical difficulties, such as poor Internet connection and computer breakdown; some of these technology problems happened frequently. It was observed that students became frustrated when the computer malfunctioned, and this disrupted their attention. In fact, this was extremely annoying to me as well as it happened despite the frequent maintenance of the hardware (before and after the sessions). This observation was supported by the teacher interview comment; she emphasised that *"students articulated their feelings of frustration when computers suddenly froze, and they felt this wasted the time".* Another technical difficulty raised by parents was the speed of the internet connection as one parent stated that *"the internet connection is not fast enough"* (Felowa's mom). However, it was clear to me that the internet speed was generally good, but the problem was with the computers themselves.

4.5.2 Teacher-level challenges

4.5.2.1 Lack of teacher competence

The findings from the questionnaire showed that all the teachers were confident in using the internet when they prepared the lessons. When they were asked *"Do you use the Internet in preparing your lessons?"*, all of them responded with either "Almost always" or "Sometimes". It was apparent that most teachers generally mastered basic computer skills and perceived computers as instructional tools to deliver the lessons information in their teaching processes. In addition, most teachers (15 out of 17) indicated that they encouraged their students to search at home for new information using the Internet as extracurricular activities. These teachers also mentioned that they give their students assignments to complete at home using the Internet and they ask them to bring it with them to school. Yet, based on casual conversations with some of the participants, they pointed out that although they give credit to students for doing the job, they never look at it and so no feedback is given to students.

However, despite the unavailability of computers and the Internet in classrooms, there is a clear lack in teachers' competence to integrate the Internet as a learning tool. The shortage of the teachers' knowledge in how to incorporate the Internet in the curriculum might have affected their confidence to use it in the classroom. This might be because they had not been trained on how to use such tools. The lack of training was apparent from the response to the statement *'I was provided with the training needed to integrate the software and e-applications into my lessons'*. Five out of seventeen teachers chose "disagree" and "strongly disagree", but, complicatedly, a significant number of them (7 out 17) were reserved to the answer by choosing "I don't know". In contrast, in a question directed to the head teacher during the interview about whether she believed that teachers do not possess the capability based on their qualifications to run such programmes in schools, she stated that *"No I don't believe so. This might be the case only with a minority of teachers"*.

4.5.2.2 Resistance to change and negative attitudes

Teachers' motivation and attitudes determine whether they are willing to try a new innovation. In this study, the findings revealed that teachers' attitudes about the use of the Internet were confusing. On one hand, most of the teachers agreed or strongly agreed (12 out of 17) with the statement that *'The integration of programs that encourage the search for new information using the Internet during the class's room lessons is important'*. Further, they seemed to have positive perceptions about SOLEs (see Table 4.18 below). Indeed, these encouraging results were obtained after the researcher did a workshop to introduce SOLE to teachers and staff and presented some of the students' outcomes which motivated some teachers to visit the lessons and one teacher was enthusiastic to participate in SOLE sessions.

Table 4.18: Teachers' perception about SOLEs.

The possible benefits of Self-Organizing Learning Environments Programme on students:	Totally Agree	Agree	Not Sure	Disagree	Totally Disagree
Learn good study habits and how to self-organize	6	10	1	0	0
Develop love of education and positive thinking	7	9	1	0	0
Develop a strong self-esteem in making appropriate decisions (selecting the group or changing the group ...)	5	9	3	0	0
Develop peer communication skills	9	7	1	0	0
Developing the skills of dumping and presentation	9	7	1	0	0
Developing problem solving skills	10	6	1		
Developing critical thinking skills	10	6	1	0	0
Developing social skills in dealing with others	11	5	1	0	0
I think SOLEs program will have a positive effect on the students' academic and social life	10	6	1	0	0

On the other hand, negative or neutral attitudes toward the use of technology in education was clear in teachers' responses to the statement *'The sense of the low importance of employing digital technology in the service of education'*. A good number of them agreed or strongly agreed (8 out of 17). Additionally, 10 out of 17 agreed or strongly agreed to the statement *'Feeling of the low importance of employing digital technology for students'*.

4.5.3 School-level challenges

4.5.3.1 Lack of time

Another barrier, in school-level barriers, is the shortage of time for teachers to introduce technology-incorporated lessons. Most of the teachers (13 out of 17) seemed to think that rigidity in national syllabus was the reason that prevented them from using the technology as they either agreed or strongly agreed to the statement *'Forcing the teachers to follow a certain plan in the curriculum so that they do not have the freedom to deliver or delay the subjects as needed*. In addition, the majority of teachers (13 out of 17) responded with either 'agree' or 'strongly agree' with the statement '*Session time is not enough to use computers / smartphones / Internet*'. Further, one of the teachers, after completing the induction workshop about the SOLE programme, said *"there is no time, we have a huge amount of information we require to teach and many educational strategies to apply"*. Moreover, a remarkable number of respondents (13 out of 17) agreed or strongly agreed with the statement *'The teacher's*

workload prevents them from using modern technologies'. This result concurs with the head teacher's opinion as she stated the following: *"Yes, as we see an increase in the responsibilities and tasks that are put upon teachers from year to year and it is in these aspects that we find teachers struggling to cope with all the application of such programs".* However, when she was asked if she believed that the lack of time scheduled on the timetable for each teacher was a factor that prevented teachers from using computers in their classes, she replied, *"No, I don't believe so, because we usually have free lessons and activity lessons that can be used to apply such programmes with all capability"*

4.5.3.2 Lack of effective training

The findings from teachers' questionnaires signify that the majority of the teachers believed that the professional in-service training courses provided by the Ministry of Education were inadequate for preparation to technology integration in school curriculum. Thirteen out of seventeen agreed with the statement '*Absence of professional development programs aimed at integrating computer technology into curriculum'*. On the other hand, when teachers were asked about the training provided with the training needed to incorporate the Internet into teaching, a considerable number (7 out of 17) chose 'not sure' and the rest divided equally between 'agree' and 'disagree'. This seems to be contradictory, but the reason for this can be understood because the professional development training on technology use is for instructional preparation of instructional delivery, but not for technology as a learning tool. In addition, the training provided by the MOE is usually generic and not specifically geared to particular technology integration. What the head teacher said might interpret this claim when she stated in response to the question 'Are the teachers trained to use technology as interactive educational tool and how to merge this tool in the curriculum?'. She said: *"Yes, it is in the process currently by the administration-training department, but it is done in stages according to a set plan".*

4.5.3.3 Lack of accessibility

Inaccessibility or unavailability of computers and the Internet, a school-level barrier, has been identified as the fundamental factor that prohibits teachers from using technology. Almost all the teachers (15 out of 17) agreed or strongly agreed to the statement *'Lack of computer / smart / internet equipment in the school is one of obstacles on the use of technology / Internet / computer in the classroom'*. This number gives a clear indication of the insufficiency of computers at the schools, particularly for teacher use. Based on the researcher observation, overhead projector was the only technology tool available to the teachers inside the classroom and the teachers needed to bring their personal laptops to be able to use it. It would be interesting to see if the teachers will change their attitude if the computers and Internet are available to them in the classroom.

In addition, there are a lot of comments exhibiting teachers' discontent with school equipment available to them. For example, one teacher wrote *"We need complete equipment (computers, Internet and smart devices) and provide a suitable classroom environment for students and teachers"*. Another expressed her resentment by questioning, "*Who is responsible for the provision of the devices, is it the school or teachers?"* One teacher explained the reason for these shortages by *"the weakness of finance support from the ministry of Education to schools."*

However, the head teacher seemed to have a different opinion. Contrary to what was observed and the teachers' comments, the head teacher responded to the question 'Do you have computers that are connected to the internet available for teachers and students?' as follows:

Yes, but not enough as we have a large number of classrooms and teachers. Because of the continuous rise in the equipment budget from year to year, there is an increase in the number of computers available to students.

In her statement she agreed to some extent with the teachers' comments that the budget for technology tool provision from MoE is not enough, but she asserted that there were computers for teacher and student usage. She added that *"unavailability is not the reason preventing teachers from applying the internet in their teaching. Look at yourself; you make it possible because you want it".*

4.5.3.4 Lack of technical support

Another major barrier resulted in computers being underutilised in schools was, beside unavailability, the lack of technical support. Most of the teachers (14 out of 17) respond strongly agreed to the statement *'Lack of hardware maintenance'*. The statistical findings are corroborated by data from the teacher comments in the researcher note. The teachers told me that they were not sure where to turn for help when something wrong happened while using computers and no one would be on hand to offer immediate technical support. This led to constant interruptions during the lesson. Surprisingly, also frustratingly, one of the teachers told me that they have to pay for the maintenance from their own expense in order to use this equipment for the teaching purposes. This is very stressful for the teachers, which may affect their willingness in the adoption of technology integration. Another teacher said

"Operating the connection and processing the network needs a technical employee …these things take time from the teacher and without help, the teacher waste too much time postponing their classes and awaiting for a tangible solution to the technical problems"

4.5.3.5 Lack of administrations support

In addition to the above challenges, teachers seemed to believe that there is no support or encouragement from schools for using technology. Teachers' responses to the statement *'Lack of encouragement from the school administration to use these means'* were divided between 'agree' and 'disagree' and five chose 'not sure'. This finding, in addition to the previous one, might indicate the internal dissatisfaction about the school administration's attitude towards technology with regard to provision and towards initiating the necessary teacher training and reward system for innovative teachers. However, the answered of the head teacher to '*Do you think that there are not enough rewards for teachers for their contributions in schools?*' was contradictory with the previous finding. She said *"No, not at all, in recent years we have seen many rewards to teachers, especially for talented teachers, to motivate them in their jobs."*

A comment from one frustrated teacher summarizes the challenges preventing teachers from applying technology in Saudi Arabia schools; she stated the following:

> *The Kingdom's schools lack a resources room. Throughout the year, the teacher runs between the school rooms to find a device to apply her lesson…the classes time is wasted in looking for and running this device. Another frustrating thing is, unfortunately, there is no difference between teachers who try to integrate technology in their lessons and others who just provide students with material to memories for the sake of the exam. Our ministry is concerned with the exam results, but not the quality of education.*

4.6 Conclusion

This chapter has presented the qualitative and quantitative findings collected through the classroom observations, questionnaire and interviews, considering students', parents, teachers' and the head teacher's points of view as well as the researcher's field notes.

In general, the findings suggest that the SOLE approach has academic and social benefits on students learning, but students need time to become familiar and gain experience with this approach. In terms of academic benefits, there is a development in the students' research skills and in the quality of the outcome. Regarding the social benefits, students and their parents seem to agree that SOLEs experience is motivating and engaging and leads to an increase in confidence. The interpersonal relationships, communicative and conflict-solving skills seemed also to develop according to the students and their parents.

On the other hand, the internal thoughts of the students and parents as well as the classroom teacher's comments revealed a serious concern about teamwork. Conflicts among students occurred, which required the teacher to intervene to save the situation. Most importantly, there was a clear internal dissatisfaction with the role of an individual, equity and involvement in the group. Pupils seemed to believe that always someone else gets the opportunities. In addition, they clearly lacked the skills needed to participate in SOLE sessions effectively. This will be discussed in depth in the Discussion Chapter.

The teacher role in SOLEs approach seems to be more important in supporting pupils socially than academically. The results of the present study seem to call for the teacher's intervention to rehearse the CL skills both prior and during SOLEs. Teachers need to continuously develop students' collaborative skills and constantly remind pupils about them before each SOLE session, monitoring students' interactions during the session and intervening when needed to

improve teamwork. Group size is also another issue the teacher should consider when implementing SOLEs. The findings of this study showed a negative impact on pupils' interaction when they form large groups, thus, four children in a single group are ideal

Beside the time, CL and teacher role, there are some difficulties and challenges that can affect the implementation of SOLEs. The unavailability of computers and the Internet alongside the lack of technical support are the main challenges mentioned by teachers and I personally faced when implementing SOLEs setting.

The most important aspects related to the findings and which help answer the research questions posed in this investigation are further discussed in the following chapter.

Chapter 5. Discussion

5.1 Introduction

The findings from this action research were reported in the previous chapter in terms of critical incidents that required my response and in terms of the development of the students' abilities and skills. This chapter discusses these findings in light of the existing literature reviewed in Chapter Two. The discussion takes into account the research questions and allows insight into the findings from classroom observations, students and parents' questionnaire and teacher and head teacher semi-structured interviews. The chapter also attempts to articulate the researcher's thoughts about what can be learnt more generally from this experience in order to transfer this knowledge to similar contexts or to meet similar objectives.

5.2 The overarching thematic findings of the study

Synthesizing the answer to the research questions, which served as a guide for this study, the analysis revealed four overarching thematic findings related to the experience of teaching and learning in the SOLE setting which is of particular significance in the Saudi context. The themes are time to develop, students' collaboration, teacher role and challenges. These overarching thematic topics will be discussed here with reference to a wider literature. It is important to point out that although the four overarching themes have been discussed here separately, this was done for the sake of clarity in writing. They are in fact closely interconnected and in an interdependent relationship; the data strongly suggests overlaps between the views and aspects highlighted by the students, their parents, class teacher and the researcher's own observations in the classroom (see Figure 2.14). This overlap will become more evident through the following four subsections focusing on these themes respectively and a further summary of this argument is also provided in Section 5.2.5.

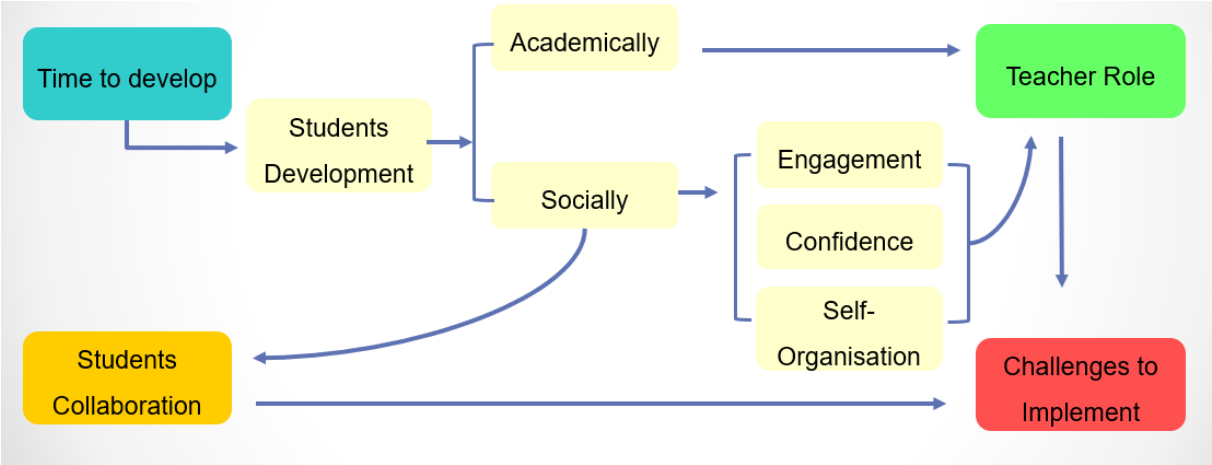

Figure 5.1: Overarching framework of themes.

5.2.1 Theme one: Time to develop

The findings discussed in this section focus on students' development throughout the SOLEs sessions. Keeping in mind the teacher's minimal intervention role, the data collected in this study suggests that the SOLEs experience has had a positive impact on the students' academic and social development, but more time is needed for a more successful implementation. The following two subsections discuss students' progress over time relating to academic and social aspects respectively.

5.2.1.1 Student academic development

This study set out to implement and develop SOLE and evaluate its effects in a school setting where students' learning is traditionally teacher-directed and textbook-oriented. To evaluate the effect of SOLE, observations were conducted to check the development of some skills and behaviours in students' performance. In doing so, knowledge acquisition was not tested because this might be difficult to investigate through observations. However, as asserted by McFarlane (2001), not all learning approaches focus on knowledge acquisition as some of these and specifically technology-based approaches give more importance to skills required to cope with the modern society such as confidence and information-building, autonomy, problem-solving and critical thinking. Indeed, the evaluation to SOLE in this study in relation to academic development went beyond the limited scope of assessment of knowledge

acquisition as the observations focused on information seeking, outcome and problem-solving and critical thinking skills. Based on these observations, academic development was found to take place for students during the 10 SOLE sessions despite the short period over which the study was conducted.

As explained in Section 3.6.1, according to Kharrufa et al. (2017), development in information seeking appears as students move from simple fact finding to more sophisticated information analysis. This assertion seems to be supported by this study findings. Information seeking skills and students' outcomes (mainly panel presentations and posters) were taken to be indicators of academic development in this study. As for the information seeking skills, the study findings (reported in Section 4.3.1) revealed noticeable developments; in early sessions, students often began their research process by typing in the whole question into Google and stopping at the first information they encountered in their initial search. They approached their task as stockpiling facts and copying the first selection of sources without engaging well with the information. Also, they seemed to lack patience or determination to check the information with an alternate source (second opinion) especially when the given question was sophisticated or consisted of more than one part. They actually got disappointed and frustrated when it did not exhibit an answer.

Previous literature also seems consistent with these findings. For example, in one study, Holliday and Li (2004) reported that their participating students settled for the first piece of information related to the topic and they collected ideas from a limited number of readings to form their own conclusions. Holliday and Li also mentioned that the study participants experienced more uncertainty and frustration in the searching stage. Kuhlthau et al. (2008) clarified this stating that students tend to conceive information as something easily available and feel frustrated when the process is not as seamless as they expect. This can be explained

in terms of the acquisition metaphor and participation metaphor of Sfard (1998); it seems that only the acquisition metaphor applies at this stage of student learning. To clarify, learning for these students, who study in traditional classrooms in Saudi Arabia, is just obtaining information from a source rather than constructing it through sharing and participating within a group. Because of this view of learning, students feel frustrated easily when the source of information (whether it be the teacher or the Internet) does not provide them with complete knowledge. They might just need time and practice to start to perceive learning as a participation process as well.

This struggle in information seeking in early stages might also be because the students do not have the skills necessary to identify the most credible information and how to improve their search skills, which is due to the long experience with traditional learning methods where they receive information without the need to look for it. Another reason might be that websites in Arabic are usually not designed for children's level. Because of this, students had difficulty sorting through all the information that they accessed. The information they found in their search was sometimes overwhelming and, in some sessions, they complained about online searches as these produced either too much information to read through in the time available or too little information and inadequate time to research it more deeply. Indeed, Nesset, (2008, 2013), who conducted her study on elementary grade 3 students in Canada, reported that the lack of appropriate websites for children was one of the challenges that faced her participants. However, this struggle in early stages is not surprising given that these students are not accustomed to obtain knowledge in this way; so the recency of the experience might make students struggle.

However, with some advice from the researcher-teacher during the feedback stage in the current study, improvements in terms of using keywords, sub-questions, figures and YouTube

videos took place and the feelings of uncertainty and confusion that were apparent in early sessions decreased throughout the project. Although these developments occurred for some students earlier than for others, by session seven, they seemed clear in the performance of most students. The results also revealed that not all students went through the search process in a similar manner; some students engaged with the collected information more analytically. Overall, it was noticed that collection and synthesis of information developed from descriptive to more analytical approach towards the end, which indicates that students' critical thinking skills improved. In support of this study findings, the literature also shows that development in information seeking skills does not take so long to develop. For example, Nesset, (2008, 2013) revealed that her students encountered some problems when they searched for information in printed materials or available online, but they seemed to overcome some of the problems and improve their information seeking skills by the end of the study, which lasted for a period of 14 weeks.

Furthermore, as exposed by Kharrufa et al. (2017), see Section 3.6.1, the information presented by students (their outcome) develop in five stages ranging from being 1) simple and sometimes irrelevant, 2) focused on one side of the answer, 3) focused on different sides of the answer but in an unconnected manner, 4) focused on different sides of the answer in a connected manner to being 5) extended to other areas. In the current study, signs of the first 4 stages were observed (see Section 4.3.2). In the first few weeks, students' main difficulty was choosing adequate and appropriate information and demonstrated superficial descriptive knowledge about their topics instead of taking a more analytical approach. In addition, it was found that many times groups would repeat the same information to the posed questions and imitate others' work. These findings are consistent with what was found by Kuhlthau et al. (2008). Kuhlthau et al report that the most challenging stages of an inquiry project for their participants were the gathering and formulation of information. They illustrate that a possible

explanation for this might be the lack of the students' experiences in how to evaluate the quality of information, how to recognise what information is or is not relevant to the question at hand, and how to synthesize information from multiple sources into a coherent piece of work.

Nevertheless, it was clear that in the current study the students developed in the levels of understanding as they started to integrate different aspects of the answers to big question into a coherent whole. This development might be influenced by the discussion after each presentation which was a much more valuable experience and seemed to spark many more thoughts and areas for further reflection in the students. In addition, towards the end of SOLE sessions in this study, students' presentations showed a strong increase in the depth of understanding of the topics. According to Nesset (2013) during presentations and discussions, children become more aware of conflicting ideas and this leads them to be more focused the next time to do their search and present their findings. This is indeed supported by Wiegel's (2019) assertion that during presentations and discussions, they start finding conflicting information and "that's where the learning takes place" (p.194). This might also justify why developments occur in relation to the depth of discussions after presentations in each session. To link all this to Sfard's (1998) metaphors of learning as acquisition and participation, it seems that, by this stage, the students in this study started to see learning as a participation and sharing process and not only as acquisition. At early sessions, the students probably felt that they should obtain full knowledge when they approached the computer and they got frustrated when this did not happen. However, a new view of learning as a participation process seemed to start to be established in students' minds and this probably led to signs of dialogic epistemology to appear in after-presentation discussions.

The results of this research also revealed that students' problem-solving skills improved during the study. The idea of learning as an ongoing process of exploration seemed to take place in students' learning behaviour. They faced a number of challenges during their search of information, but every time they used to come up with a solution. For example, the findings demonstrated how students dealt with situations when they were presented with the big question in a different language or when they did not find information when they searched in their first language (see Section 4.3.4.3). In both situations, students came up with appropriate solutions. According to English and Kitsantas (2013), in a traditional classroom, students receive information from the teacher without questioning its validity or carrying out their own assessment. However, English and Kitsantas assert that problem solving skills might develop for students when the teacher intervention is decreased because this would suppress students' fears to pose questions or make errors and their confidence to question and test expands.

Furthermore, even the apparently less positive finding that the number of students who thought they argued with their friends increased significantly in the second comparison questionnaire (see Section 4.4.3) could be an indication of the children's development in critical thinking and a sign of the development of dialogic epistemology. Johnson and Johnson (1979) illustrate that the interpersonal controversies promote high quality problem-solving and decision-making and, therefore, should be encouraged. He suggests that disagreements might result in "greater accuracy of cognitive perspective-taking, and the transition to a more mature cognitive and moral reasoning process" (Johnson and Johnson, 1979, p.56). This suggestion is also echoed in more recent publications such as Johnson and Johnson (2008) and Good and Lavigne (2017). In fact, the big question in SOLE may not have one correct answer and therefore inevitably lead to disagreements. In addition, because of the long experience with the traditional learning method, in the first few weeks, the

students seemed to be passive in learning and did not demonstrate initiative. However, the learning process with SOLE guided the students to define their goals, make their decisions, and evaluate their progress and outcomes. This also established a view that learning is not just acquisition but also participation (Sfard, 1998), which gave rise to dialogic epistemology and, thus, students became active rather than passive participants.

The development of the students' critical thinking was also clear from their comments in PVTs. The data revealed that most of the comments in the second PVTs were about the negative things in SOLE experience, contrary to the first one which focused on the benefits of SOLEs. Although at this young age, the children were new to the idea of reflection in their own learning, their views showed that there is progression in their thinking. Their criticisms seemed constructive and they provided suggestions about different aspects of the sessions, which were clear evidence that some began using higher order thinking skills. For example, the questions suggested by the youngsters as a big question in the end of this study such as "What is the impact of saying negative words on flowers!?" seemed innovative in the sense that the curriculum does not cover such topics; hence, such questions might indicate that the students started to think more critically.

The discussion so far in this section demonstrates that SOLEs sessions were beneficial for developing specific academic skills. Indeed, this finding is supported by the perceptions of students and their parents as expressed in PVT and questionnaires (see sections 4.4.2). The students thought that SOLE improved them academically as they stated that it gave them new knowledge, information seeking skills and kept their brain active. Further, their digital literacy is enhanced which encourages them to engage in further internet-based research into topics that interest them at home. For example, Jana commented that *"it was fun… I learned how to use the computer … I gain a lot of new information"*. This was also the view of the student

(Lamis), who based on the observation did not seem to be engaged in sessions. She wrote the following *"wonderful experience and fun too… teaches you to exploit your free time in something beneficial outside the school and helps keep your brain active".* The parents also expressed views supporting that SOLE developed their children academically. They widely agreed that SOLE developed critical thinking and problem-solving skills for their children. In addition, most parents described SOLE as 'beneficial'. They also went further to express why they thought it was beneficial and this was mainly for the knowledge and skills their children acquired during SOLE sessions. The view of Jude's Mom, who is an official responsible for education development in Prince Nora University, supports this claim as she stated the following:

> *I would say that I noticed significant improvement in my daughter's skills. She started to rely on herself to reach information and she felt excited to tell others what she found. She also started to know how to determine the source trustworthiness, which is very important because it helps students evaluate the online sources, they come across both in and out of the classroom, making them smarter consumers of information. (Jude's Mom)*

To sum up, it was evidenced from the observation and students display throughout SOLEs sessions that pupils developed the searching and summarising skills in SOLE and they progressively, although to varying degrees, learned how to find, select, organise, and present the information to explain a question. This experience seemed to enable most children to gain a sense of achievement and motivated them to continue research inside and outside the school. SOLE approach focuses on moving students beyond general curiosity into the realms of critical thinking and understanding. However, as maintained by Kuhlthau (2008), not all students proceeded at the same pace through the process and some of them need more time to practice and develop their thinking and searching skills especially for novice Internet searchers who are accustomed to traditional teaching methods.

5.2.1.2 Student social development

Students' social development in this study was evaluated through observing students' motivation and engagement, confidence, self-organisation and collaboration. Section 4.4.3 reported the findings related to these elements and this section will discuss these findings in light of the literature reviewed in Section 2.3.2.1. The discussion below stresses that social development took place for the participants in this research despite the short period over which this study was conducted.

Starting with motivation and engagement, this was evaluated through observing students' attention, participation and volunteering. The students and their parents were also surveyed to understand their perceptions about the effect of SOLE on student motivation and engagement. The observations revealed that although the students were motivated to engage in this study, this engagement was variable, naturally enough, from student to student and in different parts of the session. In most cases if someone disagreed or disengaged, they soon changed groups. The findings suggest that most students demonstrated enthusiasm for all SOLE sessions and positive attitude to these new experiences. More specifically, some students appeared deeply engaged as they actively participated and volunteered, and their attention seemed to be focused on what they were asked to do during sessions.

However, the level of engagement seemed to decrease after the 4th sessions (see Section 4.3.5). This rise and fall in engagement seem to be natural; Dangwal and Kapur (2008) maintain that the novelty of the SOLE approach agitates the students' curiosity and leads them to continue exploring. According to Schmidt et al. (2009), this curiosity might appear as a result of students' gap of knowledge, which they seek to close through engaging in activities. This is indeed supported by what was said by the school principal, who after an unexpected visit commented that SOLE sessions seem to "*drive students' curiosity and*

capture their interest which results in them engaging more effectively in self-directed learning". Nevertheless, curiosity did not seem to play a role after session four as students' attention seemed to decrease. This possibly happened because at this point there was not enough curriculum connection or the children seemed to get accustomed to the idea of searching for information, regardless of the lack of full development of their research skills. Hence, children seemed to require an element of creativity in the style of delivery of the session to enhance their attention. Indeed, after some procedures and changes introduced by the teacher (see Teacher Role Section in 2.2.3.4 about this), students' engagement rose again and stayed at a stable level during the few final sessions.

Indeed, this finding is supported by the perceptions of students and their parents as expressed in PVT and questionnaires (see Section 4.4.2). The student's comments revealed that SOLE provides them with creating a stimulating and engaging learning environment. They described SOLEs sessions as 'fantastic', 'interesting', 'enthusing', 'different', 'fun', 'stimulating', 'inspiring', 'exciting'. Similarly, parent questionnaires and the classroom teacher interview confirmed that students enjoyed this experience. For example, the classroom teacher expressed the whole learning experience was fun to the students.

Furthermore, the results of this study might indicate that the presence of the teacher in the way suggested by SOLE (i.e., as a facilitator) might boost students' engagements and motivation because SOLEs provide students with a freer and more relaxing environment. The data from the comparison questionnaire revealed that students felt safer in SOLE sessions than in conventional classrooms. This may be because they could move more freely and act more spontaneously in SOLE sessions, unlike the conventional classroom, where the children had to remain in their seats and ask permission to move and fear the reaction or perception of others when they respond wrongly in the classroom. Thus, the SOLE environment seems

better to reduce students' tension and fear of the teacher's power and lead students to enjoy their time, which would engage them more in learning. This is supported by Owu-Ewie (2008), who maintained that students open their minds and become engaged in learning when they feel comfortable and not concerned about the reaction of others to what they do in the classroom.

Another aspect of social development was the growth of students' confidence. It seemed that there was a noticeable difference between the children's confidence in the beginning of the study and the end. Some students experienced the feelings of confusion and anxiety when they started the research process in the first few sessions of SOLE, but these feelings changed to being more interested in SOLE and more confident during such sessions. Students' confidence appeared to increase a session after session with every time students were able to answer questions and give presentations. The learners' personalities flourished through SOLE sessions and their sensitivity to speaking in front of their peers and fear of practising decreased. Their confidence developed noticeably particularly in the oral presentations; by the end of SOLE sessions students appeared to have gained presentation skills as they started to explain findings in a clearer and more coherent manner. Beyond this, confidence and excitement among the students were clearly revealed through their standing, voice, as well as how they answer the teacher's questions. These results are consistent with what was found by Stanfield (2015). In his study, Stanfield also showed that their students gained more confidence during SOLE sessions and specifically during oral presentations. Such positive results might be due to the increased opportunities for learner participation and more chances to be responsible and independent; SOLEs allowed the students to think and reflect on their learning, which subsequently promoted their competence and confidence to participate. Another possible reason is the researcher-teacher role in fostering presentation skills during the feedback.

Moreover, the other data collected from the students, their parents and the classroom teacher generally seemed to confirm the observation results as that SOLEs experience boost learners' confidence and self-esteem which reduce anxiety and stress (see section 1.4.3). For example, as mentioned above, in the second questionnaire, students indicated that they argued in SOLE sessions more than they did in conventional classes. This might be because oral presentations and participation in group work assisted the students to overcome their sensitivity to speak and decreased their fear and the shyness to express their opinion. Hence, their confidence to participate enhanced and most of them started to believe in their own sense of self-efficacy. All this was confirmed by the participant classroom teacher, who commented that "*the way that students stood and discussed their ideas were different and it is clear that the students benefited from this program".* Such findings are also supported by the literature. For example, similar findings were reported by Ertmer et al. (2014) who stated that their findings showed significant gains in students' confidence.

Moving to another aspect of social development, that is self-organising behaviour, the findings of the classroom observations indicate that noticeable developments in student's self-organisation took place over SOLE sessions (Section 4.3.4.1). In early sessions, the students managed to formulate their groups to start their search although this took noticeably more time than it did in later sessions. This aspect seemed to improve rapidly during the subsequent sessions; it was observed that the children invariably created groups spontaneously and quickly in somewhat chaotic way. It seems that with the advance of SOLE sessions, students became more spontaneous in their self-organising behaviour. When the children entered the SOLE room and they found that there were just five computers, they spontaneously distributed themselves to the workstations and got ready to start work on the big question without the teacher's intervention.

Self-organising behaviour was not only apparent in group formulation, but it was also noticed during sessions as students adjusted how they participated, worked and interacted with each other without the teacher's intervention. Even when quarrels took place between group members, the students tended to self-organise themselves into smaller groups or simply change the group which revealed a sense of responsibility towards the group work. Understanding the key performance indicators (e.g., answering the big question), students managed to control their chaos and achieve rapid development in their self- organising behaviours. These findings can be understood in light of Sfard's (1998) acquisition and participation metaphors. To clarify, the findings might indicate that the students' mind-set is adjusting from the idea that learning is an acquisition of knowledge as the situation was in their conventional classrooms to the new idea that learning is also a participation process as they have experienced in SOLE sessions. It could be the case that the improvement of students' ability to organise themselves more quickly with the advance of SOLE session is a reflection of their development in social skills, but this development could also be triggered by a new belief that participation is essential for learning.

Moreover, such findings might not be unexpected if we consider self-organising behaviour a natural tendency that does not need to be taught or governed by an external force. This is supported by what Green et al. (2008) argues as they maintain that self-organisation is "the emergence of pattern and order in a system by internal processes, rather than external constraints or forces" (Green et al., 2008, p.58), in response to unpredictable and ever-changing stimuli. It is also worthy to note that such internal drive also exists in these children's behaviour in their religious practice in and outside the school. The culture of self-organisation is clearly apparent when Muslims spontaneously create order and organise themselves in rows once they hear the call for prayer. Although this seems a type of practised

response, it might have played a positive role in the speed of participants' development in their ability to self-organise in groups. Therefore, although self-organising behaviour seems to be universal, such culture in which self-organisation is part of religious practice might have had an influence on the participants' development during SOLE sessions. However, this interpretation is purely speculative and further research is needed to investigate it.

Besides development in students' engagement, confidence and self-organisation, data shows that, in general, students seemed to develop collaborative learning strategies and skills such as the interpersonal relationships, communicative and conflict-solving skills through SOLEs with minimal teacher's intervention. It emerged from the observation that, specifically at the beginning of the study, some of the students were not accustomed to working with others and needed time and opportunities to learn collaborative work strategies. However, this situation changed later on during the sessions where most students in the last four SOLEs sessions were observed to be more focused on the research topic and less likely to change groups during the session or to have group schism. This development could also be linked to Sfard's (1998) metaphors as it might indicate the establishment of a participation view of learning in the students' minds with the progress of the SOLE sessions.

These observations were supported by findings from the other methods used in the study. The collective data from the participants (Section, 4.4.3) indicate that SOLEs experience taught them how to cooperate better with their group members, how to adapt with others and help them articulate effective ways for instruction and communicate ideas. In addition, the comments of the participants' parents suggested that although learners were asked to complete the SOLE tasks in a group, the skills they developed and mastered may be helpful to students' individual development to some extent. All of these skills could help students develop as lifelong learners.

The data revealed some concerns raised by the participants relating to group work (see Section 4.4.5), but it seemed that students' interpersonal relationships, communicative and conflict-solving skills did indeed develop to some degree as the data also demonstrate (see Section 4.4.3). However, this development was not noticeably sufficient for some reasons relating to the students' culture about sharing and long experience in lecture style which emphasise on individual and competitive learning (see also Section 1.5.2). Another reason might also be that the researcher-teacher did not give feedback related to social skills and only provided feedback on students' academic performance and presentation skills (see also Section 4.3.5.4). More importantly, in order to acquire a satisfactory development, these skills need time (Slavin, 2015) especially for younger learners who have never been in similar situations before (Almuntasheri et al., 2016).

To conclude, the implementation of SOLEs environment has benefited students academically and socially with minimal teacher intervention which is compliant with Metra's (2014b) promises about SOLEs environments. However, based on the finding of this study, more time is required to achieve adequate academic and social skills. Unfortunately, this study was conducted over a relatively short period of time (1 session a week over ten weeks) and a longer time frame is needed in order to get more credible results. Kuhlthau (2008) stated that introducing timed educational interventions in schools, which has automated systems, is challenging and requires time to implement and develop. In addition to this, what seems challenging and requires time to establish, in the Saudi context specifically, is the integration of the participation metaphor. This is because the Saudi society remains relatively traditional and schools teacher centred and, thus, the acquisition metaphor is dominant. This requires partly an epistemological adaptation; that is promoting that learning through participation and construction of learning has its place as can be learned from the findings of this study.

5.2.2 Theme two: Students' collaboration

As discussed in the preceding section, after taking into account the duration of the study, it seemed that students developed in some academic and social aspect as the sessions progressed with minimal teacher interference. This development was also noticeable in some collaborative skills. During the observations, capturing the details of the group dynamics through the SOLE sessions was not very straightforward, but the findings reported in Section 4.4.3 reflect a general positive picture despite participants' concerns about group work as will be discussed below.

The students appeared to work as a team most of the time. Although group conflicts seemed to rise sometimes, they self-resolved within the group without the need for the intervention of the facilitator (the researcher). Barriers to effective communication seemed to manifest when the group members were unable to resolve their conflicts and refused to participate; however, when group members worked harmoniously together, it was not clear which roles the students played in their individual groups. There were a few instances' where the teacher intervened very slightly (see Section 4.2.3.2) when students did not function positively with each other, but there is no sign for more involvement needed.

However, the positive picture arising from the observation findings on student collaboration did not seem to hold true in the perceptions of the study participants. Although the data as discussed in the previous section suggest that the students socially benefited from using SOLE, their internal thoughts revealed a mixed feeling and opinion contradiction about teamwork giving rise to conflicts, which was also reflected in the opinions of the students' parents and classroom teachers. To clarify, one finding showed that although the participants generally appreciated the SOLE experience as it gave them the opportunity to work in groups and learn to practise tolerance and make adjustments (see Sections 4.4.1 and 4.4.3), some of

them felt uncomfortable with the new approach and found it difficult to engage in collaborative work (see Section 4.4.5). Moreover, a considerable number thought that their group members worked with them, but at the same time they believed they did not get the opportunity to be involved in group work. The students seemed to believe that always someone else gets the opportunities (see Section 4.4.5). They had an internal dissatisfaction with the role of the individual, equity and involvement in the group, which initially attests to the misconception of the individual's role in CL. This is consistent with the findings by Niemi and Kiilakoski (2019). As will be elaborated below, such contradiction in the feelings and opinions of participants seems natural given the culture dominant in students' learning environment.

To elucidate how the learning environment might have such effects on participants' opinions and perceptions, some important facts about the Saudi educational system must be brought under focus first (See Chapter One Section 1.4 for more details). In Saudi schools, teachers put more emphasis on academic than social skills and students are used to being passive listeners rather than active participants in social and group work. Indeed, the curricula are teacher-led and follow 'the teaching to test' approach. The students in traditional classrooms sit in rows, they usually work individually, where conversation is prohibited (they might be punished if they do so) and focus to achieve high grades and to excel over peers. Students are awarded a grade at the end of each year based on their examination results and the condition for moving to the next educational stage is to pass the exams. Almuntasheri et al. (2016) found that the system is still based on teacher-centred approaches relying on the textbook as the cornerstone of the process of teaching and learning. In one word, for most Saudi teachers and parents, the aim of education is nothing more than just helping children to pass examinations.

One explanation for the rise for mixed feelings and opinion contradiction is the shift from such traditional classroom arrangements, practices and assumptions to the new collaborative environment of SOLE. As proposed by some scholars (e.g., English and Kitsantas (2013), students cannot be easily shifted from traditional classrooms to students-centre approaches because this conflicts with deeply ingrained habits they have developed through traditional classroom experiences. Introducing SOLEs to such an environment as described in the previous paragraph would take students through a stage of contradiction due to the difference between what was prevalent previously in the traditional classroom and what they are experiencing under the new approach in SOLE sessions. It is the shift from one environment to another that might have led students to be confused in their opinions and perceptions. In addition, self-organisation method does not automatically mean everybody ends up at a position that is equal or fair; breaking the habit of having teacher make decisions for the students can be much harder than expected, not only because of losing their teacher authority, but also because some pupils just do not know how to deal with the novelty of it or simply prefer learning by receiving information from the teacher in control structure. Therefore, it might be the case that this shift from a traditional to a totally different new environment has given rise to contradiction in perceptions toward group work, which is a new experience for these students under the SOLEs environment. This points towards the importance of consciously training students on CL in general and on social skills in particular.

Another explanation for mixed feelings and opinion contradiction might be the competitiveness culture prevalent among students. The grading assessment system of Saudi education promotes competitiveness, which pushes students usually to work competitively in order to achieve higher marks than their peers to obtain their teacher's and parents' satisfaction. Such tendencies might have an impact on students even when they move to a new environment where they have to work collaboratively. So, students might like the new

environment and group work, but at the same time have negative feelings toward this experience because they have such unconscious tendencies to compete with each other. Such mixed feelings might then lead students to have controversies over what should be done and how. This is consistent with Johnson and Johnson (1979) preposition that conflicts in competitive contexts promote destructive controversy. In the current study, although the pupils present their work collectively, the competitive behaviour seemed to affect not only their own personal views giving rise to self-contradiction but also their interpersonal controversies. This is suggesting that there is a need for more effort to change the competitive culture to cooperativeness.

A further explanation for opinion contradiction might be related to authority power. The society culture and the education system of Saudi Arabia do not support the idea of expressing an opinion and taking a decision (Al-Ismaiel, 2013). People accept power distance and executing orders without the need for further justification. Children grow transferring from parents' authority to teachers' authority. Such authority does not promote discussion and dialogue and children are not usually given the opportunity to express themselves. When adult authority (parent or teacher) is absent, the authority of dominant children emerges (Mercier et al., 2014). This is indeed what happened in the SOLE sessions in this study. The group members who took more leading roles seemed to have stronger personalities or better computing skills and working on a device that is designed for an individual's use might have promoted the dominance of one member in the group (see Section 2.3.2.1). In the beginning, the rest of the group members seemed to comply. However, later in this study, students started to defy this peer authority through expressing opposing opinions or not complying with others' opinions, which gives way to conflicts. Such defiance might happen because of the confidence and feeling of responsibility gained in SOLE sessions and students' realisation that they are equally entitled to express their opinions. Yet, the lack of familiarity and

experience with CL seemed to hinder effective communication and allowed conflicts to emerge.

Therefore, the mixed feelings about group work, opinion contradiction and conflicts might be an indicator that students' self-efficacy increased, and their compliance decreased. This might lead to emergence of constructive controversy which is crucial for learning even if the students are unaware of it. Johnson and Johnson (1979, 2008) and Good and Lavigne (2018) insist that controversies among students' ideas, conclusions, theories, and opinions is an important source of learning in all educational situations and promotes high quality problem-solving and decision-making skills. However, (Johnson and Johnson, 1979, 2008) illustrate that for constructive controversy to take place, the students should be sufficiently competent in how to exchange information and aware of how to appreciate others' ideas and opinions. It was clear that children in my study needed to be taught these principles and this also implies that the guidance by a teacher is needed to ensure that everyone can participate in constructive controversy (more on the teacher role in Section 5.2.3 below).

Another noticeable finding arising from this study is that group size is a factor that might have had an impact on group work. It was found that problems appeared in large groups more often (Section 1.3.2.1). It seemed that the complexity of working in large groups may have caused participants to feel somewhat inept socially and prevented them from communicating and interacting effectively. Burke (2011) demonstrates that with increasing group size (more than five members), there is a decrease in the amount of interaction among group members and a few participants are likely to dominate, whereas others may remain passive. Conversely, in small groups, structuring group members' discussion is easier and makes students active speakers in discussion. According to Bertucci et al. (2010), the smaller size of groups (2-4) not only makes students more positively active but also more responsible, independent and accountable. Thus, large groups should perhaps be discouraged to maintain group

productivity and to make each member actively contribute to the joint efforts and increase group members' feelings of responsibility and accountability. The students still have the choice to format their groups, but the only new procedure is that the teacher might assist them with the number of each group.

Nevertheless, one contradictory finding regarding students' dominance, competitiveness and conflict appeared in the art sessions, where students seemed to work in a cohesive and collaborative manner to achieve the required work without the teacher's intervention. In these sessions, it was observed that equal participation was clear and that all members in the group had a role during the design of their work and no student seemed to be not involved in this. Niemi and Kiilakoski (2019) clarify that the use of artistic materials promotes group members' sense of relatedness and facilitates member interaction and communication. This, in turn, makes students more accountable and responsible. This might suggest that when applying for a SOLEs session, such practice needs to be considered as an important factor aimed at improving group work to increase on-task activities.

To conclude, collaborative skills might take some time to develop in groups and it might be hindered by students' previous experiences in traditional classes. Considering a strict session's time in school timetable, this might waste great opportunities for students to learn from each other and the group's focus might shift to social interaction rather than the task. Therefore, teacher intervention might facilitate group work and speed up the acquisition of collaborative skills. One of the limitations of this research is that it did not explore the justification about the mixed feelings and opinion contradiction by interviewing the children afterward.

5.2.3 Theme three: Teacher role

The role of the teacher in SOLE sessions, as in constructivism and connectivism learning approaches, is a combination between directive and non-directive roles. Directive role refers to giving students the questions formulated by the teacher and giving them feedback when they have presented their findings (Mitra, 2014a). Non-directive role means that the teacher does not instruct students on how to answer the question, but they act as an observer (ibid). These roles are in line with the orchestration role, which requires the teacher to create the learning environment, manage the learning process and adapt it to make it more beneficial for students (Dillenbourg, 2016; Pianta, Hamre and Mintz, 2010). In this section, such a teacher role will be discussed in relation to the results of this study.

5.2.3.1 Support students academically

As discussed in Section 4.3.1., it seemed that students were able to synthesise the answers to the big question with minimal teacher's support. Although students were not equipped initially with effective information seeking skills, they improved during SOLE sessions and managed to find answers to the proposed questions. Indeed, in the beginning of the current study the students often stopped at the first website that provided them with the information about the big question and copied it. However, after a number of SOLE sessions, the students seemed to be engaged with the collected information and, different from what they are expected to achieve through their conventional classes, gained more analytical understanding (see Section 4.3.1). This might suggest that while using the SOLE teaching strategy with other teaching methods, academic support from the teacher to students remains relatively minimal before or during the research period of the SOLE session. Crucially, the main teacher role remains during the feedback phase. This confirms to a certain extent the findings of Mitra (2014a) about the role of the teacher in SOLE classrooms and also the findings of Baroody et al. (2013), who claim that there is no need to highly guided and explicit practices when applying Enquiry Based Learning (EBL) approaches.

However, to the contrary of this study's findings, a number of scholars argue that students should already possess the necessary prior knowledge before applying any kind of EBL. The prior knowledge referred to here goes beyond students' ability to read or write to cover specific information about the topic to be studied by students. For example, Kirschner et al. (2006, p.1) empathise that teachers should provide "information that fully explains the concepts and procedures that students are required to learn" before transferring to the EBL teaching strategy. Indeed, in the present study, students performed much better when they were given a topic that they had previous knowledge about. Yet, they also performed fairly well even when they did not have any prior knowledge about the topic as they managed to find answers and succeed in their task to a great extent. Such findings are inconsistent with Kirschner et al arguments because the students performed well with or without prior knowledge about the research topic. This discrepancy might be because of the unique nature of SOLEs as it relies on the Internet as the source through which students obtain information, which is different from other EBL methods which take the book and/or the teacher as the source of information. The reliance on such easy-to-use and autonomously accessed tools as the internet opens unlimited horizons in front of students to obtain information in a flexible manner. To clarify further, different information might exist through the Internet and to decide on the most suitable information, students need to collaborate and discuss the issue, which, as proposed by Hoyles (1985), enhances students' conceptual understanding. According to the social constructivist perspective, such social negotiation encourages and reflects multiple perspectives which help in knowledge construction. Therefore, it is this process of accessing a wide source of information and engaging in discussions with peers that might compensate for the existence of prior knowledge about the topic.

It is true that the researcher in the current study intervened, but this was minimal and does not rebut the conclusion that students can manage academic tasks without teacher help. The teacher's intervention in the current study was only in the form of orchestration in sessions seven and ten. In session seven, the wording of the big question was changed because students were not able to comprehend it (Houen et al., 2016). It seemed that the big question used in this session was too abstract for the age of the students, which might indicate a problem with the question itself and therefore the intervention occurred. Indeed, Westwood (2011) corroborates that exposing students to difficult questions might lead to specific problems and this will negatively affect students' motivation and learning. Thus, it is important to consider the crafting of the big question. The second instance of teacher intervention in the study was in session ten when the teacher started with a discussion of the big question before allowing students to start the search. This happened because the researcher believed that the students' culture could negatively affect their answers to the question relating to insects; the intervention was only to explain to students that insects are not negative, but they also have positive effects on the environment. Therefore, the teacher's intervention in this study did not deal with the academic aspect of the process, but rather focused on providing general guidance through clarifying the question or its dimensions. On other words, it was a role of orchestration.

As for knowledge acquisition, a considerable number of students in the STCC questionnaire thought that they learned from traditional classes more than SOLE sessions and the number of students who believed so increased from the first to the second questionnaires. It seems possible that these results are due to the question limitation in STCC. It might be the case that the answer would have been very different if we asked students which approach helped them to develop communication, collaboration or digital literacy skills. In addition, these students were 9-11 years old and they might not be fully aware of what they have learned. Nesset,

(2013; p.100) ‘some form of learning occurs whether or not it is that which has been intended. For example, a student may not learn the concepts designated as the learning outcomes for a particular exercise, but the student may learn that it is helpful to try using different terms when performing an online search’.

Besides, these students were used to having a teacher to feed them all the information. Therefore, when asked which method produced more learning, they chose the method which involved a teacher being responsible for providing knowledge. This means that students’ response to this question might have been influenced by the method of instruction they have been taught through previously. Indeed. English and Kitsantas (2013) outline that students cannot be easily shifted from traditional classrooms to EBL because this conflicts with deeply ingrained habits they have developed through traditional classroom experiences such as relying on the passive receiving of knowledge.

Moreover, the researcher focused in several sessions on procedural knowledge rather than conceptual knowledge as in traditional class. In other words, the purpose of some SOLE sessions was not about adding new facts to the students, but to teach them new life’s skills, such as problem-solving, that might benefit them not only inside but also outside school. This is because the education system in Saudi Arabia focuses on indoctrination and gives students information to pass the test ignoring such skill development. In fact, the purpose of this study was not to measure the knowledge acquisition and, thus, further research is needed to measure the effect of SOLE on students’ knowledge acquisition and retention within Saudi Arabia and similar contexts.

One unanticipated finding was that the positive parents’ perception about teacher role in SOLE sessions in respect of academic support. Contrary to the researcher’s fear that parents

might resist the teachers' absence and the use of the Internet, the findings showed that the parents perceived using the web search engines to grasp knowledge as a beneficial method. The findings revealed that the parents believed that the SOLE method provided students with "fundamental 21st-century skills "research gathering, information synthesizing, utilizing high tech tools, and critical thinker". Comparing it to the traditional teaching method, they believed that the SOLE approach opens the horizon beyond basic knowledge, where students learn to take initiative and responsibility, solve problems and communicate ideas. However, it should be clarified that SOLE sessions were delivered to students in the extracurricular periods and, thus, they did not replace the traditional classes; therefore, parents' positive perceptions of SOLE might be caused by their beliefs that it is an additional learning activity rather than a replacement of the current system. This interpretation is also held by Mubin et al. (2013), who maintained that technological interventions in classrooms are perceived as additional or extracurricular activities that do not replace the main school curriculum. This is because of the absence of well-defined curriculum and learning material for technology integration.

In addition, it should be highlighted here that despite participants' perceptions of the big question, the findings suggest that because of the challenging questions, the students were forced to interact and communicate with each other to finish. This finding reflects the findings by Mitra (2014a), who found that the children will rather work in groups to increase their chances of succeeding if they perceive a task as difficult or impossible. Cohen (1994) explains that if the task is challenging to an appropriate extent (see Section 2.3.2.3 on this), students will experience the process of group work as highly rewarding. Students become intrinsically motivated when they work on tasks which were motivated by their own interests, sense of satisfaction or challenges (Hmelo-Silver, 2004).

5.2.3.2 Support students socially

One of the most significant findings of the present study is the importance of the teacher's role in scaffolding student interaction in order to implement SOLE. Many scholars (Gillies & Boyle, 2010; Järvelä et al., 2015; Niemi and Kiilakoski, 2019; Alahmadi, 2020; Al Kandari and Al Qattan, 2020) believe that it is important to expressly teach novice learner CL Skills such as negotiation, compromising to resolve conflicts, positively contributing to groups, explanation, listening and jointly solve problems and comprehend texts before applying any collaborative approaches. These results support the views of many educational researchers about the importance of the teacher's role in structuring and scaffolding these social skills. Contrary to what Mirta (2014a) asserts, they believe that establishing and sharing clear procedures with students relating to collaborative skills early in sessions will set the structure for positive interactions and aspirations later in the sessions. Further, Frykedal and Samuelsson (2016) accentuated that to increase group solidarity in the classroom, team skills should be explicitly taught.

Looking at outcome data in this study provides a complex picture between teamwork and individual role. The data illustrates the internal dissatisfaction with the role of an individual, equity and involvement in the group; this indicates that the learners struggled to work out how to participate in the task in a way that satisfied their aspirations, or they struggled to manage their interactions. Pupils seemed to believe that someone else in their group is responsible and might take the initiative. In addition, the age of these participants (9-11 years) is possibly an influential factor in this. Indeed, this is consistent with Ferguson-Patrick (2018), who found that relationships among group members, especially between 5 and 12 years of age, require mediation or facilitation by an external source as conflicts or power differences might arise. Although, in the current study, the researcher attempted not to interfere, when the learners

failed to share responsibility for the learning process, in session four, she helps them return to work collectively (Slavin, 2015).

Moreover, working on single-user-designed devices, such as personal computers, in SOLE sessions need even more skilled students to resolve the conflict and give the individual accountability. This confirms the finding by Järvelä et al. (2015), who point out that CL using one shared display, without preparing students, was found to experience lower levels of participation and motivation, less group cohesiveness and satisfaction and more conflict and contradictions because allows for one child to control while/ the others only observe the experience. For example, what happened to Tala in this study (see Section 4.3.5.2) could have been avoided if the researcher intervened from the first session. Although she integrated well in the seventh session without the teacher's help, this was a waste of a great learning opportunity. Such findings are in line with Reich-Stiebert and Eyssel (2016) finding that students' social skills would suffer from teachers' distance.

The discussion above indicates that taking into account the short duration of the study (i.e., 10 sessions), the interpersonal relationships and communicative and conflict-solving skills seemed to develop without the researcher-teacher intervention. However, in order to acquire a satisfactory development, these skills need time (Slavin, 2015) especially for younger learners who have never been in similar situations before (Almuntasheri et al., 2016). In addition, considering the strict session's time in school timetable (i.e., 45 minutes in this study), this might waste great opportunities for students to learn from each other and the group's focus might shift to social interaction rather than the task. Thus, it is clear that efforts are needed for teachers to adapt this new practice particularly when the students have long experience with the lecture method.

The parents' comments in the questionnaire revealed a serious concern about teamwork. Contrary to their view about teacher academic support, they believed that the teacher's intervention is crucial in structuring and scaffolding the social skills. This concern is consistent with the students' and the classroom teachers' comments. The comment that *"there is no collaboration between the groups' members"* was repeated several times, which indicates that negative perceptions about CL learning cannot be ignored. There was one suggestion from one of the parents that "*we hope to implement the program correctly by choosing the group members based on their homogeneity*". This parent comment seemed to indicate that he/she was satisfied with the SOLE program, however, either did not understand the groups' choice strategy or did not like this strategy. Thus, they think the teacher should involve more in choosing the group members so that the groups are more closely related.

Another indirect criticism of the teacher role was about causing some chaos in SOLE lessons. Learning ''on the edge of chaos'' was not a comfortable approach for some students or parents. The findings indicate that some participants and their parents viewed SOLEs as a noisy class and chaotic. This might be true because SOLE as an active learning relies on interactive communication where groups and pairs are talking at the same time. In addition, the SOLEs rules such as free to choose and change the groups might seem chaotic. This is consistent with SOLEs definition by Mirta (2014a, p.550) as "a set of interconnected parts, each unpredictable, producing spontaneous order in an apparently chaotic situation". Yet, as Trygestad (1997) points out, we should not give up, because authentic learning is often chaotic and inexact, and deep learning requires continual evaluation in the midst of disorder.

In sum, these findings seem to imply that some pupils found it difficult to engage in collaborative work. They like the idea of SOLEs; however, they clearly lack the skills needed to participate in SOLEs sessions effectively. The results of the present study seem to call for

the teacher's intervention to rehearse the CL skills both prior and during a SOLE. Topping et al. (2017) emphasise the need for students' preparation for effective collaboration practically when students lack familiarity with a CL environment and because of the experiences relating to the socialisation of individualism and competitiveness in traditional classrooms. Indeed, the orchestration role requires the teacher to prepare the learning environment in a way that promotes students' learning

5.2.3.3 Support students emotionally

Pianta and Hamre (2009) illustrate that teachers can create an emotionally supportive classroom environment by caring, warmth, sensitivity to student needs and showing regard for student perspectives. In the current study, students commented on their PVT and at the end of the questionnaire "I love you teacher". This indicated clearly that the learners were emotionally associated with the teacher. This might be because in SOLE session students have the choice and freedom. However, the findings from the WIHIC questionnaire indicated that the participants feel the teacher did not support them enough emotionally and one of the parents' emphasised this. This is supported by Reich-Stiebert and Eyssel (2016) who stated that their findings showed a fear that distancing teachers from the classroom might affect teacher – student interpersonal relationships negatively. The situation that happened with Shatha is difficult, when a student comes to ask for help in tears and does not receive that help from the teacher whom they believe is in an authority position. This resulted in her not participating in that SOLE class and missing the two following sessions. She was able to integrate with the students well after that, but the psychological pain she suffered was unnecessary, and the problem could have been resolved if the teacher had intervened.

In respect of the teacher, being passive and leaving a child feeling disheartened, frustrated, or helpless and ignoring their feelings contradicts with what the concept of "a good teacher"

means. Dozz (2012) points out that a good teacher is one that has the ability to establish positive and caring interpersonal relationships, which include cooperativeness, helpfulness, concern for others, and interest in students' wellbeing. This incident affected me personally and all I remember is that I wish I helped the student and especially that she tried to solve her problem and she could not. To date, however, the interpersonal relationships between teachers and students have been largely ignored as a factor of significance to teacher psychological health and personal wellbeing (Spilt et al., 2011).

On another hand, Shin (2017) argued that positive student-teacher relationships can be associated with a range of positive student behaviours in the classroom, including increased effort, help seeking, protecting students from toxic stress and cooperation with peers and less negative behaviours such disruptive behaviour and protect children from the risk of peer victimization. Therefore, teacher intervention to support students emotionally might resolve most disruptive behaviours and help them to hold respectable social interaction.

5.2.3.4 Maintaining Students engagement

As deliberated in Section 4.4.2, the findings suggested that the students generally appeared actively engaged during SOLE sessions. However, the level of the engagement seemed to decrease after the 4th sessions which made the researcher concerned that the initial enthusiasm would disappear and that students would lose their interest. This inspired the researcher to incorporate elements of creativity to maintain children's attention and engagement, which is in line with the orchestration role requiring the teacher to adapt the practice to promote students' learning. This section will discuss the findings relating to the teacher role in maintaining students' engagement in this research.

One of the intervention strategies introduced in session four was peer assessment. The students in this study were involved in evaluating each other's presentations in the aim that this process of decision-making would motivate and engage them. Indeed, the findings from this study demonstrate that students became more actively involved and paid more attention after introducing this strategy (see Section 4.3.5.1). The decisions seemed to increase student's agency and engagement in learning. Similar findings are also reached by previous research. In a study conducted by Black et al. (2004), it was found that when students participate in self and peer-assessment, they become more motivated and engaged in learning and this leads to significant learning gains.

Another two of the engagement intervention strategies used with the students after session four were a reward system and 'researcher of the week' badges. To clarify, after students' presentation in each session, one group was nominated jointly by the teacher and students themselves as the best performers and, therefore, the group members were given 'researcher of the week' badges (short term sticking plasters). In addition to this, students were given a coupon every time their group won or if they did extra efforts and extended their search at home. The findings suggest that these strategies had an encouraging impact on students' motivation and engagement. Groups seemed to work hard and compete in a positive way to obtain the group winner of the week. Students were motivated to put an effort to learn and to work in their group to get the reward. This is indeed consistent with previous research. For example, based on assessing the empirical evidence from published literature, Slavin (2014) concluded that research reveals conclusive evidence that rewards are essential for motivation and the effectiveness of team work especially in primary schools. The rewards introduced in this study were material reward, but it would be interesting to explore whether the introduction of a grading system in SOLEs sessions would affect engagement.

A further intervention strategy in this study was introducing art into three sessions (5th, 6th and 10th sessions). In these sessions, students used quilling paper strip sets or clay to present their findings. The findings (see section 4.3.3.4) suggest that students liked these sessions and found SOLE sessions motivating and enjoyable because they gave them the chance to draw and colour and specifically in the art and the clay sessions. This finding is in line with Niemi's and Kiilakoski (2019) study results, which indicate that introducing artistic elements to the learning environments make learning a pleasurable experience. In addition, Coulter and Woods (2011) suggests that the artistic element helps to sustain children's interest because their curiosity is piqued, which has the power to cause motivation and enjoyment. Jensen (2001) also found the arts enhanced concentration, motivation, and achievement. Pleasure, joy and happiness, as also supported by Achor (2010), can lead to greater motivation and they are a powerful indicator of engagement.

The final intervention strategy in this study was along the lines of 'Granny Cloud' strategy followed by Mitra (2015). This happened in the current study (9th session) through introducing the big Question and feedback to students by a teacher from Britain (Bridget Stradford) on skype. This coaching/feedback mechanism seemed to be an effective way to drive learner engagement. The students were excited and enthused before and during this session. In the beginning of the session, each child tried to snatch the British teacher's attention by asking her a question about things they knew in English, saying hi or at least wave their hand to her. This might be because in developing countries children admire and are fascinated with western people (Leonard, 2003) especially if they meet them in a friendly and non-threatening environment (i.e., online chat).

These interventions were found effective in appealing to the children and maintaining their interest. This was reflected in their increased engagement and motivation.

5.2.4 Theme four: Challenges

The results of this study revealed a number of challenges for integrating technology-based learning such as SOLE in Saudi schools. These challenges are of two types: internal and external. While the former relates to students' and educators' previous experience and attitudes, the latter has to do with resources and the school system. These will be discussed respectively in the following two subsections.

5.2.4.1 Internal challenges

In terms of the students, the findings clarified that the most noticeable challenge that faced students when working in SOLEs was their lack of previous experiences with group work skills. Due to the culture and the education system in Saudi Arabia, most pupils found it difficult to engage in collaborative work. This finding is consistent with that of Alsswey et al. (2020), who illustrate that the cultural and social context in Gulf countries including Saudi Arabia has a significant influence on students and instructors progress at the learning task when integrating digital technology (See Section 1.2.2).

In terms of the teachers, in general, the findings showed that most of the teachers were confident in using the internet when they prepared the lessons. However, the shortage of the teachers' knowledge in how to incorporate the Internet in the curriculum might have affected their competence to use it in the classroom. This might be because they had not been trained on how to use such tools. It is noteworthy that there is clear misconception about the use of the internet and integrating it in the lessons as a learning tool. The Internet is not used inside the classroom, but teachers believe they indeed use it merely because it helps them in preparing instructional delivery and classroom materials (i.e. creating lesson plans and using digital resources, and) as well as communicating with peers, students and their parents (Alsswey et al., 2020).

The findings from the interview revealed that the head teacher held positive attitudes towards introducing the Internet into students' learning. She seemed enthusiastic for internet integration in her school. However, the findings revealed that teachers' attitudes towards Internet integration in students' learning were confusing as they consisted of a mix of positive and negative thoughts in the same participants in response to questions in the same questionnaire. On one hand, most of the teachers thought it was important to integrate programs that encourage students to research using the internet in the classroom and they also had positive perceptions about SOLEs approach (see Section 4.5.2). On the other hand, a significant number of teachers had negative or neutral attitudes towards the impact of digital environment integration on students' learning and they held the belief that employing digital technology in the service of education is of low importance. Thus, although the teachers in this study had negative attitudes as indicated by their answers to some questions, the same teachers in the same questionnaire showed positive attitudes in response to other questions. This does not seem consistent with what was found in other studies. Previous studies in this context, e.g., Albugami and Ahmed (2015), detected only negative views toward using the internet at schools.

This paradox in teachers' attitudes can be understood from different directions. One explanation is that they truly believe in technology's importance in education having positive attitudes and their answers indicate this, but at the time because they do not have sufficient knowledge to involve students in lessons through using technologies, they also had negative attitudes. This interpretation coincides with findings from previous studies, e.g., Isman el al (2012), demonstrating that Saudi teachers have positive attitudes toward technology integration, but not many of them do or can use it effectively. Another possible explanation might be that teachers were not aware of the benefits of Internet integration on students'

learning. Most participants were veteran teachers who had had more than 10 years of experience in their work which they used to perform without any technology aids. The teaching-to-test approach might restrict teachers to focusing on ensuring that large classes of children achieve the learning objectives outlined in the National Curriculum. Moreover, the policymakers in the Ministry of Education (MoE) are concerned about the number of students who pass the national exam, not about how they learn (Almulla, 2017). This results in a more directive teaching approach directed to delivering particular attainment goals. Therefore, educators in schools and decision-making positions at the MOE need to be convinced that learning via the Internet is highly beneficial to students, as also postulated by Albugami and Ahmed (2015).

One limitation, however, with the data from teachers' questionnaire was regarding the interpretation of the query. In other words, the limitation of the closed question method used in the questionnaires meant that it was not clear about why this contradiction occurred in the teachers' response. Thus, an open-ended question could have gained a greater understanding of the teachers' perspective.

In fact, from all the casual conversations between me and the teachers, I conclude that teachers are willing to try any new innovations as long as it promotes and supports traditional classroom practices and helps to present the content of the textbook in a better way regardless of other possible privileges. This might reflect negatively on their interest to seek knowledge and training that helps them to integrate technology in their lessons. This, in turn, could affect their enthusiasm in overcoming the barriers preventing the provision of digital technology in schools. Another point worth mentioning is the gap between what the pupils have at home and the devices provided to them at school. The findings of this study clarified that all the students have some type of electronic device connected to the Internet in their household and most of

them owned a handheld smart device. However, these devices are not used in students learning either in the classroom or, most of the time, out of the school (Section 4.2.2). This has highlighted the need for further teachers training in terms of the importance and the use of the Internet in the classroom, especially with children who excessively use smart devices at home.

5.2.4.2 External challenges

Inaccessibility or unavailability of computers and the Internet, a school-level barrier, has been identified as the fundamental factor that prohibits teachers from using the Internet (see Section 4.5.3.1). In response to a questionnaire statement, almost all the teachers agreed that the lack of computer / smart / internet equipment is a key obstacle in front of their use of technology in the classroom. In addition, in response to an open -ended question in the same questionnaire, many teachers expressed discontent with the school equipment available to them. The overhead projector was the only technological tool available to the teachers inside the classroom and the teachers needed to bring their personal laptops to be able to use it. The computer and the Internet are mostly used in this school for administrative purposes. This is in line with previous findings by Alghamdi (2019) who suggested that there is still a lack of educational resources and devices in Saudi primary school. It would be interesting to see if the teachers will change their attitude if the computers and Internet are available to them in the classroom.

However, there was a discrepancy in the responses given by teachers and their head teacher. The head teacher seemed to have a different opinion about the availability of computers. Contrary to what was observed and the teachers' comments, the head teacher asserted that there were computers for teachers and students to use. She added that "*unavailability is not the reason preventing teachers from applying the internet in their teaching; look at you, you*

make it possible, because you want it". The head teacher agreed to some extent with the teachers' comments that the budget for computer -Internet prevision from the Saudi Ministry of Education is not enough and this was found by another study in the same context (i.e., Otain, 2016).

Another major barrier resulted in computers being underutilised in schools was, beside unavailability, the lack of technical support. Almost all the teachers strongly agreed that there is a lack of hardware maintenance. Although they only used overhead projectors connected to their laptops, no one was available to offer immediate technical support to avoid constant interruptions during the lesson. Surprisingly, also frustratingly, one of the teachers told me that they had to pay for the maintenance from their own expense in order to use this equipment for the teaching purposes. This is very stressful for the teachers, which may affect their willingness in the adoption of technology integration. Alghamdi (2019) found out that the major problems that militate against the effective implementation of the technology innovation in Saudi school was the lack of adequate technical support. He asserts that "with broken equipment and technologies and lack of adequate support, it is difficult for the teachers interested in technology use to embrace the technologies." (p.151).

Another barrier is the shortage of time for teachers to introduce technology-incorporated lessons. Most of the teachers seemed to think that rigidity in the national syllabus was the reason that prevented them from using the new innovative teaching approaches. They have a huge amount of information they are required to teach to cover the curriculum established by the MoE, which is expected to be fully covered during the school term. Most of these teachers found that time allocation for the session (forty-five minutes) is challenging within the existing curriculum. Some of them also emphasised that available class time is the major discouraging factor because of the time-consuming nature of most new approaches' tasks and

activities, which confirms the findings of Almulla (2017). He found that classroom arrangement and preparation within restricted session time are barriers preventing teachers from applying collaborative teaching approaches. In addition, Alghamdi (2019) suggests that any attempt to bring a change in the teaching approach might be in vain if it does not consider redesigning the classroom. In my experience, the most challenging factors preventing teachers from using technology is the time wasted to run and use these tools especially in light of the lack of technical support. Similar barriers to inclusion have been identified across various countries. For example, in a study conducted on the barriers to integrating technology in the USA, Francom (2020) concluded that "Over the 3 years of this study, time remained the highest cited barrier to technology integration overall… the difficulties teachers experience with a lack of time to test out a technology tool or resource and plan for transformative ways that it can be used for teaching and learning." (Francom, 2020, p.11)

Further, the findings of the current study show that most teachers seem to believe that the high workload is a barrier for using technology teaching approaches because of the lack of time for designing educational resources. Indeed, the head teacher's opinion about teachers' workload concurs with the teachers' response. However, interestingly, she believed that the lack of time on the daily school timetable to apply programs such as the SOLE approach is not an obstacle because they usually have free lessons and activity lessons that can be used to apply such programs with all capabilities. In Alghamdi's (2019) study, workload was also found to be a barrier for his participants.

The findings from teachers' questionnaires signify that the majority of the teachers believed that the professional in-service training courses provided by the MoE were inadequate for preparing teachers for technology integration in school curriculum. The findings indicate that most of the teachers used the Internet and computer to prepare their lesson and present it.

This might be because the professional development training on technology use is for instructional preparation of instructional delivery, but not for technology as a learning tool. Thus, there is a lack in the awareness of teachers about the Internet integration benefits and importance on students' learning. Alaqeel (2013) claims that Saudi teacher training does not prepare teachers to understand the importance of technology on learners' development and how to adopt new teaching methods.

There is a gap between the theoretical content provided in teacher training sessions and the real situation in Saudi classrooms. The workshops provided by the MOE focus on the education process, standards, and learning methods. They are usually general about teaching strategies and not specifically geared to how to adapt technology in the curriculum for the learners' use, not just the teachers. As pointed out by Alghamdi (2019), Saudi teachers used to be controlled and were trained to work to the book, which suppressed creativity and critical thinking skills. Alghamdi also highlights that the crucial aspect of training is to enable teachers to be able to promote the development of these attributes in their own students. Teachers need to be given opportunities to practice using technology during their teacher training programs so that they can see ways in which technology can be used to augment their classroom activities.

A large body of literature supports the idea that lack of teacher training on how to use technology effectively in the classroom is a major factor. For example, Alghamdi and Higgins (2018), by surveying 587 teachers (male and female), found that the lack of training courses was one of the most mentioned challenges of technology integration in teacher' lessons in Saudi primary schools. Hence, inadequate preparation to use technology is one of the reasons that teachers do not systematically use computers in their classes. In addition, Algamedi (2018) asserts that the planning and design of the teacher training workshop does not involve

teachers, which might make the training short of satisfying teachers' needs and lack relevance to classroom practice.

Overall, it emerged clearly that head teachers, teachers, students and their parents perceived the Internet integration in the classroom as an important tool in improving learning. However, there are some challenges that affect the application of digital environments in Saudi schools, for example, lack of students' skills in working in a collaborative learning setting, the lack of resources, maintenance, the lack of school timetable and teacher workload. In addition, and more importantly, there is a deficiency in teacher training about the benefits and how to adapt innovation teaching approaches in current curriculum effectively and, thus, leading to challenges in the transmission from teacher-led to student-centred approaches. Further, teachers should participate in designing their training program activities to cover their needs.

5.2.5 Concluding remarks on the overarching themes

The discussion above focused on four overarching themes that are related to the experience of teaching and learning in the SOLE setting in the Saudi context. These themes are time to develop, students' collaboration, teacher role and challenges. The discussion has shown the overlapping nature of these themes reflecting an overall complex system. Before clarifying this further, Figure 5.1 presented above and depicting the overlap between themes is repeated here as Figure 5.2 for ease of reference.

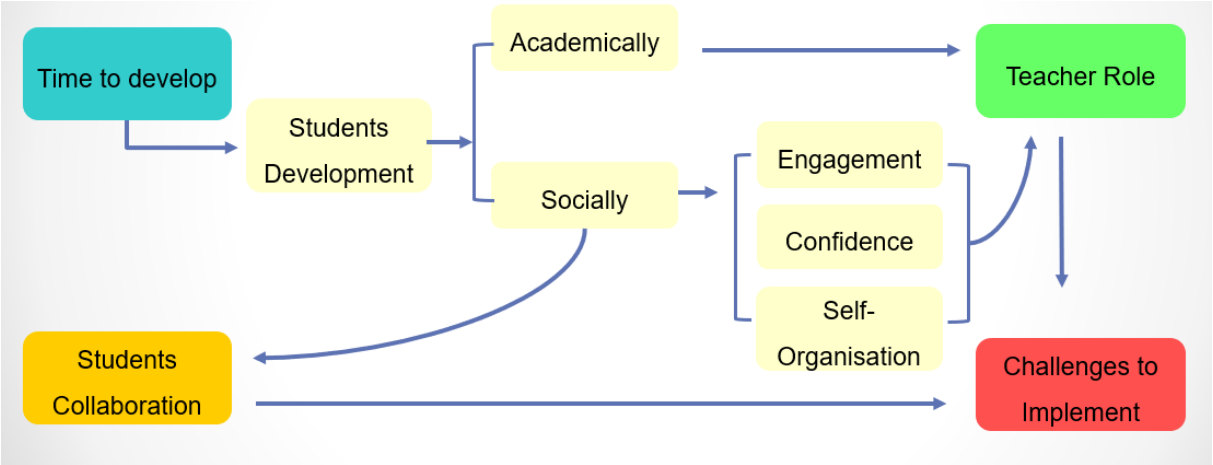

Figure 5.2: Overarching framework of themes.

As argued in the discussion above, although the students developed academically and socially with minimal teacher intervention, they needed more time (more than the duration of the current study, which was 12 weeks) for satisfactory development to occur. The feedback sessions after the presentations were helpful in developing students academically. However, although collaborative skills might finally develop with the passage of time, they remained a barrier for effective group work. Students' previous experiences in traditional classes seemed a factor hindering the development of such skills. Considering a strict session's time in school timetable, this might waste great opportunities for students to learn from each other and the group's focus might shift to social interaction rather than the task. Given that the teacher can save such a waste of opportunities through intervening and equipping students with the essential collaborative skills, the role of the teacher in SOLE needs to be reconsidered. The preposition here is that the teacher intervention might facilitate group work and support them emotionally, which could speed up the acquisition of academic and social skills that allow students to learn more effectively.

Expanding on the teacher role here, it was found in this study that the teacher role is important in designing the learning experiences to drive students' curiosity and capture their interest to increase engagement and motivation. In addition, the teacher role became under focus in this

study when discussing the challenges facing the application of SOLE in Saudi Arabia. Although some challenges at the school level such as the lack of resources and maintenance of computers and Internet connection need to be addressed by the school administration, other challenges such as the lack of students' skills in working in a collaborative learning setting can be dealt with by the teacher. However, the unsatisfactory teacher training might be an additional barrier to this type of intervention. Based on this, it is argued in this study that teachers need to be trained about how to integrate innovative teaching approaches in the current curriculum effectively.

It is clear from this discussion of the themes that they are connected and interrelated within this complex system of learning. To sum it up in a sentence, the challenges create barriers for students to develop and for the teacher to intervene effectively, but the teacher intervention could address some of the challenges and trigger students' development.

5.3 Contributions to knowledge, research and practice

The results of this study have several implications to theory, practice, research and decision making in the field of education, promoting how SOLEs should be understood to take a role in the future of learning. The section starts in 5.3.1 with returning to the concept of SOLEs to provide a new conceptualisation based on the experience gained from this study. Following this, 5.3.2 outlines the study implications about the teacher role and minimal teacher intervention approach. Next, a discussion of how and where SOLE should be used in terms of context and setting in general is presented in 5.3.3. Then, how educational innovations should be evaluated is discussed in 5.3.4. Finally, 5.3.5 focuses on the context of Saudi Arabia showing how the findings of this study can benefit research and practice in the country.

5.3.1 What is SOLEs?

As discussed in a previous section (i.e. 2.3.4), some academics and practitioners see SOLE as disruptive or an extreme way of doing things. However, based on the experience gained from this study and my previous professional experience (as a math teacher for more than ten years), viewing SOLE in this way is unfair. SOLE, as has been demonstrated so far throughout this chapter, could be seen along the lines of Sfard's (1998) preposition in relation to combining teacher-centered and student-centered approaches (captured as the Acquisition Metaphor (AM) and Participation Metaphor (PM)) to some extent in quite constructive way. As discussed in Section 2.2.1, AM and PM have different views on the goal of learning, learning, student, teacher, knowledge and knowing (for ease of reference, these views are summed up again in the first three columns in Figure 5.3 below as adapted from Sfard, 1998, p.7). Sfard (1998) asserts that these metaphors are complementary and should be used together in classrooms. I propose here that SOLEs is an approach that brings together the different views of AM and PM. The following figure clarifies how SOLEs perform this complementarity.

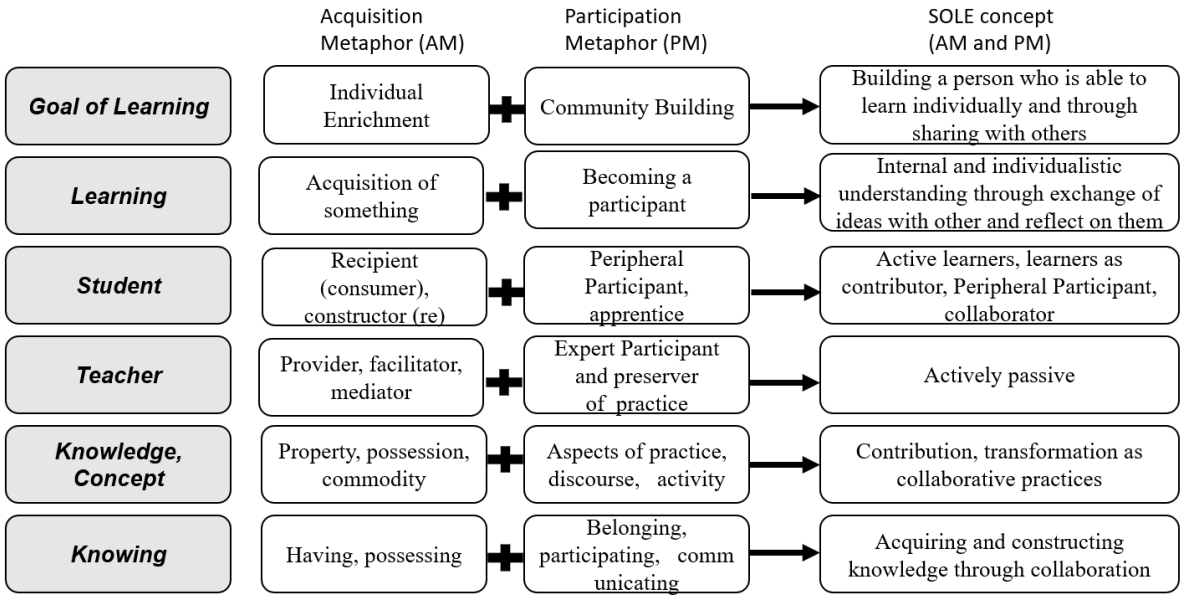

Figure 5.3: How SOLEs approach combines Sfard's (1998) AM and PM views on learning

To illustrate, in SOLEs, students exploit knowledge resources while working in groups in the aim of developing their individual learning abilities and their social skills. Some knowledge is acquired with the Internet assistance (computer-mediated practice) and some from participation, sharing and collaboration. In addition, the learning process in SOLE involves elements of both acquiring and constructing knowledge, and of engaging in a domain-specific discourse or community; learners have to research information through the Internet about specific topics, prepare presentations and reflect on this information. Researching, selecting, assessing and retrieving become a matter of participating in a network of people. In this way SOLE is used to "acquire" information through "participation" with a community of practice, confusing or blurring the boundaries between the metaphors. In this process, the student is the constructor of knowledge through both individual effort and collaboration. The teacher in SOLEs does not act only as a facilitator or mediator in the learning process (passive), but also takes the orchestration role to act as the expert who designs the learning experience and maximizes students' potentials through collaboration (active) (see also 5.3.2 about the role of the teacher).

In short, features of both AM and PM are realized in SOLEs, which can be seen as a way for combining these metaphors. This is through using digital tools to seek, find and process information, and then possibly to develop a product or solution addressing the task or problem through both personalization and participation.

5.3.2 Is the teacher dead?

Reviewing the relevant literature, including the literature on the constructivist approaches in education (student-centered approaches), about the teacher role in the context of students' learning, it was found that the importance of the teacher's role in the learning process is frequently emphasized (e.g., Järvelä et al., 2015, Galajda, 2018, Harper, 2018). Specifically,

this role seemed to be regularly redefined in pace with the emergence of many theories and methods in the teaching field. There is no optimal or universal role for the teacher in the classroom as s/he can switch between roles to facilitate the achievement of specific goals. For example, Schwarz (2002) states that when students work in groups, interaction among them becomes highly important and hence the teacher should take the facilitator role to promote interaction and help the group to improve the way they identify and solve problems. To put it differently, although no universal role for the teacher is defined, it seems important for the teacher to switch between roles depicted in Sfard's (1998) Acquisition Metaphor (Provider/ Facilitator/ Mediator) and Participation Metaphor (Expert participant and preserver of practice).

The practical findings of this study suggest that most of the time the children were successful in using the Internet to gather information about the big question; however, they needed a knowledgeable facilitator to help them in information prioritisation, the organisation and structuring of their experience and linking their findings with the wider learning context (Paradowski, 2015). Indeed, the feedback at the end of the SOLE session plays a vital role in terms of making the experience meaningful (this is in line with what has been found by some collaborative learning studies such as Jonassen and Land (2014) and Chen et al. (2019). This feedback phase gives the teacher the chance to assess students' needs and spot any shortcomings in their performance. This, in turn, allows the teacher to give directions to improve students' experiences. For this, the support of a competent guide seems indispensable.

In my point of view, based on my experience, the teacher role in SOLE can be described as being actively passive and along the same lines of scaffolding proposed by Wood et al (1976); their role is active before and after the activities because they get involved in planning and

structuring the session and launching the big question which serves as a stimulus for students to work in groups and communicate their ideas and take decisions. Further, teachers play a role in designing the learning experiences to drive students' curiosity and capture their interest. The most important teacher active role is when the students share their work in the whole-class discussion and feedback phase. However, the teacher's role is passive because s/he works as an observer and facilitator and specifically during the activity. In other words, in adopting a student-centred approach (being an observer and facilitator), the teacher supports students' learning by giving them opportunities for exploration, articulation and reflection, which would also allow the students to link current knowledge to prior experiences and knowledge (Dewey, 1963). In addition, supporting them in their learning to perform more complex tasks than they would otherwise be capable of performing on their own (Wood et al. 1976).

The teacher is indeed needed at the feedback stage, but there would not be sufficient time in this phase for the teacher to discuss and check the academic and social attainments of students considering a strict SOLE session's time in school timetable. In the light of this and based on the findings of this study, the social aspect could be covered by the teacher prior to and during the SOLE session, which would allow more time at the feedback stage for the academic aspect. In the social aspect, students could be trained on collaborative skills to give them a voice, bearing in mind that they need time to become familiar and gain experience with teamwork (Ferguson-Patrick, 2018). This can be done by various methods; perhaps the teacher could introduce pupils to 'Seven Norms of Collaboration' in a simplified manner for their age (Garmston and Wellman, 2016) and, also, discuss with them the skills they will need in collaborative learning, such as listening to others, encouraging others to talk and allowing others to finish to ensure individual accountability.

In addition, teachers need to continuously develop students' collaborative skills and constantly remind pupils about them before each SOLEs session, monitoring students' interactions during the session and intervening when needed to improve teamwork. For example, in initial stages, teachers might sit with each group, if necessary, and work with them as mediators to increase their interpersonal and group skills (Ferguson-Patrick, 2018). They could also, as suggest by Mercer (2002), encourage students to engage in 'exploratory talk' through, for example, asking 'why' questions that would raise students' interest and curiosity; this would help students develop each other's ideas in a critical and constructive manner. In addition to this, teachers could discuss and emphasise the good interactions during the feedback for continuous improvement of promotive interaction.

Another issue the teacher should consider when implementing SOLEs is the group size. In some previous studies (e.g., Mitra and Crawley, 2014, Mitra, 2019), group size is usually determined by the students themselves and the teacher does not interfere in this at all. However, the findings of this study showed a negative impact on pupils' interaction when they form large groups. This impact was not observed in groups of four, though. Thus, according to this study findings, four children in a single group seem ideal. This is also consistent with the group size in collaborative learning in general as suggested by Bertucci et al. (2010). More specifically, these authors postulate that this size is good for group productivity and to make each member actively contribute to the joint efforts and increase group members' feelings of responsibility and accountability. The students still have the choice to format their groups, but the only additional procedure that the teacher should assist them with is controlling the number of each group.

Educators also need to take into consideration that changes might happen during the process of SOLEs and thus, they should respond to each differently (Heron, 1999). While

disagreement of some students can be resolved without teachers' intervention, some situations require the teacher to intervene to save time. In either case, educators should consider students' feelings that arise throughout the sessions.

It is of paramount importance the teachers' creativity to maintain students' engagement and so SOLE sustainability in the long run irrespective of wherever it integrates in schooldays timetable. The finding of this study suggests, beside the importance of the big question formulation, it is crucial to introduce elements of creativity to sustain students' engagement. The role of rewards, whether material or moral, has had a major impact on the enthusiasm of students. The change in the strategy of displaying the big questions through, for example, offering it by another teacher, a parent using the phone or someone outside the school via Skype, has a significant impact in raising the interest of the students. Also, the opportunity for them to use handicrafts to present their conclusions had a role in their interconnectedness and collaboration as well as in their attention. Thus, this combination seems, indeed, quite substantial for SOLE approach promises especially at a particular school age.

Overall, as Heron (1999) elucidate, teachers should provide successive levels of temporary support that help students reach higher levels of comprehension and skill acquisition that they would not be able to achieve without assistance. Teachers could take an orchestration role in which they respond in the classroom as appropriate, dependent or contingent upon students' actions and needs, to reduce the negative emotions (frustration, intimidation and discouragement) and self-perceptions that students may experience when they work in groups or attempt a difficult task. In short, the effective facilitation could be supported by switching between different strands of learning and the facilitator him/herself determines the style depending on students' actions and needs. The supportive strategies might be incrementally

removed when they are no longer needed, and the teacher gradually shifts more responsibility over the learning process to the student (Heron, 1999).

5.3.3 How and where should SOLEs be used in schools?

This research aims to contribute to the body of research by demonstrating how SOLE approach features can be integrated in school curricula in the learning of different subjects. Several researchers and practitioners have proposed guidelines about the mechanisms and strategies teachers can employ to implement SOLE in school; however, the outcome of this study exhibited that most of these mechanisms and strategies required further adaptation to the context of children learning for specific experiences. I acknowledge that the findings of my study may not be general to all settings because the schools' culture and structures in other areas and countries are likely to have very different experiences and hence noting that there can be no fixed procedures or step-by-step processes to deal with SOLE implementation in schools.

SOLE can be used in different ways as previous studies as well as the current study have demonstrated. For example, many practitioners around the world have used SOLE with children at different ages in varying ways to best meet their needs. Some used SOLE as a model of the cooperative inquiry techniques in the classroom (e.g., Ma, 2018) or school lab (Vega et al., 2020) with or without Internet, and others adapted it to a different context such as after schools' club (e.g. Mitra, 2019) or in community centres (e.g., Burgess, 2016). The use of SOLE in the current study was similar to (Vega et al., 2020) as it was used in the school lab as an extracurricular activity. However, different from (Vega et al., 2020) and other SOLE studies (Burgess, 2016; Ma, 2018; Mitra, 2019), the current study provided the children with art supplies such as markers, coloured papers, quilling paper, clay, glue and scissors to create artefacts of their findings. Such an addition was made to improve students' engagement while working on their answers to the big questions.

As discussed in Section 2.2.1., schools around the world are exam oriented and focus dominantly on testing students' acquisition of knowledge (Berliner, 2011; Serdyukov, 2016). This is the case not only in Saudi Arabia but also, according to Berliner (2011), in more developed countries such as the USA and UK. This means that many of the skills needed in the 21st century might be ignored. Consequently, and as argued by Berliner (2011), national economies might suffer as a result of such testing-directed school systems. Thus, under such situations, implementing SOLE in school curriculum seems considerably challenging. However, instituting the SOLE approach into existing curriculum as part of a topic might seem beneficial; if teachers start to be aware that SOLE could at least help them achieve their goals in covering a certain amount of the curriculum, they might be more encouraged to implement it in their subject delivery. Therefore, such a situation might be ideal for most school subjects as SOLE would be employed to meet current objectives.

In addition, SOLE is a flexible approach where teachers can adapt it according to their needs and the available resources. They can make any changes they might see necessary in SOLE design management and control. Teachers could possibly apply SOLE at the beginning of the study unit to introduce the lessons; they might apply it after a short discussion about the topic or at the end of the unit to broaden the student's thinking horizons. This approach (as discussed in 5.3.1) will enable the teacher to combine the Acquisition Metaphor and Participation Metaphor proposed by Sfard (1998).

However, there are concerns about the acquisition of knowledge by an individual under collaborative learning models (Ferguson-Patrick, 2018). Indeed, many opponents of the SOLE argue about the need to make sure that the individual acquires knowledge alongside developing skills such as critical thinking and reasoning and research and information awareness (Paradowski, 2015). Therefore, it seems viable to initially introduce SOLEs into

schools to ***complement*** other pedagogical practices as part of schooling in, for example, a judiciously blended learning approach, or as extra-curricular activities such as a potential day-care or after school clubs.

5.3.4 How should we evaluate educational innovations?

Educational innovations are intended to improve student outcomes and quality of teaching and learning whether they relate to a new pedagogic theory, methodological approach, teaching technique, instructional tool or learning process (Sadowski, 2016). Although some of the innovations relating to this have globally left a significant mark on education, most of them have had the intention to integrate customized learning experiences and assessment-based learning outcomes. According to Berliner (2011) and Serdyukov (2016), many education systems place too much focus on accountability and assessment (i.e., exam results) and lose sight of many other critical aspects of education. However, using exam results to evaluate the effect of innovation is not enough because evaluation should be an ongoing process, formative and summative, formal and informal and student-led, which are all essential for authentic measurement (Alotaibi, 2019).

On the other hand, most studies which focus on evaluating educational innovations provide brief snapshots of students' performance and how they behave but fail to accommodate students' development over time; they often provide limited views of students' learning and learning behaviour. Only time will tell whether the promise of educational innovations is going to materialize. Classroom tasks need to be given enough space and time to evolve organically and to allow for group dynamics to drive them if we want to tap into a child's innate ability for self-learning. Further, according to Kuhlthau (2008), introducing timed educational interventions in schools, which have automated systems, is challenging and requires time to implement and develop to show their effectiveness. However, because such innovations are intractable in classrooms that adopt the traditional learning framework, when

applied for a short time, evidence seems to indicate their ineffectiveness, which might lead some practitioners to ignore such innovations (Fullan, 2007). Therefore, sufficient time should be given to these innovations inside classrooms and this can be achieved only if the teachers dedicate the time needed for testing such innovations and provide a more coherent picture about it.

There are various methods to consider in evaluating education innovations, but as stated by Moore (2011), the focus of the research determines the methods of evaluation. In the current study, the focus was to estimate students' reaction to learning in a new environment (SOLEs), the skills they might develop and its effectiveness on their learning. Based on this focus, to evaluate this innovation, comprehensive and periodic methods were used to identify a continuum from richness of information to breadth of coverage. Observation, in particular, was an essential research technique that helped in understanding the behaviour of the social actors in the SOLE setting and the changes that might occur over the study time.

The evaluation of new innovations, however, can do more than observing the learning process; in the current study, it is maintained that innovation evaluation should take the views of all stakeholders into consideration. Therefore, it was crucial to hear the voices of the participating students, their parents, their classroom teacher, the school head teacher and other teachers in the same school. Multiple methods (PVT, questionnaires and interviews) were used in order to gain detailed insights into how the students reacted to SOLE, how they felt and what they gained out of this experience. Further, the data provided a lens through which to look at the experience through the eyes of the participants, both direct (students) and indirect (teacher and parents). These methods provided the researcher with rich data about different aspects of this innovation.

Furthermore, the framework adopted to observe students and evaluate their outcome in this study was the "Group Spinner Axes" proposed by Kharrufa et al. (2017). This rubric was found very useful in structuring the data collection and the data analysis processes. In addition, it helped much in making the researcher focus on the research topic and prevented her from including irrelevant aspects. This tool could be recommended to teachers and researchers to get a more holistic view of students' learning behaviour and outcome in student-centred approaches. It gives not only an overall interpretation of pupils' behaviours but also a description of the different aspects such as: organisation, development, cohesion, structure and mechanics.

5.3.5 SOLEs and Saudi educational context

The Ministry of Education (MoE) and students' parents in Saudi Arabia have realized the importance of introducing new education innovation to develop students' 21st century skills (taking initiative and responsibility, thinking critically, solving problems, communicating, research gathering, information synthesizing and utilizing high tech tools) (Vision 2030, 2020). There is a contradiction between MoE efforts to develop education and its outputs. This might be because MoE efforts have drawn too much attention to curriculum reform and technology innovations and neglected teachers and learners in the process. Truly, the MoE has provided teacher training programmes to improve the quality of learning outcomes. However, the learning concept in these programmes remained as transmitting the content of the textbook to students, ignoring young people's personal, social, emotional, and creative development (Algarni and Male, 2014; Vision 2030, 2020). The research at hand attempted to introduce an approach to help MoE address the failures of the education reform initiatives and to achieve the 2030 Kingdoms' vision.

When considering a shift from teacher-centred to the student-centred approach (e.g., SOLE), it is necessary for Saudi teachers to understand initially what the meaning of learning is. They

may also need to build their confidence as creative thinkers who like the idea of the student constructing knowledge and being a life-long and social learner and a decision maker. Additionally, Saudi teachers need to consider their roles in the learning process by delegating authority to the learners and adapt active passive roles in their teaching method. As has been found in this study, the distance kept between the teacher and students in SOLE sessions overall benefited students and these benefits outweighed the challenges faced during the study. It is recommended that Saudi classroom teachers be encouraged to explore the advantages of SOLE and to give learners more opportunities to be independent and to think and reflect on their learning.

I could argue that, based on my experience in this study, SOLE is a realistic approach to achieve the MoE vision and at the same time, it can be an optimal solution for most of the challenges reported by the teachers in this study. One of the challenges that SOLE might be a solution for is ignoring existing resources (e.g., computer and the Internet) through encouraging teachers to use. Most Saudi primary schools, if not all, have computers for administration use and some have Learning Resources Centres (LRC), which usually contain computers, smart boards and recently Internet (Alenezi, 2016). Five to six computers would not be hard to find in any school in Saudi Arabia and the Internet is also available at affordable prices. If schools invest in available devices by maintaining them instead of waiting for new ones from the MoE, this encourages teachers to use them in their teaching. Alternatively, in the worst-case scenario, students can bring their own device from home.

Secondly, as for the shortage of time and the workload challenge, the teacher in the SOLE programme does not need to do a lot of preparation as s/he is most importantly required to choose the right big question. The big question formulation is not challenging especially as the new textbooks are provided by MoE which usually contain higher thinking problems that

can be used as big question. Indeed, all lessons in the science course book are closed with a critical thinking question. For example, a lesson on animal breeding includes a question about why animals which lay a large number of eggs take less care of the eggs. The answer for such a question is not included in the lesson but requires students to think and search for the answer. This, therefore, seems appropriate to be a big question. Moreover, during the research phase the monitoring task can be done by anyone else, such as a librarian or supply teachers.

On the other hand, Saudi classrooms revolve around rigid schedules, standardised curriculum and passive students' complete workbooks which prevent ambitious teachers from applying new methods in their teaching. Thus, it is recommended that schools should re-examine their traditional school schedule and rethink how the typical school day is structured. This can be done through, for example, structuring the school day in a way that allows for daily 90-minute SOLE sessions. Having such a session included in the schedule and for which the setting is previously prepared would definitely encourage the teachers to use the space provided and engage in educational innovation. However, even if restructuring the school day is not possible, the teachers can still apply SOLE sessions twice a week through, as suggested by the head teacher in this study, exploiting the extracurricular sessions.

Thirdly, the SOLE approach is easy to adapt where there is no need for long or intensive teacher training in how to use it as long as teachers have the SOLEs Tool Kit. This Tool Kit provides sufficient information about how to apply SOLE. In addition, I believe that putting SOLE in practice will help teachers refine their understanding of the principles underlying SOLE and help them to progressively develop SOLE strategies for introducing and customising it in their own setting. However, despite this, teachers in Saudi Arabia, similar to teachers in other countries, still need adequate professional training courses in how to develop

learners' exploratory talk and encourage them to think together in the learning process (Mercer, 2002).

Furthermore, as argued above (see 5.2.2 and 5.3.3), for successful SOLE implementation, the schools' cultural context and problems should be taken into account. In the Saudi context, where this study took place, it was obvious that the children needed help to facilitate collaborative learning. The teacher's involvement was found crucial in the role of facilitating the generative collaboration, to enhance children's creative thinking and to support dialogue between group members. Therefore, it would be recommended that before adapting SOLE or any collaborative model, the teachers explain to the students' group work skills and clarify how to be examining conflicting opinions, evaluate arguments, generate alternatives, draw logical connections and make reasoned judgements. This contribution could be helpful to other teachers seeking to apply teamwork methods.

Overall, it is understandable that the shift from a narrowly traditional lecture-style to more a learner-centred approach is often considered challenging and needs patience from teachers and students. However, the shift can be implemented in stages through initially creating a balance between the two approaches. In doing so, the SOLE approach, which combines acquisition and participation metaphors as discussed above, can help both teachers and students take the first step toward this change.

Chapter 6. Conclusion

6.1 Introduction

This chapter aims to present a summary of overall findings and highlights the original contribution to knowledge and to policymaking in Saudi Arabia, research and practice in the educational field. The chapter starts with a summary of the main findings in relation to the research questions posed in this study (Section 6.2). This is followed by a discussion of the contribution made to research and practice through this work in Section 6.3. Following this, the study limitations and suggestions for further research are provided in 6.4. Finally, how the findings of this research are and will be disseminated is presented in Section 6.5.

6.2 Summary of findings in relation to the research questions

The first research question addressed by this study was concerned with the learning process and products of children who were exposed to SOLE sessions (i.e., How does SOLE affect the learning process and products of children who are accustomed to a traditional approach?). To investigate this, the study focused on students' social and academic behaviour and development aspects. Adopting the Group Spinner Axes proposed by Kharrufa et al (2017), these aspects were assessed in this study through observing students' performance in information seeking, learning outcome, collaboration, working within SOLE environment and motivation and engagement. It was found that academic and social development took place for students during the 10 SOLE sessions despite the short period over which the study was conducted.

As for the academic aspect, it was evidenced from the observation and students' displays throughout SOLEs sessions that pupils developed academically, as the searching and summarising skills in SOLE improved over sessions and the students progressively learned

how to find, select, organise, and present the information to explain a question. They also started to integrate different aspects of the big question answers into a coherent whole. This development might have been influenced by the discussion and feedback after each students' presentation which was a much more valuable experience and seemed to spark many more thoughts and areas for further reflection in the students. In addition, towards the end of SOLE sessions in this study, students' presentations showed a strong increase in the depth of understanding of the topics.

Another development in relation to the academic aspect was that students' problem-solving and critical thinking skills improved during the study. The idea of learning as an ongoing process of exploration seemed to take place in students' learning behaviour. They faced a number of challenges during their search of information, but every time they used to come up with a solution. For example, the findings demonstrated how students dealt with situations when they were presented with the big question in a different language or when they did not find information when they searched in their first language. Moreover, although at this young age, the children were new to the idea of reflection in their own learning, their views showed that there is progression in their thinking. Their criticisms seemed constructive and they provided suggestions about different aspects of the sessions, which were clear evidence that some began using higher -order thinking skills. Indeed, the finding showed that the number of students who thought they argued with their friends increased significantly in the second comparison questionnaire, which might be a sign of critical thinking improvement.

Moving to the social aspect, development also occurred as the study findings revealed. One of these developments was students' engagement in SOLE sessions. The students appeared deeply engaged as they actively participated and volunteered, and their attention seemed to be focused on what they were asked to do during sessions. Another aspect of social development

was the growth of students' confidence. Students' confidence appeared to increase a session after session with every time students were able to answer questions and give presentations. Moreover, students' social development was evidenced through their self-organise behaviour. It seems that with the advance of SOLE sessions, students became more spontaneous in their self-organise behaviour. When the children entered the SOLE room and they found that there were just five computers, they spontaneously distributed themselves to the workstations and got ready to start work on the big question without the teacher's intervention.

Besides development in students' engagement, confidence and self-organise behaviour, data shows that, in general, students seemed to develop collaborative learning strategies and skills such as the interpersonal relationships, communicative and conflict-solving skills through SOLEs with minimal teacher's intervention. It emerged from the observation that, specifically at the beginning of the study, some of the students were not accustomed to working with others and needed time and opportunities to learn collaborative work strategies. However, this situation changed later on during the sessions where most students in the last four SOLEs sessions were observed to be more focused on the research topic and less likely to change groups during the session or to have group schism.

The findings above revealed that the students developed academically and socially during the study period with minimal teacher support. However, although students performed fairly well in all SOLE sessions and managed to find answers and succeed in their task to a great extent, it was found that the students were internally dissatisfied with the role of an individual, equity and involvement in the group; this indicates that the learners struggled to work out how to participate in the task in a way that satisfied their aspirations, or they struggled to manage their interactions. Pupils seemed to believe that someone else in their group is responsible and might take the initiative. Based on this, it has been argued in this thesis that the teacher is

needed to help build students' teamwork skills to precipitate the process and avoid wasting time that might offer learning opportunities for students.

Furthermore, it has been argued in this thesis that the teacher is also needed in order to re-flame students' engagement and interest when these wanes away. In the current study, students' engagement seemed to decrease after the 4th session, which made the researcher concerned that the initial enthusiasm would disappear and that students would lose their interest. It was suggested that incorporating elements of creativity in the sessions such as changing the type of task students are required to complete would maintain children's attention and engagement.

The second research question focused on the students' perception of the SOLE approach (i.e. How do students perceive SOLE?). The findings revealed that the students, their parents and the classroom teacher thought that SOLE improved students academically. The perception was that SOLE allowed the students to gain new knowledge, information seeking skills and kept their brain active. The students' digital literacy was thought to have been enhanced which encouraged them for further internet-based research into topics that interest them at home.

In addition to improving students academically, the SOLE approach was also perceived to develop students socially. In the SOLE environment, the students at first seemed to struggle to build relations with others during SOLE sessions perhaps as an effect of the traditional classroom environment. However, by time students developed these skills and started to believe that they worked well with friends during SOLE sessions. In addition, the majority of the students felt that SOLE sessions helped them with reducing anxiety and stress they feel in regular classes. A notable area related to the social outcome identified by the children is their

enjoyment of learning and the kind of opportunities that SOLE provided them with in creating a stimulating and engaging learning environment. Other perceived social benefits of the SOLE approach included increasing students' confidence and self-esteem, improving their communicative and conflict-solving skills.

In relation to the teacher role, based on this study, it can be concluded that the teacher should take an orchestration role to plan and design the learning experiences in a way that addresses students' needs and improves their outcomes. In doing so, the critical incidents and any happenings inside the classroom cannot be ignored because they might work as an indicator of what needs to be addressed in the classroom. Based on the findings of this study, it appears that the teacher is needed to build students' teamwork skills to save time for more learning opportunities. Indeed, this was supported by the findings arising from the perception of the students, their parents and the classroom teacher. More specifically, some students, their parents and the classroom teacher had a concern about teamwork. Some pupils found it difficult to engage in collaborative work. They liked the idea of SOLEs, but they clearly lacked the skills needed to participate in SOLEs sessions effectively. The argument that was made in this thesis was that the teacher is needed in such a situation in order to rehearse the CL skills both prior and during SOLE sessions. Teachers need to continuously develop students' collaborative skills and constantly remind pupils about them before each SOLE session, monitoring students' interactions during the session and intervening when needed to improve teamwork. Group size is also another issue the teacher should consider when implementing SOLEs. The findings of this study showed a negative impact on pupils' interaction when they form large groups, thus, four children in a single group are ideal.

The perceptions of the role of the teacher in SOLE sessions were both positive and negative. The role of the teacher in the way suggested by SOLE (i.e. as a facilitator) might boost

students' engagements and motivation because SOLEs provide students with a freer and more relaxing environment. Indeed, the students in this study felt safer in SOLE sessions than in conventional classrooms. This may be because they could move more freely and act more spontaneously in SOLE sessions. However, acting passively (i.e. observer) was perceived negatively as the participants felt that the teacher did not support them enough emotionally. Moreover, it has been argued in this study that being passive and leaving a student feeling disheartened, frustrated, or helpless and ignoring their feelings contradicts with what the concept of "a good teacher" means. A good teacher is one that has the ability to establish positive and caring interpersonal relationships, which include cooperativeness, helpfulness, concern for others, and interest in students' wellbeing.

Moving to the third research question posed in this study, it was concerned with the challenges that might encounter integrating Internet- and -technology-based approaches such as SOLE into Saudi schools (i.e., what are the challenges of introducing SOLEs in the Saudi context?). It was found that although the Internet integration in the classroom was perceived (by the head teacher, teachers, students and their parents) as an important tool in improving learning, there appeared some challenges that might affect the application of digital environments in Saudi schools. These challenges are the lack of students' skills in working in a collaborative learning setting, the lack of resources (computers and Internet connection), and technical support and the lack of school time due to dense curriculum and high teacher workload. In addition, and more importantly, there is a deficiency in teachers training about the benefits and how to adapt innovation teaching approaches in current curriculum effectively.

To conclude, the implementation of SOLEs environment has benefited students academically and socially with minimal teacher intervention which is compliant with Mitra's promises

about SOLEs. Based on this, it seems viable to initially introduce SOLEs into schools to complement other pedagogical practices as part of schooling in, for example, a judiciously blended learning approach, or as extra-curricular activities such as a potential day care or after school clubs. Instituting a SOLE approach into an existing curriculum as part of a topic might seem beneficial; if teachers start to be aware that SOLE could at least help them achieve their goals in covering a certain amount of the curriculum, they might be more encouraged to implement it in their subject delivery.

Moreover, this study has shown that collaborative skills might take some time to develop in groups and it might be hindered by students' previous experiences in traditional classes. Considering a strict session's time in school timetable, this might waste great opportunities for students to learn from each other and the group's focus might shift to social interaction rather than the task. Therefore, teacher intervention might facilitate group work and speed up the acquisition of collaborative skills. In relation to this, it is of a paramount importance that the teacher be creative to maintain students' engagement in the SOLE task in the long run irrespective of wherever it integrates in the school's timetable.

Finally, Saudi teachers need to consider their roles in the learning process by delegating authority to the learners and adapt active passive roles in their teaching method. As has been found in this study, the distance kept between the teacher and students in SOLE sessions overall benefited students and these benefits outweighed the challenges faced during the study. It is recommended that Saudi classroom teachers be encouraged to explore the advantages of SOLE and to give learners more opportunities to be independent and to think and reflect on their learning. However, to help schools do this, the Ministry of Education in Saudi Arabia should intervene to make the required resources available and provide training allowing teachers to integrate technology and innovation in education more effectively.

6.3 Contribution to knowledge

Over the last three decades, increased attention has been given to network-based learning approaches such as SOLE and the role the student plays in the learning process. A number of studies conducted in international contexts have indicated the effectiveness of using this method to improve learners' social and academic performance when working in small cooperative groups (e.g., Land and Jonassen, 2012; Mitra, 2019; Al Kandari and Al Qattan, 2020). However, there have been no previous studies conducted in Saudi Arabia or even the Arab world in general, where SOLE is considered to be a new teaching and learning method. This study is therefore a pioneer in the education field in Saudi Arabia which attempts to improve the traditional patterns of teaching in Saudi primary schools through introducing a new method and exploiting new sources of learning and specifically the Internet. Moreover, the study seeks to highlight the barriers in the face of introducing and implementing such methods to draw the attention of policymakers in Saudi Arabia in order to avoid them.

Furthermore, previous SOLE research has mainly focused on students' learning outcomes following their exposure to some SOLE sessions (e.g., Mitra and Rana, 2001; Mitra, 2003; Mitra et al., 2005) or comparing the performance of SOLE students against standard learning outcomes expected to be achieved by school students at a specific level (e.g., Mitra and Dangwal, 2010; Mirta and Crawley, 2014; Ma, 2018). However, these studies have little, or most of the time, no focus on what and how SOLE could improve students' academic skills such as information seeking, problem solving, critical thinking and social skills such as motivation and engagement, confidence, self-organise and collaboration. Moreover, students' perceptions of the learning and teaching process in SOLE sessions have also been ignored to a great extent in such studies. Based on this, the research at hand contributes in these (somewhat under-researched) areas through attempting to evaluate how SOLE sessions

develop students' academic and social skills and exploring how they perceive this approach of learning.

All in all, the contribution made by this research is that it has enhanced our understanding of SOLE applicability and effectiveness in the learning of students from a cultural background that has not been studied before in SOLE research; this may suggest how to customise SOLE approach to be suitable for different contexts. In addition, uncovering the barriers encountering the introduction of such innovative teaching and learning approaches has been another contribution to the teaching practice in Saudi Arabia and which might apply in other contexts.

6.4 Limitations of the present study and recommendations for further research

Although the present study has explored essential issues and aspects that have not been previously researched in the educational literature, it remains an individual effort that has its inevitable limitations and shortcomings. The main limitation in this study is that it was conducted only on a small sample of year five primarily school children in Saudi Arabia due to time and resource constraints since this study had to be completed within the timeframe given to complete a PhD study. This might make the findings representative of similar contexts only and not generalisable to other levels (i.e., intermediate, secondary school levels) or other countries with different cultural backgrounds.

However, as stated in the Methodology Chapter, generalising this study findings into other contexts is not an aim in this study as it seeks to explore how an educational innovation might work in a specific context and to enhance our understanding of the challenges that might encounter introducing this educational innovation into that specific context. Nevertheless, the researcher in this study provided a detailed description of the research contexts, research

approach, and participants in this research, which would allow for the transferability to other settings.

In light of this limitation, future research could include wider samples in terms of age and grade of students. This would allow for verifying if these study findings are attested in other school levels. In addition, longitudinal studies conducted over a long time period may provide a more comprehensive picture regarding the possibility of implementing SOLE and the factors that can affect its application in the Saudi context.

Moreover, the sample of this study posed another limitation. Specifically, this investigation was conducted in an all-female school due to the segregation by gender in the educational system in Saudi Arabia school. Based on this, the study findings might not be transferable to all-male or mixed-gender schools, where interaction, team working, and group dynamics might differ. Therefore, other researchers could conduct similar studies in such schools in order to verify to what extent the current study findings apply.

Furthermore, the time constraint disallowed the researcher to explore further some phenomena that arose during the research process. For example, the findings in this study demonstrated that the students had mixed feelings and somewhat contradicting opinions about group work but could not reveal the cause for this. Another example is the finding showing that teachers generally agreed on the importance of integrating the internet in the classroom but a significant number of them suspected the impact of the internet on students' learning Conducting follow up interviews with the students and teachers could have allowed for a better understanding of these phenomena.

Some other issues emanating from the current study were also necessarily left unexamined due to time, scope or space constraints but can be further researched in future work. These include how some aspects of teamwork affect SOLE. Two specific issues in relation to this are member roles and their influence on collaboration and students' hesitation to change their groups and how this affects their productivity. In addition, another issue that came up but was not examined further here was the emotional impact of the teacher's role in SOLE sessions on the teacher him/herself and on the students. Future research is recommended to investigate these aspects through conducting post-session interviews with teachers and students.

Finally, future research endeavours in SOLE are recommended to adopt, similar to this study, the "Group Spinner Axes" proposed by Kharrufa et al. (2017) in observing students and evaluating their outcome. This rubric was found very useful in this study in structuring the observational data collection and analysis processes. In addition, it helped the researcher focus on the research topic and prevent her from including irrelevant aspects. Therefore, this tool could be recommended to teachers and researchers to get a more holistic view of students' learning behaviour and outcome in student-centred approaches. It gives not only an overall interpretation of pupils' behaviours but also a description of the different aspects such as: organisation, development, cohesion, structure and mechanics.

6.5 Dissemination

This work cannot be considered complete without disseminating its findings to researchers, educational policy makers as well as educators in Saudi Arabia and the wider educational community. A copy of this thesis will be available to these stakeholders and the wider academic community in the Saudi Digital Library once the degree is awarded by Newcastle University. In addition, a summary report will be prepared and sent to the school where this study was conducted in order to inform the participant teachers about the findings of this

study. Moreover, presenting this work at academic platforms and publishing its findings in academic journals has already started. Some of the findings of this research were presented at the International Conference on Modern Research in Education, Teaching and Learning, June 5–7, 2019 in Brussels, Belgium. A paper was also published in the same conference proceedings (Otain et al, 2019).

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Appendices

Appendix A: Observation schedule used during SOLEs sessions

General	Information Seeking	Learning Outcome	Collaboration	Working within SOLE	Motivation and Engagement
Reaction: Group Formation:	A) fact finding: B) balancing info: C) scrutinizing and analysing info:	A) No/ incorrect information: B) facts on one aspect of the answer: C) multiple aspects but no links: D) development of answer: E) applying info to new areas:	A) sharing resources: B) joint actions: C) mutual planning: D) equal participation: E) communication: F) reaching consensus:	A) take responsibility: B) share knowledge: C) explore resources: D) behave spontaneously:	A) attention: B) participation: C) volunteering:

Appendix B: Background information questionnaire

Dear Student:

I would like to thank you for your participation in this study.

Please fill out this questionnaire

Part One: Personal Information

Name: .....

Age: .....

Part Two:

Section One: Computer and Internet Use:

1- Do you own or can use any kind of home appliances (computers, smart devices)? ☐ Yes ☐ No

2- If yes, is the device connected to the Internet? ☐ Yes ☐ No

3- Are you an Internet user? ☐ Yes ☐ No

4- If yes, what are your uses?

☐ Search for information related to lessons ☐ Writing research

☐ Homework ☐ Browse websites related to the curriculum

☐ Reading books ☐ Games ☐ Websites

1- Do you use the Internet?

☐ Daily ☐ Weekly ☐ Monthly ☐ As needed

2- If you are using a daily how many hours the average

☐ Less than an hour ☐ Hour ☐ More than an hour ☐ Two hours and more

3- Is there anyone who can help you choose websites when you surf the Internet?

4- If the answer is yes, who will assist you?

☐ One of the parents ☐ One of the brothers ☐ Friends

Section Two: Cooperative Education

5- Teamwork drives me forward and helps me learn effectively

☐ I agree ☐ Disagree ☐ Sometimes

6- Sharing information with others is a useful method to learn

☐ I agree ☐ Disagree ☐ Sometimes

7- I prefer to perform the tasks by myself and without help of others

☐ I agree ☐ Disagree ☐ Sometimes

Appendix C: "What Is Happening In this Class" (WIHIC) questionnaire

What Is Happening In this Class? (SOLE)
Student Questionnaire

Name: _____ Age: _____

Directions for Students:

This questionnaire contains statements about practices that take place in this class. You will be asked how often each practice takes place. There are no 'right' or 'wrong' answers. Your opinion is what is wanted.

Think about how well each statement describes what this class is like for you.

Circle Number:

1	If the practice takes place	Almost Always
2	If the practice takes place	Sometimes
3	If the practice takes place	Seldom

Be sure to give an answer for all statements. If you change your mind about an answer, just cross it out and circle another.

Some statements in this questionnaire are fairly similar to other statements. Don't worry about this. Simply give your opinion about all statements.

STUDENT COHESIVENESS		Almost Always	Some-times	Seldom
1.	I make friendships easily among students in this class.	1	2	3
2.	I am friendly to members of this class.	1	2	3
3.	Members of the class are my friends.	1	2	3
4.	I work well with other class members.	1	2	3
5.	I help other class members who are having trouble with their work.	1	2	3
6.	Students in this class like me.	1	2	3
7.	In this class, I get help from other students.	1	2	3
TEACHER SUPPORT		**Almost Always**	**Some-times**	**Seldom**
8.	The teacher takes a personal interest in me.	1	2	3
9.	The teacher considers my feelings.	1	2	3
10.	The teacher helps me when I have trouble with the work.	1	2	3
INVOLVEMENT		**Almost Always**	**Some-times**	**Seldom**
11.	I discuss ideas in class.	1	2	3
12.	I give my opinions during group discussions.	1	2	3
13.	My ideas and suggestions are used during classroom discussions.	1	2	3
14.	I explain my ideas to other students.	1	2	3
15.	Students discuss with me how to go about solving problems.	1	2	3
16.	I am asked to explain how I solve problems.	1	2	3

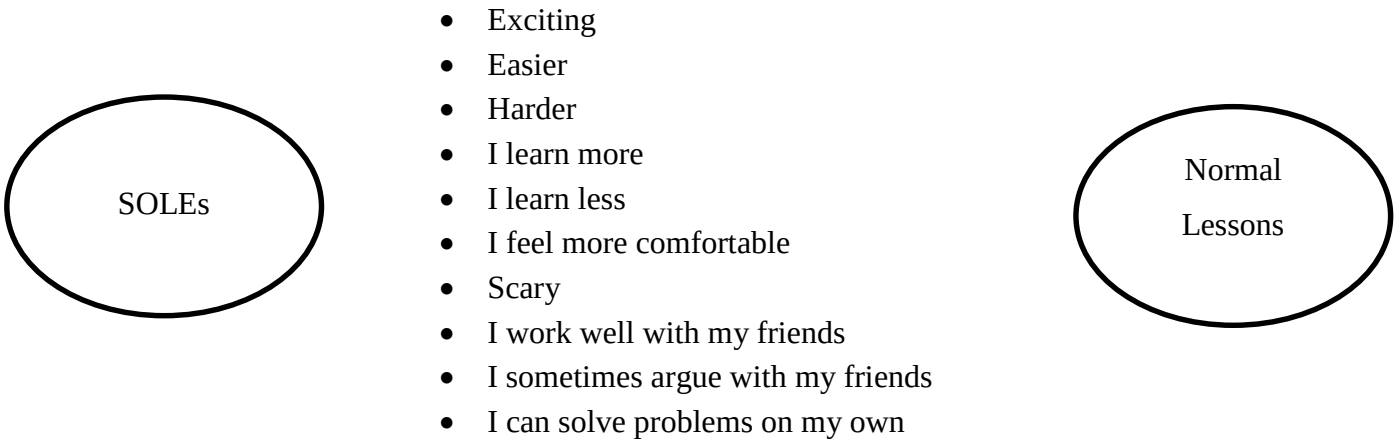
COOPERATION		Almost Always	Some-times	Seldom
17.	I cooperate with other students when doing assignment work.	1	2	3
18.	I share my books and resources with other students when doing assignments.	1	2	3
19.	When I work in groups in this class, there is teamwork.	1	2	3
20.	I work with other students on projects in this class.	1	2	3
21.	I learn from other students in this class.	1	2	3
22.	I work with other students in this class.	1	2	3
23.	Students work with me to achieve class goals.	1	2	3
EQUITY		**Almost Always**	**Some-times**	**Seldom**
24.	I have the same amount of say in this class as other students.	1	2	3
25.	I am treated the same as other students in this class.	1	2	3
26.	I receive the same encouragement from the teacher as other students do.	1	2	3
27.	I get the same opportunity to contribute to class discussions as other students.	1	2	3
28.	I get the same opportunity to answer questions as other students.	1	2	3

Modified Attitude Scale

1.	I look forward to SOLE lessons.	Disagree	Not Sure	Agree
2.	SOLE lessons are fun.	Disagree	Not Sure	Agree
3.	I enjoy the activities we do in SOLE.	Disagree	Not Sure	Agree
4.	SOLE is one of the most interesting school subjects.	Disagree	Not Sure	Agree
5.	I want to find out more about the world in which we live.	Disagree	Not Sure	Agree
6.	Finding out about new things is important.	Disagree	Not Sure	Agree
7.	I enjoy SOLE lessons in this class.	Disagree	Not Sure	Agree
8.	I like talking to my friends about what we do in SOLE	Disagree	Not Sure	Agree
9.	We should have more SOLE lessons each week.	Disagree	Not Sure	Agree
10.	I feel satisfied after a SOLE lesson.	Disagree	Not Sure	Agree

Appendix D: SOLEs and Traditional Classroom Comparison (STCC) questionnaire

Pupil Comparison of Sole and 'Normal Lesson'



Appendix E: The school teachers' questionnaire.

Supervisor: Pamela Woolner
Phone: 0191 20 85470
Pamela.Woolner@newcastle.ac.uk

Investigator: Fatma Otain
Mobile: 0504910345
F.M.O.OTAIN1@ncl.ac.uk

Teachers' questionnaire

Dear teacher:

There is no doubt that the success of any educational program requires your support. Therefore, your views and judgments are important in the development process.

In the past few weeks, we have started in your school with a research study titled: "Future of Learning: A Case Study of the Implementation of self-organised learning environments SOLE in a Saudi Primary School" to complete the requirements for a PhD in the Department of Education Technology, College of Education, University of Newcastle, UK (For more information on the program, please read the enclosed brochure). This questionnaire is designed to inform your opinion about this program and the strengths and aspects that need to be developed. I hope you will be able to participate in answering the attached questionnaire clearly and accurately. Your answers will be treated in strict confidence and will only be used for academic research purposes.

Thanks in advance for the information and a sincere effort you provide which will contribute to the enrichment of research.

Sincerely,

Fatma Otain, Investigator

First: Personal Information:

1) Educational Qualification
   - Diploma
   - Bachelor
   - Postgraduate studies

2) Years of Experience:
   - Less than 5 years
   - 5-10 years
   - More than 10 years

3) The course you are teaching: - Loghaty Religious Mathematics Science Family education National education English language other (.....)

4) The grade you are teaching: .....

Second: 1) Do you use the Internet in preparing your lessons?
   - Almost always
   - Sometimes
   - Seldom
   - Almost never

2) Do encourage your student to search for new information or questions that they are trying to identify using the Internet?
   - o Almost always
   - Sometimes
   - Seldom
   - Almost never

Third: To what extent do you agree with each of the following statements:

FIELD I: GENERAL INFORMATION						
#	**Item**	**Totally Agree**	**Agree**	**Not Sure**	**Disagree**	**Totally Disagree**
1	The integration of programs that encourage the search for new information using the Internet during classes is important					
2	Cooperative education is important in providing the student with life skills and useful information when exchanging ideas					
3	I have been trained to improve my computer skills in my teaching.					
4	I was provided with the training needed to integrate the software and e-applications into my lessons					
5	I was provided with the training needed to incorporate the Internet into teaching					

FIELD II: THE STUDENT MAY HAVE A ROLE FOR THE SELF-ORGANIZING LEARNING ENVIRONMENTS PROGRAM						
#	**Item**	**Totally Agree**	**Agree**	**Not Sure**	**Disagree**	**Totally Disagree**
6	Learn good study habits and how to self-organize					
7	Develop love of education and positive thinking					
8	Develop a strong self-esteem in making appropriate decisions (selecting the group or changing the group ...)					
9	Develop peer communication skills					
10	Developing the skills of dumping and presentation					
11	Developing problem solving skills					
12	Developing critical thinking skills					
13	Ability to work cooperatively within the team					
14	Developing social skills in dealing with others					
15	This program encourages students to dialogue and accept the other opinion					
16	I think with time the program will have positive effects on the behaviour and skills of the student life					

FIELD III: OBSTACLES ON THE USE OF TECHNOLOGY / INTERNET / COMPUTER IN THE CLASSROOM						
#	**Item**	**Totally Agree**	**Agree**	**Not Sure**	**Disagree**	**Totally Disagree**
17	The teachers' workload prevents them from using modern technologies					
18	Forcing the teachers to follow a certain plan in the curriculum so that they do not have the freedom to deliver or delay the subjects as needed					
19	These methods are not suitable for use in current curriculum					
20	Session time is not enough to use computers / smartphones / Internet					
21	Lack of encouragement from the school administration to use these means					
22	The sense of the low importance of employing digital technology in the service of education					
24	Feeling of the low importance of employing digital technology for students					
25	The weakness of the English language limits the use of modern techniques in education					
26	Absence of professional development programs aimed at integrating digital technology into curriculum					
27	Lack of computer / smart / internet equipment in the school					
28	Lack of hardware maintenance.					

Comments you would like to share:

.....

.....

.....

.....

.....

Thank and regards,

Sincerely,

Investigator

Appendix F: The parents' questionnaire

Supervisor: Pamela Woolner
Phone: 0191 20 85470
Pamela.Woolner@newcastle.ac.uk

Investigator: Fatma Otain
Mobile: 0504910345
F.M.O.OTAIN1@ncl.ac.uk

Parental questionnaire

Dear Parent/ Guardian

There is no doubt that the success of any educational program requires your support. Therefore, your views and judgments are important in the development process.

In the past few weeks, we have started in your school with a research study titled: "Future of Learning: A Case Study of the Implementation of self-organised learning environments SOLE in a Saudi Primary School" to complete the requirements for a PhD in the Department of Education Technology, College of Education, University of Newcastle, UK (For more information on the program, please read the enclosed brochure). This questionnaire is designed to inform your opinion about this program and the strengths and aspects that need to be developed. I hope you will be able to participate in answering the attached questionnaire clearly and accurately. Your answers will be treated in strict confidence and will only be used for academic research purposes.

Thanks in advance for the information and a sincere effort you provide which will contribute to the enrichment of research.

Sincerely,

Fatma Otain, Investigator

_____ _____
Principal Signature Date

_____ _____
Parent/ Guardian Signature Date

Please return this form to Teacher: Fawza - Thank you

First: Personal Information:

5) Student name (first name only) ……..

6) Educational Qualification for Parent/ Guardian
   - Less than high school
   - high school
   - Diploma after high school
   - Bachelor
   - Postgraduate studies

7) Age of Parent/ Guardian:
   - From 20 years – 29 ears
   - From 30 years – 39 ears
   - From 40 years – 49 ears
   - More than 50 years

Second: 1) Can you let me know about your daughter impression of SOLEs program (advantages, disadvantages).

2) Do you encourage your daughter to search for new information on her own using the Internet

3) What do you think about integrating Internet use into education in the classroom? And why?

4) Do you think this program has positive effects on your daughter in the present and future? What and why?

Third: After discussing your daughter about this program to what extent you agree with each of the following statements:

FIELD I: GENERAL INFORMATION						
#	**Item**	**Totally Agree**	**Agree**	**Not Sure**	**Disagree**	**Totally Disagree**
1	The integration of programs that encourage the search for new information using the Internet during classes is important					
2	Cooperative education is important in providing my daughter with life skills and useful information when exchanging ideas					
3	I can see some program features (self-organizing learning environments) on the character of my daughter					
4	My daughter enjoys participating in this program and always looks forward to it					
5	I look forward to my daughter's participation in this program in the coming years					

FIELD II: THE SECOND AREA: THIS PROGRAM MAY HAVE A ROLE FOR THE STUDENT						
#	**Item**	**Totally Agree**	**Agree**	**Not Sure**	**Disagree**	**Totally Disagree**
1	Learn good study habits and how to self-organize					
2	Develop love of education and positive thinking					
3	Develop a strong self-esteem in making appropriate decisions (selecting the group or changing the group ...)					
4	Develop peer communication skills					
5	Developing the skills of dumping and presentation					
6	Developing problem solving skills					
7	Developing critical thinking skills (selecting information that is directly related to the question)					
8	Ability to work cooperatively within the team					
9	Developing social skills in dealing with others					
10	This program encourages students to dialogue and accept the other opinion					
11	I think with time the program will have positive effects on the behaviour and skills of the student life in and out of school					

Comments you would like to share:

.....

.....

.....

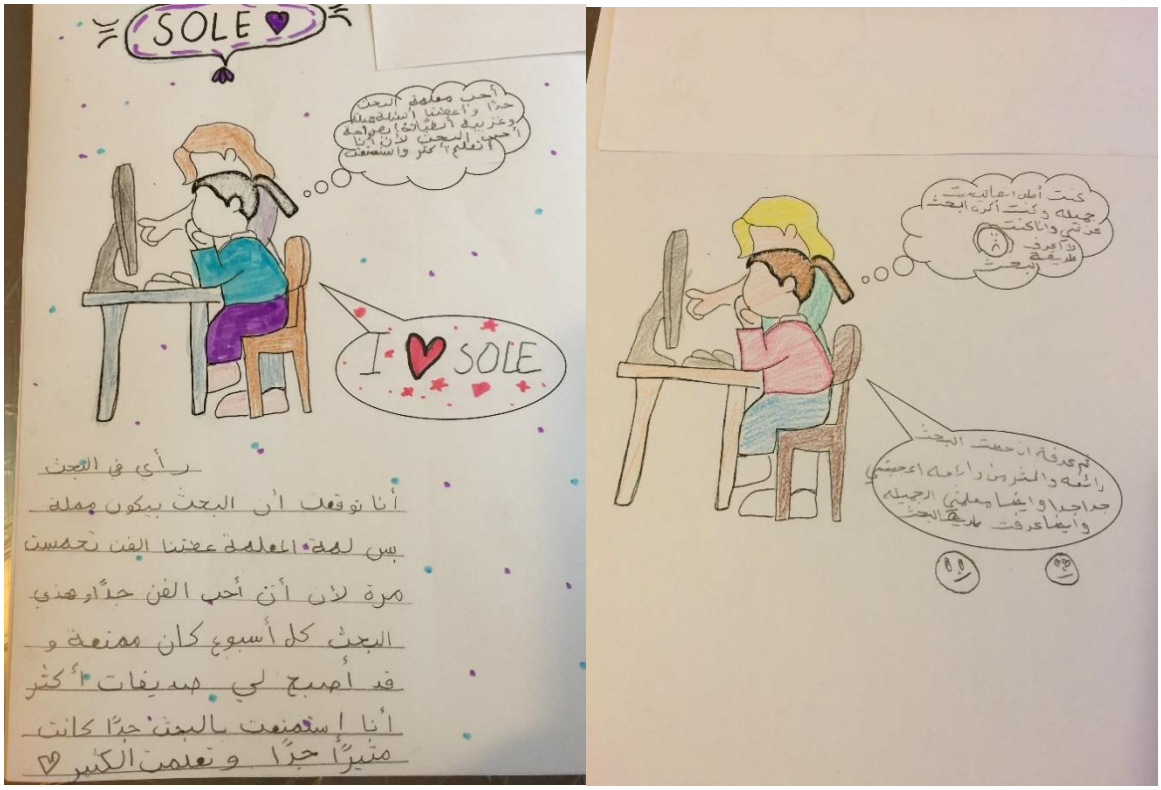
.....

Thank you again,

The pen is gift from the University of Newcastle – UK

Please return this form to teacher of the class

Appendix G: Sample of Pupil View Templates (PVTs)



Appendix H: Interview questions

Fatma: Greetings

Guest: Hi

Fatma: In the beginning I just would like to clarify that the purpose of these questions and interview is for the research that i am conducting and no one will see the answers to these questions except me the researcher and my supervisor and it will be saved on the Universities computer and my personal one.

My first question is how long is your experience in education?

Guest: 25 years.

Fatma: and in administration?

Guest: 7 years

Fatma: what is the highest qualification that you have acquired?

Guest: Bachelor's in chemistry

Fatma: To what extend do you agree or disagree with the following considering that it is big challenges facing our educational system in our current time.

Are there applications to programs such as SOAL that use a computer and the Internet, and do you believe that there is a lot of pressures on teachers which are considered to be a challenge that faces those teachers

Guest: yes, as that we see an increase in the responsibilities and tasks that are put upon teachers from year to year and it is in these aspects that we find teachers struggling to cope with all the application of such programs.

Fatma: Do you believe that teachers do not possess the capability based on their qualifications to run such programs in our schools?

Guest: No, I dont believe so, it might be the case only with a minority of teachers

Fatma: do you see that the time that is consumed to train or apply such programs is to be consuming, do you believe there is a time constraint on the application of such programs?

Guest: no, I don't believe so, because we currently have the patient lessons and activity lessons that can be used to apply such programs with all capability

Fatma: do you think that there are not enough rewards for teachers on their contributions in schools?

Guest: no not at all, in recent years we have seen many rewards to teachers to motivate them in their jobs for those who possess talent.

Fatma: do you believe that there are financial constants on the government to provide such systems and technology to apply such programs

Guest: it might be the case

Fatma: yes, I mean for traditional educational hardware such as computers and projectors, is there a budget that is specifically spend on such things or are they from the teacher's pockets?

Guest: No, there is a budget specified for such things, but we don't believe that it is enough as we have large number of classrooms and teachers, it is not fully covered.

Fatma: is it prepared by the teachers or the ministry of education?

Guest: the ministry of education

Fatma: do you have computers that are connected to the internet available for students?

Guest: yes, but not enough for the number of students we have in our school. We also try to include in our budgets that from year to year there is an increase in the number of computers available to students.

Fatma: Are the teachers trained to use technology such as interactive educational computer programs and how to merge the educational curriculum with such programs?

Guest: yes, it is in the process currently by the administration or the training department, but it is done in stages according to a set plan.

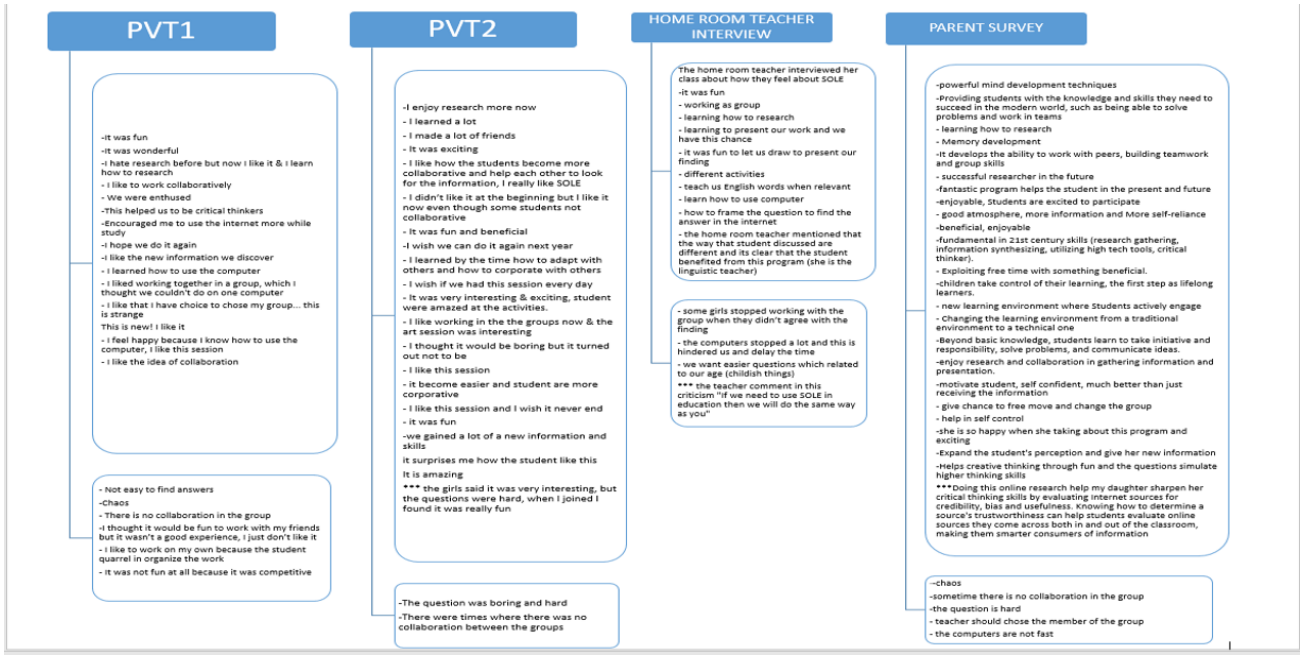
Fatma: since there are computers that are connected to the internet for teachers, do you see that maintenance of hardware is a setback that teachers face when something with the hardware goes wrong?

Guest: yes, that is the case, and it is also with **the bad usage of these machinery** make life harder in term of maintaining these machineries.

Fatma: in general, what do you believe is the main hardships that teachers face when implementing such programs in schools

Guest: like I said**,** pressures in work that face teachers and not enough preparations in term of training, application. If we concentrate on these points and consider the importance of transferring a piece of knowledge to the student and the student have numerous of sources to obtain that piece of information in an appropriate manner, then we will be able to overcome hardships in running such programs

Appendix I: A sample of the data coded under themes by data collection tool



Appendix J: Information sheet and debriefing form

Supervisor: Pamela Woolner
Phone: 0191 20 85470
Pamela.Woolner@newcastle.ac.uk

Investigator: Fatma Otain
Mobile: 0504910345
F.M.O.OTAIN1@ncl.ac.uk

Information sheet

Project Title: Future of Learning: A Case Study of the Implementation of SOLE in a Saudi Primary School

My name is Fatma Otain and I am currently a student at Newcastle University, England. I am doing a study to investigate Saudi primary school students' experience of self-organised learning environments (SOLEs). SOLEs are created when an educator encourages their class to work as a community to answer questions using computers with internet access. The class work around a guiding set of rules:

- Students need to form groups of about 4
- Children choose their own groups
- They can change groups at any time
- Children can look to see what other groups are doing and take that information back to their own group
- They should be ready to present their answers back to the class at the end of the session

This investigation endeavours to measure the impact of SOLEs environment on students' engagement and motivation while working in groups and using the internet without supervision. The study also will investigate in how students perceive the SOLEs environments in comparison with traditional classroom and what is the principal views about the challenges of introducing SOLEs in Saudi context. Newcastle University has been involved in research work for a decade and are committed to generating knowledge and understanding research that can be used with other researchers, government officials, and policy makers.

What is the study about?

This study aims to introduce a new approach that can enhance students' engagement and maximize their attainments. This is an innovative pedagogy focusing on improving children's educational experience and skills such as using the internet to research by working in groups. It is hoped that the result of this study will be sufficient to serve the education system in Saudi Arabia and share a new learning model with local authorities, academics, and the decision-makers/educators inside Saudi to help incorporate SOLEs module as part of daily schedule to enrich student and improve learning outcomes. It will be a privilege for me to have your child participating in this study. At the end of the study, I will contact you to discuss what we have found out.

Do I have to participate?

Participation in the study is completely voluntary. You are free to withdraw your son/daughter from the project at any time without this affecting his/her school records

What is involved in the study?

If you allow your child to participate, this will involve your child to attend one hour weekly sessions for a period of three months and all sessions will take place in term time in the Learning Resources Centres room in the child school. After explaining to the pupils, the experiment and their rights, the researcher will give the student a question and ask them to research for answer using the internet. During each session the researcher will observe the students focusing on the students' behaviour (engagement, motivation, self-regulation, social self-interaction skills) and how they manage to organise their groups by themselves without the researchers' intervention, and how this will improve with time. In the end of each session the student required to fill a questionnaire or pupil view templates (PVTs) to identify the students' perspective and perceptions about SOLEs and compare them with those about formal education. The experiment will be conducted on the school premises. Please be noted that the results of this experiment will have no effect on your child's school records and will not be shared with anyone in their school or out. They will only be used for the purpose of the study.

What are the benefits of the study?

There are many benefits to the study. Previous study shown, There are some direct benefits to the children are expected from participation for example Be empowered to take ownership of their learning experience, Develop the habits of a lifelong learner, Develop stronger memory recall, Strengthen interpersonal and presentation skills, etc. in addition, this research might involves helping improve education from the information we find in this study, as the main benefit from the study will arise in the research results.

Are there any possible disadvantages and risks?

There are no physical risks of participating in the study. Possible risks are for children to get distressed or worried if they couldn't find the answer for the question. To avoid them getting distressed or worried, the investigator will explain to the children they can change their groups any time during the session and look to other student work (non-competitive) and in the end of each session, after the student present their finding, will be followed by feedback from researcher. The children will be assured that the data of this experiment will be used only for the purpose of this study and will not be effect their grade.

Who has reviewed this study?

This application has been reviewed by the School Research Ethics Committee and has been given a favourable ethical opinion for conduct. If you would like your child to take part in this study please fill in one of the consent forms and give it to your child teacher.

Please keep the second copy of the Information Sheet/Consent Form for your own future reference. If you have any questions you can contact us at any time on the phone number or email at the top of Page 1.

What will happen to the results of this study?

The research findings might be published in academic journals. However, these findings will be on an aggregate level and will not feature information about any particular school in any way. Your school will not be identifiable from anything published.

Confidentiality: We will take the following steps to keep information about your child confidential, and to protect it from unauthorised disclosure, tampering, or damage. The results of this experiment will be used solely for the purpose of this study and will not be passed on to a third party or used for additional studies without your consent. Results will not be shared with other students, parents or teachers. We need to protect who you are and your results so all the information will be kept on a computer that is protected. Additionally, Individuals will not be named in written documents. Any data used in interim or final reports will be anonymised.

Please note that participation is voluntary and that you are free to withdraw your child at any time, without giving a reason. The children have the option of opting out of the study if they wish too. This includes immediately, before or during the study. If you have, any other further questions about the study please contact me or the other research members on the information provided above.

Thank you.

Supervisor:
Pamela Woolner Phone: 0191 20 85470
Pamela.Woolner@newcastle.ac.uk

Investigator: Fatma Otain
Mobile: 0504910345
F.M.O.OTAIN1@ncl.ac.uk

Debriefing Form

Project Title: Future of Learning: A Case Study of the Implementation of SOLE in a Saudi Primary School

Thank you for participating in this study! We hope your child enjoyed the experience. This form provides background about our research to help you learn more about why we are doing this study. Please feel free to ask any questions or to comment on any aspect of the study.

You just have agreed for your child to participated in a research study conducted by: Fatma Otain, f.m.o.otain1@ncl.ac.uk

You were told that the general purpose of this research is to investigate Saudi primary school students' experience of self-organised learning environments (SOLEs). In actuality, we were interested to know how children behave in SOLEs environments; how does their behaviour change over time? (Engagement, motivation, self-Regulatory, Social self-interaction skills). In addition to that, how students perceive the SOLEs environments in comparison with traditional classroom? The results from this study might involves helping improve education from the information we find in this study, as the main benefit from the study will arise in the research results.

As you know, your participation in this study is voluntary. If you so wish, you may withdraw your child after reading this debriefing form, at which point all records of his/her participation will be destroyed.

If you have questions or any concern about the research, please feel free to contact me or the other research members on the information provided above.

For more information about SOLEs project, please see the following link:

- https://s3-eu-west-1.amazonaws.com/school-in-the-cloud-production-assets/toolkit/SOLE_Toolkit_Web_2.6.pdf
- https://twitter.com/schoolincloud

Appendix K: Consent letter used for children and their parents

STUDINT INFORMATION FORM

Dear student

My name is Fatma Otain and I am currently a student at Newcastle University, England.

For next couple of weeks we going to do SOLEs. SOLEs is new padogogy where student work in groups to answer questiond using the internet. The class work around a guiding set of rules:

- Students need to form groups of about 4
- Children choose their own groups
- They can change groups at any time
- Children can look to see what other groups are doing and take that information back to their own group
- They should be ready to present their answers back to the class at the end of the session

I have ask the headteacher premition to do this experment

I have ask your parnts premtion so you can participate in this study

If you have any questions about the study please feel free to ask.

Thank you.

Supervisor: Pamela Woolner
Phone: 0191 20 85470
Pamela.Woolner@newcastle.ac.uk

Investigator: Fatma Otain
Mobile: 0504910345
F.M.O.OTAIN1@ncl.ac.uk

Parental Information Form

Project Title: Future of Learning: A Case Study of the Implementation of SOLE in a Saudi Primary School

Dear Parent/ Gaurdian

My name is Fatma Otain and I am currently a student at Newcastle University, England. I am doing a study to investigate Saudi primary school students' experience of self-organised learning environments (SOLEs). SOLEs are created when an educators encourages their class to work as a community to answer questions using computers with internet access. The class work around a guiding set of rules:

- Students need to form groups of about 4
- Children choose their own groups
- They can change groups at any time
- Children can look to see what other groups are doing and take that information back to their own group
- They should be ready to present their answers back to the class at the end of the session

This investigation endeavours to measure the impact of SOLEs environment on students' engagement and motivation while working in groups and using the internet without supervision. The study also will investigate in how students perceive the SOLEs environments in comparison with traditional classroom and what is the principal views about the challenges of introducing SOLEs in Saudi context. Newcastle University has been involved in research work for a decade and are committed to generating knowledge and

understanding research that can be used with other researchers, government officials, and policy makers.

What is the study about?

This study aims to introduce a new approach that can enhance students' engagement and maximize their attainments. This is an innovative pedagogy focusing on improving children's educational experience and skills such as using the internet to research by working in groups. It is hoped that the result of this study will be sufficient to serve the education system in Saudi Arabia and share a new learning model with local authorities, academics, and the decision-makers/educators inside Saudi to help incorporate SOLEs module as part of daily schedule to enrich student and improve learning outcomes. It will be a privilege for me to have your child participating in this study. At the end of the study, I will contact you to discuss what we have found out.

Do I have to participate?

Participation in the study is completely voluntary. You are free to withdraw your son/daughter from the project at any time without this affecting his/her school records

What is involved in the study?

If you allow your child to participate, this will involve your child to attend one hour weekly sessions for a period of three months and all sessions will take place in term time in the Learning Resources Centres room in the child school. After explaining to the pupils, the experiment and their rights, the researcher will give the student a question and ask them to research for answer using the internet. During each session the researcher will observe the students focusing on the students' behaviour (engagement, motivation, self-regulation, social self-interaction skills) and how they manage to organise their groups by themselves without the researchers' intervention, and how this will improve with time. In the end of each session the student required to fill a questionnaire or pupil view templates (PVTs) to identify the students' perspective and perceptions about SOLEs and compare them with those about formal education. The experiment will be conducted on the school premises. Please be noted that the results of this experiment will have no effect on your child's school records and will not be shared with anyone in their school or out. They will only be used for the purpose of the study.

What are the benefits of the study?

There are many benefits to the study. Previous study shown, There are some direct benefits to the children are expected from participation for example Be empowered to take ownership of their learning experience, Develop the habits of a lifelong learner, Develop stronger memory recall, Strengthen interpersonal and presentation skills, etc. in addition, this research might involves helping improve education from the information we find in this study, as the main benefit from the study will arise in the research results.

Are there any possible disadvantages and risks?

There are no physical risks of participating in the study. Possible risks are for children to get distressed or worried if they couldn't find the answer for the question. To avoid them getting distressed or worried, the investigator will explain to the children they can change their groups any time during the session and look to other student work (non-competitive) and in the end of each session, after the student present their finding, will be followed by feedback from researcher. The children will be assured that the data of this experiment will be used only for the purpose of this study and will not be effect their grade.

Who has reviewed this study?
This application has been reviewed by the School Research Ethics Committee and has been given a favourable ethical opinion for conduct. If you would like your child to take part in this study please fill in one of the consent forms and give it to your child teacher.
Please keep the second copy of the Information Sheet/Consent Form for your own future reference. If you have any questions you can contact us at any time on the phone number or email at the top of Page 1.

What will happen to the results of this study?
The research findings might be published in academic journals. However, these findings will be on an aggregate level and will not feature information about any particular school in any way. Your school will not be identifiable from anything published.

Confidentiality: We will take the following steps to keep information about your child confidential, and to protect it from unauthorised disclosure, tampering, or damage. The results of this experiment will be used solely for the purpose of this study and will not be passed on to a third party or used for additional studies without your consent. Results will not be shared with other students, parents or teachers. We need to protect who you are and your results so all the information will be kept on a computer that is protected. Additionally, Individuals will not be named in written documents. Any data used in interim or final reports will be anonymised.

Please note that participation is voluntary and that you are free to withdraw your child at any time, without giving a reason. The children have the option of opting out of the study if they wish too. This includes immediately, before or during the study. If you have, any other further questions about the study please contact me or the other research members on the information provided above.

Thank you.

Supervisor: Pamela Woolner
Phone: 0191 20 85470
Pamela.Woolner@newcastle.ac.uk

Investigator: Fatma Otain
Mobile: 0504910345
F.M.O.OTAIN1@ncl.ac.uk

Future of Learning: A Case Study of the Implementation of SOLE in a Saudi Primary School

I _____ (parent/ guardian) have read the statement provided for the above research project. I give permission for my child _____ (child's name) to take part in the research activities

I understand that:

- All results from the study are confidential and will be used strictly for the purposes of academic research
- Codes or pseudonyms will be used to protect my child's identity and right to confidentiality.
- Participation is voluntary and that I can withdrawal my child from the project at any time without needing to give a reason.

_____
_____

Parent/ Guardian Signature Date

Please return this form to your child's class teacher – Thank you

Appendix L: Consent letter used for head teacher and school teachers

Supervisor: Pamela Woolner
Phone: 0191 20 85470
Pamela.Woolner@newcastle.ac.uk

Investigator: Fatma Otain
Mobile: 0504910345
F.M.O.OTAIN1@ncl.ac.uk

Principal consent form

Future of Learning: A Case Study of the Implementation of SOLE in a Saudi Primary School

Dear …….

Declaration of Consent

It is a university requirement that all respondents give their formal consent to take part in any research. For this reason, could you please sign and date the declaration below.

Consent

I have read the statement provided for the above research project and I have had the opportunity to ask questions. I consent to participate in this research project. I understand that all the data will be kept confidential and I will be anonymous in the research report. I also know that the data gathered from this project will be used for the purposes stated in the Participant Information Form.

I understand that participation is voluntary and that withdrawal from the project is possible at any time without needing to give a reason.

Name of participant:_____ Signed:_____ Date:_____

Name of researcher:_____ Signed:_____ Date: _____

Supervisor: Pamela Woolner
Phone: 0191 20 85470
Pamela.Woolner@newcastle.ac.uk

Investigator: Fatma Otain
Mobile: 0504910345
F.M.O.OTAIN1@ncl.ac.uk

Dear teacher: ……..

Future of Learning: A Case Study of the Implementation of SOLE in a Saudi Primary School

Declaration of Consent

It is a university requirement that all respondents give their formal consent to take part in any research. For this reason, could you please sign and date the declaration below.

Consent

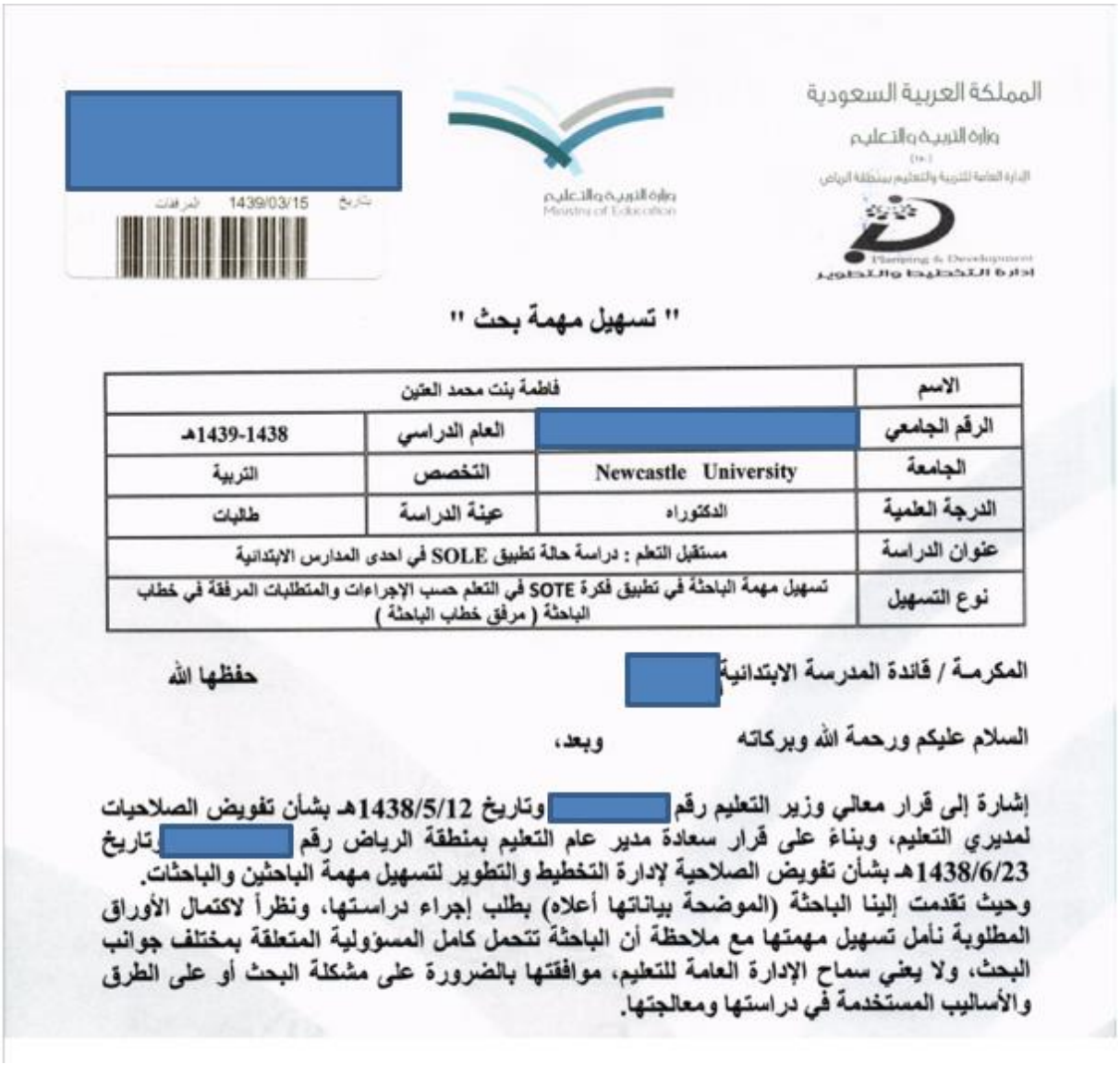
I have read the statement provided for the above research project and I have had the opportunity to ask questions. I consent to participate in this research project. I understand that all the data will be kept confidential and I will be anonymous in the research report. I also know that the data gathered from this project will be used for the purposes stated in the Participant Information Form.

I understand that participation is voluntary and that withdrawal from the project is possible at any time without needing to give a reason.

Name of participant:_____ Signed:_____ Date:_____

Name of researcher:_____ Signed:_____ Date: _____

Appendix M: Permission letter from the Planning and Development Department at the Ministry of Education in Saudi Arabia



المملكة العربية السعودية
وزارة التربية والتعليم
الإدارة العامة للتربية والتعليم بمنطقة الرياض
Planning & Development
إدارة التخطيط والتطوير

وزارة التربية والتعليم
Ministry of Education

[redacted]
التاريخ 1439/03/15
المرفقات

" تسهيل مهمة بحث "

الاسم	فاطمة بنت محمد العتين		
الرقم الجامعي	[redacted]	العام الدراسي	1438-1439هـ
الجامعة	Newcastle University	التخصص	التربية
الدرجة العلمية	الدكتوراه	عينة الدراسة	طالبات
عنوان الدراسة	مستقبل التعلم : دراسة حالة تطبيق SOLE في احدى المدارس الابتدائية		
نوع التسهيل	تسهيل مهمة الباحثة في تطبيق فكرة SOTE في التعلم حسب الإجراءات والمتطلبات المرفقة في خطاب الباحثة (مرفق خطاب الباحثة)		

المكرمة / قائدة المدرسة الابتدائية [redacted] حفظها الله

السلام عليكم ورحمة الله وبركاته وبعد،

إشارة إلى قرار معالي وزير التعليم رقم [redacted] وتاريخ 1438/5/12هـ بشأن تفويض الصلاحيات لمديري التعليم، وبناءً على قرار سعادة مدير عام التعليم بمنطقة الرياض رقم [redacted] وتاريخ 1438/6/23هـ بشأن تفويض الصلاحية لإدارة التخطيط والتطوير لتسهيل مهمة الباحثين والباحثات.
وحيث تقدمت إلينا الباحثة (الموضحة بياناتها أعلاه) بطلب إجراء دراستها، ونظراً لاكتمال الأوراق المطلوبة نأمل تسهيل مهمتها مع ملاحظة أن الباحثة تتحمل كامل المسؤولية المتعلقة بمختلف جوانب البحث، ولا يعني سماح الإدارة العامة للتعليم، موافقتها بالضرورة على مشكلة البحث أو على الطرق والأساليب المستخدمة في دراستها ومعالجتها.

Appendix N: Arabic version of the information sheet

جامعة نيوكاسل
المشرف: بامسل ورنير
تلفون: 01912085470
Pamela.Woolner@newcastle.ac.uk
الباحث: فاطمة عتين
جوال: 0504910345
F.M.O.OTAIN1@ncl.ac.uk

خطاب موافقة المدير لإجراء دراسة بحثية

التاريخ 2018 /22/1

السيد/ .....مدير المدرسة

العنوان

عزيزي، المدير

اسمي فاطمة العتين، وأنا حاليا أعمل على نيل درجة الدكتوراه مع جامعة نيوكاسل. أود أن أطلب موافقتكم لمشاركة المدارس الخاصة بكم في بحثي بعنوان: "مستقبل التعلم: دراسة حالة تطبيق لـ سولي في مدرسة ابتدائية سعودية"

يتم إنشاء سولز عندما يشجع المعلمين الفصول الخاصة بهم للعمل كمجتمع للإجابة على أسئلة باستخدام أجهزة الكمبيوتر الموصولة بالإنترنت. يتمحور عمل الفصل حول مجموعة من القواعد الإرشادية:

- يحتاج الطلاب لتشكيل مجموعات من حوالي 4
- الأطفال يختارون مجموعاتهم الخاصة
- يمكنهم تغيير المجموعات في أي وقت
- يمكن للأطفال تفقد ورؤية ما تقوم به المجموعات الأخرى وأن يطلعوا مجموعاتهم بهذه المعلومات
- يجب أن يكونوا مستعدين لتقديم إجاباتهم إلى الفصل في نهاية الدورة

آمل أن تسمح لي إدارة المدرسة بتعيين (على سبيل المثال، تحديد 30 طالبا من السنة 6-4) من المدرسة للمشاركة في دراستي. نظراً لطبيعة الدراسة، سوف أقوم بإعداد بيئة سولي والطالب، في حال تم منح الموافقة، سوف يحضر الطالب حصص أسبوعية لمدة ساعة لفترة ثلاثة أشهر. تقام كل الحصص في الوقت المحدد في غرفة مركز مصادر التعلم في المدرسة. مشاركة الطالب لن يعطل الدروس الصفية، وسوف تجري في الحصص الغير شاغرة. لن يتم تحديد عينات الطالب للحفاظ على السرية. الطلاب المهتمين، الذين يتطوعون للمشاركة، سيتم إعطائهم نموذج موافقة ليتم توقيعها من قبل الوالدين أو ولي الأمر (مرفق نسخة) وإعادتها إلى الباحث الأساسي في بداية عملية البحث.

سيقوم المعلمون بتسليم واستلام نماذج الإذن للطلاب التي تخطر الآباء بأن الطالب سيشارك في واحد أو أكثر من طرق جمع البيانات التالية:

الملاحظة أثناء المشاركة في حصص أسبوعية

هناك العديد من الفوائد للدراسة. فقد أظهرت الدراسة السابقة، أن هناك بعض الفوائد المباشرة للأطفال متوقعة من المشاركة على سبيل المثال القدرة على تولي ملكية تجربة التعلم، وتطوير عادات المتعلم مدى الحياة، وتطوير قوة استرجاع الذاكرة، وتعزيز مهارات التواصل بين الأشخاص والتقديم، إلى أخرة. بالإضافة إلى ذلك، قد تتضمن هذا البحث على المساعدة في تحسين التعليم نتيجة للمعلومات التي نجدها في هذه الدراسة، حيث أن الفائدة الرئيسية من الدراسة ستظهر في نتائج البحث.

وستكون موافقتك على إجراء هذه الدراسة محل تقدير كبير. وسيتم تضمين نسخة من خطاب موافقتنا من مدرسة في منطقة الرياض. في حال موفقتكم، يرجى التوقيع على نموذج الموافقة المرفقة. وسيكون هذا النموذج جزءا من خطاب موافقة الطالب الذي سيتم إرساله إلى الوالدين .إذا كان لديك أي أسئلة أخرى حول الدراسة يرجى الاتصال بي أو بالأعضاء الآخرين في البحث بخصوص المعلومات المذكورة أعلاه.

المخلص،

وأؤكد أنني قرأت ورقة المعلومات المتعلقة بالبحث وأدلي بموافقتي لـ _____ للمشاركة في أنشطة البحث. وسيشتمل ذلك مشاركة البيانات المدرسية والطلابية، على نحو مناسب، مع الباحثين.

أي بيانات تنتج ويتم الحصول عليها سيتم نقلها بعناية فائقة من قبل الباحثين. وسيتم التعامل معها على أنها معلومات سرية ضمن المشروع البحثي. في حال مشاركة الطلاب، سيتم تسجيل الاسم الأول فقط والفئة العمرية. لن يتم تسمية الأفراد في وثائق مكتوبة. وسيتم إخفاء هوية أي بيانات مستخدمة في التقارير المرحلية أو النهائية. سيتم تخزين معلومات تحديد هوية المشاركين البالغين بشكل منفصل في بيانات المقابلة، والتي سيتم ترميزها. وقد تكون المقابلات مسجلة صوتياً وتدون. الملفات النصية والصوتية سيتم ترقيمها وترميزها، مع تحديد البيانات المخزنة بشكل منفصل. سيتم تخزين التعيينات المادية بشكل آمن في مكتب مقفل. البيانات الإلكترونية سيتم تخزينها على خوادم بيانات البحوث محمية برقم سري في الجامعة. سيتم تخزين النصوص والملفات لمدة خمس سنوات وفقا لتوجيهات جمعية البحوث التربوية البريطانية وسيمكن المشاركين من الوصول إلى البيانات الخاصة بهم في أي وقت خلال الفترة. في التقرير عن البحث، لن يتم تسمية الأفراد في وثائق مكتوبة أو في العناوين المصورة ولن يتم تحديد مدارس معينة مع نتائج معينة.

وأنا أفهم أن المشاركة في هذه الدراسة البحثية هي تطوعية، وأنه يمكننا الانسحاب من المشروع البحثي في أي وقت.

يرجى كتابة الاسم .....

التوقيع .....

التاريخ .....