



**Early Childhood Students' Use of Educational Apps: A case
study of Saudi teachers' perceptions and practices**

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Sarah Alarfaj
School of Education
University of Leicester

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Sarah Alarfaj

Abstract

This study explored the potential use of educational apps (EAs) in early childhood education. Studies of teaching and learning have shown not only the benefits of EAs but also certain limitations. Although EAs have been used in classrooms for many years, resistance to them continues to be a common response among teachers (Bovey & Hede, 2001). Researchers have found that teachers' perspectives play a key role in their adoption of EAs in their classrooms.

This study focused on Saudi teachers' thoughts and use of EAs that have the potential to enable pupils, ages four and five, to learn and support teaching. Most empirical studies have focused on the use of EAs and the nature of students' interactions with them, while few have addressed teachers' views of EAs' ability to affect their teaching. Further, very few studies of the use of technology in classrooms have been conducted in the Kingdom of Saudi Arabia (KSA), where EAs are still considered new teaching methods.

The present study was conducted in a state-run pre-school in KSA. Data were collected through interviewing 12 teachers to understand to what extent, how, and why EAs have the potential to be used in classrooms. This was followed by classroom observations to capture the possibility of change EAs bring to teaching and learning. The results show, first, that teachers perceived EAs as useful for facilitating access to learning content drawing on language and literacy, and numeracy. Second, EAs are used daily to enable students to complete an array of self-learning activities (SLAs) individually and in a limited time. Then, the findings illustrate the considerable effects of using EAs, such as holding students' attention and promoting the development of students' subject knowledge. However, further analyses highlight that the adoption of EAs faces several barriers, including home use, in terms of parents' lack of awareness of the effects of technology on their children. Based on these results, practices and further research relevant to the usage of EAs are discussed.

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Glossary of Terms

The following terms would be used in this study:

- Early childhood education: The process of facilitating learning to students under six years old in classrooms in pre-schools.
- Conventional self-learning activities (SLAs): A method used to engage young pupils of early childhood stage (age 3 – 5) with various independent cognitive tasks/ exercises, which have their contents developed across range of early subjects, including language and literacy; and numeracy (Ministry of Education [MOE], 2020a). The focus of teaching, here, places the emphasis on students' use of physical learning materials, such as whiteboards, teacher-made instructional materials, or toys, to undertake SLAs, but these are not 100% self-learning as they need the guidance of teachers (AL-Othman et al., 2015; Sjoerdsma, 2016).
- language and literacy: An interrelationship of speaking, listening, writing and reading which are very important language skills, including the knowledge of alphabet codes and phonological awareness (Johnston & Halocha, 2010). Preschools conduct alphabet learning to develop students' self-esteem and skills used in expressing themselves. Chances are provided to students to enjoy listening, speaking, reading and writing, and their skills are tested by practicing different letters and words and reacting with each other through discussions and practice (Palaiologou, 2013).
- Numeracy: Basic mathematical awareness aimed to develop early mathematical skills, which consist of the use of shapes and numbers for counting (Beckley, Elvidge & Hendry, 2009).
- Digital SLAs: A method that apply technological tools, techniques and equipment to engage young learners with independent cognitive tasks without the guidance of teachers (Hammed, 2014). According to Ertmer et al. (1999), digital learning is defined as an underlying learning structure that applies technologies that have the ability to offer opportunities for students to access information and tasks/exercises that are relevant to early childhood education. This study focuses on the use of tablet computers because of their affordability

and their capability to enable learning and support teaching with a large array of apps.

- Tablet computer: A wireless portable device with connectivity having a touch screen interface (Henderson & Yeow, 2012), used for its ability to access subject knowledge electronically in the classroom at various schooling stages (Vanderlinde, Aesaert & van Braak, 2014).
- EAs (a shortened form of educational apps): Interactive media that facilitate active usage by students; software programmes, which run-on tablet computers, are developed for the purpose of learning subject knowledge for a specific age group through an appropriate blend of games, practice, and learning goals.
- Perceptions: The ability of teachers to be aware or to know; processes of evaluation that teachers apply to their own teaching based on information, attitudes, values, theories, and assumptions they have accumulated over time and that they bring into their classrooms.

Chapter 1: Introduction

This study explored the possibility of using educational apps (EAs) to enhance learning and support teaching in early childhood institutions. The use of EAs is one of the latest effort by the Ministry of Education (MOE) to support young pupils aged four to five years in the early childhood stage working with self-learning activities (SLAs) (MOE, 2020). SLA is a method used to engage learners with exercises/tasks, which include content from a range of early stage subjects, including language and literacy (alphabets), and numeracy (numbers and shapes) (Palaiologou, 2013), but these are not 100% self-learned as they require the guidance of teachers (AL-Othman et al., 2015; Sjoerdsma, 2016). However, there has been renewed interest around the world on using an approach in which a student can receive guidance from EAs instead of a teacher (Behnamnia et al., 2018). That is, learners have the opportunity to engage with SLAs in which they have autonomy in their learning (Bello, 2014; Castek & Beach, 2013; Comi et al., 2017), whilst being observed by their teachers. These activities are based on the premise that learners take the initiative to interact with learning tasks without the assistance of their teachers (Peng, 2011).

Over the past few years, EAs have gained prominence as new learning tools that enable young learners to engage with SLAs on language and literacy, and numeracy in order to develop their reading and writing skills (D'Agostino et al., 2016; Dennis, 2016; Kiili et al., 2014). EAs are of interest in this study because they have the potential to change teaching methods and materials. Very little is known about this subject generally and in Saudi early childhood learning specifically. The aim of this study was to explore the possibility of engaging learners aged four and five with EAs in preschools in the Kingdom of Saudi Arabia (KSA). The motivation behind the current study was the desire to understand the potential of EAs in creating new SLAs that can enhance the process of teaching and learning. Although the MOE introduced an initiative in 2016 (MOE, 2020) to use EAs in early childhood learning, a few studies, such as those of Alzannan (2015), Sulaymani, Flear and Chapman (2018), and Sulaymani and Flear (2019), were carried out in the KSA with the aim of understanding how EAs are used to reform teaching and learning practices.

The current study focused on building an understanding of the affordances of EAs that are used by teachers in a pre-school in KSA. The focus herein is on the teachers' perceptions of students' learning rather than the learning itself. This is because, while the Saudi MOE may be trying to incorporate EAs to enhance learning, the teachers' perceptions seem to play a major role in hindering their application for students' use (Amoudi & Sulaymani, 2014). Resistance to the use of digital technologies, and their availability to learners, appears to be common among early childhood teachers (Bovey & Hede, 2001; Howard & Mozejko, 2015). Therefore, the aim of this study was to investigate teachers' perspectives and experiences of using EAs to change learning practice in early childhood classrooms, and the impact of such change on students' interactions. This was achieved by closely examining and observing the interplay between teaching instructions and EAs, the resulting changes in teaching methods and materials, and their potential for learning.

This topic has been chosen for several reasons. Firstly, this study aims to capture the change of using EAs in SLAs and the impact of such change on student interactions. This may prove to be useful in informing teachers and policymakers on the potential of EAs. Secondly, limited studies exist on using EAs in the Saudi context (Sulaymani and Flear, 2019). The study's findings could be used to enhance the early childhood training programmes and facilitate the implementation of these apps in the early childhood classroom. Moreover, the findings could be of relevance to teachers in other early childhood schools in the KSA, since all schools in the country follow the same educational system and learning processes in terms of curriculum, teaching guide, and teacher training (Alnaji, 2014).

As a university teacher who teaches student teachers, I will not only be able to inform my teaching practices in relation to digital learning approaches in pre-schools but also provide further evidence of the training needs of teachers. The results of this research will help early childhood teacher-trainers design the initial teacher training programme. As an early childhood teacher-trainer myself at a Saudi university, I believe that I may contribute to improving teachers' pedagogy in two ways:

1. Help policymakers in the development of teachers' pedagogy to include an introduction of EAs for teaching and learning

2. Provide opportunities for student-teachers to explore the use of EAs in early childhood learning under the supervision of the Saudi university (where I have been teaching), which invests much time, effort and money in re-evaluating teacher education programmes.

To make these initiatives a reality, I can provide information on improving the context and knowledge being taught, as well as the approaches to teaching and learning. Supported by developments in teaching and learning theories, changes to digital learning could be achieved with consistent teacher training and education programmes focusing on EAs and early childhood learning.

Additionally, this study helped answer three questions (which are also part of my RQs): (1) How can EAs be integrated/used in early childhood learning practice? (2) What are the challenges preventing such an integration? (3) What are the effects of this integration for young students? Although answering these questions is part of my own development as a teacher-trainer, my role in the research context (the pre-school) at the time of the study was as an early childhood faculty member. My task was to evaluate the digital learning proficiency of early childhood students aged four and five. Thus, the validity of my interpretations of the social event is questionable. It is possible that in trying to interpret and understand the results, I might rely on “what it feels to be a participant in the action under study” (Verma & Mallick, 1999, p. 29). Here, I am part of the activity being explored as an *insider*.

As I relied on my experiences as an early childhood faculty member to interpret the information provided by the participants, the current research was conducted by ensuring that the participants’ perceptions were accounted for. My role was to help teachers verbalise these issues without influencing their opinions one way or the other. This was achieved through building a dialogue with the participants, who expressed their perceptions, experiences and use of EAs in their classrooms. My task was to find meaning in all encountered issues and in every interaction with the participants. The main instruments for conducting this study were conversations, evaluations and interpretations (more details can be found in Chapter 4, Section 4.5.1).

This chapter firstly provides a brief introduction into the historical aspects of the educational system and its current status in the KSA. It then discusses the possibility of the change that EAs can bring to SLAs in early childhood institutions. Secondly, the possibilities of this new learning practice in classrooms from the standpoint of early childhood researchers and teachers is discussed. The chapter explains (1) why the study focuses on Goodwin's (2012) classification of 'instructive', a typical example of which are the well-known gaming apps; and (2) why the study is conducted in the KSA. Finally, the chapter presents the research questions that guided this study to address the research gaps discussed in Chapter 2 and 3.

1.1 Background

The rapid evolution of digital technologies has had significant influences on the modern social world (Dhir, Gahwaji & Nyman, 2013, Neumann & Neumann, 2017). Many adults and children have been exposed to different forms of technology tools, both at home and in the outside world (Kalogiannakis & Papadakis, 2017). With the increased use of technology in society over the past few decades, research has highlighted the prominence of these technologies among individuals, including students, thanks to issues such as easy access to simulated information (Souto et al., 2020). Digital technology has now gained widespread use in many organisations, including businesses, governments, and educational systems. Consequently, policymakers in the education sector have turned their attention to the significance of introducing these technologies into schools to support teaching and enable learners to be equipped with the knowledge and skills that are required in the twenty-first century (Dong & Newman, 2016). Students' use of technological devices and resources have been implemented at various levels of schooling (Gil-Flores, Rodríguez-Santero & Torres-Gordillo, 2017; Jimoyiannis & Komis, 2007).

A great deal of research reports the use of several types of technological tools, both hardware (computers, tablet computers and mobile phones) and software (databases, multimedia programmes and apps) that enable teachers to facilitate SLAs electronically (Lin, Cherng & Chen, 2017; Yalin, Karadeniz & Shain, 2007). As a result of the increasing popularity and availability of various digital technologies suitable for all educational stages (Alzannan, 2015), teachers have sought to use hardware and software that are useful for the processing of information, while enabling students to practice

various skills and knowledge (Hammed, 2014; Hirsh-Pasek et al., 2015). Due to the rapid development of educational technologies, the current study aimed to explore teachers' perspectives and experiences of using EAs to change learning practice in early childhood classrooms, and the impact of such change on students' interactions. Thus, the following sub-sections provide a brief history of the start of the early childhood educational system, followed by the current status of this system in the KSA.

1.1.1 A brief history of the Saudi educational system

The first step towards a national educational system in KSA was the establishment of a local educational authority in Mecca in 1926 (MOE, 2017a). Its mission was to organise schools in the city and to oversee the teaching and learning processes. The critical step towards a national educational system, as reported by Aldaweesh and Almoharb (2012), was laid later that year, when the General Directorate of Education, an educational committee, was set up in the Western Province (Alqarni, 2015). This committee, according to Alqarni (2015, p. 70), “was solely responsible for opening schools, ... as stated in Article 23 of the 1926 Constitution of the Kingdom.”

By the end of 1926, twelve primary schools in the KSA were opened for boys only. Following this, the educational committee opened the first secondary school, also for boys only, in 1927; its objective was to prepare its students as educators who would teach in primary schools (Algarfi, 2010). In 1935, the first all-male high school opened to prepare graduates to study at national and international universities (Alhogail, 2011). The educational policies of these male schools aimed to provide education that met the social and economic needs, and the religious customs, of the country (MOE, 2020).

In the middle of the twentieth century, the Saudi educational authorities started to allow girls to receive an education (Algasseem, Doaa & Alzahrani, 2016). However, they considered that male and female education should be conducted differently, and that the two sexes should be instructed separately (MOE, 2020). Therefore, separate public schools were established to provide free education for students aged between six and eighteen. In 1960, the Saudi government opened the first female school in Riyadh (Alamri, 2011), and by the end of the 1990s, 3 female schools were open—but with only 3 classes for 103 students (Al Shaer, 2015). By the end of 2006, 106 female schools with 260 classes and 4,087 students were open across the KSA, including

Riyadh, Mecca and Dammam (ibid). These female schools' educational policies were also established with the intention of providing an education that meets the Saudi social needs and religious customs (MOE, 2020).

The increased number of girls receiving education has shaped the Saudi educational and social structures. For example, the number of females in the workplace has increased since the middle of the twentieth century (AL-Othman et al., 2015). This in turn has created the need for childcare institutions (Palaiologou, 2013). In 1965, the country established its first private pre-school in Jeddah. A public pre-school was opened in Riyadh a year later, followed by two public pre-schools in Dammam and Alhsa in 1967 (Aljabreen & Lash, 2016). Since then, the Saudi government has established several educational and childcare settings that contribute to the academic development of early childhood students (AL-Othman et al., 2015).

1.1.2 The Saudi educational system

The Saudi educational system is the outcome of the interplay between various authorities and agencies. The highest educational authority is the Supreme Commission on Educational Policy, responsible for developing policy for primary, intermediate and secondary schools at a national level (Almutairi, 2015). To implement these policies in well-defined educational settings, three primary educational offices were established. These are the MOE, the Ministry of Higher Education (MOHE) and the Technical and Vocational Training Corporation (United Nations Educational, Scientific and Cultural Organization [UNESCO], 2011).

The MOE is the key educational office in the KSA (Alqarni, 2015). The Saudi government established the MOE officially in 1953. The ministry monitored and regulated the education in male schools: primary schools, secondary schools and high schools. For example, the first Minister of Education, King Fahad, initiated the modernisation of learning resources in Saudi schools (Ministry of Higher Education [MOHE], 2006). In 1960, the Saudi educational authorities formally established the General Principle for Girl Education (GPGE) with the specific goal of monitoring and regulating girls' education from pre-schools to secondary schools (Rugh, 2002). However, the MOE took over the GPGE in 2002. The MOE has since been overseeing

and regulating education provision in male and female schools across the Kingdom, thus streamlining the educational system (MOE, 2020).

The Saudi educational system is now exclusively controlled by the MOE (MOE, 2020). The MOE ensures the setup, usage and monitoring of Saudi educational policy that meets the economic and social needs of the Kingdom, and adheres to its religious customs. It also strives to improve the proficiency of educators and reduce illiteracy among Saudis (Al Shaer, 2015). Under the MOE's requirements, the system of education is divided into four broad systems (Aldaweesh & Almoharb, 2012):

1. Pre-schools/early childhood education available to students aged from three to six and lasting for three years;
2. Primary school/education starting at the age of six and lasting for six years;
3. Intermediate school/education starting at the age of twelve and lasting for three years; and
4. Secondary school/education starting at the age of fourteen and lasting for three years.

The Saudi MOE controls the administrative parts of educational provision in all four stages. These include monitoring the educational budget, recruitment of teaching staff, timetabling, school organisation, teacher performance assessment, improving educational policy and approaches, and in-service training provision (MOE, 2008). Not only that, but the MOE is also responsible for providing teaching guidance (Khoja, 2013) concerning the national educational modules (curricula), learning materials, teaching methods and procedures, and even the construction and maintenance of structures erected for educational purposes (AL-Othman et al., 2015).

Furthermore, education provision across all four educational stages is free for students between the ages of three and 18 (MOE, 2020). In the educational setting of KSA, the principles, policies, regulations and practices embraced are similar for all pre-schools in the nation. This is regardless of the location of the schools (e.g. rural or urban), the societal position of the population they serve, and the way that they are schools, with all-female staff. Course teaching guidance is set and provided by the MOE and used in all pre-schools (MOE, 2020). Similarly, the teaching methods and materials, alongside

the procedures for evaluating students' performance, are also set by the MOE and applied to every educational context (Alnaji, 2014).

The context of this research is early childhood education that includes the use of EAs. In Chapters 2 and 3, an overview of the MOE policy that is relevant to this research is presented. Chapter 2 offers a summary of the development of early childhood education to provide a basic understanding of the context of the present study, while Chapter 3 presents a review of the literature on the use of EAs in early childhood learning.

1.2 Digital Revolution in Pre-Schools

Various types of technologies have gained prominence as teaching tools in early childhood education (Crescenzi, Jewitt & Price, 2014). These technologies can be used in varying degrees to facilitate the teaching process and enable students' learning. For example, teachers may use a specific software programme (e.g. EAs) that has the ability to facilitate learning exercises/tasks across range of subjects (Aarsand, 2019; Falloon, 2013). Learners may also use technologies to gain subject knowledge by using EAs that can help them to engage with information relating to subjects (Garduno, 2016).

Researchers have provided a positive picture of multiple possibilities for the use of different forms of technologies in early childhood education to enhance their way of teaching subject knowledge (Kerckaert, Vanderlinde & van Braak, 2015). Evidence in the literature reflects the widespread use of technology, such as computers (Howard, Miles & Rees-Davies, 2012) and tablet computers (e.g. Aarsand, 2019; Karsenti & Fievez, 2013) that is being used to improve the way teachers teach a range of subjects. The findings of these studies indicate that such devices are perceived as new teaching tools that are complementary to classroom teaching. Teachers continue to view technology as a new learning material which they use to assist them to present knowledge and information to their students.

Notably, studies of tablet computers (e.g. Karsenti & Fievez, 2013; Price, Jewitt & Crescenzi, 2015) have revealed an additional potential for their use to become like teachers in guiding the process of learning. These studies explored how teachers had begun to change the way they used technology, putting the devices in the hands of early childhood students to engage with digital SLAs. In other words, students could take the

initiative to learn without the help of others (Peng, 2011). Even though early childhood teachers were not actively teaching in that situation, they had nonetheless determined the content and materials of the digital learning (Otterborn, Schonborn & Hulten, 2018). In response to such change, I can foresee the possible transformation of the process of receiving subject knowledge from the teachers to tablet computers, which in turn can bring changes in existing SLAs, subsequently impacting the teachers' role.

From the results of Gil-Flores, Rodríguez-Santero and Torres-Gordillo (2017), the role and responsibility of early childhood teachers in the use of digital SLAs in early childhood classrooms can be divided into two stages:

- The emerging stage refers to the building of infrastructure. It is characterised by the availability of tablet computers and by the teacher exploring their use in the classroom. Lynch and Redpath (2014) found that early childhood teachers considered the affordances of tablet computers, such as their portability, touch interfaces and simple navigation systems, to be particularly attractive for early childhood education.
- The application stage refers to the use of the device in the process of teaching and learning to replace an existing SLA. The role of teachers is to facilitate learning by using suitable EAs to engage students with SLAs in a 1:1 ratio (Carr, 2012). According to Kerckaert, Vanderlinde and Van Braak (2015) teachers are responsible for providing opportunities for their students to use the devices to access information and tasks/exercises that are relevant to early childhood education.

Research on improving teaching methods using tablet computers is an evolving area in the field of early childhood learning and technology (e.g. Hirsh-Pasek et al., 2015; Price, Jewitt & Crescenzi, 2015). Evidence in the educational literature indicates that the potential benefits to be gained from the use of tablet computers, changing the existing SLAs, are derived from their features of multiple touch-screens, versatility, connectivity, and the potential to access a huge number of EAs (Ferguson & Oigara, 2019; Kucirkova, 2014). It seems that tablet computers are deemed suitable for students' use because of the possibility of using them to access EAs.

A case study conducted by Henderson and Yeow (2012) explored the usage of EAs in early childhood learning by interviewing the school's technology manager, a senior teacher (curriculum co-coordinator) and a classroom teacher in the Redoubt North Primary School in Auckland, New Zealand. Their findings demonstrated that increased access to a tablet computer could lead to a higher frequency in students' usage of tablets to engage with SLAs. Teachers can use these devices to facilitate digital SLAs by selecting appropriate EAs from the app store based on the learning objective of a specific topic. Due to the ability of EAs to enhance teaching and support learning, it is not surprising that the interest in the use of EAs in classrooms has expanded to Saudi early childhood learning.

The National Association for the Education of Young Children (NAEYC) and the Fred Rogers Centre in Saint Vincent College (2012, p. 1) define technology (apps in this case study) as interactive media "designed to facilitate active and creative use by young children and to encourage social engagement with other children and adults." These apps were programmed to run on either iOS operating systems (Apple, 2019) or Google's Linux-based operating system (Android, 2014). Apps have become widely popular among a variety of users worldwide, including early childhood students (Costello, 2019; Kucirkova et al., 2014), for their entertainment and socialising value. Many apps, which are developed to support education, are known as EAs (Cherner, Dix & Lee, 2014). Consequently, Godwin-Jones (2011) suggests that Apple® and Android® are the world's largest providers of EAs, depending on age, subject area, and educational level.

Over the past few years, teachers have used tablet computers to download a number of EAs in the early childhood educational category targeting students under six years old, which makes them more attractive for students' use (Cherner, Dix & Lee, 2014; Dore et al., 2019). However, several researchers have questioned the value of using EAs for the teaching and learning process, and reported on the perspectives of senior personnel who work in pioneering technology companies, including Apple and Google (Bilton, 2014; Gardner, 2011; Jenkin, 2015). These experts, who themselves are parents of students at various stages of schooling, voiced their concerns about the potential impact of any technology on the achievements, motivations, and learning for learners under six years of age. Keeping up with using EAs to push early childhood students to undertake SLAs

in in a 1:1 ratio seems, therefore, to be an ongoing challenge for teachers who are required to recognise the potential impact of these digital SLAs on early childhood students' interactions.

1.2.1 Educational apps (EAs)

The classifications offered by Goodwin (2012, p. 26) are used in this study to help understand the types of EAs used by early childhood teachers to facilitate digital SLAs across a range of subjects. Efforts were made to classify three types of EAs presently available for students' use (see Table 1.1). Firstly, EAs were considered instructive if they “delivered a predetermined ‘task’ which elicited a homogenous response from the user.” Secondly, EAs were considered constructive when users could create their own content about information they accessed or gained when using an EA. Finally, EAs were considered manipulable if they “guided discovery and experimentation, but within a predetermined context.”

Table 1. 1: Goodwin's (2012) categorisation of EAs

App categories	Types of EAs	Design	Users
Instructive	Gaming apps	Drill-and-practice	Respond to predetermined tasks
Constructive	Creative apps	Open-ended design	Create their own contents
Manipulable	E-books	Reproduced stories	Discover or experiment within a predetermined context

Although there are several well-developed EAs for learners' use outlined in Table 1.1, this study focused on EAs that had the ability to motivate self-learning and problem-solving in order to change the process of teaching and learning, especially to keep up with a sudden situation, such as the Covid-19 pandemic and the switch to online teaching (Teras, 2020). Lu et al. (2017) showed that EAs with the potential to provide a balance between information, instruction, and learning were more likely to be used in developing SLAs resulting in facilitating the teaching process. Thus, the debate here should focus on Goodwin's classification of 'instructive', typical examples of which are the well-known gaming apps. Recent statistics show that gaming apps are the most

popular category of EAs used for educational purposes (Clement, 2019) and it is gaming apps that the term EAs is referring to in this study.

Cherner, Dix and Lee (2014) defined EAs as small computer programmes (software) that have the potential to engage early childhood students with an appropriate blend of games, practice and learning goals. The unique features of these EAs, such as offline mode, understandable content that targets a specific age group, and testing the user's knowledge, have been cited by Geist (2011) as being particularly relevant for educational use. Thus, many studies have begun to explore the potential of using these EAs to change early childhood learning practices, and a corresponding body of research into engaging students with EAs has heralded their potential effect on learners' engagement with their SLAs (Kucirkova et al., 2014).

The popularity and ready access to EAs as a new medium for learning have triggered more research (Lee & Cherner, 2015). The present study was motivated by the possibility that EAs can be effective ways of transforming the very nature of schoolwork (learning practices) in the early childhood classrooms (Kiili et al., 2014). According to Geng, Disney and Mason (2016), early childhood learning has witnessed an increased emphasis on the efficiency of EAs to change few SLAs into a way that can be more motivating to early childhood students. Some international studies that evaluated the possibility of change that EAs bring to the learning practice, recognised the significance of these EAs in providing an opportunity for early childhood students to undertake SLAs on reading and writing (Dennis, 2016), and numeracy (Kyriakides, Meletiou-Mavrotheris & Prodromou, 2016; Noorhidawati, Ghalebanti & Hajar, 2015).

Keeping up with this change is critical as EAs begin to be used in early childhood education (Dunn et al., 2018). However, previous research in the literature has highlighted the importance of studying the availability of EAs, but has not prescribed the frequency of their use to update the process of teaching and learning (Blackwell, Lauricella & Wartella, 2014). Increased access and use (or underuse) of EAs in early childhood learning were found to correlate with teachers' perceptions (Prestridge, 2012). The findings of the present study shed light on how teachers' thinking and use of EAs influence the way language and literacy, and numeracy were learnt. They have further highlighted the impact of teachers' views of EAs on students' interactions with

the newly-provided digital SLAs, which may have influenced teachers' decisions to use EAs in their teaching. Thus, it is necessary to consider teachers' perceptions when exploring the change of learning practice to produce relevant and informative findings (Zaranis & Oikonomidis, 2016).

1.3 Rationale and Significance of the Present Research Study

The meticulous planning and preparation of the MOE with regards to early childhood students paves the way for the provision of advanced SLAs. In 2016, as part of the Aljwdah Project, the MOE recommended an additional change to the learning methods of these students (MOE, 2020). Among the Project's objectives was the encouragement of the use of EAs in early childhood learning because of their perceived ability to engage students with digital SLAs (Sulaymani, Flee & Chapman, 2018). Today, the use of EAs is widespread because of the Covid-19 pandemic that has necessitated online learning in Saudi educational institutions (MOE, 2020).

Due to the ongoing Covid-19 pandemic, early childhood learners in the KSA have been receiving their education virtually via The Virtual Preschool app made available by the MOE (2020). Before the Covid-19 pandemic, early childhood teachers motivated learners to partake in digital SLAs, decided the learning content to be taught, prepared the tablet computer and monitored the progress of the students (Beauchamp, 2012). However, during the Covid-19 pandemic, the early childhood teacher now has to ask for assistance from the parents (usually mothers) of learners to prepare the learning environment (MOE, 2020).

Research on the use of EAs to facilitate SLAs in early childhood is beginning to gain momentum (Alzannan, 2015) due to the Aljwdah Project. The focus is on the potential use of EAs to guide four- and five-year-old students during their engaging with SLAs. During the data collection for the current study, it was found that six state preschools invested a lot of time, effort and money in introducing tablet computers in their classrooms. At the beginning of this study, all six pre-schools had reportedly provided one tablet computer to each classroom, but only one school had teachers who had actually used EAs to facilitate digital SLAs. (Statistical information about early childhood teachers who used EAs was personally communicated by Al Tubaeli in 2017; see Appendix E, p. 258).

Gathering information of what early childhood teachers do to teach their students was the first step I took before deciding my topic. Between March-April 2017, I firstly contact the MOE for information about early childhood teachers who used EAs. Secondly, I obtained permission to visit their schools in order to determine which of these data were correct. As a researcher, I noted that there was limited application of EAs for students' use in Saudi pre-schools. It was therefore evident that there was a need to study the potential of using EAs to develop the SLAs resulting in changing the learning practices that teachers have employed for many years.

At the same time, negative reactions had been expressed by teachers who did not use EAs, even though they had a tablet computer in their classroom. It was interesting to explore early childhood teachers' viewpoints on the affordances of EAs and how they were being used to improve the learning practice. My focus on teachers' perceptions and their use of EAs was twofold. Firstly, studies on the use of EAs among teachers (e.g. Alzaidiyeen, Mei & Fook, 2010; Dong, 2018b; Kaymakamoglu, 2018) have demonstrated the importance of teachers' perspectives in changing their teaching methods. It has been interesting to understand early childhood teachers' views on, and responses to, using EAs that have the ability to engage students with the subject knowledge electronically. Secondly, studies have yet to investigate such changes in the teaching and learning process in Saudi pre-schools (Sulaymani & Flear, 2019).

Surfing the Internet was another way used to find information about the educational change within Arabic pre-schools. To the best of my knowledge, this is the first study in the Saudi early childhood learning context to capture teachers' points-of-view on the potential of EAs for early childhood students and what actually happens in the classrooms. This has been confirmed through a manual search of Saudi libraries (e.g. King Fahad National Library, 2019; Saudi Digital Library, 2015) using keywords such as tablet computers, educational and/or learning apps, Saudi education, early childhood learning, and teaching development.

A study on using technologies in education mainly focused on the use of devices in schools in the KSA and the United States (Alharbi, 2013). Participants in the study included 12 teachers who participated in an interview to examine their methods of using digital technologies into learning sessions. Alharbi found that Saudi teachers

demonstrated the use of digital technology to support teaching. Another study clarifies teachers' use of technology in secondary schools in Riyadh (Oyaid, 2009). Participants in Oyaid's study included 266 teachers who completed a questionnaire; interviews were also conducted with 14 of these teachers. The study's results indicated that digital technology was viewed as a new learning material to supplement or add to the taught subjects. That is, subject-specific learning contents were taught by the teachers using physical learning materials, while some subject information was presented in new ways using videos, pictures, and podcasts.

These findings were confirmed by studies in other Arab countries, including Kuwait and Qatar. In Kuwait, Alharbi (2014) conducted a study with teachers, students, and decision-makers in secondary schools to explore the impact of using computers in classrooms. In Qatar, Ibrahim and Walters (2012) conducted a small study about the usage of digital technology in early childhood learning to examine whether technology has a positive impact on teaching. The results of both studies revealed that teachers used technologies to complement their teaching of subject knowledge.

The evidence from reviewing previous literature shows a clear use of technologies by teachers to complement their teaching of subject knowledge and information at different educational levels, and this also applies to the early childhood educational stage. Almalki, Finger and Zagami (2013), however, outlined a change occurring inside Saudi early childhood classrooms as a result of the use of EAs. A few Arabic researchers have begun to study the possibility of change EAs bring to the early childhood learning practice. Recent research has recognised the potential of EAs to enhance the ability of early childhood students to learn in Jordan (Oliemat, Ihmeideh & Alkhawaldeh, 2018). Another case study explored the use of tablet computers through observing one early childhood student's engagement with the device at home and primary school in KSA (Sulaymani, Flear & Chapman, 2018). Both studies found that EAs, which have the ability to deliver predetermined exercises to students, can be used to improve early childhood teaching and learning.

Additionally, an experimental study investigated the affordance of EAs as teaching tools with the ability to offer early childhood students the chance to engage with digital SLAs on reading and writing in pre-schools in Kuwait (Safar, Aljafar & Alyosefi,

2016). They examined the impact of using literacy-specific EAs when facilitating the English alphabet activity to students. The study's participants included 42 students divided into two groups: an experimental group taught using EAs and a control group taught by following the teacher's instructions. The results showed the superiority of learners in the experimental group when interacting with the digital English alphabet activity compared with learners taught through following teachers' instructions. Such results in turn demonstrated the impact of early childhood teachers' decisions when using EAs in their learning practices.

Although a few studies provide evidence on the possibility of change that EAs can bring to SLAs in Arabic classrooms, little evidence exists in Saudi early childhood education on what teachers thought of, and how they used, EAs to enhance the ways students were taught (Alharbi, 2012; Sulaymani & Fleer, 2019). Literature in the field of early childhood learning consists of several studies in which researchers employed different methods to investigate the ways in which early childhood teachers enhanced SLAs by incorporating digital learning tasks following the introduction of EAs (e.g. Papadakis, Kalogiannakis & Zaranis, 2018a; Shifflet, Toledo & Mattoon, 2012). In Saudi early childhood learning, what distinguishes this study is its focus on the experiences of teachers who employ EAs in their classrooms to enhance few SLAs. Moreover, this study, unlike most research in the early childhood educational field conducted in Arab countries, is concerned with the perceptions and learning practices of teachers on the affordance of EAs as new teaching tools that are introduced for learners' use.

The following outlines the practical significance of the current research study. Its contribution to knowledge in theoretical terms is presented in a later section.

1. It may help teachers in other pre-schools to think about how to match their methods of learning subject knowledge with their expectations of EAs.
2. The findings could be relevant to Saudi teachers in other pre-schools, since all schools in the KSA follow the same learning system, in terms of the curriculum and teaching guide (Alhogail, 2011; Alnaji, 2014). Thus, the present study may assist in developing and improving the ways early childhood students are taught inside classrooms by addressing the affordance of EAs on teaching and learning.

3. By revealing teachers' perceptions of using EAs, the current research may help policymakers in the education sector to obtain new insights into how to change current learning practices in order to improve students' engagement with SLAs.
4. The findings of this research will inform a training programme at a Saudi university; the results will be used to help train early childhood teachers on the use of EAs during their initial teacher-trainer period.

1.4 Aim and Scope of this Study

The primary aim of this study is to investigate teachers' perceptions and experiences of early childhood students' use of EAs. To achieve this aim, I need to explore the affordance of EAs to change learning practice in early childhood classroom, as well as, the impact of such change on students' interactions. This change in the process of learning seems to be related to whether teachers took on the responsibility for facilitating SLAs using EAs (Blackwell, Lauricella & Wartella, 2014). Thus, this study focuses on exploring the affordance of EAs for early childhood students' learning, through investigating teachers' perceptions and experiences.

Considering the objectives of this study and the gaps found in the literature on using EAs for educational purposes, this research established the following three research questions (RQs):

1. What perceptions do Saudi teachers have in relation to the affordance of EAs for early childhood learning?
2. How do these teachers at the pre-school use EAs in their learning practice?
3. How do teachers perceive the capability of EAs vis-à-vis early childhood students' engagement with SLAs?

To answer RQ1 and RQ3, early childhood teachers' own words were collected to explore the potential use of EAs in early childhood education, and to explore their influence on students' engagement with digital SLAs (these two questions focus on teachers' thinking about students' learning). RQ2 led to exploring these teachers' active reflections on their application of EAs for students' use (the question examines how teachers used EAs inside their classrooms to enhance the process of teaching and learning). This study focused on few early childhood teachers who have allocated each student a limited time with digital SLAs. A case study, a qualitative research method,

was considered an appropriate investigative method as this approach can be used to explore a certain set of circumstances in their natural context to help appreciate the complexity of the case and its setting (Punch, 2009).

Qualitative research methods carefully examine the words or actions of individuals in a narrative or descriptive way representing their experiences (Bryman, 2016). The qualitative approach was selected as the most suitable to conduct the present study as it enabled me to gain insight into teachers' perceptions as well as their learning practice. Furthermore, the current study planned to examine what actually happens in the classrooms. To achieve such an objective, it may have been difficult to use a conventional standard of validity and reliability. Following Bassey's (2001) view, trustworthiness is more relevant here.

The case-study method presents an overall structure to process and detail the current research of enhancing the learning practice using EAs in Saudi pre-schools. This study recognises the limitations of the case-study approach, in which research data and results are not representative. However, following Bessy's (2001) view on the possibility of generalising results to other similar contexts, this study described the context in a way that makes it possible for other researchers to apply the results in their own context. (A description of early childhood education is provided in Chapter 2).

1.5 Originality (Contributions to Knowledge)

One of the main contributions of this study is the use of the theory of affordance to assess the relationship between three factors (educational policy, availability of digital devices and teachers' perception) and the action inside the classroom, in terms of using EAs to facilitate digital SLAs. This study's results are summarised in Figure 8.1 (p. 205). Increasingly, policymakers, schools management, and teachers find it difficult to ignore the potential of EAs and what they can bring to early childhood learning practice. Also, little is known about how these teachers use EAs as part of their teaching strategies (Otterborn Schonborn & Hulten, 2019). Thus, this study contributes to the existing literature on teachers' perceptions and use of EAs in SLAs. Secondly, it contributes to exploring the top-down approach in which early childhood learners received information and support from, and get their knowledge tested through EAs' games.

Additionally, limited studies exist on the use of EAs by Saudi teachers in pre-schools. This study contributes to our understanding of how teachers in the KSA handle this innovation in teaching and learning. This contribution of the use of EAs in Saudi early childhood teaching and learning practices may be pertinent in two ways. Firstly, it can help early childhood teachers to think about the compatibility between their preferred ways of supporting SLAs and their expectations from EAs. Secondly, in revealing teachers' perspectives on digital teaching and learning using EAs, this study may help the early childhood educational community in the KSA and similar early childhood contexts to gain better insights into how to embed EAs in SLAs.

Although similar studies have been conducted in other early childhood learning contexts, such as in England (Flewitt, Messer & Kucirkova, 2015) and Jordan (Patchan & Puranik, 2016), exploring the use of EAs in Saudi early childhood education is useful for three reasons. Firstly, this is the first study to examine the perceptions of Saudi early childhood teachers on assigning technology for students' use. Secondly, the data collected on this topic can help teachers around the KSA to understand experienced teachers' viewpoints on the use of EAs in their learning practice. This might be possible as the study aims to develop an understanding of the extent to which this new approach affects the process of teaching and learning within an early childhood institution. Thirdly, the findings of this study could help Saudi authorities to make future decisions on teachers' training regarding the introduction of EAs for students' use.

This study addressed the teaching experiences and professional aspirations of improving the methods and materials of SLAs through including EAs. The findings may be useful to help other teachers in a similar field to understand the potential implications of such change in early childhood learning. Moreover, this study can work to facilitate research-based recommendations that can be employed to better meet the expectations of modernising teaching and learning within pre-schools. In addition, this is the first study on Saudi early childhood learning that provides an opportunity for young learners to access subject knowledge using EAs. Therefore, this study may outline a new pathway for engaging students with SLAs that differs from the usual learning practice. More evidence has been provided from this study to add to the body of knowledge on early childhood educational professional development. Such evidence may inform training

programmes for early childhood teachers on the possibility of engaging students with digital SLAs.

1.6 Overview of the Chapters

Chapter 2 provides an overview on the field of early childhood education. It delves into experiential learning theory and theory of affordance, and explore teaching strategies. It also provides insights into changes that occurred within SLAs due to the use of EAs and discusses the development of technology in Saudi classrooms.

Chapter 3 reviews the current literature in the field of EAs and early childhood education to identify potential gaps in the digital learning research. The chapter starts with a discussion of the developments in the early childhood learning due to the use of EAs. This is followed by a section on the relationship between early childhood teachers' perceptions and use of EAs. This relationship between teachers' perceptions and practice regarding EAs' use in classrooms is considered to be the first step in changing the process of teaching and learning. The chapter continues with an examination of whether EAs have the potential in enhancing SLAs. This leads to a discussion on the impact of such change on students' interaction with their learning and on students' learning itself.

Chapter 4 deals with the current study's research methodology and the selection of an appropriate research design, context and sample. This is followed by a discussion of the methods of data collection and analysis. The chapter then discusses the results' credibility, transferability, dependability and confirmability. It concludes with a consideration of qualitative research ethics.

Chapters 5, 6 and 7 present the results of the current study regarding teachers' perceptions and use of EAs in early childhood classrooms. These findings are gathered through a combination of interviews and classroom observations exploring the process of using EAs in learning practice. To shed light on RQ1, Chapter 5 analyses teachers' perceptions of the potential of EAs in early childhood education. To shed light on RQ2, Chapter 6 analyses the way early childhood teachers used when facilitating digital reading and writing, and numeracy activities for students using EAs. Finally, to shed

light on RQ3, Chapter 7 analyses teachers' perceptions of the impacts of such changes on learners' engagement with digital SLAs.

Chapter 8 discusses the results presented in Chapters 5, 6 and 7 with reference to studies presented in the literature review (Chapters 2 and 3). The chapter discusses the findings in relation to the three RQs of the current study. To address RQ1, the chapter discusses early childhood teachers' perceptions of EAs that they currently use in the learning practice. This section focuses on their views of the ability of EAs for early childhood students' use. A number of factors and challenges were reported due to their association with teachers' perceptions. This is followed by a discussion of lesson plans, digital SLAs and learners' interactions with EAs, which addresses RQ2. Finally, to address RQ3, the chapter discusses the impacts of EAs' use on students' interactions with SLAs. Two positions are taken: one that supports the use of EAs in schools and one that rejects their use at home.

Chapter 9 summarises the main findings and contributions of the study to answer the RQs related to teachers' perceptions and use of digital SLAs. The chapter then presents several implications of the study and recommendations to researchers and practitioners in the field of early childhood education. This is followed by offering suggestions for future research and a discussion of the current study's limitations. The chapter concludes with a brief consideration of how to disseminate the findings of this study.

1.7 Chapter Summary

Technology has permeated the daily lives of students, prompting the development of new ways to learn skills. EAs seem to be considered by teachers as an indispensable tool in early childhood education and a fundamental competency in the twenty-first century. Early childhood learning is meant to equip students at the ages of four and five with the skills to engage with learning activities in a more self-directed way. The present study explored the potential of EAs to transform few existing SLAs into digital learning. It studies this phenomenon in the Saudi context by exploring teachers' perceptions of and reflections on students' use of EAs. Studying teachers' perceptions and use of EAs is critical, as knowledge of the process of such change is still limited in terms of perceptions and learning practices. This study took place in an early childhood learning context in which EAs, mainly gaming apps, were used to enable early

childhood students to learn and support the process of teaching. The study includes one pre-school in the KSA and twelve teachers currently using these EAs.

Chapter 2: Overview of Early Childhood Education

This chapter provides an overview on the field of early childhood education. It delves into experiential learning theory and theory of affordance. This chapter explores teaching strategies, which play the main role within the early childhood curriculum of SLAs, are (1) teacher-guided; and (2) play-based grounded on experiential learning theory. It also provides insights into changes that occurred within these SLAs due to the use of EAs to engage four- and five-year-old students with learning tasks independently within their classrooms. Finally, this chapter discusses the development of technology in Saudi classrooms.

2.1 Early Childhood Learning

To understand the research context, it is first important to describe what is meant by the term early childhood. Various definitions have been proposed by researchers in the educational field. Bruce (1997) and Fisher (2002) suggested that early childhood is referred to the period of time when young children started to apply in educational institutions, which are known as primary schools, that offer care service for students from the age of three up to eight years old. Beckley, Elvidge and Hendry (2009) and White (2015), however, considered the concept of early childhood to encompass students between three to five years old, who attended these early childhood learning settings, which are known as pre-schools. Research has clarified that the early childhood stage of education is concerned with providing education and care services that aim to nurture the physical, social, mental, intellectual and emotional developments for students at the ages of three, four and five, before they go on to primary school at the age of six (Palaiologou, 2013). According to Faisal (2014), this definition has been applied to Saudi early childhood education institutions. She argued that Saudi pre-schools need to develop appropriate learning and an enriching environment in order to prepare learners at the age of three to five for the formal educational stages (at the age of six to eight).

In Saudi pre-schools, there are three age group levels: Year 1 for the under-fours, Year 2 for four-year-olds and Year 3 for five-year-olds. Attendance in any or all of these educational stages is optional and not regarded as essential for enrolment in primary school (Aldaweesh & Almoharb, 2012). However, the Saudi MOE currently considers it

necessary for students to attend the final year of early childhood learning at the age of five before they can enrol at primary school. The current MOE strongly believes that in Year 3, learners should develop several basic learning skills, such as reading, writing, counting, problem solving and social skills, in order to prepare for enrolment in primary education (MOE, 2020). Palaiologou (2013) also recommended that it should be compulsory for five-year-old students to attend the early childhood class to understand the basics of primary education. Since 2017, therefore, 124,164 students have been enrolled at pre-schools across the KSA (MOE, 2017b).

This increase in the number of early childhood students in Saudi pre-schools raises the question of the best ways to help learners at the ages of three, four and five to learn (AL-Othman et al., 2015; Hammed, 2014). The KSA has set broad educational goals for this learning stage. These are mainly related to the religious customs of the country, its beliefs and how to make sense of the world. Education seems to help students to understand the religion of Islam, learn the values and teachings of Islam, and gain the knowledge they need to live in modern society (Hammed, 2014). Currently, the following aims are included in Saudi schools:

- Develop students' understanding of theoretical and practical Islamic beliefs;
- Provide the necessary information and skills to understand the world;
- Develop effective orientations towards society;
- Positively respond to, and interact with the latest social and educational developments; and
- Develop the ability to deal with technology (MOE, 2020).

These aims can be achieved through an effective practical educational system that enables learners' potential to be discovered. Thus, it is crucial to describe how curricula have been developed in order to understand how students have been educated in KSA. The *Ten-Year National Action Plan for Education for All* issued in 2005 by the MOE currently used in Saudi schools puts education at the heart of human development (MOE, 2020). This national plan sets a key goal for the establishment of education for students at the age of four to six and the consideration of pre-schools "as an independent stage in terms of its buildings and syllabi from other education stages"

(MOE, 2005, p. 13). To achieve this, the following objectives for the establishment of early childhood education have been set:

1. To accommodate students at the age of four to six at the rate of 40% by the end of the plan;
2. To update the programs and activities upon which learning is based;
3. To supply early childhood schools with specialized cadres in order to meet the stage classes at a rate of 10%;
4. To develop the programmes and tools to measure students' preparedness for the early childhood educational stage; and
5. To develop a personnel preparation and qualification programme for the early childhood educational stage (MOE, 2005, p. 13).

This was followed by three main educational goals set by King Abdullah bin Abdul-Aziz Public Education Development Project, usually known by the Arabic acronym *Tatweer*. Tatweer, which is the Arabic website developed to support the MOE in enhancing the quality of education, was developed in 2007 (Alshmrany & Wilkinson, 2017). These goals are:

1. Enhancing learning standards in line with best practice worldwide;
2. Building an outstanding national framework to improve educational achievement, appraising performance and providing feedback to students; and
3. Informing learning design, instruction and professional advancement (Tatweer, 2018).

Additionally, the Ninth Development Plan emphasised the role of education in human resources development. This plan supports a comprehensive educational system that strives to develop and strengthen the roots for a modern and functional society. This is achieved through training educational professionals, and enabling them to improve early childhood learners' capabilities, intellectual and imaginative skills to meet the needs of society (Ministry of Economy & Planning, 2018).

The Tatweer Project is a development program for early childhood education that was developed in order to launch the abovementioned plans/projects (Tatweer, 2018). These are:

1. The National School Development Program;

2. The Early Childhood School Development Curricula (ECSDC); and
3. Twenty-first Century Skills and teacher improvement programs.

The ECSDC was launched in the 1980s by the cooperation between the GPGE, the Arabian Gulf Programme for United Nations Development (AGFUND) and UNESCO, and these forces prepared the facilities required for its integration in pre-schools (Alqassem, Doaa & Alzahrani, 2016). The aims of this curriculum were the following:

1. To enhance the standard of early childhood learning facilities and the capacity to prepare new teaching staff;
2. To train the existing teaching staff to attain higher skill levels; and
3. To build a practical and theoretical framework for the early childhood stage of education in order to coordinate teaching at this level (MOE, 2016).

Saudi early childhood education encompasses the formal and informal education that is provided to young students aged three, four and five, with the aim of building a strong foundation for their future academic life (Faisal, 2014). Much discussion on the quality of early childhood learning is centred on the provision of teaching that builds on the foundations for lifelong learning (Hinsotroza, Labbe & Matamala, 2013). Research into the way that teaching subject knowledge has developed from the mere transmission of knowledge, information and instructions, to SLAs, highlights the contribution made by early childhood institutions to the short- and long-term gains in the development of learning skills (Peng, 2011). For example, early literacy skills (e.g. reading and writing letters and numbers) can be reinforced when early childhood students engage with a set of varied alphabet activities that lead to different experiences in reading and writing (Morrison, 2007). Thus, the process of teaching and learning in early childhood institutions has always been a topic of interest to researchers.

2.2 Attribute of Early Childhood School Development Curricula (ECSDC)

... preschool curricula do not have designed standards; therefore, once researcher begin to study preschool classrooms there will be a vast array of instructional philosophies and strategies that may be informative about how children come to know and understand the nature of knowledge and the process of knowledge (Winsor, 2012, p. 26).

The above statement describes how ECSDC was influenced by the ideas of several learning theories developed in Western countries (Alhariri, 2015). A number of scholars, such as Dewey (1998), Piaget (2001) and Vygotsky (1978) proposed ideas about the method of teaching that aimed to create the best learning environment. Their thoughts are still used in today's classrooms, and remain a major influence on many teachers and researchers. From an early childhood research perspective, it is believed that the approach to teaching and learning associated with early childhood classrooms was viewed as a process whereby knowledge and information are created through the transforming of experiences (Alhariri, 2013; Green, 2007). This is known as experiential learning, which focuses on knowledge comprehension of learning experiences, where young students are given the opportunity to bring in their existing knowledge (Fisher, 2002).

To demonstrate, let us consider the use of alphabet activities. In this learning practice, students can gain comprehension experience of phonemic awareness. They first receive a learning practice that might lead to disequilibrium (this occurs when a student's previous knowledge of the alphabet is challenged, therefore he or she seeks an answer to the problem that he or she faces). This is followed by a discussion of the new concept to help early childhood learners accommodate the new information. After that, learners try to perform several learning tasks relating to the alphabet in order to link the new knowledge to the existing information for the sake of retaining the new information (Green, 2007). Here, teachers decide and plan their learning sessions, deliver the learning practice, assess, and report on students' development and progress based on this experiential learning (Watkinson, 2006). A brief account is given in this section about this model of learning that describe the early childhood learning environment (for an in-depth understanding and review of several learning models see Cohen & Waite-Stupiansky, 2013; Samuelsson & Johansson, 2006; Winsor, 2012).

2.2.1 Experiential learning

The experiential learning theory developed by Kolb (1984, p. 30) assesses the methods used by students in learning. By reviewing different type of learning models, Kolb suggested that "learning is by its nature a tension and conflict-filled process." New knowledge and skills can be gained through the four models of experiential learning. Learners need four different types of abilities in order to effectively grasp material.

These abilities are concrete experiences, reflective observations, abstract conceptualisation and active experimentation.

1. Concrete experiences focus on involving students fully and openly in new experiences of different learning skills. Students learn through perceiving new knowledge by counting on sensing the concrete world.
2. Abstract conceptualisation is concerned with grasping experiences of subject knowledge. Learners learn by grasping new knowledge through thinking.
3. Reflective observations focus on transforming experiences. Learners learn through observing others, then reflect on what is occurring.
4. Active experimentation also concentrates on the transformation of experiences. Students learn through getting into SLAs right away.

However, the interrelation among these abilities might be difficult to understand. For example, how can a student act and reflect at the same time? How can experiences be concrete and immediate while being theoretical? In this case, learning requires opposing abilities, and as a result, students have to select a set of learning abilities that are relevant to a particular step of the learning process. For instance, students can move from actors to observers in the learning process.

Kolb (1984) also described four processes of experiential learning: convergent, divergent, assimilation and accommodative. These processes of learning, which are related to the transformation of experiences, explain how the best way of learning practice that is suited to the various forms of knowledge that students encounter is chosen. To demonstrate, in a problem-solving situation, students with the style of accommodative learning prefer to work with their peers instead of solving the problem on their own. For early childhood learning practice, research has suggested that early childhood classrooms are likely to follow the assimilation learning style (Parsons, 2017). This means that early childhood students learn best through obtaining knowledge, developing learning concepts, understanding how things work, and how to use this information.

This aligns with the views of Cohen and Waite-Stupiansky (2013), who recognised the importance of having theoretical models when researching early childhood stage of education, including the experiential learning theory. The more models teachers have

access to, the more likely they are to be able to understand the learning processes, and make appropriate decisions for teaching and learning. Parsons (2017) discussed how experiential learning within early childhood classrooms can be explained from various theoretical perspectives, such as behaviourism, constructivism and social-constructivism. These theories aim to provide clarification on how students learn, and provide a theoretical framework for learning environments to capture the work within the classroom. In line with this, Samuelsson and Johansson (2006, p. 51) stated that early childhood education is highly influenced by the experiential learning theories and models, which regard students' learning as "part of their own experiencing of and giving meaning to the world."

These learning theories and models affect the learning environment and guide research (Peng, 2011). To better understand the processes of learning within an early childhood classroom, researchers need to consider the development issues within early childhood learning and interpret research findings from multiple perspectives (Winsor, 2012). Thus, this study explored the development of learning practice from two theoretical perspectives: behaviourism and constructivism. Together these two perspectives provide an understanding of the essential learning aspect of pre-school classrooms. Behaviourism considers the planning of learning and teaching by teachers, and the inclusion of face-to-face interactive learning related to the subject's topics, which are delivered throughout the learning sessions. The constructivism theory explains how students engage with various learning exercises related to the subject knowledge through active engagement.

2.2.2 Affordances

Affordance within the context of learning relates to what can or cannot be done with objects, for example, the influence obtained upon the execution of actions towards objects (Gibson, 1986). This means learning to predict the impact that actions may create in a certain context, and focusing on objects that is available in the environment. Gibson emphasise that affordance is the ability of individuals to act with an object, respond to the object's potential and to adopt their actions to the current situation. This, according to Borghi et al. (2012), is fundamental to the human ability to interact with the environment. Therefore, the affordance is used to explore the relationship between individuals and objects and pieces of information, whether good or bad, that are

available in the environment (Gibson, 1986). The term affordance is attributed to Gibson to indicate to the potential use of learning resources. Thus, affordance is the attribute of the experiential learning context that can offer an action and instruments to activate that action (Greeno, 1994).

According to Wright and Parchoma (2011), individuals' interactions with the environment gave rise to the concept of affordance to measure the ability of these individuals to recognise the capabilities of external objects. What is offered by the environment is directly perceived and exploited during a set of activities by individuals, who act upon what has been provided through interpreting it to determine how objects could possibly be used (Glaveanu, 2012). The notion, in this way, indicates an ability which involves understanding and choice (Blewett & Hugo, 2016). Evidence in Blewett and Hugo's study confirmed that affordance is about action and an individuals' perceptions regarding that action. That is, the action is independent of actors' experience and knowledge. In this sense, "perceptions, actions and interpretations are part of one dynamic process" (Van-Lier, 2004, p. 105). Therefore, affordance in the current research study is understood in terms of possibility, meaning the potential and action potential of EAs to engage students with different experiences.

2.2.2 Technological features in EAs that support experiential learning

The nature of learning change and growth can be facilitated through an incorporated process that starts with receiving knowledge followed by comprehending that knowledge. Hence, Kolb's (1984) work is reordered to clarify two aspects:

1. Knowing:
 - Students are involved fully, openly, and without bias with direct experiences (concrete experiences).
 - Students 'knowing about', forming a theory, create concepts based on what they observed (abstract conceptualisation).
2. Understanding knowledge:
 - Learners consciously attempt to find the meaning of the concrete experience by watching and listening to others (reflective observations).

- The new theory is tested in a new situation (learning by practice). For example, learners can use their new experiences and concepts to make a decision or solve a problem (active experimentation).

Here, Kolb's (1984) experiential learning considers a student as a producer, who learn best through acquiring knowledge and developing a concept; through knowing how something works; and through applying knowledge in an immediate learning setting. This process of learning is aligned with the digital learning within EAs. Reviewing Stagg, and Donkin (2016), who explored the interplay between affordances of technology and how it is framed within the context of experiential learning, EAs can support early childhood students' learning and increase the level of new knowledge creation, improve the learning's awareness, and enrich the conceptualisation of knowledge and information through learning experiences. Thus, EAs is a typical example of experiential learning in portraying learners as producers, who engage with learning contents without the physical presence of a teacher. More details are provided in Chapter 3 on how EAs can be regarded as a new possibility contributing to the experiential learning context.

2.2.3 Learning environment

From an experiential learning perspective, teaching is based on the transformation of early childhood developmental learning areas of subjects (Tan & Rao, 2017), such as language and literacy, and numeracy. It is deeply rooted in educational philosophy and has been hugely influenced by one of the learning philosophers, Dewey, who pioneered research on classroom environments (Beard & Wilson, 2013). Carr (2012) reviewed Dewey's philosophy on learning and confirmed that Dewey wanted to obtain a superior comprehension of how and why students learned, and how they became actively involved in the teaching and learning process. The review showed that most of Dewey's models of learning practice focussed on learners' needs to engage with their environment through offering them a new and innovative experience, and that experience is educative.

Experience has been placed at the heart of education by Dewey. The key aspect of his theory is that learning is conducted through transforming student experiences (Winsor

& Blake, 2012). Dewey (1966, p. 139) argued that students at any educational level obtain their knowledge through their individual experiences. To learn more about experiences, one should make backward and forward connections. In Dewey's words: "we act upon it; we do something with it; then we suffer or undergo the consequences." In these uninvolved developments, students could procure learning through productive experiences (Dewey, 1998). Interestingly, Larsen-Freeman and Cameron (2008) found that learning outcomes are probably unlikely to be anticipated since learning relies upon the interactions among students. Larsen-Freeman and Cameron argued that these interactions might be influenced by a variety of elements, including the educational environment, rather than just the information provided by teachers. According to Mooij et al. (2014), the core idea here is grounded on the belief that students' construction of their own knowledge is the aim of the learning environment. Thus, learning should be supported by teaching, rather than pre-controlled by it (Land, Hannafiny & Oliver, 2012).

The main theoretical perspective of the ECSDC is based on learning through practice, in which early childhood learners engage with multiple learning tasks for the purpose of increase their subject knowledge while enhancing their learning skills (MOE, 2020). The curriculum represents the ideology of the belief system of self-learning that is based on theories of practice and doing (Schunk, 2014). According to AL-Othman et al. (2015), learning, here, is considered to be a process where knowledge is created through transforming experiences. This is known as experiential learning, which relies upon early childhood students gaining experience through their own actions and transforming this experience during active and interactive processes. The nature of learning practices in Saudi early childhood classrooms varies between learning:

1. Various skills through training;
2. Through discovery and examination;
3. Based on individual development; and
4. Through accepting information from various sources, including books, teachers and classmates (Hammed, 2014).

It should be noted that the determination of teaching is clearly and firmly associated with developing appropriate learning practice (Gahwaji, 2013; Tan & Rao, 2017). Piaget was one of the most influential contributors following a developmentally

appropriate practice (Winsor & Blake, 2012). Piaget studied the process of learning and teaching at various schooling levels (Piaget, 1964) and reported on how cognitive development is the most appropriate theory on studying students' intellectual development. Glasersfeld (1982) interpreted Piaget's views on how students build their knowledge through interactions with objects in the learning environment. Glasersfeld found that knowledge is not dependent just on input, but might also be the result of connecting the exiting knowledge to older knowledge (developing from their own experiences).

The basic start of Piaget's work was to think about how students could develop and learn to form their own understanding of their surroundings. In his book about the cognitive developments of learners, Piaget considered these students to be progressing through four stages; or what is known here as four age-based educational models (Piaget, 1964):

1. *Sensorimotor* (birth to two years): infants use their own senses to understand the surrounding world;
2. *Preoperational* (two to seven years): young learners enter a new developmental stage through constructing their input knowledge while they play;
3. *Concrete operational* (seven to eleven years): learners use logic appropriately to perform problem-solving tasks; and
4. *Formal operational* (twelve years and older): learners start to construct their own knowledge.

This research on the early childhood stage of education has applied Piaget's preoperational model focusing on identifying and evaluating how students aged two to seven learn (Piaget, 1951). The key concept, in this model, is that knowledge is achieved actively based on the prior experiences of learners and their reflections on these experiences (Piaget, 1977). Piaget argued that the development of early childhood students consists of building experiences about the world through thinking. Accordingly, learning in the early childhood stage cannot be educational without students making sense of it. Thus, early childhood learners can learn when they construct their own personal understanding based on their prior experiences, which are generated (Piaget, 1951). The processes of learning underpinned here involved four important opportunities for students to:

1. Explore a new experience;
2. Practice on the experience while building their own basic concepts, ideas and skills;
3. Take a risk and make a mistake on their learning; and
4. Develop their own imaginative thinking (Aljabreen & Lash, 2016).

Muijs and Reynolds (2011) focused on the core of Piaget's theory to address three fundamental components that influence students' subjective advancement, including SLAs. With SLAs, students independently build skills and abilities that drive them to connect with their environment. In Saudi early childhood education, SLAs are used to engage young pupils at the early childhood stage (ages 3 – 5) in various independent cognitive tasks/ exercises. These activities include content from a range of early subjects, including reading, writing and numeracy (MOE, 2020). During SLAs, an emphasis is placed on students' use of physical learning materials, such as whiteboards, teacher-made learning games (e.g., teacher-made alphabet matching games), or toys, but this processes cannot be classified as 100% self-learning as they require the guidance of teachers (AL-Othman et al., 2015; Sjoerdsma, 2016). The current study examined the change that occurred in these SLAs in the early childhood classroom following the use of EAs.

Within SLAs, learners have opportunities to learn best when they observe and interact with nature during play (Wood & Attfield, 2005). This sort of play-based learning could prompt change in students' considerations and in their reasoning procedure. A play-based SLA implemented inside the classroom provides many opportunities for working with conceptual learning materials to construct new information (Piaget, 2001).

A five-year longitudinal project was conducted with 3000 students aged three, four and five, in 141 pre-schools in England (Siraj-Blatchford & Sylva, 2004). The study reflected on how good learning practice have the ability to foster students' learning, their prior experiences, and reflections on these experiences. The results of their study showed that early childhood students needed to have tasks and exercises that were developed to provide them with opportunities to be active. Thus, creating various SLAs with the aim of enabling learners to independently address a unique learning interest and need is the core of Saudi early childhood learning sessions (MOE, 2020).

There is consensus worldwide regarding the fundamental features of early childhood education. Research by Bertram and Pascal (2002) conducted an international review on pre-schools in 20 countries, identifying common features of learning for students over three years of age. The process of teaching and learning:

1. Is structured around learning areas or activities instead of school-style subjects;
2. Is based on six core developmental learning areas: personal, social and emotional, cultural, aesthetic and creative, physical, language and literacy, and numeracy;
3. Uses play-based learning, independent thinking development, and encourage learning; and
4. Considers teachers as facilitators, who provide support to students, instead of teachers who are didactic class leading.

The National Association for Education of Young Children of United States (NAEYC, 2009) published guidance that lays the foundation of early childhood learning in the United States and reflects the consensus reached earlier in the United Kingdom (Siraj-Blatchford, 1999). Seven key points were included:

1. A balance between self-paced and teacher-guided SLAs;
2. The availability of meaningful selection;
3. Scope for exploration;
4. Variety of SLAs: individual, pairs and small groups;
5. Play-based SLAs (play is necessary, but not the main medium);
6. Teachers' information, instruction and reflection; and
7. Observing and recording the development of early childhood students.

These features are incorporated into the standards for early childhood education in the KSA, as described by Hammed (2014). Within the Saudi ECSDC, there was a requirement from the MOE in 2010 to divide the six specific areas of learning mentioned above into several well-defined play zones inside the classroom. These zones include the artwork zone, the cognitive zone, the exploration zone, the construction zone, the relaxation zone and the role play zone. Each zone were arranged in distinct spaces and included tables and chairs or carpets as well as different learning materials, such as toys and teacher-made learning games, including printable sequencing cards and teacher-made alphabet matching games, to enable the facilitation of a number of well-

defined SLAs (MOE, 2020). These activities were aimed at maintaining a balance between independent and teacher-guided learning exercises that build up with the aim of enabling three types of learning: individual, in pairs, or in-class small groups.

SLAs represent the ideology of the learning system of meaningful selection that is based on exploration, practice and thinking (Hammed, 2014). This arrangement of the selected concept enables early childhood students to learn by preference because they have the flexibility to select what they want to learn (AL-Othman et al., 2015). The Saudi classroom introduced this selection concept within the learning sessions to:

1. Empower students towards better and more valuable learning;
2. Open the way to discovery and investigation;
3. Provide students with chances to explain; and
4. Help students work out how to communicate with each other and encourage them to learn values, such as sharing, participation and concordance (MOE, 2016).

Within this learning stage, students can learn best with their SLAs when they observe and interact with nature and life experiences during play (Sjoerdsma, 2016; Wood & Attfield, 2005). According to Piaget's (1951) theory, performing SLAs through play cannot be educational unless a student makes sense of it. Through play-based SLAs, learners can discover what they want to learn and what they are interested in and concerned about. Students can also engage with prepared SLAs parallel to those they plan by themselves (Whitebread, 2012). Whitebread believed that learners could be responsible for their own learning and gain several benefits from that responsibility, becoming what is indicated in this developmental stage as *self-regulating* or *independent learners*. Thus, these students acquire their understanding through experiences generated during play (Verenikina & Herrington, 2006).

In examining the facilitation of play-based SLAs in early childhood schools, Anning and Edwards (2004) emphasised that play-based approach made learning more effective because they focussed more on helping children to become learners, through enjoying learning and recognising their ability to learn. This sort of learning environment strengthens the family atmosphere due to mimicking what students do in a home situation (Johnston & Halocha, 2010). Sjoerdsma (2016) further explored students'

engagement with their play-based learning environment in Midwestern schools, including pre-schools. The study included 30 teachers who answered a questionnaire. The findings of this study confirmed that early childhood education was concerned with students who imagine, create, explore, extend experiences, discover, manage conflict, solve problems, succeed and have the freedom to learn through playing. This confirmed the work of Anning, Cullen and Fleen (2004), which highlighted that play was of crucial value to early childhood learning sessions and fundamental to high-quality SLAs.

Much of Piaget's (1954) work on this stage did not consider the impact of more extensive factors on the development of students; instead, he concentrated on a student's own activity in the play-based learning environment. This is an issue for KSA and has educational implications for specialists in other learning contexts (Plowman & Stephen, 2007; Stephen, 2010; Stephen & Plowman, 2008). There is still a little consensus in relation to this issue, and suitable SLAs for students under six years of age remain debatable. For example, research has indicated that early childhood education should be based on acknowledging that play is central to learning, but it is not the only way for four- and-five-year-old students to learn (Bruce, 2005). Bruce suggests that students should learn through:

1. Observing others and imitating what they observe;
2. Interacting with others;
3. Using their senses;
4. Having a first-hand experience; and
5. Instruction.

From the previous arguments, the Saudi ECSDC strikes a balance between self- and teacher-guided play-based SLAs that are grounded on group or individual learning environments (Roger, 2011). These requirements are incorporated into the standards by which early childhood learning is governed in KSA (MOE, 2020). In the early childhood curriculum,

There is a balanced approach between different types of activities. The daily programme is divided into five sessions, with a balanced variation between free and teacher-led activities ... An alternative pattern is group

activities followed by individual activities or quiet activities followed by noisy activities (Hammed, 2014, pp. 31-32).

The ECSDC is organised with the use of these patterns based on the growth and development of early childhood students. The teacher's role during the learning session of SLAs is clearly defined, as described in the following section.

2.3 Teaching Methods

Even though several methods of teaching are now available to teachers and can be implemented in the classroom (Hall, 1999), teachers' and researchers' (e.g. David, 2003; Spodek & Saracho, 2003) views on early childhood learning can be mainly grounded on face to face interactions, direct instructions, discussions, problem-solving, SLAs, and individual and group learning. Details of such methods have been found in the MOE's guide developed for early childhood teachers' use (MOE, 2020). This guide was issued in 1984 covering the basics of working with early childhood students and providing individual interpretations for classroom teachers. It offers practical advice on several variables, including teaching methods (MOE, 2016). That is, it presents a different view on early childhood learning practices, and reflects on a different philosophical orientation regarding how students learn. For example, the teaching approach within early childhood classrooms should provide students with access to subject knowledge to develop their learning skills, such as reading and writing (Cohen & Waite-Stupiansky, 2013).

Principally, the ideas for teaching early childhood students correspond with Piaget's thoughts of teaching and learning, which focus on the thinking process and the use of tools to shift this process (Piaget, 2001). Piaget believes that students can realise how to learn through a well-planned learning environment, focusing on their ability to engage with SLAs that revolve around a key learning experience. Research has explored the core aspect of established SLAs in the context of early childhood and found that learning the basic skills of a subject (e.g. reading and writing a letter), requires students to draw on various sources of knowledge that inform them what needs to be achieved (Keating, 2002). In Keating's study, early childhood learners used the basic learning skills of reading to learn the letters of a word. These students engaged with a well-planned SLA consisting of a carefully sequenced task, repetition, practice and a review

of basic skills. However, these learning experiences seemed to be teacher-guided (MOE, 2016). Learning here depended on doing a learning exercise, and the teaching style tended to support and guide the students to undertake this exercise (Hammed, 2014).

One of the strengths of the teacher-guided approach is that it has been created based on the premise of shaping early childhood students by the environmental experience, while at the same time providing a learning opportunity (Sjoerdsma, 2016). Thus, these learners pursue and complete different directed learning exercises. However, researchers in early childhood learning (e.g. Berge, 2005; Hsieh, 2004) have criticised this method of teaching. They referred to it as a developmentally inappropriate learning practice. Spodek and Saracho (2003) claimed that this method of teaching does not relate to students' daily experiences, the learning materials are not meaningful to students; and there are few opportunities for self-guided exercises. This results in a failure to support mathematical thinking, for example.

A case study that was conducted by Peng (2011) included an aspect of teachers' perspective of play as a means to promote students' learning in a pre-school in Singapore. The study findings raised concerns that this approach concentrated more on what students cannot do, while possibly overlooking their true capabilities. Such concerns are important because of the differences between acquiring learning skills and having these skills as active users. This has been further shown in the work of Miller, Cable and Devereaux (2005) who explored the methods of teaching in the early childhood stage of education. Their work included an examination of the development of SLAs. The results of this examination found that teachers tended to combine the self-and-guide learning. That is, teaching and learning here placed the emphasis on students being able to perform various SLAs either with or without the guidance of their teachers (Peng, 2011).

Aljashaam (2017) studied the way teaching tends to support SLAs and suggested including directed SLAs relating to several developmental learning areas, such as language and literacy, and numeracy. Teaching in this way would be centred on guiding students to capture an experience, understand it, and then perform learning exercises for later reflection and transformation into knowledge. According to Aljashaam, teachers

tend to support their students' SLAs with information and instructions. That is, early childhood students spent their time learning the skills of reading and writing following the teachers' instructions, which was known as the "valued part of the daily routine" led by teachers (Whitebread & Colman, 2008, p. 31).

Research in the field of early childhood has studied the establishment of education for students at the age of three, four and five (Alhariri, 2013). This study found that teachers tended to follow teacher-guided learning because they viewed early childhood learners as *empty bottles* that were ready to be filled with teacher-provided knowledge. Thus, teaching within early childhood learning sessions can be defined as a skill-oriented method that is directed by teachers using face to face instruction (Sjoerdsma, 2016). Saudi teachers are considered by Alhariri to be fundamental to bringing the learning content of language and literacy, and mathematics activities to students. They often break down cognitive skills into smaller units to enable learning. Teaching here aims to enable students to capture experiences, then understand them through active engagement. Thus, teachers offer students appropriate hands-on learning materials, ideas and practical achievements from their own ideas, where they have SLAs that involve basic learning skills, such as "word recognition, language and literacy skills, phonemic awareness and number concepts" (Peng, 2011, p. 180).

For example, Peng (2011) conducted a case study with 18 teachers, focusing on students' experiential learning in the context of early childhood. The author showed that teachers sometimes needed to explain the learning content of a number of SLAs and ask students comprehension questions, often through using repetition, breaking a task into pieces, and offering external reinforcement to shape behaviours. That is, teachers structured a well-planned SLA consisting of a carefully sequenced task of learning skills. Such tasks were given to learners in the form of flashcards or worksheets containing letters, for example a writing activity at the end of alphabet learning.

According to AL-Othman et al. (2015), early childhood students still require the support of their teachers during their engagement with SLAs. They claim that even though teachers' control of students' learning is reduced, teachers still need to guide their students. Teachers facilitate the SLAs while guiding their students' learning with instructions in order to ensure that each student understands the task or activity. As has

been shown in Moore and Hansen's (2012) study, teachers tend to set various learning goals for each SLA and inform early childhood students of what they want them to acquire before they participate in that activity. Figure 2.1 summaries the way teachers facilitate SLAs for their students to learn subject knowledge.

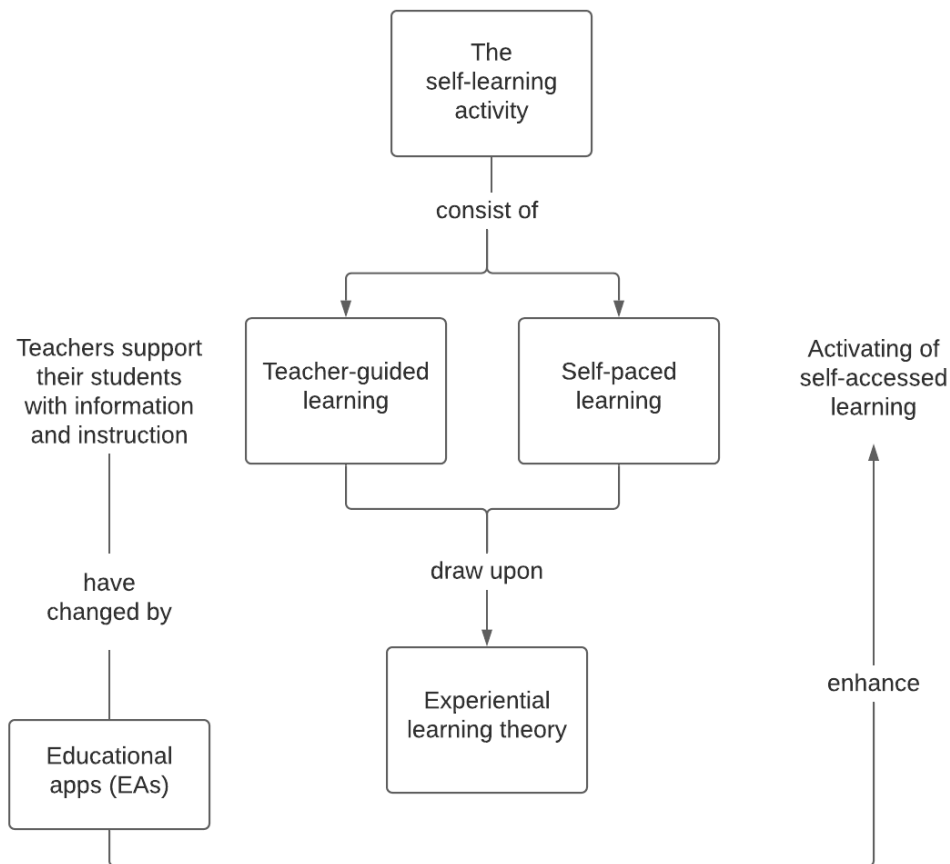


Figure2. 1: The facilitation of SLAs inside the early childhood classroom

Figure 2.1 shows the active knowledge's construction of the subject matter by students through participating in two type of SLAs, including teacher-guided learning, with the emphasis on students being able to perform a learning exercise because of teachers' instructions. For example, phonics are literacy skills helpful in identifying the tone of letters. Students engage in the phonics activity to develop their understanding of the relationship between written letters and spoken letters, while teachers inform their students how to identify such relationships. What stands out in Figure 2.1 is the improvement in the way information and instructions were delivered with stimulating learning materials.

There remains an ongoing controversy concerning the way early childhood teachers engage their students with SLAs (NAEYC, 2009). Scholars argue that many teachers are still engaging in longstanding debates on how to make the learning practice useful for all learners. Recently, with the announcement of school closures, KSA is one of the nation where learners have been going through online teaching (AL-kinani, 2020). As the fight against coronavirus continues, teachers need to avoid losing track of the learning goals to develop students learning skills (Teras et al., 2020). Integrated EAs for students' learning can be considered a significant achievement in today early childhood learning as they focus on delivering learning exercises/tasks. Notability, EAs have been already used by few early childhood teachers to facilitate digital SLAs in KSA since 2016 (MOE, 2020). However, in the current literature, there is still no evidence on whether these EAs have the ability to produce a desirable outcome in early childhood education. Still, the use of EAs in early childhood learning has been covered by international researchers (e.g. Falloon & Khoo, 2014; Geist, 2011; Reeves, Gunter & Lacey, 2017). This thesis contributes to the ongoing debate by conducting research on how learning practice may be changed due to the use of these EAs in Saudi early childhood education.

2.4 Changes in Early Childhood Teaching and Learning

Although Saudi early childhood learning has seen considerable development and modernisation, it still faces numerous issues and challenges in terms of changing the methods of learning. Available literature includes various studies on the quality of pre-schools, the problems faced by teachers, and the obstacles hindering service delivery and/or the application of development that is recommended by the Total Quality Management (MOE, 2020). Hammed (2014) highlighted the MOE's tight control over the educational system in pre-schools as an issue. Interestingly, the MOE is attempting to modernise the Saudi early childhood educational system and improve its outcomes, but these modernisation efforts are not always implemented (Alnahdi & Abdulaziz, 2014).

A study by Khoja (2013) investigated the early childhood learning and found that the methods of teaching followed in Saudi pre-schools had not noticeably changed. Another study conducted by Hamroun (2009) pointed out that the MOE's centralist approach might explain that lack of change. For example, the present system of education (the

Early Childhood Teacher Guide consisting of curricular materials and the teaching methods that should be used) has not changed for a long time, and school regulations have been fundamentally the same for more than 25 years (MOE, 2020).

Research studying the change that has occurred in the Saudi educational system has found that the system is facing several challenges (Alnahdi & Abdulaziz, 2014). For instance, educational technology is not regularly used for students to do SLAs, either because it is not accessible or because teachers do not understand its use. Saudi teachers in pre-schools and other educational settings still engage their students with physical learning materials, such as toys and story books (MOE, 2016), and these may no longer be adequate for students' developments. For example, the Covid-19 pandemic has precipitated an unprecedented change in the learning life of students (UNESCO, 2020). This international health crisis, according to Thomas and Rogers (2020), has pushed early childhood students to online teaching for narrow learning skills, such as spelling and counting, while their teacher serves as a curator for the virtual learning environment.

Innovating and strengthening education has always been a top priority in various countries around the world (Hinds, 2019; Levin, 2001), including the KSA (Alawad, 2013). Hargreaves's (1998) work highlighted that economic development and globalisation play an essential role in educational reforms. In the last decade of the twentieth century and the first of this century, social, economic, and cultural contexts of the KSA have changed due to various factors, including globalisation and technology (Almalki, Finger & Zagami, 2013). Thus, teaching needs to progress with new thoughts and ideas of teaching methods that identify the essential skills students require to become part of the new world (Verenikina & Herrington, 2006).

In light of these changes, the educational system has been influenced in numerous areas, including learning materials and methods, as well as the learning environment in schools. Verenikina, Harris and Lysaght (2003) revealed that internationally, the teacher-guided approach was no longer adequate to prepare students in pre-schools to face the challenges and constant changes in a global society. As a result, researchers such as Al-Asmari and Khan (2014) recommended that early childhood teachers endeavour to enhance their methods of engaging their students with subject knowledge

through using technologies to cope with global changes (Johnson et al., 2011).

However, Nikolopoulou and Gialamas (2015) argued that teachers cannot be fully replaced with other approaches, including digital technology. Instead, technological tools can be used to support, enhance, or modify teacher-guided SLAs.

The International Society for Technology in Education (ISTE) in United States highlighted various strategies that could be used to turn early childhood education into modern learning environments (ISTE, 2007). This is essential to prepare students with the right skills and knowledge for the modern world. When ISTE strategies are used, the modern classroom provides an environment favourable to the SLAs, including the following:

1. Flexible progression within multiple-options paths;
2. Rich media and multi-sensory stimulation;
3. Student-constructed knowledge from multiple resources;
4. Data and experiences; and
5. Collaborative work on authentic real-world projects (ISTE, 2018).

The initiatives previously mentioned, such as the Ten-Year Plan 2004–2014, the Ninth Development Plan 2010–2014, and the Saudi National Strategy for early childhood education, together with the Tatweer Project, reflect on the Saudi government's efforts to modernise and strengthen the early childhood learning system. These projects also aim to improve the early childhood schooling infrastructure and enhance teacher development and training (MOE, 2020). However, some proposed changes have yet to be implemented. This thesis focuses on using EAs among students aged four and five to engage digitally with SLAs. Even though Saudi teachers may be familiar with the concept of technology in education, new learning materials like EAs are still rarely used (Al-Hariri & Al-Hattami, 2016).

2.5 The Development of Technology in Saudi Classrooms

Research on conditions that influence the introduction of technology to enhance early childhood education has identified a common contextual factor, namely educational policy (Unal & Ozturk, 2012; Yalin, Karadeniz & Sahin, 2007). A systematic literature review of 87 empirical studies showed that in many developed countries a technology-integrated policy seemed to promote favourable conditions for schools to use technologies in the learning practice (Hsin, Li & Tsai, 2014). According to Jimoyiannis

and Komis (2007), the technology-integrated policy has been established in 1165 primary and secondary schools in European Union (EU) countries, plus Australia and the USA. This policy began to appear in pre-schools in the USA, Scotland, New Zealand, and China, as mentioned by Dong and Newman (2016), as well as in Scotland and England (Stephen & Plowman, 2008). To determine the usage of technology in everyday learning practice, the policy seems to focus on addressing the potential of technology to access, store, present, and communicate subject knowledge.

However, previous studies on this technology-integrated policy have not dealt with the possibility that the successful use of technology is likely to cause a little distance from existing SLAs and lower dependence on others (Sehnaiová, 2014). This suggests that early childhood teachers need to understand the affordances and limitations of technology, particularly how technologies could support teaching and learning. The affordance of technology is apparently addressed in the Curriculum Guidance for Early Childhood Educational Stage in Scotland and England (Stephen & Plowman, 2008). The guidance includes information about early childhood learning, the objectives it aims to attain, and how teachers use technology tools (Dong & Newman, 2016; Stephen & Plowman, 2008). This guidance would be more useful if it had also focused on the limitations of technology in order to raise teachers' awareness.

Such technology-integrated policies have also appeared in Arab countries such as Kuwait (Alharbi, 2014) and Bahrain (World Data on Education, 2006). In KSA, however, the education policy in general aims to ensure that education meets the religious, economic, and social needs of the nation and to eliminate illiteracy among the Saudi population (MOE, 2020). In this generic vision, no particular consideration is given to the affordances and limitations of engaging students with digital SLAs in early childhood classrooms. Even though the Saudi MOE has consistently tried to develop and change education since its establishment, the idea of using technology to support learning, according to Alasaadi (2012), only came to the MOE's attention when modern technology, especially personal computers and connectivity, became increasingly accessible at the end of the twentieth century.

The effort to enhance education in Saudi schools has been a number-one priority of the MOE, as indicated by Almalki, Finger and Zagami (2013), and using technologies

seems to have been deemed necessary for changing teaching methods that has been followed by teachers to date (Alharbi, 2013). At first, the National Plans for improving Saudi education considered the importance of introducing new learning materials in classrooms (Alqarni, 2015). In 2004, the attributes of digital technology, such as accessibility, speed, interactivity, and communication, began to gain institutional support after the establishment of the King Abdullah National Education Project (Alasaadi, 2012). In 2007, the First National Plan for Science, Technology, and Innovation was established, and in 2014, it published the science, technology, and innovation framework for schools' use (King Abdul-Aziz City for Science and Technology [KACST], 2018).

Since then, many projects have been established to study the potential of the use of technology in schools. For example, the King Abdullah bin Abdul-Aziz Project for Public Education Development emerged to address many possibilities of digital technology to enhance the way teachers tend to deliver subject knowledge (Tatweer, 2018), and to specifically address six objectives related to integrating technology into education:

- 1 To improve students' results by using technology in teaching and learning, thereby successfully preparing these students for the future;
- 2 To enhance teachers' potential by employing technology for classroom use;
- 3 To present rich information about educational environments, scientific content, and direct learning sources for teachers and students;
- 4 To improve the results of educational procedures by facilitating the graduation of a future generation of exceptional learners who have mastered the use of technology;
- 5 To share information about technology by forming a core of advanced technology industry in the Kingdom; and
- 6 To take advantage of using technology in learning and to disseminate knowledge of educational technology throughout society.

These targets can be viewed as framing the premise of the national technology-integrated policy in the whole educational system, including pre-schools, in the KSA (MOE, 2020), although some stakeholders may not be fully convinced of the impact of this policy. The Saudi plan in the facilitation of digital technology for students' use

started in 2010 and focused on the possibility of changing the SLAs in these classrooms (Hammed, 2014). Using questionnaires, semi-structured interviews, classroom observations, and documentary analysis, Hammed conducted four case studies in Jeddah city, KSA, that focused on studying the use of technology in early childhood learning. The findings of the study reported the policy efforts made by the MOE to coordinate the possible use of digital technology in in early childhood learning. This was in response to the Total Quality Management for early childhood learning services instigated by the Early Childhood Education Department in 2010 (MOE, 2020).

The current study considers that this technology-integrated policy may lead to fulfilling the basic requirement for the use of technology in pre-schools, being the availability of devices in classrooms. However, Saudi schools do not seem to have any suitable technology equipment and infrastructure (Almalki & Williams, 2012; Almuqayteeb, 2009). Research has shown that international teachers may struggle to change existing SLAs from teacher-guided to digital learning because of the lack of tablet computers (Bello, 2014; Hew & Brush, 2006). A meta-analysis was conducted by Hew and Brush (2006, p. 226) to identify the main barriers to the use of technology tools in classrooms in various schools in different countries, including the United States. Reviewing their investigation of 48 studies, it can be said that the lack of devices was the most frequent (40%) barrier. Hew and Brush commented that, “without adequate hardware and software, there is little opportunity for teachers to integrate technology into the curriculum.” Even in the case where tablet computers are abundant, in accordance to Hew and Brush, “there is no guarantee that teachers have easy access to those resources.”

A case study using questionnaires and interviews in a Saudi pre-school was conducted into the possibility of teachers using technologies in their classrooms of five-year-old students (Aseri, 2016). Aseri demonstrated that early childhood education had the opportunity to see the use of technology in learning subject knowledge with the support of the MOE. The study acknowledged that the significance of using digital technology in classrooms needed to be recognised by the MOE, who could make substantial investments in technology devices for educational use (Nutt, 2010). In the pre-schools, EAs might be considered as teaching tools that have the potential to deliver subject knowledge to students in the form of SLAs.

From the perspectives of international research, a recent study examined the potential use of technologies in early childhood education and found that tablet computers had been identified by the Michael Cohen Group and the US Department of Education in 2011 as likely to be suitable for four- and five-year-old students (Lu et al., 2017). Chang (2016) used questionnaires to explore the affordances of these tablet computers in early childhood classrooms. This research involved 307 teachers from five southwestern Missouri schools. Kyanka-Maggart (2013) also investigated the potential of these devices in a classroom of five-year-old students with only two teachers and twelve students, using Likert-type surveys and interviews. These two studies reported that tablet computers seemed to be in demand in classrooms because of their affordances of *a user-friendly processing system, ease of use, being lightweight and handheld* devices, and because of their EAs. Flewitt, Messer and Kucirkova (2015) discussed how EAs could provide many opportunities for early childhood students to do SLAs in their own. Their results showed that accessing EAs could provide an opportunity to modify students access to subject knowledge resulting in engaging these learners with digital SLAs.

The KSA is one of many countries that has made many efforts to incorporate EAs in four- and five-year-old students' classrooms (Amoudi & Sulaymani, 2014). Recent research conducted by Sulaymani, Fler and Chapman (2018) indicated that the new Saudi educational policy, known in this study as the technology-integrated policy of the Total Quality Management, seems to encourage the use of EAs in pre-schools. A few Saudi pre-school principals have already purchased tablet computers for classroom use following the guidelines of the Aljwdah Project (this has been confirmed personally through contacts with some pre-schools in 2017).

Clearly, the availability of tablet computers in Saudi pre-schools can provide opportunities for teachers to use EAs. This research was conducted under the assumption that once tablet computers are available in classrooms, EAs' usage automatically follows. However, changes in the teaching and learning process cannot occur simply due to the devices becoming more available in classrooms (Almalki, Finger & Zagami, 2013; Blackwell, 2014; Ertmer et al., 1999). Research has summarised the findings in the literature about the potential use of technology in education and states that "there appears to be relatively low usage of modern

educational technology in Saudi Arabia and Middle Eastern countries” (Alasaadi, 2012, p. 28).

An international study conducted by Blackwell, Lauricella and Wartella (2014) concluded that the presence of tablet computers in the classroom may be deemed necessary but is not an adequate condition for using EAs that provide students the opportunity to engage with digital SLAs. From exploring the role of technology infrastructure from a study of 1,234 teachers in pre-schools, Blackwell, Lauricella and Wartella found that access to tablet computers was essential for using EAs in the classroom, but was not generally related to the frequency of classroom use. Their results indicated that increased access to, but the use or continued underuse of, these EAs seemed to be related to whether teachers took on the responsibility for the effective use of EAs (to help early childhood students achieve academically) or ineffective use of these EAs (never using them in learning sessions).

Interestingly, resistance to the use of EAs seems to be because Saudi teachers may be less convinced of their potential as alternative methods of instruction during students’ engagement with SLAs (Alqarni, 2015). These findings generally appeared to indicate that the presence of a tablet computer in early childhood classes was a condition for its effective or ineffective use, which in turn correlated with the teachers’ perceptions. Badran and Zoubi (2010), however, highlighted the lack of educational studies in the Arab world, especially those examining teachers’ views about using EAs to replace teacher-guided SLAs. Findings of international studies (e.g. Brown & Englehardt, 2017; Dennis, 2016; Price, Jewitt & Crescenzi, 2015) verify that usage of various types of EAs in pre-school classrooms have the potential to change the learning process.

However, because of a lack of studies exploring the affordances of EAs in Saudi classrooms in pre-schools, teachers’ perspectives, the use of EAs to change their way of approaching SLAs, and the affordance of such change on students’ interactions, remain unexplored. The main theoretical framework that guides this project is that the external policy leads to the availability of the devices—encouragement from early childhood management to give teachers the responsibility to change their way of teaching (see Figure 2.2). This makes early childhood teachers’ decisions critical and could have a lasting impact on changing their teaching and learning practice.

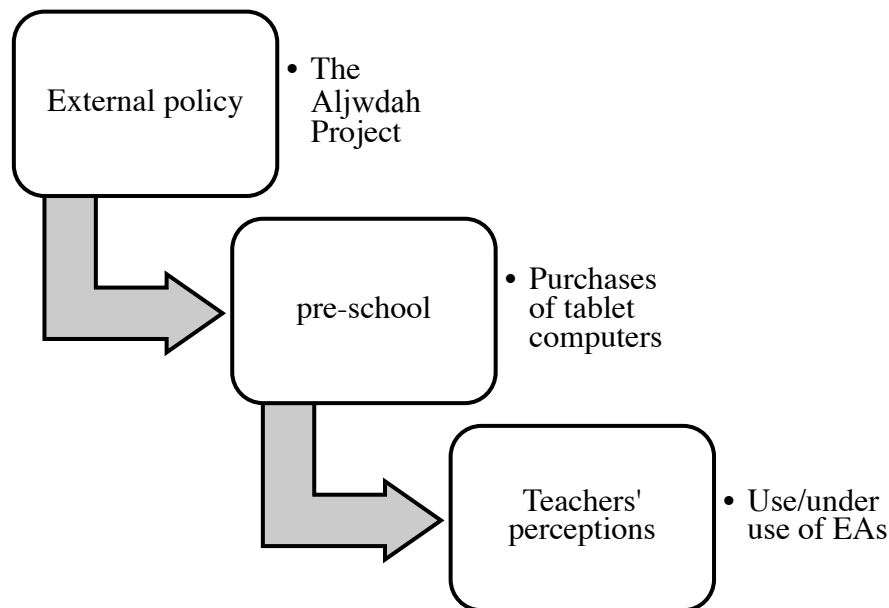


Figure2. 2: The main factor causing changes in teaching and learning practice

The above figure illustrates that external policy from the MOE may encompass a societal and economic reason for introducing EAs in classrooms. The MOE seems to support the use of EAs through the provision of resources, funding, and policy, namely the technology-integrated policy aiming to prepare the future workforce of pre-schools. That is, EAs have the ability to guide students when engaging with digital SLAs. Only a few preschools within the KSA have a detailed educational technology strategy for assigning EAs for student's use (Al Tubaeli, 2017). However, what stands out in Figure 2.2 is that the application of EAs for learners' use cannot take place in a pre-school without the teachers' full approval. In other words, increased access to, but continual use/underuse of, these EAs in a classroom makes it imperative to understand teachers' perceptions.

Exploring teachers' perspectives and experiences of using EAs to change learning practice in early childhood classrooms, and the impact of such change on students' interactions is the main aim of this study. Thus, the next chapters provide existing evidence from the literature of early childhood learning and technology. It reviews EAs used internationally to give readers a broader insight into the issue being investigated, alongside identifying existing knowledge gaps.

2.6 Summary

This chapter provides a short introduction to the field of early childhood education, curricula, and other related concepts. The teaching strategies, which play the main role within the early childhood curriculum of SLAs, are (1) teacher-guided; and (2) play-based grounded on experiential learning theory. This thesis focuses on the changes that occurred within these SLAs due to the use of EAs to engage four- and five-year-old students with learning tasks independently within their classrooms. This study aims to investigate teachers' perspectives and experiences of using EAs to change learning practice in early childhood classrooms, and the impact of such change on students' interactions. It explores students' learning practice inside the classrooms in order to evaluate the quality of such change. By achieving this aim, this study advances knowledge within the field of technology and early childhood learning.

Chapter 3: Changing the Early Childhood Learning Practice with EAs

The current study explored the views of early childhood teachers towards the affordance of educational apps (EAs) in early childhood learning. An investigation was conducted on how these EAs were used in the classroom to provide opportunities for students to participate in digital SLAs considering student engagement: the ways in which early childhood students engage with these EAs to learn. Finally, the study focuses on understanding teachers' views on the potential impact of EAs on students' interactions with their learning.

The literature was searched using the following online databases: Google Scholar, Saga Journals, Scopus, Saudi Digital Library, the University of Leicester Library and Zetoc. Keywords used in the search included early childhood, teaching practice, learning practice, tablet computers, apps that are education, teachers, and students.

Several inclusion criteria have been considered for article to be included in this review:

1. Educational research studies must be conducted in early childhood settings;
2. Studies must be in a technology-enhanced learning, especially tablet computers and EAs;
3. Digital learning studies must have been published in the last 10 years (considering the start date of the current study).

Several exclusion criteria have been also considered to disqualify research studies in this literature review:

1. Studies published in a language other than English;
2. Studies on EAs that was published more than 10 years ago;
3. Studies that were published in other educational stages other than early childhood.

This chapter first provides an account of how early childhood digital SLAs has developed and their impact on teachers' perceptions and learning practice. The correlation between teachers' perceptions and learning practice is considered as the first step towards changing teaching and learning within classrooms. This is followed by examining the process that is followed by teachers to facilitate digital SLAs across

range of early subjects, which in turn emphasises the change in students' interactions with their learning. The subsequent sections explored the literature on the changes in SLAs through the use of EAs to provide students with digital access to subject knowledge. This highlights how teachers harness the appeal of EAs in their student cohorts who may increasingly be drawn towards using these EAs for learning. Finally, this chapter draws on the impact of students' engagement with digital SLAs.

3.1 The Development of Learning Practice

Arthur, Beecher and Downes (2001, p. 145) recognised that there was a need to establish appropriate learning environment, which consist of a balance between novelty, predictability and appropriate repetitions. For this to happen, Arthur, Beecher and Downes argued that the facility of the early childhood educational environment was required to actively interact students with an appropriate learning practice to “satisfy their learning focus, strengths, interests and needs in appropriate and challenging ways.” In designing such learning environments, the current study considered that teachers may need to actively seek the application of digital SLAs. Indeed, early childhood institutions have, in varying degrees, embraced digital technologies into their curricula in order to offer good learning practices grounded on a philosophical perspective of how students work (learn) (Bajovic, 2018; Otterborn, Schonborn & Hulten, 2018).

However, Some researchers have uncovered the ways in which early childhood teachers used technology in their classrooms is less transformative (Al-Faleh, 2012; Alharbi, 2013). According to Al-Faleh (2012, p. 76), “the revolution technology has brought so far in education is far below the changes that were orchestrated when it first emerged.” For example, Aldhafeeri, Palaiologou and Folorunsho (2016) studied the relationship between access to and use of tablet computers in learning subject matter. The researchers used questionnaires completed by 195 teachers in pre-schools in Kuwait. They found that these devices were only used by teachers to complement their conventional learning practice, specifically the way subject knowledge and information were presented.

Such expositions about how tablet computers were used inside the classroom were unsatisfactory because they indicated that there was no student involvement in technology use. The assumption on the use of tablet computers in early childhood

learning is that increasing access to EAs does not necessarily lead to a higher student engagement level with digital learning (Blackwell, 2014). This might be due to teachers' long-term experiences with engaging students with conventional SLAs (Fullan, 2007; Partte, Quesenberry & Blum, 2010), during which students made progress in their learning due to their teachers' instructions and feedback (Aldhafeeri, Palaiologou & Folorunsho, 2016). These previous studies indicated that teachers who had been employed in particular schools for a long time and had used conventional SLAs, were less likely to abandon their teaching approaches and materials and replace them with new ones.

However, these previous studies failed to recognise the significance of EAs to encourage a constructivist way of learning, which may have an influence on teachers as indicated by Kim, Kim and Choi (2016). Evidence in the literature frequently paints a positive picture of EAs in pre-schools because of their ability to enhance learning practices (e.g. Neumann & Neumann, 2017; Vaala, Ly & Levine, 2015). These researchers examined teachers' use of EAs in their classrooms with a focus on the potential use of EAs to provide an opportunity for students to access subject knowledge and information. Their inclusive notion of EAs was to demonstrate their potential for interacting students with digital SLAs. Getting students engaging with SLAs electronically seems to be favoured by today educational systems to keep education running with the universal closing of schools at all educational stages due to Covid-19 pandemic (Teras et al, 2020).

Still, for this integration of change in SLAs to be successful, research has reflected on the impact of several factors, including teachers' values and attitudes and their experience of using EAs (Blackwell, Lauricella & Wartella 2016; Nikolopoulou & Gialamas, 2013). Previous studies have confirmed that the early childhood teacher is a central element in the process of pushing early childhood students to perform digital SLAs (Blackwell et al., 2013; Dong, 2018a). Dong (2018a) confirmed that digital technologies will not be involved in classrooms for students' use unless teachers change their thinking about the potential of these technologies to enable students to learn. The effective use of EAs, thus, ultimately depends on teachers, who are paramount in influencing what happens in their classrooms (Chen, Looi & Chen, 2009). Learning practices are therefore related to teachers' choices and behaviour, which may be

developed from their perceptions of the affordance they have in the learning environment (Loveless, 2003).

A predominant belief between researchers is that EAs have the affordance to influence the way teachers facilitating SLAs (Hinojosa, Labbe & Matamala, 2013). For example, research has uncovered that students have a greater level of involvement in digital activities on language and literacy compared with the conventional way of approaching literacy activities (Price, Jewitt & Crescenzi, 2015). This involvement does not require the guidance of teachers (Papadakis & Kalogiannakis, 2017), because a digital SLA on educational game exercises can be carried out with the guidance of EAs instead of teachers (Liu, Toki & Pange, 2014; Papadakis, Kalogiannakis & Zaranis, 2018b). This learning environment reflects on a set of assumptions about teaching and learning that has been influenced by teachers' thinking and decisions regarding the use of EAs in their classrooms (Dong, 2018b). What this means is that the affordance of EAs should be viewed in relation to the individuals who use them, taking into account their perceptions and the context where they are being. Thus, the understandings of teachers' views and use of EAs is pertinent to the current research's discussion.

3.2 Perceptions and Digital Learning Practice

Perceptions can be defined as the ability of teachers to be aware or knowing (Buldu, 2006). Perceptions are scientific processes of evaluations that teachers make about their teaching based on their information, attitudes, values, theories, and assumptions that they have accumulated over time, and bring with them into their classrooms (Richards, 1998). In other words, teachers' perceptions are affected by their education, knowledge and experience, which could have a considerable impact on their teaching and learning processes (Roehrig & Kruse, 2005; Vorkapic & Milovanovic, 2014).

Previous studies have discussed how the perceptions of teachers about their roles and responsibilities, and their disciplines, are important in determining what occurs in classrooms (Hirsh-Pasek et al., 2015; Mohammad & Mohammad, 2012; Ramirez et al., 2017). They have also demonstrated an interplay between perceptions and digital teaching styles and methods (Domingo & Gargante, 2016; Vorkapic & Milovanovic, 2014), and the relationship between teachers' perceptions and educational change (Blackwell, Lauricella & Wartella 2016; Zaranis & Oikonomidis, 2016). However, this

relationship between teachers' perceptions and learning practices is unidirectional, and change in either of them may imply change in the other.

Vorkapic and Milovanovic (2014) conducted a study to investigate the perceptions of future teachers regarding engaging students with digital SLAs in pre-schools. The study developed an 18-item questionnaire, which was given to 77 undergraduate students from the Faculty of Teacher Education in Rijeka. The findings of this study concluded that the use of technology tools relied on the attitudes of teachers towards education, and the match between the approaches that they used (experience), and their understanding of how to change their approach for a better learning environment (knowledge).

Knowledge held by teachers has been considered a vital element that can lead early childhood teachers to change their thinking about using EAs, as mentioned by Cox and Graham (2009, p. 64). "A teacher's knowledge of how to coordinate and combine the use of subject-specific activities or topic-specific activities... using emerging technologies to facilitate student learning." Changing their learning practice is linked to the extent of the realisation and understanding of early childhood teachers regarding the potential of EAs to provide chances for learners to take the initiative to perform SLAs.

Even though teachers' perceptions are shaped by their knowledge and information, which influences learning practices, their perceptions cannot exist without personal experience (Oppell & Aldridge, 2015; Prestridge, 2012). Oppell and Aldridge (2015) explored teachers' perceptions and their learning practice in Abu Dhabi using questionnaires completed by 198 teachers, with 15 of them also being interviewed. The findings of their study indicated that the knowledge, information, and experience of teachers are all required to build up their perceptions. Thus, perceptions without any knowledge, information and experience are impossible. Figure 3.1 demonstrates the relationship between these three elements: experiences, knowledge and perceptions.

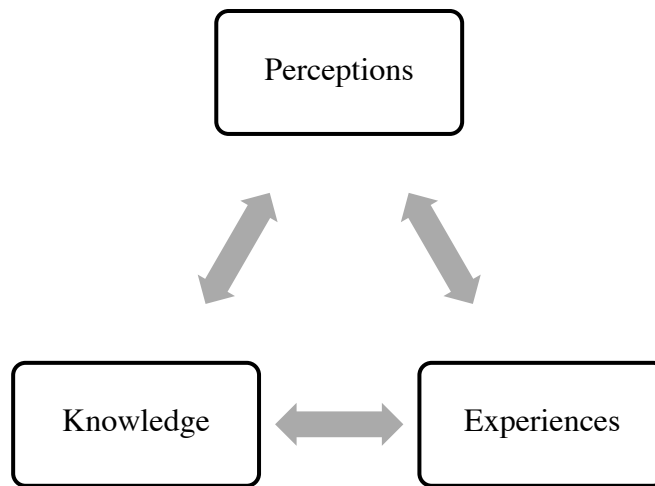


Figure 3. 1: The relationships between three elements affecting the use of EAs

Flewitt, Messer and Kucirkova (2015) believed that teachers' understanding and experiences in using EAs in pre-schools shaped their application of digital SLAs. Teachers who are familiar with the potential of EAs for learning, confidently apply them to enhance learning opportunities, compared with those who are unfamiliar with digital learning and often lack confidence in applying EAs (Almalki, Finger & Zagami, 2013). However, the authors overlooked the fact that perceptions may change, and to change teachers' thinking, there needs to be discussions with other colleagues to understand how to foster a new type of SLA (Camilleri & Camilleri, 2017). Having these discussions with colleagues, who have experience of using EAs, contributes to the shaping of teachers' own knowledge, and this in turn leads these teachers to apply EAs in their classrooms.

Other research has investigated how the experiences of individuals tend to make rational contributions to their knowledge, which in turn can lead to them forming their own judgements and perceptions (Lynch & Redpath, 2014). Lynch and Redpath found that various sources of experience, such as a change in teaching approaches and teachers' awareness of the ability of this change to alter students' engagement with SLAs, could shape their perceptions. Another study highlights that the choice of teaching methods and materials is an important factor that determines what happens inside the classroom (Kaymakamoglu, 2018).

Alharbi's (2013) study on teachers' perceptions in KSA and the United States questioned how teachers' perceptions could lead to a change in teaching and learning.

She claimed that the views they held led these teachers to create a set of personal assumptions that could lead to the development of new views and practices. Hence, different perceptions might lead to different learning practices (Alzaidiyeen, Mei & Fook, 2010). Thus, teachers' perspectives and experiences of using EAs to change learning practice in early childhood classrooms, and the impact of such change on students' interactions are needed to be considered (Bas, Kubiato & Sunbul, 2016).

3.3 Perceptions on Changing the existing SLAs

By reviewing Petko's (2012) study of teachers' perceptions of, and changes in, the learning practice, it can be argued that embracing a perspective of enhancing students engaging with technology requires a shift in teachers' fundamental assumptions and perceptions about learning and teaching. Research on the implementation of digital SLAs in classrooms has focused on teachers' perceptions and the use of EAs (Domingo & Badia, 2016). Domingo and Badia conducted a survey with 102 teachers from 12 schools in Spain. The results of their study revealed that the choice to use EAs might have been because teachers perceived EAs as tools that could provide an opportunity for students to increase their subject knowledge by enabling them to do several predetermined tasks in early childhood classrooms.

Different attempts have been made to identify the potential of EAs to engage students with subject-specific SLAs. For example, Flewitt, Messer and Kucirkova (2015), explored the use of EAs in learning new knowledge regarding language and literacy in early childhood classrooms in England. Flewitt, Messer and Kucirkova found that these EAs could offer chances for students to engage with digital activities on reading and writing because of their ability to support and lead students through delivering information and instruction. This considerable potential of such EAs to support students' learning is well recognised by Falloon and Khoo (2014). Their study has firmly established that EAs might become ubiquitous in changing from teacher-guided SLAs to digital learning.

Prior research on EAs has reflected on a certain assumption about aiding the changing process of teaching and learning by applying EAs, which might have an impact in learning (Oliemat, Ihmeideh & Alkhawaldeh, 2018). In Jordan, for example, EAs have been considered helpful for young students to improve their learning skills, such as

reading and writing. This benefit has been attributed to different features afforded by EAs, such as animations, monitoring and evaluating learners' work, and increasing students' control (Patchan & Puranik, 2016). Here, it can be believed that EAs, which have the potential to engage students with digital SLAs, are critical in early childhood classrooms to optimise teaching, which in turn improves learning (Vaala, Ly & Levine, 2015).

What stands out from these digital SLAs is that learning takes place inside the classroom when early childhood learners take the initiative to use EAs that have the ability to provide each students with visual and acoustic interactions as well as instructional learning content that develops student-learning experiences (Papadakis, Kalogiannakis & Zaranis, 2017). For example, Dennis (2016) studied the effect of using EAs on the development of six students who had participated in an assessment and intervention program. Dennis found that EAs provided an opportunity for an independent student to discover, decide, and realise the consequences of his and/or her actions.

Many studies that have focussed on the use of this type of EA in pre-schools have concentrated on providing examples of how these EAs are perceived and used to engage students with SLAs on language and literacy (Castek & Beach, 2013; Cubelic & Larwin, 2014), numeracy (Bebell & Pedulla, 2015; Bullock et al., 2017; ; Rogowsky et al., 2017), shapes (Noorhidawati, Ghalebanti & Hajar, 2015), and sciences (Castek & Beach, 2013; Falloon, 2013). Drawing on previous studies, EAs are perceived as an affordance to easy access of subject knowledge (Almashaileh, 2016; Kyriakides, Meletiou-Mavrotheris & Prodromou, 2016); to open up a new means of cooperation and the sharing of information among students (Falloon & Khoo, 2014; Kim, Kim & Choi, 2016); and to stimulate learners' thinking through training them to solve problems (Hartatik, 2019).

However, these authors overlooked the fact that such EAs do not encourage students to create ideas, concepts and knowledge (Henderson & Yeow, 2012; Lynch & Redpath, 2014). According to Henderson and Yeow (2012), the function of EAs focuses only on providing and receiving results, which only help students to develop their ability to answer questions, follow instructions, drag objects and tap the screen at certain times

(more details are provided in section 3.5.2), while preventing these students from creating and developing their own content. Therefore, some early childhood teachers may not be convinced of the affordance of these EAs on students' progress (Kerckaert, Vanderlinde & van Braak, 2015).

An example of a teacher's perspectives about the use of these EAs in a classroom of five-year-old students in Australia illustrated unsatisfactory outcomes of digital SLAs (Lynch & Redpath, 2014). Their results indicated that when these EAs were used, learners could become mere passive receivers of instructions. Thus, even though several researchers may approve of the influential use of these EAs in the classroom, this does not guarantee success in changing teachers' perceptions of engaging their students with using these EAs (Qureshi et al., 2012).

Generally, What the relevant literature has demonstrated is that teachers' responses regarding the use of EAs in their classrooms seems to be related to their perceptions, which are likely to be affected by the affordance of EAs to access subject knowledge resulting in students interacting with digital SLAs (Khlaif, 2018). In short, teachers' perceptions serve as the main factor that determines how learning practice has changed in the classroom. Thus, bringing the voice of teachers on board may lead to better understandings of the development of digital SLAs for students' work. Figure 3.2 summaries the relationship between teachers' perceptions and educational change.

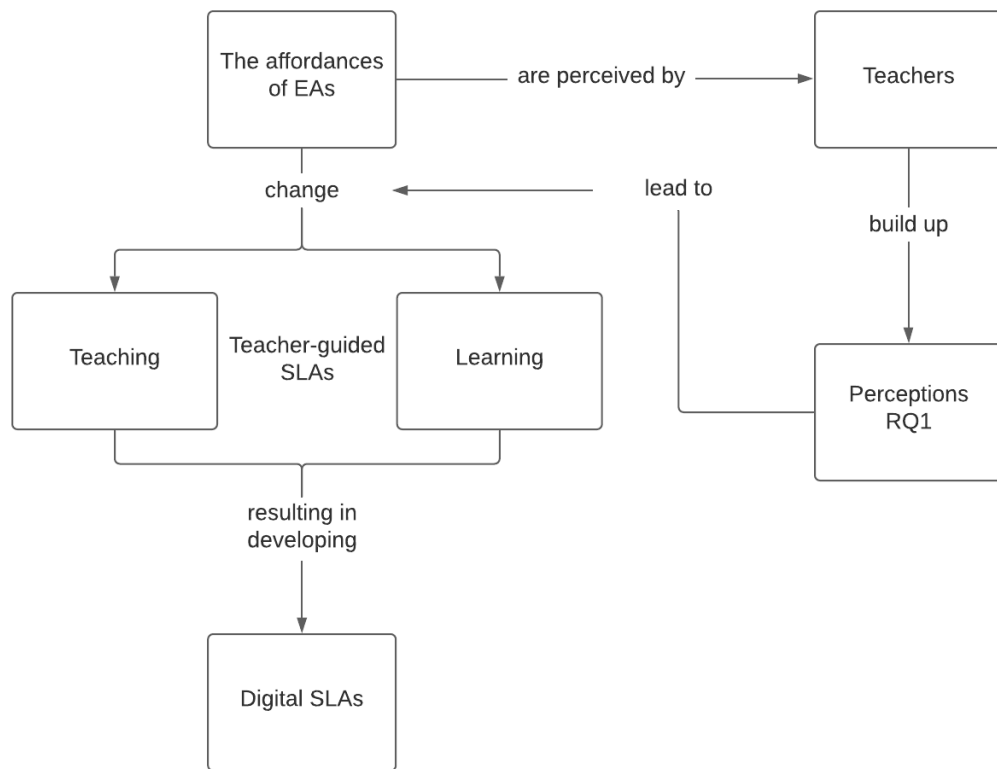


Figure 3. 2: The relationship between teachers’ perceptions and educational change

Figure 3.2 identifies a knowledge gap among the findings of previous studies in relation to the questions of perceptions and educational change. The diagram shows that taking advantage of the combination of affordance and EAs to enhance several aspects of teaching and learning is determined by teachers’ perceptions. The results of the previous studies indicated an increase in attention to research that examines the perceptions of teachers. What can be clearly seen in this figure is that teachers’ thinking is helpful to determine what happens in classrooms and to know that there are various ways of using EAs in early childhood learning practice, if these EAs are used appropriately (Comi et al., 2017). Thus, the following section looks at examples of how EAs have the ability to enhance the way of leading students’ learning, which can bring an effect on these students.

3.4 Teachers’ Use of EAs in Early Childhood Classrooms

The current study responds to the increased interest in using EAs in pre-schools. It examines how early childhood teachers used EAs to change the way subject knowledge was taught to students resulting in engaging early childhood learners with digital SLAs.

The main aspect is to explore actual digital learning practice with EAs in terms of teachers' roles and responsibilities and the use of EAs. To change from teacher-guided to digital SLAs, there should be a change in perspective and learning practice. This change can be understood as a situation where early childhood teachers improve the preparation of students for productive function.

3.4.1 Teachers' roles and responsibilities

Planning for students' learning is one of the tasks carried out by early childhood teachers before taking direct action in their classrooms as it relates to the way these teachers teach (Ramirez et al., 2017). Ramirez and his colleagues argued that teachers should make a few preparations when choosing to use EAs that have the potential to provide an opportunity for students to do exercises of subject matter digitally. The researchers explored the relationship between lesson planning and delivery by interviewing 18 early childhood teachers, and observing nine of them. They found that learning practice is linked to teachers' decisions regarding what needs doing inside the classroom.

Firstly, teachers should be aware that their roles are shifting from providers to facilitators (Beauchamp, 2012). As a facilitator of digital SLAs, teachers should "make judgments about what is age appropriate, individually appropriate, and culturally appropriate" (NAEYC, 1996, p. 1). This position statement by the National Association for Education of Young Children (NAEYC) places a great responsibility on the teachers to critically explore EAs and use them to benefit students. In reviewing Mohammad and Mohammad (2012), who questioned the usage of technologies in classroom, it is believed that early childhood teachers should firstly evaluate EAs to prepare a suitable digital SLA.

Therefore, the present study took into consideration how early childhood institutions provides learning experiences that are developmentally appropriate to students, who depend on their teachers to choose suitable EAs (Blake et al., 2012). The following criteria were considered when examining how teachers provide learning experiences with EAs:

1. Age appropriate;
2. Purposeful and educational;

3. Clear instruction;
4. Students in control;
5. Independence;
6. Non-violent content; and
7. Process orientation (Haugland & Rui, 2002).

When identifying EAs that meet these criteria, teachers should plan the learning for the lesson as well as planning the digital SLAs. However, this step can bring a challenge that has been highlighted by Ali (2013), who studied the use of tablet computers in schools, including pre-schools in Dubai, United Arab Emirates (UAE). The author reported that most EAs had been developed in English. “English as a medium for instruction is a serious hindrance for promoting” SLAs in Non-English-speaking countries (Qureshi et al., 2012, p. 314). According to Qureshi and his colleagues, students with low proficiency are unlikely to use these English EAs due to their lack of confidence in understanding the learning content.

Secondly, teachers need to determine the learning objectives required for students to begin engaging with digital SLAs. Research suggests that students learn best when they interact in learning experiences that are guided by specific goals (Hirsh-Pasek et al., 2015). Therefore, EAs that are developed with a suitable blend of games, practice, and educational goals are required for classroom use due to their ability to enrich early childhood students’ cognition, resulting in promoting effective learning (Fleer, 2018). This conclusion is supported by the literature and deserves to be further clarified. Research suggests that using EAs facilitates the retention of taught subject knowledge with appropriate content, timing and intensity (Radesky, Schumacher & Zuckerman, 2015). A quasi-experimental study of 28 students in a public pre-school in Florida found teachers’ chose to use EAs that had the potential to provide students with access to subject knowledge and information (Reeves, Gunter & Lacey, 2017). These EAs were specifically used to support numeracy and language learning goals (e.g. concentrating on phonics or counting). Early childhood teachers chose EAs that targeted a wide array of functional learning skills, in line with language and numeracy developments.

To cite an example, Alzannan (2015) explored the use of EAs to support the natural way that students learn in the pre-school in KSA. A tablet computer was provided to each of 20 students to use for digital SLAs within the classroom. The findings of the study show that teachers selected various literacy-specific EAs to engage learners with SLAs on language and literacy, and that these EAs have the ability to engage students with several literacy goals, including improving language skills. These EAs are very effective as a real-life experience for assigning language activities to students.

According to this study, EAs can increase these early language skills, including reading and writing by offering SLAs with letters, phonics and word recognition. Therefore, EAs that are developed with literacy content can be useful in promoting vocabulary developments, as well as reading comprehension, while engaging students with digital scaffolds, such as oral animation and games (Radesky, Schumacher & Zuckerman, 2015).

In contrast to these previous studies, which have only dealt with using these EAs to learn subject knowledge in order to achieve specific learning skills, Price, Jewitt and Crescenzi (2015) suggested the possibility of using EAs to help students take control of their own learning. That is, the learning objective of applying EAs is to help students to create their own content about subject knowledge. Instead of focusing on the subject-specific learning objectives, Price, Jewitt and Crescenzi believed that engaging students with EAs needed to focus on achieving the objective of active learning. However, they made no attempt to differentiate between different types of digital SLAs. Another study conducted by Geng, Disney and Mason (2016) focussed on various types of digital SLA, found that the main aim of engaging students with EAs was playing.

Thirdly, students' competence in using tablet computers and EAs should be considered as an important aspect when preparing digital SLAs. Hammed (2014) conducted four case studies in Jeddah, KSA and two in Scotland, focusing on the use of technology devices in early childhood classrooms. Hammed used a range of research methods, including questionnaires, interviews, classroom observations and documentary analysis. The results of the study highlighted the fact that unfamiliarity with the operating features of technologies might hinder the learning process where students needed more assistance. These results were also confirmed by Plowman, Stephen and McPake (2010), who reported that students may need assistance with new technology tools if

they are unfamiliar with their features. This in turn revealed another issue for Scottish early childhood teachers who found it difficult to dedicate the time needed to help their students to become familiar with using technology due to time constraints.

Fourthly, teachers should determine the number of students working on digital SLAs. Previous research attempted to determine the number of students required for this approach to work. A quantitative, quasi-experiential research study examined the effect of one to one tablet computer on students' numeracy achievements in two rural Virginia primary schools, include early childhood classrooms (Carr, 2012). This study suggested that the success of learning with EAs relied on individual learning. One of the findings of this study was that learners had opportunities to gain a better understanding of learning concepts through individual experiences when working with EAs. Thus, EAs were used to foster individualised learning in pre-schools (Blackwell, 2014). That is, a student engaged in an individual piece of work for a limited time before he/she took turns with another student (Cubelic & Larwin, 2014).

However, Beschorner and Hutchison (2013) found that the function of taking turns was a disadvantage to several students, because not enough time was dedicated to performing digital SLAs for all students within one classroom. They continued to study students' engagement with EAs, and suggested that EAs could be applied successfully in classrooms when teachers engaged their students in pair learning. Learners now had opportunities to begin a meaningful conversation with their classmates and were able to solve problems together, resulting in constructing their own knowledge through their interactions with their classmates (Vygotsky, 1978). Prior research on the benefits of such interactions showed that students at the age of five could develop their interactions, collaboration, communication and negotiation skills when they participated in digital and sociocultural tasks (Martin et al., 2018).

However, critics of such work include Henderson and Yeow (2012), who investigated the use of EAs in a primary school in New Zealand. Interviewing teachers revealed that when one student dominated the learning task in an EA, the other student was marginalised. However, this study did not consider the features of cooperative learning that enable students to help each other to understand the operation of the digital task

(Falloon & Khoo, 2014). Reviewing Falloon and Khoo's study indicated that students helped each other to complete the learning task by making suggestions.

Finally, early childhood teachers should set several rules for their students to use tablet computers in order to teach these students self-discipline:

1. Place the device on the table when working with an EA;
2. Log off the device after every use and place it on charge when finished;
3. Handle the technology device gently; and
4. Learn with any EA quietly (Gecawich, 2018; Sanders, 2015).

The relevant literature has demonstrated that more and more early childhood teachers may bring EAs into their classrooms to enhance teaching and engage learners with digital SLAs (Papadakis, Kalogiannakis & Zaranis, 2018a; Shifflet, Toledo & Mattoon, 2012). However, regular use of EAs requires these teachers to add a new set of rules to their SLAs dictating a proper behaviour and use of these EAs (Sanders, 2015). It is worth noting that teachers have to find a balance between engaging students with digital SLAs and banning them from using EAs. For example, a student engages in an individual piece of work for a limited time (Cubelic & Larwin, 2014). However, less is known about the way teachers tend to engage their students with EAs. Therefore, the next sub-section describes some of the work undertaken in the field of engaging learners with digital SLAs.

3.4.2 Learning using EAs

There is a growing interest to better understand the use of EAs in a naturalistic setting in early childhood education (Palaiologou, 2016; Yelland & Gibert, 2017). In this context, a great deal of discussion is directed toward the nature of these EAs to support teaching inside classrooms across a significant number of SLAs (Kokkalia, Drigas & Economou, 2016; Levy & Sinclair, 2017). Therefore, EAs have the potential to enhance the digital knowledge and experience of students while supporting their development of learning skills.

Falloon (2013) studied the use of EAs through observing one classroom of 18 students and a teacher in a school in New Zealand. The study found that several EAs were developed to support and facilitate literacy, numeracy and science activities through puzzles, matching games, maths games etc. The study's results indicated the

possibilities of using these EAs to enhance literacy, such as phonemic awareness and alphabet principles, as well as numeracy, including the identification of numbers and learning to count. Thus, EAs have attracted the attention of researchers and teachers in the early childhood education field, who have realised the potential of applying them to enhance emergent learning skills (Ibrahim, Ahmad & Shafie, 2015).

For example, Noorhidawati, Ghalebanti and Hajar (2015) described the use of EAs in classrooms by observing 18 students at the ages of four to six. They explored students' interactions with EAs that were developed for literacy and mathematics, such as Alphabets App, Mathematics Game for Children App and Shapes Apps. Noorhidawati, Ghalebanti and Hajar found that these EAs can be used to engage early childhood students with literacy and mathematics activities in a simple way in which students could access and understand subject knowledge. For example, when a student accesses the Alphabet App, he or she is engaged with letters and words related to the reading and writing of vocabulary. Such intervention is associated with promoting emergent learning skills, such as letter-sound knowledge and counting numbers.

The teaching perspectives of these types of digital SLAs have been questioned by many researchers, such as MacCallum and Parsons (2016) and Harasim (2012). Accordingly, EAs can form an association between different learning experiences through drill and practice (Harasim, 2012). This research examined the use of technologies for drill and practice in early childhood classrooms using questionnaires given to 154 teachers in Jordan (Ihmeideh, 2010). Learning here is a matter of imitation and practice. In using EAs, students have the opportunity to engage with SLAs that are built around a number of developmental learning areas, and which involve practice and reward. Learning with these EAs occurred when students were shown the appropriate reinforcement, whereby teaching within them was supported by drill and practice (Keskin & Metcalf, 2011). Thus, it can be argued that the experiential behaviourists' principles are commonly seen in these EAs (MacCallum & Parsons, 2016).

From a behaviourists' perspective, teachers can "house[s] a list of questions and mechanisms through which the learner respond[s] to questions. Upon delivering a correct answer, the learner is rewarded" (Harasim, 2012, pp. 42). According to Skinner, the impact of behaviourism can be found in the stimulus-response pattern of classroom

interactions, with the teachers giving the information and instructions. Teachers present students with educational material to learn and then test them to ensure that they clearly remember the correct answer (Skinner, 1986). When students pass the test, teachers provide the next set of learning materials in a learning sequence.

Following this line of thought, Skinner's theory (2003) provides a basis for developing an educational machine (i.e. a mechanical device that presents educational materials), measurable learning objectives and technology-assisted instructions. This means that teaching has developed in ways which increase a desirable behaviour through instructions and guidance, which could also occur through EAs. As indicated by Gahwaji (2016, p. 13), "transformation of the traditional forms of instruction into the modern form of teaching is possible" because of the introduction of EAs. Brown and Englehardt (2017) provided insight into how early childhood pre-service teachers used EAs in their coursework. They studied the transformation of teaching instructions and the experiences of their participants in the context of a real daily learning environment. The study highlighted an opportunity for teachers to consider as they sought to introduce a new instructional strategy into their classrooms, when aiming to use EAs.

For instance, Outhwaite and Faulder (2019, p. 284) conducted a study on the use of EAs to engage learners with a mathematics activity; the participants were 389 students aged four and five, in the United Kingdom. The study revealed that EAs that were developed with early mathematical content had the ability to change the way information and instruction were informed. Also, results showed that the features of such EAs, combining aspects of knowledge and instruction with play, may have accounted for students gaining early mathematical skills. These results suggest that "structured, content-rich," EAs can offer "a vehicle for efficiently delivering high-quality" teaching instruction for all students in an early childhood classroom context.

Previous studies questioned the use of EAs as teaching tools in early childhood learning and concluded that the process of learning in the form of EAs seemed to be an attractive method of instruction that supported and enabled the process of learning new knowledge (Cubelic & Larwin, 2014; McLean, 2017; Neumann, 2018). To cite an example of students' learning with EAs, Neumann (2018) examined the effect of using EAs that were developed to enhance language and literacy skills with 48 English

speaking students aged two to five. Of these students, 24 were provided with tablet computers to use the Endless Alphabet App, focusing on matching games, and the Letter School App focusing on the tracking of letters. The study described the patterns of these EAs and found that they were developed to guide students through the provision of learning content with instruction to promote their acquisition of letters and vocabulary, and reading comprehension. Thus, an increasing interest among researchers regarding the use of EAs seems to rely heavily on the successful replacement of teaching instruction (Cubelic & Larwin, 2014).

Hence, Cubelic and Larwin (2014) questioned how early childhood teachers used EAs to replace their teaching instructions. They conducted a quasi-experimental study with 281 early childhood students in Dynamic. The study's results revealed that several EAs were developed to enable early childhood learners' access to subject matter supported by learning tasks and the influence of teaching instructions. As demonstrated in Flewitt, Messer and Kucirkova's (2015) study, when students accessed an EA, information and exercises about the alphabet were displayed, in which students could be directed with instructions. The aim of these tasks within EAs was to provide learners with the correct answer, followed by monitoring and supporting them to ensure that each student acquired the necessary knowledge. That is, they were required to fill in answers, select a pattern and so on, after which they received feedback to correct any errors.

Meyer's (2013) study investigated students' engagement with EAs, and concluded that learners were actively engaged with digital learning because of the potential of EAs to guide their learning through instructions and immediate feedback. Falloon considered the function of providing immediate feedback in situations where an EA suggests a change that enables a student to continue and finish their learning exercises. For example, the Pirate Treasure Hunt App, in which the five-year-old students forms a ladder by sequencing from the hottest words to the coldest words, with the App checking his/her responses and providing feedback to help him/her finish the exercise (Falloon, 2013).

Hence, research has questioned the ability of EAs to support learning in the form of immediate feedback on students' progress (Oladunjoye, 2013). Oladunjoye studied how four teachers introduced EAs into classrooms and considered how the feedback from

these EAs assisted the performance of early childhood learners. Oladunjoye believed that feedback was helpful to check, trial and refine students' work, which means that an EA with learning content supports self-correction. Thus, the four teachers considered EAs as effective tools that supported teaching at the same time as enhancing learning. That is, these EAs had the potential to provide information for students who received guidance on how to undertake the SLA, followed by evaluation and comments on their work.

What has been shown in the literature is the affordance of EAs to provide opportunities for students to do digital SLAs that are grounded on digital teaching instructions and feedback to extend students' control over their learning.

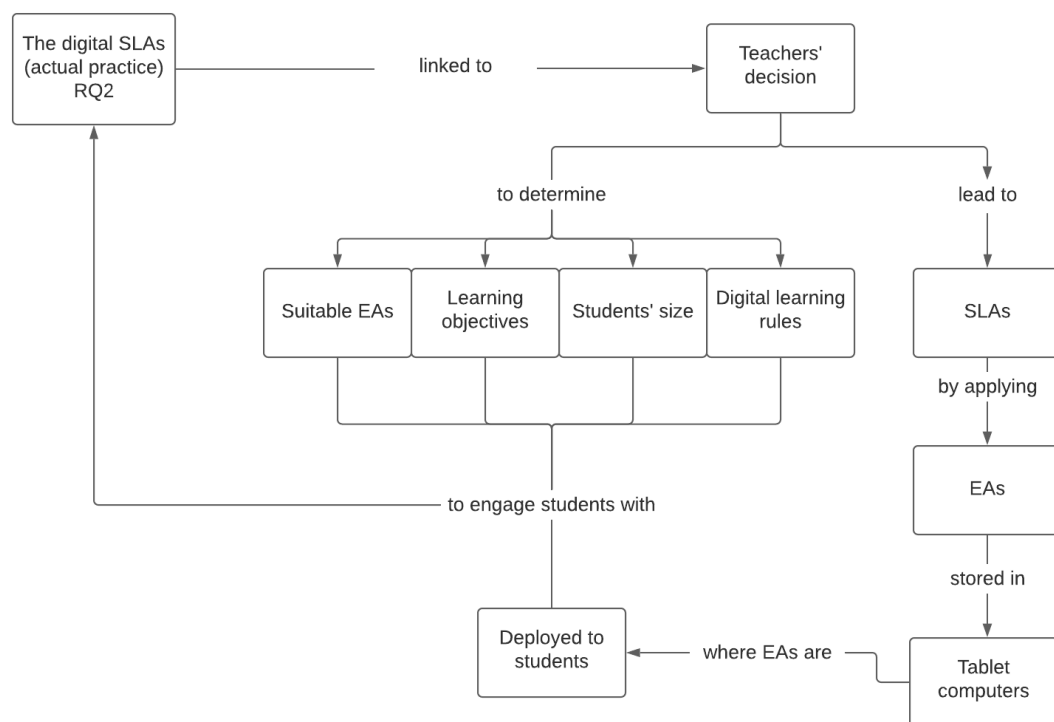


Figure 3. 3: The process in applying EAs in the classroom: Actual practice

This section has described the process followed by many teachers for applying EAs in their classrooms. Figure 3.3 provides a summary of the results of previous studies in relation to the question of applying EAs in classrooms. As shown in the diagram, teachers are responsible for preparing their digital SLAs in order to change teaching and learning. The findings of previous research have revealed a growing interest in

providing a better understanding of the actual digital learning practice in naturalistic settings of early childhood education. What can be clearly seen in this figure is that teachers' decisions are linked to the engagement of students with EAs. Therefore, the following section discusses teachers' views of the impact of using EAs on students, which in turn may have an impact on their decisions.

3.5 The Effect of Digital SLAs on Students' Engagement

As the interest of engaging students with EAs has increased, examining the impact of these EAs on students have been considered by previous research studies (Alresheed, Leask & Raiker, 2015; Lindahl & Folkesson, 2012; Vanderlinde, Aesaert & van Braak, 2014). A possible drawback of applying this approach has been internet connectivity. With access to the Internet, researchers believed that early childhood students might be inappropriately exposed to uncritical engagement with knowledge (Henderson & Yeow, 2012, p. 80). Henderson and Yeow expressed a concern that students may be exposed to digital SLAs that were "unproductive and unrelated to school," for example, some learners might access inappropriate websites during learning time. However, such concerns may not be relevant in the context of EAs that can be used without Internet connectivity.

In comparison with other technology devices, Bebell, Russell and O'Dwyer (2004) claimed that because of connectivity to the Internet, teachers have to be in control of the learning process when students engage with digital SLAs using computers. However, at present students can use a tablet computer to access specific EAs that promote learning without using the Internet (Castek & Beach, 2013). For instance, Garduno (2016) studied the use of EAs for mathematics activities by students aged three to five, and argued that there is no need to be concerned about students being exposed to inappropriate materials as these students only access EAs, which are downloaded by their teachers, without the need for Internet connection.

Previous studies have indicated the availability of a huge number of EAs that have the potential to engage students with digital SLAs. (Hartatik, 2019; Neumann, 2018; Rogowsky et al., 2017; Sharkins et al., 2015). In a study of students engaging with EAs in classrooms, Papadakis and Kalogiannakis (2017) found that the ease of use and portability of these EAs made them ideal to be used for digital SLAs to be deployed to

learners. Research on these digital SLAs presents some basis for hypothesising that students' interactions with these EAs have a moderate influence on their achievements, motivation and behaviours (Bullock et al., 2017).

3.5.1 Early childhood students' achievement

Raising achievement in students' digital SLAs is an issue of national importance. The NAEYC and Fred Rogers Centre in Saint Vincent College (2012) released a positive statement about using technology with students, that is, when technology is used appropriately and intentionally, it becomes an effective tool to achieve learning goals. Combining such guidelines with two studies on the use of EAs (Alade et al., 2016; Kiili et al., 2014) further illuminates the understanding of early childhood teachers for engaging students with EAs to promote an increase in students' achievements of early language and literacy, and numeracy. The two studies indicated that there was a significant discrepancy in developments of attainment in reading, writing and counting when EAs were used. In response, Kiili et al. (2014) called for a focus on learning in early childhood classrooms through an effective, efficient and evidence-based intervention to support early language and literacy, and numeracy, developments and to increase language and literacy, and numeracy achievements.

For instance, Bebell and Pedulla (2015) investigated the short-term and long-term quantitative impact of the Auburn Public pre-schools' efforts to provide five years-olds' classrooms with a tablet computer. Eight classrooms were provided with these devices to use different EAs. The results of Bebell and Pedulla's longitudinal study demonstrated a potential increase in the achievements of technology users. For example, EAs had the ability to stimulate students' engagement with mathematics activities to increase their numeracy skills. The objective of these EAs was to identify different numbers as one, two or three depending on the order, followed by counting how many objects were on the screen at the same time, which became possible with numeracy EAs. In this context, the flexibility provided by EAs permitted students with motivation to develop and increase their learning skills.

3.5.2 Early childhood students' motivation

According to the proponents of using digital technology in the classroom, the results of teachers' decisions to apply EAs in their classroom demonstrate that an EA seems to

play an important role in motivating students to learn (Papadakis, Kalogiannakis & Zaranis, 2018b; Pegrum, Oakley & Faulkner, 2013). A multi-setting study was conducted to examine the use of EAs by students across four schools in the Australian context (Geer et al., 2017). The project took place in two government schools involving students aged five to twelve and two non-government schools involving students aged six to fourteen. Data was gathered through teacher interviews, online surveys for teachers and students, and focus groups for all students. Findings suggested that 40% of students used EAs at least six times a week. The researchers noticed that these students were more motivated to learn when they used EAs.

Another study conducted by Price, Jewitt and Crecenzi (2015) observed early childhood learners from two to four years of age in the classrooms of a London pre-school. They focused on exploring how students responded to two types of learning materials, such as (1) pen, paper and toys, and (2) EAs. The findings of this study revealed high levels of motivation among learners who used EAs. A similar increase in students' motivation was also found by Flewitt, Messer and Kucirkova (2015, p. 297). They conducted an observational study of students at the ages of three to thirteen using different types of EAs in England. They noticed that students "particularly enjoyed the facility to undo and review stages of their work," which reduced "the perceived consequences of making mistakes." From reviewing these studies, it seems that students at the age of four and five were more motivated to learn when they used EAs.

Nevertheless, these findings failed to consider that although early childhood students are highly motivated when they engage with EAs, they might have a negative disposition towards students' developments (Sehnařlová, 2014). A qualitative study, consisting of classroom observations and semi-structured interviews, explored how EAs were used by nine teachers in four suburban Midwest schools (Blackwell, 2014). The study showed a concern regarding the possible detrimental effects of students' engaging with digital SLAs. Possible negative effects can include the lack of physical exercise, isolation and aggressive behaviour (Cordes & Miller, 2000). From reviewing a study by House (2012), an example can be used to illustrate a negative effect; using EAs that have the potential to engage students with subject knowledge digitally may lead to a lack of physical exercise in the case of tracing and matching a letter, number and shape, using only one finger.

Hence, the urge to protect students at any educational stage from technologies has been propagated by House (2012), who reported that any type of technology has no place in teaching and learning because of their negative effect on students. However, other research has reported on the increased access to different types of technology devices in schools (Blackwell et al., 2013). Thus, some concerns about the consequences of these devices, such as isolation and addiction are raised here.

3.5.3 Social interactions

Research has indicated that early childhood students tend to spend a long time working with technologies, including EAs, at home or school, resulting in them potentially missing out on social interactions with their families, teachers or classmates (Sehnařová, 2014). Sehnařová expressed strong concerns on the negative effects of EAs on students' behaviours in relation to the time spent using these EAs. The author concluded that learners at the ages of three to four may become used to the sedentary way of spending their learning's time, which could lead to social problems. According to Sehnařová, the more time an early childhood student spends on EAs, the greater the number of signs he/she displays of isolation, anti-social, and aggressive behaviour.

Even though EAs face strong criticism due to the potential negative effects on students' behaviour, Yurt and Cevher-Kalburan (2011) studied the impact on students of using technologies from the perspective of 100 teachers. They argued that any positive or negative effects of learning with EAs depended on how they were used in actual practice. Yurt and Cevher-Kalburan emphasised that technology had a positive effect on students when teachers used it appropriately. To apply digital SLAs in classrooms, teachers are responsible for deciding how students should use EAs. For example, evidence in the literature shows that monitoring how students use an EA by enforcing rules on how much time they are allowed to perform digital SLAs could be a good solution (Saxena & Hew, 2016).

3.5.4 Independence

A mixed method study that assessed the viability of tablet computers in early childhood classrooms found in favour of using EAs as a new teaching tool (Couse & Chen, 2010). They stressed the importance of allowing students to have more control of their own learning. The study's results show that students can learn quickly when using EAs, and

they become more motivated to learn, which in turn positively affects their behaviour as they become independent learners. Upon reviewing the work conducted in four pre-schools in Scotland by Stephen and Plowman (2008), before the development of EAs, students may have had opportunities to engage with digital SLAs using technology tools to enhance their learning. Based on their results, it can be argued that students can change significantly, become independent, and gain confidence in their performance when they learn with EAs. Nevertheless, students still need a facilitator who can direct their actions so that they do not become over-dependent on technology.

A similar finding was expressed by Lynch and Redpath (2014) who conducted an ethnographic study investigating the use of EAs in classrooms by interviewing a classroom teacher, the principle and 12 students aged five, followed by classroom observations in a primary school in Australia. The classroom teacher was unsatisfied with using EAs but was using them because of the sense of independence that they imparted, in which five-year-old students could access an EA on their own. Moreover, the study considered the issues that may arise from using these EAs; based on the classroom teacher's perceptions, students' closing and re-opening of a selected EA often solved the problems that occurred when they use any EA.

Lynch and Redpath's study, however, overlooked the technological problems that may occur when dealing with technology devices. Other researchers further highlighted concerns regarding the challenges that may be faced by teachers attempting to use tablet computers and requiring technical support, which, if inefficient, would complicate the provision of technology in classrooms (Almalki, Finger & Zagami, 2013). Considering such challenges faced by teachers when they apply EAs for learning, it is possible that applying EAs might not be successful and might not provide effective SLAs.

To sum up, this section has described contradictory views regarding engaging students with digital SLAs. The results of previous studies have indicated a growing desire to investigate these contradictory views. The third aspect of this study considers teachers' awareness and thoughts of the ongoing debate regarding whether EAs positively or negatively influence students when engaging with digital SLAs. The assumption here is that early childhood teachers are undoubtedly conscious of the controversy surrounding the use of technology in their classrooms. However, this needs to be balanced with

ensuring the motivation, well-being (behaviour) and development of students, particularly the use of EAs since they are the latest tools used for teaching and learning (Fabian & MacLean, 2014). Figure 3.4 provides a summary of this section.

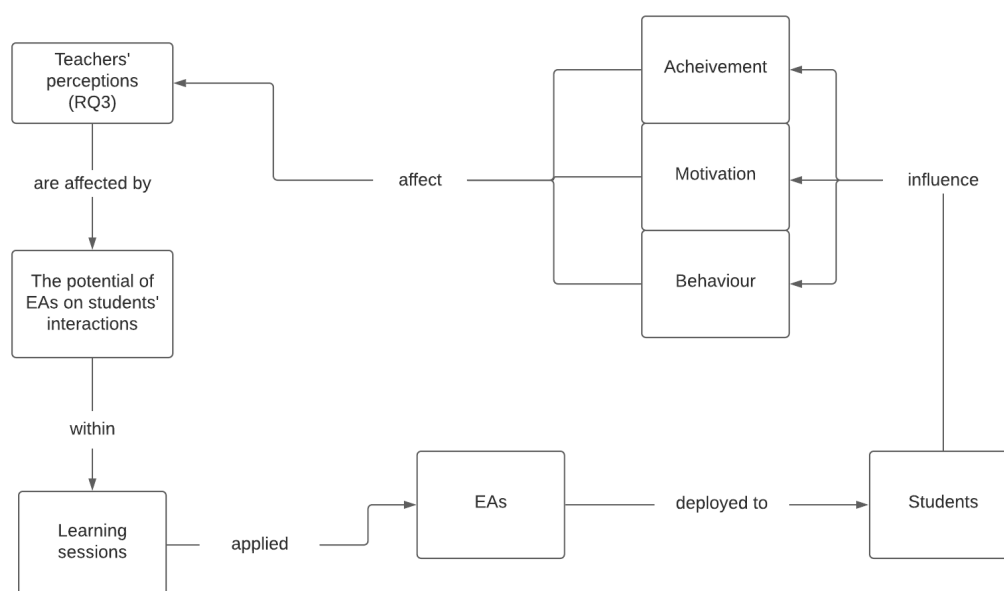


Figure 3. 4: The potential of EAs on students' interactions: perceptions

It is apparent from Figure 3.4 that the potential of EAs has an impact on students' engagement with SLAs, which in turn has an influence on teachers' perceptions. Therefore, the current study investigated teachers' perceptions of the impact of using EAs on students' engagement.

3.6 Summary

This chapter has reviewed studies focusing on the continuous change in the way of teachers provide their students with access to subject knowledge through facilitating SLAs to include EAs in early childhood education. From this review, three main elements (teachers' views, affordance of EAs to change teaching and learning, and the impact of such change on students' interactions) have been covered. These elements have been examined in various cultural and teaching settings. Studies in the literature seem to confirm the principles of the theory of affordance, which advocates that the interpretation of the perceptions of teachers (who used EAs) might determine how new teaching tools can possibly be used (to change learning practice). This review shows

that EAs are regarded as tools for supporting students' SLAs with information, instructions and feedback, resulting in extending students' control of their learning. Practically, because of the variety of procedures and the inconsistency of learning practices across settings, early childhood teachers remain doubtful about this affordance in their classrooms.

Using the experiential learning theory, SLAs seem to be created through the transformation of experiences. early childhood teachers claim that the presence of EAs enable content learning of literacy and mathematics to take place without the physical presence of a teacher. This could refer to Skinner's (2003) theory of educational machines and Piaget's (2001) theory of learning, but clearly at work is the theory of educational machines, evident through participants' use of the word delivery to emphasise the necessity of literacy and mathematics learning content, and the affordance of EAs as a delivery and knowledge provider.

Although many studies exist on how EAs have been used in classrooms with students, there is still a knowledge gap on how early childhood teachers perceive these EAs for continually improving their own way of supporting SLAs. Thus, this study explored the extent to which teachers' views on the affordance of EAs could lead to change the method of teaching that has been followed by teachers (in line with RQ1). Through questioning, followed by observing the actual classroom practice, this study explored how these teachers use EAs in their classrooms (in line with RQ2). In order to provide an understanding of students' engagement with digital SLAs, and the effects of EAs on students, this study addressed the ongoing debates on the perspectives of the impact of EAs on students' engagement with digital SLAs (in line with RQ3).

Based on my review of the literature, the theoretical bases that were used to answer the RQs are the theories of affordance and experiential learning. The first significant theory contributing to this study is the theory of affordance, which has been applied to the psychology of perceptions (Borghi et al., 2012). It has been appropriated by educational systems where it has been found to be interested in the "relation of possibility... and action potential" (Van-Lier, 2004, pp. 91-92). The second significant theory is the behaviourists' learning theory, namely Skinner's (2003) theory of educational machines, which has been applied to the use of EAs to guide students. The third

significant theory is the constructivists' learning theory, namely Piaget's (2001) theory of learning which has been applied to develop appropriate practices.

Using the theory of affordance, EAs used by students seems to be central to their teachers' perceptions. The study found that there are several affordances of EAs, including displaying and planning. It emerged from the study that EAs are tools that are used to uphold learning content.

This study was carried out in a setting where teaching instructions have been the core forms of SLAs. Thus, the results will potentially be relevant to teachers and educational policymakers who are working on introducing EAs in pre-schools.

Chapter 4: Research Methodology

This chapter, therefore, describes the research philosophy guiding this study and the choice of research design, the study context, and the sample. A discussion follows presenting the methods of data collection and analysis. A reflection on the credibility, transferability, dependability and confirmability of the study findings are also discussed. This chapter concludes with a discussion regarding the ethical considerations relating to qualitative research and how the issues of ethics are managed in the current study.

4.1 Research Questions

This study investigates teachers' perspectives and experiences of using EAs to change learning practice in early childhood classrooms, and the impact of such change on students' interactions. The study focused principally on the possibilities of using EAs to supplement SLAs in order to establish evidence that would reveal the potential of using EAs in pre-schools. Data were collected to answer the following RQs:

1. What perceptions do Saudi teachers have in relation to the affordance of EAs in early childhood learning?
2. How do these teachers at the pre-school use EAs in their learning practice?
3. How do teachers perceive the capability of EAs vis-à-vis early childhood students' engagement with SLAs?

This study focuses on teachers' experiences of using EAs, which have potential to enhance SLAs on language and literacy, and numeracy. The study, therefore, concentrated on the following four EAs:

1. Arabic Letter and Word App
2. Abjad App
3. Shapes Learning App and
4. Number Learning for Kids App

A description of these EAs is provided in section 4.3.

These EAs were chosen because teachers were advised to use these EAs and, when they were given tablet computers, these EAs were already downloaded for classroom use.

How students learn from the interaction with EAs is beyond the scope of this study. This is similar to previous studies (e.g. Brown & Englehardt, 2017; Lu et al., 2017; Lynch & Redpath, 2014). As explained later, I used the observation method to explore how these EAs were used by teachers to change their learning practice.

4.2 Research Philosophy and Approach

Educational research aims to increase our understanding of the social world and generally lead researchers to action. Johnson and Christensen (2014) argued that researchers' views of the social world is shaped by their beliefs and purposes that form their paradigm. Punch (2009, p. 16) stated that a paradigm is "a set of assumptions about the world, and about what constitute proper techniques and topics for inquiring into that world." That is, a paradigm means an entire constellation of thoughts and techniques shaped by members of a given educational community. This system of beliefs relies on two types of assumption: the ontological assumption, which refers to what we believe the nature of social reality is; and the epistemological assumption, which indicates how we understand the reality of our world (Thomas, 2013). These two assumptions are paramount in studies because they have an influence on the design and process of research (DePoy & Gitlin, 1998).

These ontological and epistemological assumptions can be recognised in an educational research depending on the nature of the RQs (Scotland, 2012). The three questions of this study investigated the interactions of humans in a complex context, *the classroom*, while looking at the intentions and reasons that govern behaviours (Bryman, 2016). The attempt, here, is to retain the quality of EAs in early childhood learning, through reflecting on everyday experiences of early childhood teachers in relation to the change of teaching and learning in, and students' interactions with SLAs. Thus, the aim of these RQs is concerned with "personal meaning, interactions and subjective interpretations. Ideas construct reality (...) through understanding human motivation and action" (Kettley, 2010, p. 68).

The interpretivist approach is more suited for this study since this approach stresses that an educational setting can be properly examined when referring to the meaning given by participants about their actions (Blaxter, Hughes & Tight, 2010). According to Cohen,

Manion and Morrison (2000), interpretivism comes from values, informed views and moral judgements, alongside an accepting of the idea that individuals can provide interpretations of their own experiences. Thus, this approach acknowledges that individuals actively construct their social world. Consequently, the interpretivists attempt to make sense of social events around the individuals by limiting reality to contexts, spaces, times, individuals or groups in each situation, and thus, it may not be generalised into one reality (ibid).

Additionally, the social world change over time, thus research study is meaningless without evidence made with the regard to a political, ethical and reflexive concern (Scott, 1996). The interpretivists allow for a social event to have multiple interpretations as it recognises the complexity of a social reality, in most instances (Creswell, 2003). However, it is difficult to perceive the social world directly, as Thomas (2017, p. 110) indicated, “it is not simply ‘out there’; it is different for each of us with words and events carrying different meanings in every case.” In interpretivist studies, therefore, researchers talk and listen to participants to understand their perceptions, experiences and interactions of the social world to generate reliable knowledge (Corbin & Strauss 2008). However, critics of such methods have argued that such negotiated meanings are not absolutely accurate and trustworthy because researchers might fail to appreciate the power of external forces shaping the social world (Cohen, Manion & Morrison, 2011).

4.2.1 Implication for research methodology

According to Maxwell (2013), the credibility of any research is based on the research process and the clarification of the ontological and epistemological assumptions. In this way, readers can make a judgment regarding whether the knowledge produced in the study is valid. Furthermore, it provides integrity and coherence to the study (ibid). The interpretivist inquiry is reflected in this study process for choosing a research design, sample, data collection and analysis that fit with the philosophical assumptions of interpretivism, in which the main purpose is the acknowledgement of multiple perspectives of the phenomenon (Castle, 2012). Table 4.1 summaries the different research processes of the current study guided by the selected research paradigm.

Table 4. 1: The consistency between the research process and interpretivism

Research process stages	The reflection of interpretivism in the different stages
RQs	This study posed questions to understand the teachers' views and practices regarding the affordance of EAs in early childhood classrooms and their effects on students' interactions with their learning.
Research design	The choice of a qualitative study as it is an interpretivist inquiry.
The selection of sample	The choice of a purposive sampling approach.
Methods of data collection	Using two different research methods: interviews and observation to acquire different perspectives on the investigated phenomenon.
Methods of data analysis	The selected approach for analysis enables the incorporation of different perspectives.

4.2.2 Qualitative approach

In its need for verification, the interpretivist paradigm suggests a concern with social events, the matters and things that individuals directly capture via their senses as they go about their daily lives (Cohen, Manion & Morrison, 2011). In seeking insight into individuals' perspectives, the interpretivists use qualitative approaches, such as interviews to permit the participants' voices to be heard (Castle, 2012), and classroom observation to establish how the affordance of EAs is changing the methods of teaching, which in turn may have an impact on learning. Observing what occurs inside the classroom is considered to be another source of data that can be used to validate data collected from interviews to answer RQs.

Qualitative study is concerned with gathering and analysing data in "as many forms, chiefly non-numeric, as possible." It tends to concentrate on examining, "in as much detail as possible, smaller numbers of instances or examples which are seen as being interesting or illuminating, and aims to achieve 'depth' rather than 'breadth'" (Blaxter, Hughes & Tight, 2010, p. 65). Using a qualitative method, I was involved closely

enough to be able to gain an insider's view of the field (commonality shared by participants). This allowed me to learn and understand participants' experiences so that insights could be obtained regarding the complexities and subtleties that are often missed by the positivist inquiry (Dwyer & Buckle, 2009). The qualitative approach uses a more descriptive style of the events in the specific learning situation, resulting in new insights from practitioners, which may be otherwise unavailable (Blaxter, Hughes & Tight, 2010). A qualitative description may play an essential role in gaining an understanding of the underlying reasons and motivations of a dynamic process (ibid).

However, there are quite unique limitations to the qualitative research approach as described by Cohen, Manion and Morrison (2007). Firstly, the results from qualitative research cannot be verified because of the subjective nature of the data, and the research origin in a single context makes it difficult to apply a conventional standard of reliability and validity. Contexts, situations, individuals and events are unique and largely non-generalisable. Thus, the points of view of participants and the researcher have to be identified and clarified as a result of the possibility of bias. In fact, my presence may have a profound impact on the issues under investigation. Secondly, the process of qualitative research is time-consuming. The time needed for collection, analysis and interpretation of data is lengthy, for which several weeks or months are required (Burns, 2000). A more balanced view on verification, subjective nature, reliability, and validity of data is provided in section 4.8.

Although many have criticised the use of subjective judgements (refer to the influence of a personal feeling and opining (Cohen, Manion and Morrison, 2011)), in my opinion, such judgements are not disadvantageous. As Woods (1996, p. 40) argued, it is 'unnatural to ask questions as if there is no implicit shared knowledge at all'. As a researcher, I am not involved in any way with early childhood teachers' digital learning experiences. However, I am an early childhood educator who is experienced in teaching early childhood students using technology (i.e., I bring my own teaching experiences of using devices in early childhood classrooms during my Bachelor's degree to the present study site). In this way, I consider myself to be an *insider*. I believe that as a member of the same early childhood community as my participants, my teaching knowledge and experience of the organisational and cultural setting in which my participants work will be very useful to my understanding of these participants' utterances.

Cohen, Manion and Morrison reinforced this view of insider knowledge (2011, pp. 19–20), emphasising that “individuals’ behaviour can only be understood by the researcher sharing their frame of reference: understanding of individuals’ interpretations of the world around them has to come from the inside, not the outside”. As an insider, I can make sense of the words, thoughts and reasons my participants offer (Johnson & Christensen, 2014). I believe that I was able to more accurately read the nuances of their experiences and practices. These experiences exist in an educational setting, which I can use to collect details on the rich interactions between factors and processes. I use a qualitative approach to examine early childhood teachers’ perspectives on the change in learning practices when they use EAs as well as the effect of such changes on students’ interactions. My overall aim to investigate the affordances of EAs in early childhood education warrants a qualitative approach, as it allows me to uncover the complex patterns inherent to the social environment of the case study (Cohen, Manion & Morrison, 2007).

4.3 Case Study

Various methodologies, described by Newby (2010) and Sharp (2012), were explored to determine the research method that can be adopted to answer the three RQs in the current study. These three questions are concerned with the enhancing learning practice through engaging students with digital SLAs using EAs. To answer these questions, a case study was used in this research study. This method is preferred over other strategies when the researcher has limited control over the events (Sharp, 2012, p. 54), and when the focus is on a “dynamic of everyday life rather than the outcomes or products which emerge as a result of it,” in order to explore the social world in the real-life of participants in a specific time and space. Johnson (1994, p. 20) defined a case study as “... an enquiry which uses multiple sources of evidence. It investigates a contemporary phenomenon within its real-life context, when the boundaries between phenomenon and context are not clearly evident.”

Cohen, Manion and Morrison (2011) further clarified what is meant by a case study, arguing that it is a set-in context, with obviously characterised limits (organisational, geographical, institutional), involving real individuals and groups with shared roles and capacities. By selecting a particular single case to be investigated, the researcher can break down the social world in detail to provide an insightful understanding with

respect to participants, who voluntarily share their experiences and practices (Denscombe, 2010). Corbin and Strauss (2008) explained the strength of the case study method, which provides interpretations of other similar cases and the ability to explore the diversity of activities. Also, the perspectives and understandings of individuals' experiences, as well as the concepts generated from a typical case study can be extended in a subsequent case (Yin, 2012).

Even though one of the most notable limitations of a case study approach is that the results can be hard to generalise due to the small sample size (Bell & Waters, 2014), case studies can attempt to draw theoretical propositions rather than generalise results. Hence, rather than generalising results, the current study seeks to describe, explain and investigate a phenomenon. As further argued by Lee, Mishna and Brennenstuhl (2010), a case study approach can provide a clear understanding of the specific learning situation as opposed to being concerned with statistical generalisation. However, when the circumstances of the selected case are similar to other cases in the same learning setting, as is the case of this study, an alternative method may be required in light of how much researchers can unquestionably foresee whether they can transfer the results to similar settings. This is referred to as "best estimate of trustworthiness" by Bassey (2001, p. 19).

The current study was carried out in one of the public pre-schools with an all-female staff in the Alhsa administrative area of KSA. To ensure confidentiality, the name of the pre-school has been anonymised. The school, occupying a government building, is located in the eastern part of KSA. The school's teaching staff had received formal requests to use various EAs by Saudi educational authorities (Al Tubaeli, 2017). The staff consisted of the principal, three senior staff members, two student academic advisors, 17 teachers and a secretary. Two of the teachers were responsible to provide a good learning practice for each class of the three early childhood learning levels/grades. The school had eight classes; three grade-three classes with students aged five years, three grade-two classes with students aged four years, and two grade-one classes with students aged three years. Each classroom had an average of 30 students.

In this school, only one Samsung tablet computer was available per classroom for all students, who took turns to use it to access EAs. Early childhood teachers employed in

this school were selected to participate in the initial stage of the MOE's new project, the Aljwdah Project (Al Tubaeli, 2017). The project required the school to create a variety of SLAs on language and literacy, or numeracy using pencils and papers, toys, teacher-made learning materials and EAs (MOE, 2020) so that students could perform different type of exercises at the same time. For example, four students could colour letters or numbers using crayons and paper, while two learners could write the letters or numbers using pencils and papers. In addition, one tablet computer was requested to be placed in the classroom so that one student at a time could participate in SLAs on language and literacy and numeracy using EAs for up to fifteen minutes. The current study examined early childhood students' use of EAs when they had only one tablet computer to share.

This study investigated the affordance of EAs that ran on this tablet computer. The tablet computer is defined as a wireless portable device with connectivity having a touch screen interface (Henderson & Yeow, 2012), used for its ability to access subject knowledge content electronically in the classroom at various schooling stages (Vanderlinde, Aesaert & van Braak, 2014). Evidence in the literature has indicated the potential of tablet computers in pre-schools, derived from their potential to access a huge number of EAs (Ferguson & Oigara, 2019; Kucirkova, 2014).

The current study investigated the affordance of EAs as a new teaching strategy within early childhood classrooms. To reflect more accurately on normal classroom use, the present study focused on investigating the types of EAs that were applied by the research participants. Interestingly, sufficient EAs were available for students to develop their language, numeracy, and distinguishing skills. These EAs were *Abjad App*, *Arabic Letter and Word App*, *Shapes Learning App*, and *Number Learning for Kids*. The learning focus of each of the selected EAs are explored in this section. These EAs were carefully chosen by the management supporter (T12) because of their interacting features, ease of use for young students, and potential to foster emergent reading and writing, and numeracy skills.

4.3.1 Abjad App

The *Abjad app* is a literacy-specific EA that provides visual reading and writing prompts and embedded sound to help support and guide early childhood students as they learn to read and write. This EA teaches students the twenty-eight letters of the

Arabic alphabet and allows them to learn both how to write the letters and the proper pronunciation of the letters and words. With a colourful interface, this EA ensures that students are continually engaged as they learn the basics of reading and writing. When students open this EA, they have two options: *Learning* or *Playing*. The *Learning* option teaches students how to read and write letters, while the *Playing* option offers a variety of exercises that will help them apply the lessons they have learned (see Figure 4.1).

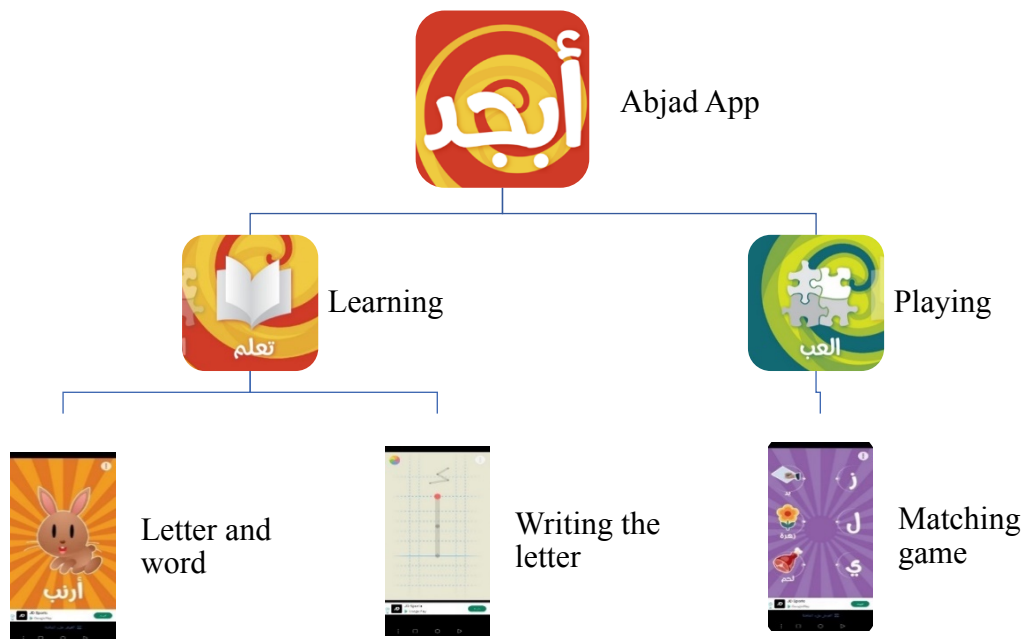


Figure 4. 1: The function of Abjad App

In the *Learning* menu page, students will again see two options: *Letters and Words* or *Writing the Letters*. In the *Letters and Words* tab, students can select one of the letters/words listed on the screen to hear the pronunciation of the letter. Afterwards, the screen will show a singing animated character accompanied by the word that will be pronounced. The students can then return to the *Learning* menu page to play the *Letter Writing*. Here, a red dot with a light black line over the letter appears on the screen. The learner must tap the red dot to complete the shape of the letter. If they tap the correct dots, the letter will be formed and students will hear a sound that the task has been completed.

In the Games' menu page, students can choose from five easy games: *Search Game*, *Matching Game*, *Installing Words Game*, *Memory Game*, and *Form of Letters Game*.

1. In the *Search Game*, the screen will show a picture of an animated character or food, a word, and three proposed letters. This is accompanied by an audio recording of a child saying "search for the first letter."
2. The *Matching Game* presents three pictures of animated characters or foods with words and three proposed letters on the left and right side of the screen, respectively. This is accompanied by the child's voice saying "match the letter and picture."
3. In the *Installing Words Game*, there is a picture of an animated character or food shown with a jumbled word. This is accompanied by the child's voice saying "rearrange the letters."
4. The *Memory Game* provides sixteen cards containing eight letters, with two cards containing the same letter. This is accompanied by the child's voice saying "look for similarities."
5. The *Form of Letters Game* function presents a word with a missing letter under a picture of an animated character or food. The screen will show different ways of writing the missing letter, accompanied by a child's voice saying "look for the correct way of writing the missing letter."

When the students correctly accomplish these exercises, they will hear a congratulatory sound and a new game screen will appear. However, if they incorrectly do the exercises, there is an alert sound which indicates that an incorrect answer has been given. Students then have to redo the activity until they select the correct answer.

4.3.2 Arabic Letter and Word App

The *Arabic Letter and Word* app is also a literacy-specific EA for early childhood students (Lynch and Redpath, 2014). This EA was developed to teach the twenty-eight letters of the Arabic alphabet. It offers a variety of exercises and games that test a child's knowledge of the letters, words, and animals, accompanied by a person's voice through the EA's audio. Students can likewise learn the proper pronunciation of letters and words through using this EA. When a student opens the EA, he or she has six options: *Reading*, *Writing*, *Drawing and Colouring*, *Test of Alphabet*, *Test of Words*, and *Test of Picture* (see Figure 4.2).

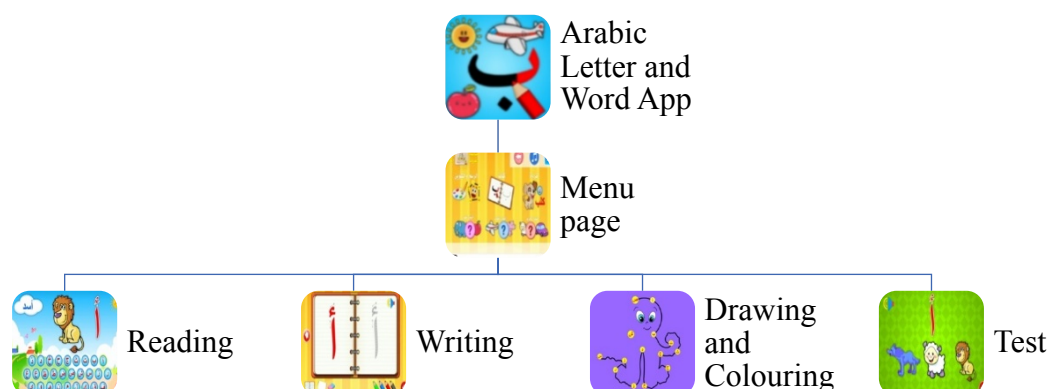


Figure 4. 2: The function of Arabic Letter and Word App

The *Reading* option teaches students how to read letters using both the pictures and words of an animated character, accompanied by a human voice pronouncing the letter. Meanwhile, the *Writing* option teaches them how to write letters. The rest of the options offer a variety of brain tests with exercises that will help test their knowledge of the alphabet and vocabulary to apply the lessons they have learned. These exercises are:

1. *Drawing and Colouring* is an easy game to test a student's knowledge of a new letter, which allows students to discover different letters and sounds. The screen shows an incomplete picture, accompanied by the pronunciation of the letter. Students need to hear and select the letters in the correct sequence to complete the picture. If they successfully do this, a colourful picture will appear, followed by a new option to colour the picture themselves.
2. The *Test of Alphabet* presents three animated characters with a letter of the alphabet, while the *Test of Words* shows three animated characters with a word. These are accompanied by a human voice pronouncing the letter/word. These are simple games in which students need to match the picture to the letter/word to proceed to the next letter/word. These exercises aim to test students' previous and new knowledge.
3. The *Test of Picture* works in the opposite way. Here, three alphabet-words are presented with the first alphabet-picture. It is a good game to test the students'

memory from the previous two tests. In a similar way, students need to select the matched word to the picture to move to the next alphabet-picture.

When students finish any of the tests, they have to press the arrow to move to the next exercise. When they choose the wrong answer, nothing will happen; but when they answer correctly, an arrow will appear to signal that they can move on to the next item, along with an animated character of a baby who is clapping.

4.3.3 Shapes Learning App

The *Shapes Learning* app is a mathematics-specific EA for early childhood learners to distinguish between different shapes. It was designed to teach shapes through three different exercises, which are presented by a panda character and accompanied by a voice telling students what to do. Each exercise provides an easy game that helps students to distinguish between various shapes (see Figure 4.3 below).

1. For the *Collection and matching* game, a panda character appears in the middle of the screen, accompanied by a voice saying “Help Yumu collect the shapes.” This game then begins by showing an incomplete object with four different shapes. When students match the shapes correctly, a voice prompt says the name of the shape and another incomplete shape appears.
2. In the *Messy Room* game, the Panda is shown stumbling over objects, accompanied by the voice saying “Help me arrange the room.” The panda character is then shown holding a basket with the drawing of a shape on the left side of the screen, with objects of different shapes, accompanied by the voice saying the required shape.
3. In the *Shape form* game, students are tasked to finish the form of the shape. It starts with an unformed shape, accompanied by a voice saying “Let’s play music together” Or “I am hungry, help me in make delicious dessert.” Next, a green flashing dot with the white dotted-line forming the shape will appear on the screen. The learner must tap the green dot to form the shape.

When students correctly do the exercises, they will hear a congratulatory sound and a new game screen will appear. However, if they incorrectly do the exercises, a reject sound is heard. This indicates that an incorrect answer has been given and students have

to try it again until they choose the correct answer. After doing a number of exercises correctly, students automatically move on to the next exercises.

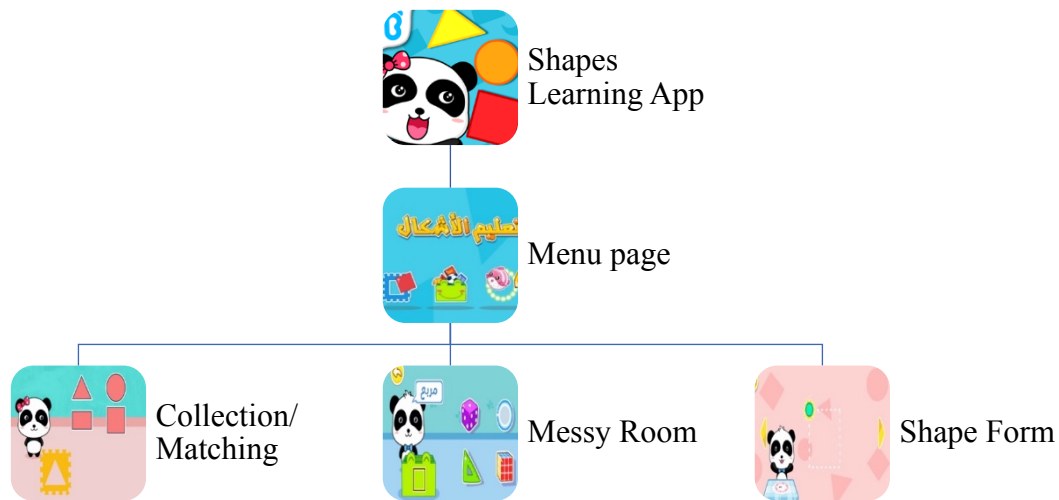


Figure 4. 3: The function of Shapes Learning App

4.3.4 Number Learning for Kids App

The *Number Learning for Kids* app is a mathematics-specific EA that teaches early childhood students to distinguish between numbers from one to ten. This EA was designed to teach numbers by offering a variety of exercises related to the form of the number and how to count things—which in this EA are ducks—guided by a child's voice. When a student opens the EA, he/she will have three options: *Numbers' Learning*, *Test of Number*, and *Where is the Number?* (see Figure 4.4).

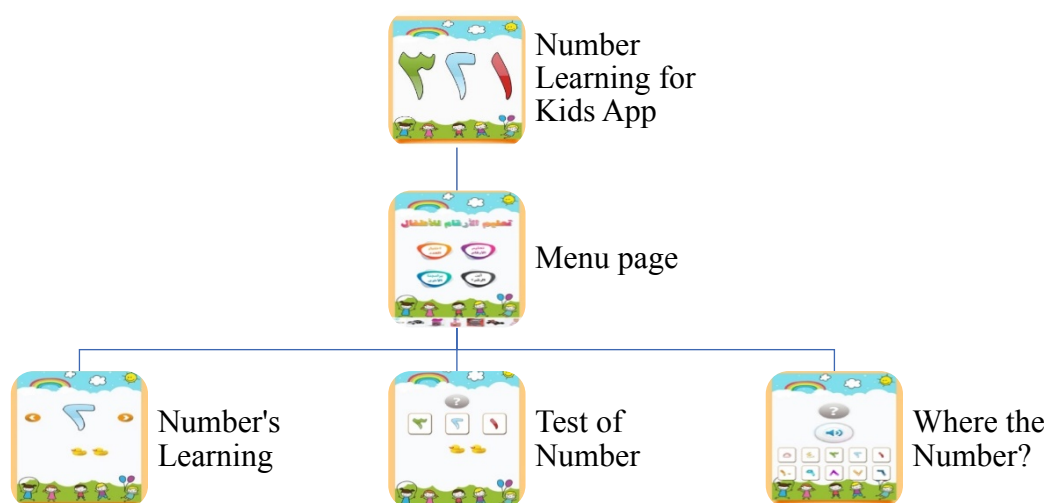


Figure 4. 4: The function of Arabic Letter and Word App

1. *Numbers' Learning* teaches students how to read numbers. They can learn the numbers in sequence from one to 10 or from 10 to one. They are shown a number with a corresponding number of ducks equalling the number and a child's voice saying the number.
2. The *Test of Number* game is an easy game that tests students' ability to count things. Three random numbers are shown, along with three sets of ducks corresponding to the numbers. The students are tasked with matching the number with the set of ducks, accompanied by a voice saying "How many ducks?" When they finish the first exercise, they automatically move to the next exercise.
3. *Where the Number?* is a test of recognition. The screen shows the numbers from one to 10 accompanied by a child's voice saying "Where is the number ...?" When they select the correct number, they are asked to find another number.

In view of the EAs' determination criteria by Hillman and Marshall (2009), these four EAs can be effective literacy/mathematics-learning tools for early childhood pupils

because of their multimodal features (e.g. sounds and animations). They have simple but intelligent features (e.g. drag, swap, and tap) that learners can use to finish their academic tasks. Navigating through these EAs' interfaces can likewise support students' technical and operational skills and establish information about various letters, words, numbers, and shapes.

Teachers have used literacy-specific or mathematics-specific EAs that have the potential to promote literacy and mathematical exploration among students aged four to five. These EAs have the potential to engage learners with subject knowledge and clear content to learn, test their knowledge, and ensure that they clearly remember the correct answers (Skinner, 1986). The function of literacy-specific or mathematics-specific EAs seems to be in accordance with Skinner's (2003) theory, which states that students form associations between sensory experiences through practice. Learners can experiment with letters, numbers, or shapes by completing multiple digital SLAs on literacy and mathematics. Furthermore, these activities are open-ended with no score, levels, or time limits. The four EAs provide an opportunity for students to do or perform a digital SLA that is built around a type of learning that involves practice and reward (Flewitt, Messer & Kucirkova, 2015). Specifically, they provide learners with the correct answers and help them to achieve a sense of accomplishment (Harasim, 2012). When the pupils pass a test, an EA provides the next set of learning materials in a learning sequence.

The evidence in the literature review indicated that the affordance of these types of EA is an emerging area of research in pre-schools. According to Best and Kahn (2006); Lee, Mishna and Brennenstuhl (2010) and Yin (2014), there are a significant number of reasons why the case study method is the most relevant method for this type of research. Firstly, the element of typicalness is at the centre of this type of study (Best & Kahn, 2006). Secondly, one of the qualities of using the case study method is that it enables the researcher to use a qualitative and subjective approach with two or more data collection techniques (Lee, Mishna & Brennenstuh, 2010), as is being proposed in this study. Thirdly, case studies are very helpful in capturing the changes in teaching that occur over time (Yin, 2014).

As the RQs are exploring a contemporary issue, the research data was collected from two different sources: interviews with early childhood teachers, and classroom

observations. This choice is supported by Crowe et al. (2011), who argued that the nature and state of the cases and research determine the quantity of cases and units of analysis. A case was chosen due to the low number of early childhood teachers who use EAs in their classes (19 teachers in private pre-schools and 32 teachers in public pre-schools, see Appendix E, p. 258). Thus, a public pre-school was chosen because it has a large number of teaching staff working with EAs.

4.4 Research Sample

The approach used to choose research participants is essential for accomplishing validity in any qualitative research. Qualitative researchers aim to understand a certain phenomenon from the perspectives of the research participants (Mason, 2002). According to Denscombe (2010), the sample in a qualitative case study focuses on selection. Thus, a non-random sampling techniques has been used (Davies, 2007). Non-random or non-probability sampling, as stated in Johnson and Christensen's (2014) study, includes:

- *Quota sampling*, when a specific number of research participants is needed within each group category;
- *Purposive sampling*, when participants are chosen for the study due to their experience, information and knowledge;
- *Snowball sampling*, when volunteer participants identify an individual who meets the research characteristics; and
- *Convenience sampling*, when - because of some limitation beyond the control of the researcher - these are the only participants accessible.

The choice of a suitable sample approach for this study was based on its potential to enable me to study teachers' use and perceptions of EAs that have the potential to provide an access to subject knowledge and SLAs. Since the participants' perceptions and experiences were required, a purposive case study was used. The aim of this approach is to "involve simply the pursuit of the kind of person in whom the researcher is interested" (Thomas, 2017, p. 142).

Purposive sampling is based on the principle that researchers can obtain the best data, concentrating on a modest number of instances, intentionally chosen based on their

known attributes (Denscombe, 2010). It is a vital strategy for accessing a typical sample of the population being investigated that is relevant to the RQs (Davies, 2007). Using this type of sampling approach enabled me to access an appropriate range of individuals, who had experience of the use of EAs inside the classroom. This case study includes several early childhood teachers from one pre-school located in KSA. These teachers were chosen because the school emphasised the importance of using EAs in class to support teaching. That is, the school and teachers were asked by the Presidency for Girl's Education department, MOE to apply digital learning in their classrooms (Al Tuba'eli, 2017).

4.4.1 Recruitment of participants

The number of participants in this study is appropriate and consistent with the numbers usually recruited in qualitative studies (Onwuegbuzie & Leech 2007). Onwuegbuzie and Leech investigated the sampling size for qualitative studies and highlighted the lack of consensus regarding the number of participants in qualitative research. However, it is clear from their results that the sample size should not be too small as this makes it difficult to accomplish data saturation. They also argued that the sample size should not be too large because the researcher may lose the ability to establish clear details of the case being investigated. That is, it should be a balancing act between representativeness and saturation (Teddlie & Yu, 2007).

Guest, Bunce and Johnson (2006) carried out a scientific analysis of the degree of data saturation and variability. They used their own information from interviews with sixty women in two countries of West Africa, to establish which of their data returned no new themes, and consequently had been saturated. They discovered that saturation and variability could be reached from their first twelve interviews, while the basic themes could be provided as early as six interviews. Guest, Bunce and Johnson recommended twelve participants to be interviewed as an adequate sample size for qualitative studies.

In this study, therefore, the main target participants were twelve early childhood teachers, who had been using EAs as a new teaching tool for students' use. With a specific end goal to gather data from a variety of perspectives, the sample sought to incorporate teachers with various social background educational experiences, who were working with two age groups. Part of early childhood policy is to have two teachers in

one class because it is necessary to have a key teacher and assistant teacher (MOE, 2020). Thus, only six classes, in which EAs were applied to enhance teaching and engage students with digital SLAs, were involved in this study. These twelve teachers and their classes were selected in accordance with the following criteria:

- each teacher had at least three years of experience in teaching students within an early childhood classroom; plus
- at least one year of experience in teaching using EAs in their classroom learning.

A possible limitation, however, is that if an early childhood teacher was using technology other than EAs, she would not to be included in the present study. These teachers were excluded due to their inability to substantiate their opinions with an experiential account as those with relevant experiences would. The exclusion criterion of one year of experience was a reasonable minimum period for teachers to have obtained basic knowledge and formed opinions on the potential of EAs to change current learning practices. Thus, one year of experience was adopted as a cut-off-point, but with no imposition of a maximum number of years that teachers had taught using EAs. Without the help of the Local Department of Education, it would have been time-consuming to discover which of the chosen pre-schools had applied EAs in their classrooms. Additionally, it was necessary to involve one or two of their students when observing the learning environment, where EAs were applied.

4.4.2 Accessing the research context

Permission to carry out the study in this school was authorised by the Local Department of Education via email. A letter was sent to the principal requesting that the school participate in this study and approval was granted. However, a problem with this approach was that the participating school might not have been able to make an informed decision regarding participation. To avoid this problem, I spent some time with the principal, advising her of the right to nonparticipation or withdrawal from the study at any time. I further explained the aim of the study to the principal, who in turn informed all early childhood teachers. The twelve teachers were selected based on the abovementioned criteria by the principal, who contacted me by telephone and scheduled a date (on the following day) to introduce myself and my study to the selected teachers when I again requested their participation in the study, including taking part in interviews and classroom observations. I also reassured these teachers of their right to

nonparticipation or withdrawal from the project at any time to ensure their participation was voluntary. All twelve early childhood teachers agreed to participate in the interviews while only ten of them were interested in taking part in the classroom observation.

For anonymity, the names of the participating teachers and students were removed and replaced with codes. That is, each classroom pair of teachers was allocated a letter code and a number. Thus, I refer to these participant–teachers as T1 to T12, while referring to the classes as C1 to C6. The number assigned to each teacher and the order in which the interviews were carried out have no special significance regarding an order of importance. Additionally, background data about the participants, such as number of years they had been teaching in early childhood classrooms and how long they had been using EAs, was requested at the start of each interview. This data was requested in order to enhance the credibility and reliability of the current research (more details of the ethics of this study are provided in section 4.9).

4.5 Methods of Data Collection

The three RQs target teachers' perceptions and their learning practice regarding the affordance of EAs in classrooms. In order to answer this inquiry, a qualitative case study approach was the method of data collection that seemed to fit the study, as this would gather several teachers' perspectives on a particular situation (i.e. the potential use of EAs). Evidence in the literature demonstrated that data collection within a case study can involve interviews and observations (e.g. Johnson, 1994; Yin, 1994), which have been used in this study.

Triangulation of the collected evidence, according to Thomas (2017), is a prerequisite when employing case study methods. This research data was collected from two sources to address the RQs and ensure the triangulation of research evidence (more details are provided in section 4.8.1, p. 123). The interview was used to gain a more comprehensive picture of the participant–teachers' words in order to capture perceptions and practices. Another method used was classroom observations, which was chosen to track the modification process of leading students during SLAs with information and instructions.

Early childhood teachers were interviewed before the classroom observation as a way of collecting richer information and gaining access to teachers' narratives of their experiences. Whole day classroom observations were then conducted using observation sheets to provide subjective information of the changes that had occurred in the teaching methods and materials of SLAs because of the use of EAs inside the classroom. This way of learning depended on my capturing the changes occurring inside the classroom then reflecting on those changes (Lu *et al.*, 2017).

4.5.1 Interviews

The thought process, which early childhood teachers go through when changing their methods of teaching through applying EAs for students' use inside their classrooms, presents important information and knowledge regarding the issue under investigation. Wellington (2000) emphasised that interviews, which are the conventional method in a qualitative study, are used as a main research resource when accessing teachers. Using interviews, researchers can access the participants' knowledge about educational issues and construction of their reality (Punch, 2009). Punch considered interviews to be the most powerful tool for understanding others. Knowledge about the application of EAs to change the way of teaching and learning is generated through two-person conversations initiated by the interviewer for specific purposes, resulting in gaining research-relevant data focusing on descriptions, predictions, and explanations (Cohen, Manion & Morrison, 2011). The viewpoints are consistent with the interpretivist inquiry guiding this study and dealing with human behaviours and activity (*ibid*).

The advantages of having a two-way communication are the possibility of gaining answers, and those answers being based on the participants' personal experiences (Newby, 2010). This provides the opportunity to clarify the interpretations of the participants' thoughts on the potential of EAs in early childhood learning as they are expressed. A face-to-face conversation, according to Thomas (2017), is likely to provide the researcher with the opportunity to take advantage of the various experiences of the participants. This study, therefore, conducted face-to-face interviews to gather information on the teachers' experiences and perceptions of applying EAs in their classrooms.

Finally, interviews were selected as the primary method of data collection from participant-teachers because they provide a starting point on the perspectives to be examined. The interview method, in this study, was a semi-structured design (Appendix F, p. 259) that drew out teachers' reflections on their experience of using EAs. The semi-structured interviews were chosen because of their flexibility where unanticipated responses can be explored (Denscombe, 2010). The researcher has the opportunity to ask participants about their experiences and their views of that experience, while seeking explanations of unanticipated responses.

One strength of this instrument is the open-ended and non-standardised questions that are designed in advance to help researchers to collect in-depth information (Bryman, 2007). Thus, in order to collect useful evidence on perceptions and practice, several pre-determined and open-ended questions were drawn up. To elicit responses, the participants were asked to briefly talk about how they tended to teach subject knowledge with digital technology. This step provided the participants with opportunities to clarify the technologies they had used so far. The structure of the pre-determined and open-ended questions then moved from brief questions to place the interviewees at ease to more topic-focused questions on teaching experiences in terms of the potential of EAs and SLAs. The following areas are covered in the semi-structured interviews:

1. The teaching experience of participants inside the classroom;
2. Their digital technology experience, focusing on EAs;
3. The starting point for the development;
4. Teachers' perceptions of these EAs;
5. The ways in which EAs were used for learning; and
6. Technology-affected learning.

The interview questions were structured in accordance with the RQs. To answer RQ1, the interview started with questions exploring teachers' perceptions on the changing processes that had occurred in their learning practice due to their use of EAs. Here, the focus was on the potential of EAs for students' access to subject knowledge and exercises resulting in changing the method of teaching through engaging students with digital SLAs. That was followed up by exploring the ways in which EAs were used for facilitate SLAs inside the classrooms to elicit responses that would answer RQ2. The

final part focused on answering RQ3 regarding the impact of EAs on students' interactions and engagements with digital SLAs. Table 4.2 outlines the RQs, themes, and interview questions.

Table 4. 2: The relationship between RQs, themes and interview questions

RQs	Main themes	Sub-themes	Interview questions
Background information			Q1 and Q2
What perceptions do Saudi teachers have in relation to the affordance of EAs in early childhood learning?	The development	The potential of EAs for learning	Q3 to Q6
		Factors affecting the use of EAs	Q7 to Q8
How do these teachers at the pre-school use EAs in their learning practice?	The digital SLAs	Preparation stage	Q 9
		Usage stage	Q10 to Q15
How do teachers perceive the capability of EAs vis-à-vis early childhood students' engagement with SLAs?	The effect of EAs on students' interaction	EAs and students' learning	Q16 to Q17

In an attempt to answer the research questions, individual face-to-face interviews were conducted, consisting of the three main themes describing the research objectives. During the interviews, all interviewees were asked the same interview questions in the same way, to a certain extent, to ensure consistency in the procedure, while having the flexibility to change the order, remove and add questions (Bryman, 2016) as it was necessary to adapt the questions in response to participants' concerns. This *controlled flexibility* (Thomas, 2017) provided an opportunity to cover all the key elements of the experiential learning.

As much as possible, I avoided explicitly asking early childhood teachers to state their perceptions in a structure, such as *Do you think ...?* in order to avoid a situation in which teachers may answer "towards what is expected in the interview situation than

what is actually held in the teaching situation and actually influences teaching practices” (Woods, 1996, p. 27). This was similar to Woods’ study, but instead of using a video-taped lessons I was present in the classrooms to elicit the comments of teachers on their classroom actions and decisions (more information provided in the following section). However, I also sought a substantiation of views through reasoning, explaining, and anecdotes, which are referred to as “concrete terms” (Woods, 1996, p. 28). As Woods explains, a thought “articulated in the context of a ‘story’ about concrete events, behaviours and plans, is more likely to be grounded in actual behaviour” (ibid, p. 27). This appeared to work well, as the following sample extract from an interview demonstrates. In the interview with T5, the topic of effectiveness of teachers’ experiences in applying EAs came up. In justifying her view, T5 recalled her experience as a facilitator:

T5: ... my understanding of the functions of EAs which can be used to provide basic learning such as shapes and letters changed my mind about using them.

Interviewer: Can you please explain more?

T5: Applying an EA without appropriate understanding of what I would like to achieve from using it or how it changes my teaching and learning process might lead me to apply an uncomplicated EA, which disrupts the learning environment.

Not only that, but when teachers did not understand what was required, they were probed further, for example:

(on The development of learning practice): you may think about EAs as objects or activities, so if you were to describe these EAs in this way, what would they be?

(on the affordance of EAs: usage stage): it may be helpful to think about a simile, for example, it has been said that chocolate is rich, sweet and satisfying coming in different forms. What about learning with EAs? Think about it as filling in the blank: learning within EAs is like _____.

These probes were used on several occasions during the interviews resulting in more insights and focusing on specific themes. Nonetheless, the answers and responses are legitimate and valid because they were provided by the participants themselves. By observing the reactions of the interviewees, the prompting questions were points of interest, maybe because teachers were asked to think of the issues, then verbalise their thinking in a different way.

As in the study by Woods (1996, p. 27), information based on perceptions, experiences and assumptions “arose when volunteered by the teacher.” The interview questions were open-ended, developed with the intention of allowing teachers to be relatively free to express themselves. At the same time, these questions helped me to probe the teachers when more details were needed. Hence, several of the interview questions could/could not be pursued for more details, based on the participants’ responses. For example, the question regarding the way of learning subject knowledge using EAs sometimes became redundant as several of the early childhood teachers had already volunteered data about this in their evaluation of their preparation of EAs for students’ use.

Additionally, all data from the interviews were collected, regardless of the interview duration. That is, a longer interview was not believed to be more valuable than a shorter one. In this study, each interview lasted for 35 to 45 minutes and all interviews were recorded and then transcribed. According to Denscombe (2010), the interview recordings provided information on what was said during the interview, therefore all the interview data could be captured.

Finally, two dimensions, which are (1) the context, and (2) the cultural background, were essential to consider when planning an interview. In the context dimension, it was important to create a harmonious relationship in the fieldwork because the quality of the relationship has an influence on the degree of interaction and the quality of the collected data (Eide & Kahn, 2008). Throughout the study, I aimed to engage in a dialogue with the participants in order to evoke memories of experiences. A positive relationship was established between the interviewees and interviewer, and this might be because I also had a similar background and experience in teaching early childhood students during my bachelor degree.

Keeping this in mind, teachers might have been unwilling to report all that they recalled on the topic for some reason, or there could have been a misunderstanding of what had been said either by the interviewees or by me. This relationship was therefore built based on trust so that the participants were willing to provide accurate and reliable information. To be clear in the interviews, participants and/or I sometimes re-phrased what had been said in simpler words, which facilitated the process of correcting any misunderstandings.

At the end of each interview during the pilot study, I collected comments from teachers on the questions of the interviews. They were asked if they found any questions to be ambiguous, unclear or sensitive. I discussed any questions with teachers that they were uncomfortable answering and feedback was collected on the style of interviewing. Teachers did not report any problems with the questioning and they reported that they were at ease during interviews. This removed any doubts and fears on how the interviews were conducted.

During the actual interviews, the participants were forthcoming in sharing information on their experiences in teaching early childhood classrooms and their thoughts on the application of EAs to change their learning practice. For instance, while two teachers were openly critical on their lack of knowledge regarding the use of technology, many voiced their unhappiness about students' use of technology at home. Such openness when sharing negative opinions was regarded as a sign of building trust between the teachers and me. This trust emerged due to the structure and tone of the interviews, as they were carried out in a formal manner, while maintaining a conversational tone to put interviewees at ease. The interviews were conducted in a pleasant and comfortable atmosphere. Generally, my credibility was achieved once I shared the aims of the research and clarified the issues that would be discussed during the interview.

For the cultural background, the interviews were conducted in the pre-school in KSA, my home country. The reasons for conducting the interviews in KSA were:

- My familiarity with the context;
- Avoiding any context comprehension issues; and
- Fostering clear communication.

Additionally, I was made aware of several potential sources of invalidity during conducting an interview, such as the gap between the response of an interviewee and its actual event. For example, the teacher:

1. Misperceived and/or selectively perceived the affordances of EAs;
2. Did not remember all of what they perceived and used; and
3. Was no longer conscious of what they had originally been doing.

Being aware of these potential gaps, classroom observations were conducted after the interviews to reflect on what teachers actually did inside their classrooms.

4.5.2 Classroom observation

Classroom observation can provide social researchers with a special method of data collection that is not based on what the participants say they do, or what they say they think (Thomas, 2017). According to Denscombe (2010, p. 196), observations rely on “the direct evidence of the eye to witness events at first hand. It is based on the premise that, for certain purposes, it is best to observe what actually happens.” That is, observation of classrooms provided me with opportunities to examine behaviours as they occurred while recording the educational events as they happened. The aim of conducting classroom observations was to have a chance to capture what actually occurred inside the classrooms in terms of the possibilities of changing the methods of teaching through applying EAs in a natural context (Newby, 2010). Even though such a method has limitations in its lack of generalisability, Sharp (2012) highlighted the advantages of observing classrooms to witness what participants say and do without asking them. This can be useful because it enabled me to gain insights that supported or clarified the information collected through interviews.

Conducting an observation enables researchers to access data on the classroom environment and practice, which were not directly obtainable from the participants (Punch, 2009). During observations, however, a disadvantage may occur. According to Denscombe (2010), participant–teachers might behave differently when they are observed by researchers and this might create a conflict of interest. To avoid unintentional bias, I established a good relationship with participant–teachers and clarified my position as an observer. Therefore, a short discussion session to

communicate the objectives of the current study and to help teachers to behave in as natural a way as possible was considered essential.

From Cohen, Manion and Morrison's (2011) study of classroom observations, it can be concluded that observing classrooms requires considerable time and effort to analyse the data. Hence, using a pre-coded observation may facilitate the process. The observation carried out in this research was structured based on "predetermined categories" (Punch, 2009, p. 155). The pre-coded items are related to the procedures of changing the methods of teaching through facilitating digital SLAs inside the classroom (Appendix G, p. 261). The observation method focused on how EAs were used in the classrooms. When conducting classroom observations, I focused on students' engagement with digital SLAs, planning these activities, describing these activities, and teaching strategies. The observation was conducted following my request to be part of the teachers' sessions in order to clarify and triangulate the data collected from the interviews. Thus, after each interview, ten teachers willingly granted me classroom access to conduct the observations of their learning practices. During the observations, notes were taken on the general information of digital SLAs and their learning objectives; the EAs that were used and the number of students allowed to work with EAs; the features, characteristics and learning content of these EAs; approaches to digital SLAs; students' interactions; and teachers' role with respect to monitoring and intervening. The data was collected through general field notes (Bryman, 2016), which were coded based on emerging themes.

These observation notes were used alongside data collected from the interviews in order to answer the RQs. The data collected from observations complemented the data collected from interviews. The observations served the purpose of examining the existing patterns that were shared by participant-teachers in the interviews and helped me to fill any gaps that were not expressed by these teachers but were observed in the classrooms.

4.5.3 Reflection of pilot study

After ethics approval was granted by the Ethics Committee at the University of Leicester (see Appendix H, p. 264), a pilot study titled "early childhood students' learning with EAs: A case study of teachers' perceptions and practice" was conducted

during November–December 2018. The pilot study consisted of two individual interviews with two early childhood teachers and one whole day of classroom observation of one of the interviewed teachers. Both participants, who worked in a pre-school in Alhsa, were chosen because they had used EAs in their classrooms for students to undertake digital SLAs. The rationale behind this small study was to test the RQs, research protocols, interview and observation schedules, sample recruitment strategies and to practice these research techniques in preparation for the main study (Newby, 2010).

A pilot study was essential for me to familiarise myself with the procedures in the protocol and to ensure that rigorous measures and techniques were used (Blaxter, Hughes & Tight, 2010). For example, the goal of the research instrument was to elicit responses that could be used to address the RQs guided by the theoretical framework. To ensure the reliability of measures used to collect the data, teachers were asked questions such as “... what do you think of the phraseology of this question,” and the collected feedback was used to ensure that what was being asked reflected what the teachers understood from the questions. Also, teachers were asked whether they were comfortable with my style of questioning, and the collected feedback was used to ensure that teachers were at ease during the interviews. This re-assured me that my way of interviewing was appropriate and that I could carry out the interviews. Thus, the pilot study provided a good indication of the kinds of responses that might be received during the fieldwork.

The benefits of pilot studies have been addressed in the work of In (2017). For this study, the following four steps were taken:

1. To determine the feasibility of the research protocol, an invitation was sent to the pre-school (the same pre-school where the main study would be conducted), which employs several teachers, to participate. With Alhsa Local Department of Education providing access to the school, two teachers who had applied EAs in their classrooms to bring change in SLAs were invited to participate in this study; these participants did not take part in the main study.
2. Pilot studies are also helpful for testing the recruitment and consent rate, including the explanatory statement and consent form. In this study, only those who gave consent were included in the pilot study.

3. Research interviews and observations were tested with the teachers in their classrooms. Both teachers were individually interviewed on different days. Each interview lasted for approximately twenty minutes. The school was contacted again after completing the interviews to approve piloting the observation sheet, and permission was granted.
4. The final stage included testing the collected data and conducting the analysis.

These four stages allowed for the identification of potential problems (In, 2017). Several deficiencies in the research instruments were identified prior to carrying out the main study, as described in the following paragraphs.

During the first stage, not all teachers in the different preschools were able to apply any type of EA to fulfil predetermined tasks on various topics, and this resulted in having their students to be not able to engage with digital SLA. As a result, these teachers did not meet the criteria to participant in this study. Nearly half of the teachers approached had not had time to use them, and most of the teachers who had used at least one EA in their classroom did not have time to be interviewed. As a result, my interview pool was small, and the teachers had limited availability. Contacting schools in advance and being flexible to teachers' schedules would help avoid such a problem. Additionally, explaining the purpose of the study to the principal gave her full control of informing and selecting teachers. This proved to be a good technique to facilitate the research process, and was followed by confirming teachers' consent to participate in the present study.

After critically evaluating the pilot study and the research procedures used, amendments and additions were made to the RQs and research design. For example, despite originally stating that the RQ1 would identify teachers' perspectives on using *Alphabet Apps*, the participants suggested using EAs with other types of learning, including numbers, with similar learning functions. Consequently, RQ1 was modified to ensure that it was more precisely related to teachers' perspectives on using EAs that have the ability to change from teacher-guided to digital SLAs. This would allow me to identify any findings that could contribute to teachers' use of any EA in the classroom.

In addition, by piloting the interview, the average time needed to complete each interview could be estimated. Conducting one interview with each participant was enough to gather the necessary data. Thus, interviews with the main participants were conducted once, while considering the possibility of conducting a second interview if needed. The schedule of the interviews was also tested in order to find how well the questions worked. This was to ensure the clarity of each interview question while reviewing the type of responses to avoid the “imposition of the interviewer’s use and interpretation of particular terms” (Woods, 1996, p. 40).

After critical reflection on the collected data, several interview questions needed rephrasing to make them clearer to the participants. Thus, interview questions were reviewed and re-organised, including adding and removing several questions, to improve clarity and understanding. For example, the term digital learning needed clarification in the pilot study and this term was therefore explained at the beginning of each interview. To the two teachers, the term seems to be understood as their own use of technology tools to introduce the new topic, instead of students’ use. In the actual study, the term digital learning was replaced with a more comprehensive phrase “the use of technology for SLAs” and with the addition of “applying digital SLAs for students’ use.” Also, based on the teachers’ comments and suggestions, interview questions were re-ordered. When transcribing the two interviews, more detailed responses could be elicited by asking the teachers to either elaborate on or clarify their answers. Thus, I noted this as a developmental area and improved my interview skills and techniques for subsequent interviews.

After piloting the classroom observation, the observation sheet was edited, and the final version was subsequently produced. According to Denscombe (2010, p. 208), “the longer the researcher is able to spend ‘on site’ the better, because the longer he or she is part of the action, the more can be learnt about the situation.” However, After completing a classroom observation during the piloting stage, observing the whole-day classroom practice once or twice was enough to understand the potential of EAs to enable early childhood learners perform an SLA independently. Therefore, the initial plan of observing early childhood classrooms four times was re-considered, and the number of observations was reduced to once or twice. As a result of this, and the limited availability of the teachers as noted above, each teacher was observed once or twice in

the main study, when they participated in a whole day observation. This schedule would enable the researcher to observe the entire function of EAs used by teachers and students, either in one or across different lessons.

4.6 Data Collection Procedures

The informed consent letter (Appendix B, p. 250) was sent to the principal of the selected pre-school by the Local Department of Education by email. Data collection occurred over approximately three months between December 2018 and March 2019. After securing access to the school, the first stage was meeting the principal again and informing her of the purpose of conducting this study. She was also asked to kindly identify and inform twelve of her teachers who met the study's inclusion criteria and who were interested in taking part in the study. However, a lack of participants' preparation was a major setback that I encountered during the data collection process for the pilot study. I expected the two participants to be able to respond to any kind of questions resulting in collecting a number of irrelevant data. That is, I interviewed the participants before discussing with them the issue under investigation. Here, it was not possible to gather research data without establishing trust with the teachers. Thus, the next stage involved spending more time in the school, approaching the potential participants to discuss the research. I met with the potential teachers and have a brief discussion about the study aims and the nature of their involvement. Their agreement to participate in interviews and classroom observations was then obtained, and the timetable of the teacher interviews was finalised, with teachers' agreement that they be conducted after school hours.

The first contact was essential to create a good relationship with teachers, gather good-quality information, establish a sense of ownership of the study between participants, and develop successful collaborative relationships. A whole classroom observation was scheduled after each interview with the teachers who had agreed to take part. Students at the age of four and five are vulnerable when involved in research because of the difficulty in them giving informed consent to become a subject of research studies (Ferdousi, 2015). To uphold their rights, this study ensured obtaining the consent of parents before the observations could take place. The parents (mothers) of the students who were involved in the observations were contacted by the participant-teachers to ask for their permission to have their children included in the observation. Because of the

strict regulations of the participant–school in providing parents’ information to a third party, teachers were asked to contact the parents. Using such an approach has implications for this research as teachers were not able to obtain all of the parents’ consent forms back in time for the classroom observations. At the time of the observations, only a few parents’ consents had been obtained, which limited the number of participating students. However, this was not a major problem as the original plan was developed to involve only a few early childhood students.

4.6.1 Initial plan and changes

The process of collecting the main data is presented in Table 4.3 below.

Table 4. 3: Initial plan for data collection

Planning weeks	Instruments	Participants	My role	Description
1-4	Interview	12 Teachers	Interviewer	Conducting an interview with one or two teachers every day in the teaching staff room.
5-7	Observation	10 Teachers and 8 students	Observer	Observing the potential of EAs on changing teaching and learning (observe one classroom of two teachers every two/three days).

Most of the above–mentioned steps were not followed as planned, and changes were necessary. The participants’ interviews were initially scheduled on 23rd December 2018, instead they were conducted two weeks later, as one week coincided with public holidays, and another week the school was inaccessible due to an unforeseen circumstance. Thus, the interviews had to be re-scheduled and took place two weeks later. As a result, the initial plan to conduct interviews with fifteen interviewees was not feasible, therefore, this number was reduced to twelve. Additionally, the interviews were carried out over a period of eight days instead of twelve days. To avoid disruption of teachers’ workloads the principal suggested, after conducting the first interview, to re-schedule the interviews to be two interviews three days a week for approximately 60

minutes, and they took place in the second and third weeks. This demonstrated the significance of having flexible timetables and arrangements for the interviews.

Changes also occurred to the classroom observation schedule as a session originally planned for 27th January 2019 needed to be re-scheduled to 10th February 2019 due to the school's participation in an educational event as part of the Aljwdah Project. Each observation was conducted during three days a week to accommodate the schedule of participant-teachers who supervised the classes each Monday, Wednesday and Thursday. Ten of the participant-teachers agreed to being observed twice: one as a main teacher and the other as an assistant teacher, while two teachers only agreed to being observed as an assistant teacher. As six classrooms were involved, four classrooms were observed twice, whereas the other two classrooms were only observed once. The classroom observations were conducted over a period of 14 days instead of the nine days initially planned. Three teachers were absent - two in the first week and one in the third week – resulting in their observations being re-scheduled to two subsequent weeks.

4.6.2 Data collection procedure

The data were gathered between January and March 2019 and carried out in two stages, the teachers' interviews and whole day classroom observations. The interviews with teachers were carried out in the teaching staff room after class. Teachers were interviewed individually to examine their attitudes, views, desires and experiences to obtain an understanding of the investigation issue. Interviews took approximately forty minutes each, were conducted in Arabic and were audio recorded to be transcribed later.

Classroom observations commenced after the interview results had been analysed. The observations were conducted inside the classrooms to create field notes through an observation sheet. Of the teachers who had agreed to take part, eight participated in the classroom observations twice, while four were observed once. There was a whole day of classroom observation, with the three-main learning periods inside the classrooms being observed for each teacher. A total of twenty observations were conducted between February and March 2019. During the classroom observations, I took notes only when teachers talked about, or there was a classroom interaction, with EAs. When a pupil was working digitally with EAs, I focused on the function and teaching process

rather than the learning. Thus, the results from these observations were found to be relevant to the research questions regarding the potential of EAs for students' learning.

4.7 Methods of Data Analysis

From the perspective of interpretivists, qualitative data can be analysed through breaking it down into various stages (Creswell, 2005; Castle, 2012), which is divided in this study into two key stages: (1) preparing and organising the data; and (2) conducting data analysis.

4.7.1 Preparing and organising the data

It is essential to prepare data for analysis, and this process begins with the design of the research study (Radnor, 2002). Before collecting data, the RQs were examined and used to shape the interview guide and observations covering the main areas of the topic where a response was required. At the interview stage, the interviews were recorded with digital Voice Memos so that I could re-access the conversations with the teachers. Data was organised by keeping a duplicate copy of all the data audio files in a personal computer file. I then transcribed the interviews from the recording into a text document. This allowed me to become more familiar with the participants' discourse, and explore possible new elements for analysis (Bryman, 2016). Participants' personal information, including names, were transcribed with codes for the sake of ensuring anonymity and confidentiality (Cohen, Manion & Morrison, 2011). After that, I translated each transcript into English, and then the English source file was backward translated by an independent translator who was an expert in English-Arabic translation and had not seen the original file (in Arabic). After completing the preparation stage of the interviews, data obtained from the classroom observations were organised. Each observation note was also translated into English and kept safe in a computer file for analysis.

4.7.2 Data analysis

Data collected from both semi-structured interviews and classroom observation sheets were analysed using thematic analysis (Bryman, 2012). Creswell (2005) explained that the first step to perform thematic analysis is to perform a preliminary analysis. The most distinctive characteristic of qualitative studies is the emphasis on interpretations that “involves explaining the findings, answering *why* questions, attaching significance to

particular results, and putting patterns into an analytic framework” as asserted by Patton (1990, p. 375). This approach was described as interpretational analysis by Gall, Gall and Borg (1999, p. 298). They explained that “it involves a systematic set of procedures to code and classify qualitative data to ensure that the important constructs, themes and patterns emerge. These procedures can be earned out manually.” The practical steps which were followed in this research are summarised in Figure 4.5 below.

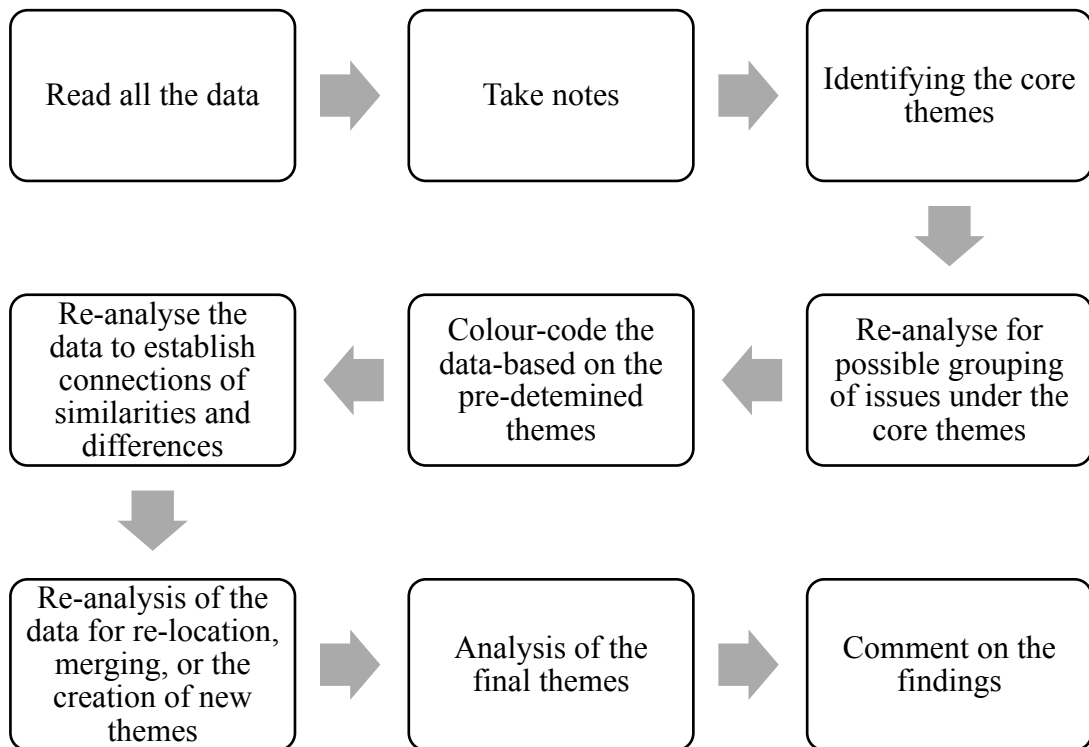


Figure 4. 5: The analytical procedures

The qualitative evidence, namely words and phrases expressed by the teachers, was examined using the above approach to answer the RQs. From this, recurring themes within a topic were identified. These important themes emerged from examining teachers’ perspectives on the affordance of EAs and their use of these EAs in classrooms. According to Cohen, Manion and Morrison (2011), researchers who follow such an approach need to carefully identify appropriate themes that reflect on the nature of data being analysed and their studies’ objectives. The essence of this approach is “a multipurpose research method developed specifically for investigating a broad spectrum of problems in which the content of communication serves as a basis of inference” (Holsti 1968, quoted in Cohen & Manion 1997, P. 55). Therefore, the teachers’

interview transcripts and the observation notes were read several times in order to become familiar with, and make sense of, the data. Memos and notes were written with the purpose of helping the initial process of examining the data in relation to the interview questions. This process started at the transcription stage: when a clear similarity or contrasting item was highlighted, it would be marked for future reference. This also occurred when a significant point of comparison and contrast was highlighted in relation to what was provided by teachers and what I observed. Notes were made immediately after each interview and classroom observation in order not to miss these points in future considerations.

The next step started the coding process through identifying the broader themes in the data. Even though there is no definite procedure for coding data, several researchers (e.g. Corbin & Strauss, 2008; Newby, 2010) have suggested useful guidelines which were followed at this stage. In the process of coding, the raw data, according to Corbin and Strauss (2008), needs to be broken down into categories and sub-categorises, referred to as themes and sub-themes in this study. Therefore, once all data were organised and coded with preliminary themes, the data were reviewed again to define the main themes and sub-themes (Thomas, 2017). The initial core themes were firstly created using the research purpose, the RQs and the interview questions (Cohen, Manion & Morrison, 2011; Newby, 2010). These themes were refined, reviewed and grouped as appropriate with the data. These are: The development of learning practice, the potential of EAs for learning and the effect of EAs on students' interactions. These were assigned accordingly, as demonstrated by the following examples:

TEXT: "Recently, our school has purchased a TV screen for each class with a cable to connect our phone with the TV screen to present our learning content, as well as purchasing tablet computers to apply digital SLAs for students."

"I have been using it for two years."

"Two years ago, our school was asked to participate in a new project called the Aljwdah Project. The project consisted of several policies, and one of them was to engage students with EAs. Under its guidance, our principal provided each class with a tablet computer and requested everyone use it for engaging students with SLAs. The tablet computer contained various letters' and numbers' apps

downloaded by T12. Of course, we still have our freedom to add any EAs that we believe are suitable for students' learning."

CORE THEME: The development of learning practice

The next phase of data analysis was to re-analyse and re-present these grouped data in relation to the possible grouping of issues under the core themes. These are presented in Table 4.4, which summarises the initial pre-determined themes prior to data analysis.

Table 4. 4: The initial pre-determined themes

The development of learning	The digital SLAs	The effect of EAs on students' interactions
The potential of EAs for learning	Preparation stage	EAs and students' learning
Factors affecting the use of EAs in the classroom	Usage stage	

The context of each statement was taken into consideration when coding, for example:

TEXT: "Recently, our school has purchased a TV screen for each class with a cable to connect our phone with the TV screen to present our learning content, as well as purchasing tablet computers to apply digital SLAs for students."
 "I have been using it for two years."

SUB-THEME: Current use of technology in early childhood education

TEXT: "Two years ago, our school was asked to participate in a new project called the Aljwdah Project. The project consisted of several policies, and one of them was to engage students with EAs. Under its guidance, our principal provided each class with a tablet computer and requested everyone use it for engaging students with SLAs. The tablet computer contained various letters' and numbers' apps downloaded by T12. Of course, we still have our freedom to add any EAs that we believe are suitable for students' learning."

SUB-THEME: Factors affecting the use of EAs in the classroom

Additionally, data was colour-coded to identify sub-themes, for example:

Pre-determined sub-themes for the development of learning practice (perceptions)
Current use of EAs in early childhood education
Factors affecting the use of EAs in the classroom

TEXT: “Recently, our school has purchased a TV screen for each class with a cable to connect our phone with the TV screen to present our learning content, as well as purchasing tablet computers to apply digital SLAs for students.”

“Two years ago, our school was asked to participate in a new project called the Aljwdah Project. The project consisted of several policies, and one of them was to engage students with EAs. Under its guidance, our principal provided each class with a tablet computer and requested everyone use it for engaging students with SLAs. The tablet computer contained various letters’ and numbers’ apps downloaded by T12. Of course, we still have our freedom to add any EAs that we believe are suitable for students’ learning.”

Next, the data that had been transcribed from the interviews, and the observation data, were coded. The procedure of coding was relatively straightforward. The first step of coding sought to assign a specific code to distinguish items in each grouping issue and/or sub-theme. This was followed by numerous readings of the research data to make sense of the identified patterns. The following Table are examples of this:

Table 4. 5: An example of coding the research data

Text	Code
Our school has purchased tablet computers to apply digital SLAs for students.	Applied for students' use
I have been using it for two years.	Duration of using EAs
Two years ago, our school was asked to participate in a new project called the Aljwdah Project.	School participation of development project of the country
The project consisted of several policies, and one of them is to engage students with EAs.	The project principle regarding EAs
our principal provided each class with a tablet computer and requested everyone use it for engaging students with SLAs.	Direct support
The tablet computer contained various letters' and numbers' apps downloaded by T12.	Who is in charge of downloading EAs
we still have our freedom to add any EAs that we believe are suitable for students' learning	Flexibility in installing more useful EAs

Next, the data were re-analysed to create a connection of similarities and differences between elements/items/codes using data collected from two different sources: interviews and classroom observations (Bryman, 2016). This stage of analysis is referred to as *focus coding* (Bogdan & Biklen, 2006), where the researcher analyses the data line by line, concentrating on the themes that emerged from the previous analysis phase to cover other emerging themes. At this stage, the data were also closely examined to generate new conceptual themes based on my understanding of the similarities and differences among the indicators (Punch, 2009). The following samples illustrate how data from the two sources were connected:

CODE: Example of using EAs based on the need of students

INTERVIEW: "... so, if I found a student had difficulty with writing a letter, I then made this student do several writing exercises in the individual learning zone using various letter apps."

OBSERVATION: This was not observed as students in all classrooms showed no sign of having difficulty with their learning skills.

CODE: Literacy-specific app is used to provide end-of-lesson exercises

INTERVIEW: “At the end of the alphabet learning, I use one of the letter tests in the Arabic alphabet EAs because I want to provide a letter exercise that is helpful in supporting students’ thinking.”

OBSERVATION: This was confirmed through classroom observation, when using a literacy-specific app in the alphabet learning was observed. For instance, in her class, the alphabet learning included a new letter. During the presentation of the new letter, she used the *Arabic Letters and Words App* that had the ability to display a test for the selected letter placed above three pictures of animal characters, and accompanied by a human voice pronouncing the letter. Three students used this EA in turn, and ran the letter test by following the EA’s instructions. To encourage the rest of the class, the teacher reminded all students that they could repeat this activity using the EA in the individual learning zone during the time of play zone.

A further analysis of the interview data led to a new theme emerging, while re-naming a few of the initial themes. Under the first main theme relating to the ‘the development of SLAs,’ the sub-theme ‘factors affecting the use of EAs in the classroom’ was split into two different sub-themes: ‘factors affecting the use of EAs’ and ‘challenge of EAs’ usage.’ Such a division was crucial as the analysis indicated that there were differences between factors/enablers and the challenges faced by teachers who set plans to overcome them. Thus, such division would make this clearer to the readers. No changes were made under the second main theme relating to the ‘potential of EAs for learning.’ In the third main theme ‘students’ interaction with EAs,’ the sub-theme ‘EAs and students’ learning’ was divided into three different sub-themes: ‘EAs and learning,’ ‘motivation,’ and ‘behaviours.’ This was because the data indicated that teachers’ believed that introducing EAs could create a useful and attractive learning environment and that certainly had an impact on how students interacted with their learning. The sub-themes have been identified to help answer the RQs.

The whole process of analysing the data is illustrated in the final analytical configuration in Figure 4.6. This figure illustrates the main themes and sub-themes emerging from data analysis, based on the research and interview questions. They cover teachers' perceptions and practices in relation to the ability of EAs to learn subject knowledge. Teachers' perceptions were considered in terms of the modification of their way of teaching when these EAs were used and the impact of using these EAs on students. Additionally, the change in their learning practices within classrooms due to the application of EAs was then observed.

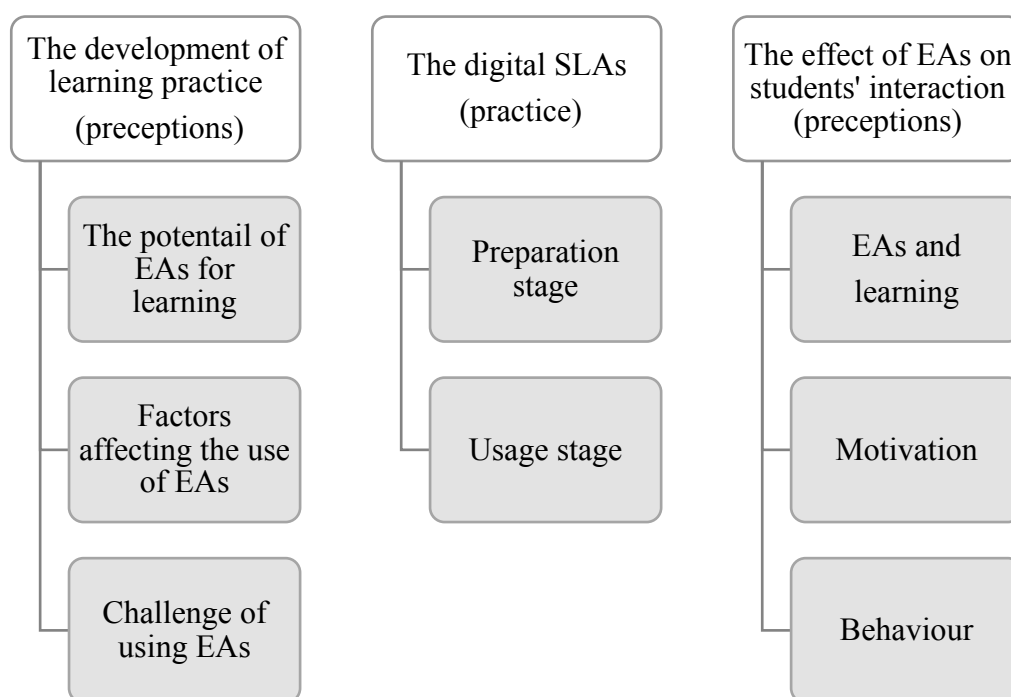


Figure 4. 6: Themes emerging from data analysis

To sum up, the coded data under the selected main themes and sub-themes emerged, after which summaries and memos on each theme were written (Bogdan & Biklen, 2006). The main themes were cross-checked carefully with each transcript and the classroom notes to link data from different sources. All data were grouped under one theme, then marked with a supplementary interpretive note (Creswell, 2005). Finally, the details of the patterns were reported in the results chapter, and the findings were

discussed in the discussion chapter in relation to the literature reviewed (Denscombe, 2010). An overview of the methodology employed in this present research study is described in Table 4.6 below.

Table 4. 6: Overview of the methodology employed to answer the RQs

RQ		Variables	Instruments	Data analysis
RQ 1	What perceptions do Saudi teachers have in relation to the affordance of EAs in early childhood learning?	Perceptions	Semi-structured interviews and observations	Qualitative thematic, exploratory and interpretational analysis
RQ 2	How do these teachers at the pre-school use EAs in their learning practice?	Practice		
RQ 3	How do teachers perceive the capability of EAs vis-à-vis early childhood students' engagement with SLAs?	Perceptions		

4.8 Reflection on the Quality of the Research (Trustworthiness)

Since this research was carried out in an educational setting dealing with teachers in their real learning context, the validity and reliability of the results relied on the participants' honesty during the data collection process (Creswell, 2009). Reliability was considered regarding the degree at which research instruments produce stable and consistent findings when repeating the collection and analysis of the studies' results (Bryman, 2012). Validity was considered as another criterion, which refers to whether the instrument measures what needs to be measured (Bell & Waters, 2014). To ensure such reliability and validity of the findings, the concept of *trustworthiness* (Bryman, 2012) was adopted. The use of this term was also addressed by Bassey (2001, p. 20), who attempted to address the issue of generalisation to find a solution for qualitative researchers. The author suggests that "the estimates – of –trustworthiness may provide a powerful tool for researchers to communicate with potential users of research." In other words, trustworthiness is based on internal rigour, and refers to the extent to which the qualitative research can be considered truthful (Creswell, 2009). To ensure the

trustworthiness of this qualitative study, four essential criteria are considered: credibility, transferability, dependability and confirmability (Gay, Mills & Airsian, 2006; Morrow, 2005; Shenton, 2004).

4.8.1 Credibility

Credibility, which relates to the internal validity, refers to the approximate truth of interference with regard to the cause-effect or causal relationship, can be demonstrated by the authenticity of the study's findings (Castle, 2012). The results in this study were linked to social reality to show their validity. These findings were confirmed by employing the technique of member-checking where the interpretation and conclusion of the data were shared with the participant-teachers to ensure that they could be fully interpreted. This technique was supported by Bryman (2012) who confirmed that credibility could be checked by submitting the results to the participants to see how representative they were of the participants' views of their own reality. Thus, the interview transcripts and later on the findings, were shared with the research participants to clarify their intentions, correct any errors and add or delete any unnecessary information (Lee, Mishna & Brennenstuhl, 2010).

This method was very useful as the study is concerned with the interpretation and meaning that a teacher attaches to the phenomenon. However, a likely argument against sharing a copy of the interview transcript with the participant-teachers is that the participants might modify what they had previously stated, consequently bringing into question the validity and reliability of the collected information. If a teacher changes her mind about sharing any information this could lead to concerns regarding the truthfulness of the original information that is now being withheld. Thus, an original version of each interview was kept while respecting the decision of teachers.

Nonetheless, it is important to remember that a qualitative study contains data and the voices of the participants. If the participants do not permit the sharing of their data, who then is in a position to verify the qualitative data? Is it the researcher? Or the participants? Therefore, before publishing the information, the agreement to do so must first be granted by the participants. As for the validity and reliability of the data, the participants are in the position to judge the truthfulness of what they have said, not the researcher. The collected data consists of words used by teachers and my interpretations

during the interviews. An example is provided here (my interpretations are contained in the brackets):

I engage with my students to enable them to understand and apply new knowledge and concepts (learning of subject knowledge). Here, I create a discussion and try to engage with my students to share what they know about the topic, encourage them by asking questions (leading students through the process of thinking and understanding) (T1).

The interview's contents and interpretations were checked with the participants, who returned the summaries to me with revisions. Only five of the participants corrected terms, such as *tablet computer* instead of iPad. Seven of the teachers, however, added missing information. An example is provided here with the underlined words as the additional missing data:

My focus on using EAs is to provide a learning environment where students have fun while learning. They enjoy the digital SLAs and show better learning outcomes (T3).

The previous records show that the additional information was not new, but only after-thoughts.

Furthermore, triangulation was used to increase the credibility of the study by employing two data collection instruments: interviews and classroom observations. These instruments were employed because they have formed the major techniques of data collection for many qualitative studies (Shenton, 2004). Even though they were conducted separately, these two methods worked concomitantly to examine the same source of information, that is, the potential of EAs to modify the conventional way of learning. For example, aspects of the ability of EAs were discussed with participant-teachers during the interviews, then observed in practice during the classroom's digital SLAs. These two methods were complementary, presenting two different sources of information, but due to their focus on the same event, they offered information that was connected, thereby they could be checked against each other. The credibility of the

findings, thus, was confirmed by using a constant comparative method to ensure that they could be interpreted fully (Brundrett & Rhodes, 2014).

4.8.2 Transferability

Transferability relates to external validity in which the findings of the current study are applicable to another situation (Shenton, 2004). I have described the context of this study in a way that makes it possible for other researchers to decide on how they can apply the results to their own context (Lee, Mishna & Brennenstuhl, 2010). Even though this study does not claim statistical generalisation to a wider population, the results can be transferred to other early childhood classrooms in a similar situation. The data from this qualitative case study is described in adequate details to increase the possibility of transferring the results of the present study to another situation (Castle, 2012). This possibility can be confirmed by the fact that this study is conducted in a typical pre-school that is representative of other pre-schools that participated in the Aljwdah Project in KSA (Al Tubaeli, 2017). However, this is a small sample compared to the large number of schools in the whole Kingdom where the main tools for learning are technological. Therefore, even though the generalisability is low, the potential for the relevance of the research results to other similar early childhood learning contexts is high. Thus, a comprehensive description of the investigated culture was provided in Chapter 2 to determine the transferability of this study's findings (Bryman, 2012).

4.8.3 Dependability

Shenton (2004, p. 71) indicates that dependability relates to “the issue of reliability, the positivist employs techniques to show that, if the work were repeated, in the same context, with the same methods and with the same participants, similar results would be obtained.” That is, when the procedure produces a similar result under the same conditions, then the data is reliable. Thus, in this study, dependability was assured through conducting the process in detail so that other researchers could repeat the work in similar situations (Gay, Mills & Airsian, 2006). In addition, readers are able to assess the extent to which a research practice has been followed (Bryman, 2012). Thus, they would be able to develop an understanding of the research methods and their effectiveness.

4.8.4 Confirmability

Confirmability was achieved through providing a description of the research data, which is sufficient to guarantee that the findings could be confirmed by the presented evidence (Cohen, Manion & Morrison, 2011). The objectivity of the data was addressed (Gay, Mills & Airsian, 2006) to demonstrate that I played an independent role, that did not affect the findings of the study (Morrow, 2005). An auditor was used to determine the confirmability of the findings by examining the data. Backward translation was used on the transcribed interviews (in English), which helped to evaluate the Arabic-English transcripts to confirm the accuracy of their content.

4.9 Ethical Considerations

4.9.1 Ethical consideration of EAs' use in classrooms

The study considered some of the ethics of using EAs in classrooms to provide the readers with insights that permit them to proactively engage with potential ethical issues. This study does not justify the broad use of tablet computers in early childhood learning. Instead, it focuses on the consequences of teachers' endeavours to engage their students with EAs, particularly whether these EAs influence the rights of young learners in a way that is problematic, unjust, or difficult to justify (Spector, 2016). Potential ethical issues involved were identified, supported by the current literature on emerging technology in education.

The present study focuses on early childhood teachers' perspectives on the potential of EAs to modify the way of accessing subject knowledge resulting in engaging students with digital SLAs. According to these teachers, they have engaged their students with EAs under the guidance of an educational Project, conducted by the MOE (Alhussein, 2016). However, various ethical concerns remain (Starr, 2003) and this study attempts to recommend a practical way of dealing with such concerns by explaining the strategies teachers used when faced with such concerns:

1. Early childhood teachers did not think of EAs as a reward, instead, they had been using them with the aim of creating the best chances for their students to engage with digital SLAs (Flewitt, Messer & Kucirkova, 2015). This was confirmed by the whole-day classroom observations of all participant-teachers, in which they provided their students with EAs that had the ability to learn

language and literacy, and numeracy. Students had an equal chance to use these EAs for educational purposes (all class, Observation 1 and 2).

2. The teachers were aware that the planning of a digital SLA using EAs was being done by a teacher who understood students' needs, rather than EAs (Lin, 2007). The selected EAs observed in the current study were all appropriate for the age of these students and were used to achieve a particular learning goal, as was the case in Henderson and Yeow's (2012) study. Information and content of subject knowledge displayed by these EAs were suitable for students at the age of four and five. For example, the use of EAs that were developed to provide numeracy content aiming to develop basic mathematics' skills as students learn to count the numbers from one to ten and to twenty (all classes, Observation 1 and 2).
3. The selected EAs may not bring harm to students in any way (Falloon, 2013), instead, they provided appropriate content and struck the right balance between games and education (Lynch & Redpath, 2014). This was also confirmed during the classroom observation since all participant-teachers shared the name and function of each EA personally with me (all classes, Observation 1 and 2).

4.9.2 Ethical consideration of conducting a qualitative study

The adherence to ethical guidelines ensures the research's integrity and implies a certain level of discipline (Bryman, 2016). Ethical guidelines "are intended to help keep participants safe from harm, build trust with participants and ensure trustworthy outcomes from the research which will benefit society" (Busher & James, 2012, p. 1). When researching a human-participant, the nature of the research, data collection tools, and the selected participants, play important roles when considering potential ethical issues (Potter, 2006). Thomas (2009) stated that researchers should follow the formal procedures of the learning institution to ensure ethical practice in educational research. Thus, this research was conducted according to the University of Leicester's Research Ethics Code of Practice (University of Leicester, 2015). Consequently, the appropriate ethical approval was granted by the University Ethics Committee (Appendix H, p. 264) before collecting data for this study.

Participant-teachers were treated respectfully throughout the research process (Castle 2012). When approaching these participants for consent, I strived to not only gain informed consent, but to also enable participants to feel a sense of ownership of this

study, to establish a successful relationship between gatekeeper and participants (Busher & James, 2012). The sense of ownership in this study was sought through showing teachers that their thoughts, work and experiences had meaning. Thus, the purpose of the interview and the topics of inquiry were communicated to teachers in order to clarify the link between their thoughts and the present study's purposes. This is because when teachers are aware that what they say will be analysed and is of importance to the research, they will be more likely to feel a responsibility towards their views.

Informed consent forms and participant information sheets were provided to each participant to explain what they were agreeing to. The following points, suggested by Thomas (2009), were included in the consent letters:

1. The nature and objectives of the research, including data collection methods;
2. Confidentiality and anonymity information, including how data are stored;
3. Expected benefits for participation; risks or potential harm that might arise from the research;
4. The option for voluntary participation and withdrawal;
5. My name and contact details (Appendix A, C and D).

In order to begin data collection, permission to gain access to the preschool was requested from the Saudi Local Education Department. The objectives of the study were explained in detail in the consent letter (Appendix A, p. 248), and the principal of the preschool was informed about this project by Local Education Department (Appendix B, p. 250). Although this process was not in line with the principle of voluntary participation, this was the only approach available for recruiting participants in the KSA. In order to ensure informed consent, participants were informed of the purposes of the research, information on participating teachers' involvement and procedures for data collection as well as the right to withdraw from the research at any time.

Once permission was granted, each teacher was approached in an ethical manner (Punch, 2009). Trust was established with teachers; however, setbacks were encountered during the collection of data as there was limited time to collect data, and this suggested that it might not be feasible to gather data without establishing a relationship with participants. Thus, before collecting data, the purpose of the research

and consent procedures were discussed in person with potential participating teachers (Appendix C, p. 252).

This project first focused on examining the affordance of EAs through talking with teachers in the staff room. Teachers gave up their time “allowing an intrusion into their private space” (Potter, 2006, p. 201). Thus, interactions with participant-teachers were carefully considered to avoid any ethical issues, while maintaining the research’s integrity. For example, the interview questions did not contain any bias whilst making sure the data needed for the current research were collected. After each interview, teachers were asked whether they were interested in taking part in the classroom observations.

For the second focus of this study, students’ consent for participation was essential as part of the classroom observations. However, according to Castle (2012, p. 5), “early childhood is a special and vulnerable age young children are the most vulnerable because what happen to young children can leave long lasting effects including detrimental ones.” This means that the younger the pupil is, the more damaging the detrimental impact could be on her/him. Thus, possible ethical concerns or issues arising from working with these pupils were taken into consideration. These participants could not be conventionally vulnerable, but might be in a dependent relationship. This refers to their lack of ability to protect their own interests and rights, or feel pressured to participate, so extra care was needed to ensure their participation was truly voluntary through seeking permission from their guardian (Ferdousi, 2015). Therefore, an appropriate consent letter was sent to parent to seek their approval.

However, parents might consent to their children’s participation because they were asked by the teacher. Thus, in the parents’ consent letters (Appendix D, P. 255), they were informed of the objectives and procedures of the current research study and their children’s rights to withdraw from the study at any time. The parents’ consent letter concentrated on exploring the actual practices of EAs’ usage, through taking notes of the teaching and learning process where EAs were used inside the classrooms.

However, there was an issue with teachers disseminating the forms, then getting them back in time for classroom observations. In preparation, and to allow for the dissemination of the forms, sufficient time, almost 2 weeks, was given to each teacher.

That is, after each interview, teachers who had agreed to take part in the classroom observation were requested to kindly ask the parents (via a letter of consent) for the potential students' participation.

Each letter was provided to inform the participant–teachers and participant–pupils' parents that their contributions would only be used for educational and research purposes. In the participation letters, the purpose of conducting this research project was provided. Each participant would have the right to refuse to take part in the study or withdraw from it at any point during the data collection process.

All personal information has been treated as anonymous and confidential. Electronic data have been securely stored in a password protected file in my personal computer, while the consent forms have been kept in a personal locked cabinet. Anonymity was guaranteed by assigning a number for each participant during the analysis process. Following ethical guidelines, all research data will be destroyed after a period determined by the University of Leicester. A summary of the results of the current project will be sent to the principal of the pre-school involved in this study, if requested. Additionally, a copy of the final thesis will be sent to The Saudi Committee located in London, which has sponsored this research.

4.10 Reflections

The Probation Review Meetings and the Progression Review Meeting have helped me to improve the study focus, theoretical framework and methodology. Significant changes have been incorporated with the assistance and direction of the supervisor. RQs were modified several times to ensure they precisely reflect the focus of the study on teachers' perceptions and learning practices in relation to students' use of EAs. This enabled me to choose a suitable theoretical framework to answer the questions of the current study and make contributions to what is already known regarding students' use of EAs to learn subject knowledge. The change of focus moved away from an investigation of teachers' attitudes towards the use of technological tools within the pre-school in Saudi Arabia to "Early Childhood Students' use of Educational Apps: A case study of Saudi teachers' perceptions and practices."

From the Probation Review in the first year of the PhD programme, the following changes were made to address the feedback from the two meetings. Various changes were made to the methodology chapter as described below:

1. A clear definition of the key terms of the research was incorporated into the Glossary of Terms at the beginning of the thesis to list the key phrases and concepts at the core of this study;
2. A detailed description of the learning theory was included with ideas and teaching approaches clearly distinguished. This was considered in the first and second year as a separate section, however, later on during the third year these sections were modified in Chapter 2 to focus on the early childhood curriculum that is fundamental to explaining the learning process of experiential learning theory being used in Saudi pre-school classrooms.
3. A detailed description of the chosen method and how it was carried out in the present study was provided. Here, I moved from a mixed-method approach to qualitative research. This was as a result of refocusing the research to investigate the topic from the participants' own words and to capture the events occurring inside the classrooms. This focus provided valuable information from thoughts, experiences and use, instead of focusing on details showing statistical inferences on the subject under investigation.
4. From the previous note, a questionnaire with the TPACK framework (which is not applicable to this study as my focus was not on knowledge, but perceptions) was disregarded. The main aim of this approach was to quantify teachers' knowledge regarding their use of EAs, the development of which provides a path for further exploration allowing access to a large amount of information on teachers' perspectives of using EAs in classrooms. However, as the number of teachers using EAs is limited, the approach has been altered. Additionally, to answer RQs, interviews supported by classroom observations could provide much richer data.
5. The sample needed clarification, therefore a full explanation of the sampling process was provided under the guide of RQs that aimed to involve teachers who had been using, or had used EAs in their classrooms (digital SLAs for students' use). Thus, this study used purposive sampling, which enabled me to access a typical sample from the population to provide data that was relevant to my RQs.

6. As a result of moving to qualitative research, trustworthiness was adopted in this study to ensure the reliability and validity of the study's results. One of the most important aspect in this study was the participant-teachers' honesty when answering the questions, and behaving normally in practice, so that the data that was collected was free from bias.
7. Finally, the data analysis approach was altered to accommodate the panel's comments.

Following the Progression Review Panel at the end of the third year of the PhD programme, more changes were incorporated. These changes included issues in relation to the fieldwork and data collection, as well as chapters written so far, and future plans. A number of clarifications were developed to make the thesis more readable:

1. RQs and what had been completed so far needed aligning. These questions needed to be articulated to reflect the present study's focus. For example, the changes that the questions of this research are focusing on needed to be specified. In this case, changing an existing SLA specifically focused on the effect of EAs on modifying the conventional way of approaching SLAs. Additionally, and in addressing the panel's comment, the aims of this study were much clearer with the introduced focus. This focus on teachers' thoughts was reflected in both the research aims and questions.
2. The originality of this study was incorporated with specific contributions.
3. Making a clear distinction between beliefs and perceptions. The latter was the focus of this study.
4. In conducting empirical qualitative studies, researchers use their RQs to guide research strategy for answering these questions. However, this was missing in the report submitted to the panel. To make this link clearer, I carefully explained how the research method was selected in order to answer my RQs. One way to make this link more explicit is through linking data collection methods and each RQ.
5. The findings were re-analysed to convey a richer picture on the issues being investigated while focusing on uncovering teachers' stories in order to avoid reporting superficial findings.
6. Another missing link, which has been made more explicit, is how the analysis of the data led to the findings of this study.

7. Two main points needed to be covered in the literature review: (1) the nature of early childhood learning settings - this was covered in Chapter 2; and (2) early childhood teachers' thoughts about the potential of EAs in pre-school classrooms, and this was covered in Chapter 3.

4.11 Summary

This chapter describes how this research study was carried out to identify: (1) teachers' perceptions on the potential of EAs in pre-school classrooms, and (2) their actual classroom practice regarding the application of digital SLAs for students' use. The chapter explained interpretivism – the research paradigm guiding this investigation. It then discussed numerous elements associated with the interpretivist inquiry, from the theoretical issues to the practical aspects of obtaining access to the study's site, and the procedures for collecting and analysing data. This study is based on the notion that researchers should conduct studies applicable to the educational context wherein they are conducted and that may contribute to the development of the learning practices. It is also based on the perception that the research design created possibilities for participant-teachers to express their views and share their perceptions of the investigated phenomena, to provide me with insights into their teaching experiences and practices regarding EAs' usage in their classrooms.

This study adopted a qualitative case study approach to develop an understanding of human motivations and actions in relation to the teaching changes. Qualitative research instruments: interview and observation has been employed to triangulate teachers' experiences and actions with my own notes. The data analysis was followed by a thematic analysis guided by RQs, the research purposes, literature review and the research framework. Trustworthiness was also discussed concerning credibility, transferability, dependability and confirmability. Finally, ethical concerns and issues were considered for this study context, and appropriate consents and approvals were obtained before collecting the data for this study.

Chapter 5: Data Analysis: The development of self-learning activities (SLAs)

The RQs guiding this study are:

1. What perceptions do Saudi teachers have in relation to the affordance of EAs in early childhood learning?
2. How do these teachers at the pre-school use EAs in their learning practice?
3. How do teachers perceive the capability of EAs vis-à-vis early childhood students' engagement with SLAs?

To answer the three RQs, chapters 5, 6 and 7 present the data analysis regarding the teachers' perceptions and use of educational apps (EAs) in early childhood learning. The data analysis explores their use of these EAs in their classrooms and is based on data gathered through semi-structured interviews (n=12) and classroom observations (n=10). The results are organised into themes based on the perceptions and practices of the participants.

This chapter reports the teachers' perceptions and experiences regarding the change EAs can bring to SLAs. The findings indicated to teachers' views about the potential of EAs to provide early childhood students with the opportunity to access subject knowledge and exercises digitally, enhanced few SLAs. During the data analysis of the interviews, it was repeatedly found that the teachers' perceptions of the affordance of EAs to provide chances for students to do digital SLAs were associated with factors such as external issues and device availability in school. An examination of the perceptions of the participating teachers regarding the challenges of using EAs in classrooms will follow. The data from the interviews with the participants is combined with classroom observations to analyse the current educational changes. These insights shed some lights on RQ1: What perceptions do Saudi teachers have in relation to the affordance of EAs in early childhood learning?

5.1 Participants' Profiles

Twelve teachers participated in this study. There was a range of teaching experience in early childhood classrooms between participant-teachers with similar years of experience of teaching with EAs. An overview of their characteristics can be found in

Table 5.1. All data in the table were obtained during the individual interviews, which were conducted in January 2019.

Table 5. 1: Teachers' characteristics

Teacher (T)	Teaching experience		Teacher's degree	Class	Levels taught
	In early childhood	With EAs			
T1	7 years	2 years	Bachelor of Education, Kindergarten	C1	Grade 3
T2	8 years	2 years	Bachelor of Education, Kindergarten		
T3	8 years	2 years	Bachelor of Education, Kindergarten	C4	Grade 2
T4	5.5 years	1 year	Bachelor of Education, Kindergarten		
T5	4 years	2 years	Bachelor of Education, Kindergarten	C2	Grade 3
T6	5 years	2 years	Bachelor of Education, Kindergarten		
T7	9 years	2 years	Bachelor of Education, Kindergarten	C3	Grade 3
T8	8 years	2 years	Master of Guidance and Psychological Counselling		
T9	10 years	2 years	Diploma in Kindergarten Pedagogy	C5	Grade 2
T10	22 years	2 years	Bachelor of Islamic Studies		
T11	6 years	1 year	Bachelor of Education, Kindergarten	C6	Grade 2
T12	10 years	2 years	Bachelor of Education, Kindergarten		

As can be seen from the table above, all participant–teachers met the criteria for participation in this study (see Chapter 4, section 4.4.1). That is, they had been teaching early childhood learners for more than three years and it had been at least one- year since they began applying EAs in their classrooms. Participants with various experiences could enrich our understanding of how these distinctions in their years of experience may affect the application of EAs in classrooms. At the ages of four and five, students are engaged in several conventional SLAs on language and literacy, and numeracy using physical learning materials while being guided by their teachers has been enhanced thanks to the use of EAs. Three classrooms, from both grade two and three were observed in this study. In each class, the teachers used EAs that could support early childhood students’ learning. Table 5.2 highlights the classes, teachers and the number of students involved.

Table 5. 2: Classes taught by early childhood teachers who used EAs

Class	Teachers	Number of students
Grad 2 (4-year-old students)	T3, T4, T9, T10, T11 and T12	30
Grad 3 (5-year-old students)	T1, T2, T5, T6, T7 and T8	30

Table 5.2 shows two different early childhood learning levels that are taught by teachers using EAs. This study was interested in observing these classes to explore any possible changes to teaching and learning in the classroom following the introduction of EAs. The focus of these observations was the teaching processes and changes associated with it. That is, in order to provide an in-depth and richer analysis on the use of EAs inside the classroom, the involvement of students was essential.

As seen in Table 5.2, the class sizes are large, with 30 students, and it would have proved time-consuming involving them all in the classroom observation. I therefore only observed eight students across the six classes, as follows:

- Two five-year-old students were in C1, which was taught by T1 and T2;
- One five-year-old student was in C2, which was taught by T5 and T6;
- One five-year-old student was in C3, which was taught by T8;
- One four-year-old student was in C4, which was taught by T4;
- Two four-year-old students were in C5, which was taught by T9 and T10; and

- One four-year-old student was in C6, which was taught by T11 and T12.

5.2 Teachers' Perceptions of the Development of Learning Practice

This section outlines early childhood teachers' perspectives on the change EAs bring to early childhood learning. Views regarding the process of teaching and learning were solicited from twelve participant-teachers in order to understand how early childhood SLAs were influenced by the application of EAs. The data collected on this issue is grounded on the participants' early experiences as in-service teachers (see Table 5.1 above).

As an early childhood teachers, participants stated that there were three best practices for SLAs in early childhood classrooms: face-to-face interactions with teachers and peers, active learning from hands-on experiences, and taking responsibility for their learning. Students' learning performance has often been based on play in such learning environments, using physical learning materials (e.g. toys, papers, pens and whiteboard) and only recently using digital learning materials (e.g. EAs). As the process of learning is related to the process of teaching, the notions of both teaching and learning are examined here.

Interviewees reported that they had responsibilities to fulfil, including facilitating the process of learning a new subject by interacting with students, leading students through the processes of thinking and understanding, and the fostering of opportunities for students to interact with each other. For example, these teachers firmly engaged a number of students in a dialogue about new learning concepts using learning materials (e.g. printable sequencing cards and toys of the main topic) and digital learning materials (e.g. tablet computers). The dialogue was central to the main topic and had the aim of engaging students in thinking processes, specifically what they know and what the teachers want them to know. These views are firmly entrenched in the MOE's (2020) curricula (see Chapter 2, section 2.2). One of the teachers said:

... in the context of the Fruits Theme, I began my dialogue by asking them what they ate that morning. I told them what I had for breakfast, and then I asked each student to talk about their breakfast. If several fruits were mentioned, I would focus on asking them to describe these fruits, how they

tasted and so on, while displaying the fruit using toys and cards. Then, I displayed a video about different types of fruits. At the end, in order to find out what they learnt, I had them paired-up to create a basket of fruit while discussing their preferences and how to create and design the basket using colourful clay (T8, C3, Grade 3).

As the data show, in participant-teachers' minds, there is a variation of teaching aids grounded on face to face interaction and hand-on experiences. They had a varied number of years of experience teaching in early childhood classrooms, as shown in Table 5.1 above. They reached a consensus that a variety of learning practice was crucial for the development of early childhood students' skills. This description is what Piaget (1964) referred to as *appropriate practice*, that is, forms and constructions of knowledge with well-planned learning practice embedded in play. The concept of Piaget's principle on learning was preparing several activities with the aim of permitting students to learn, experiment and discover in ways that would benefit their abilities, using suitable teaching and learning materials. This learning environment facilitates learners' participation in a variety of games with toys, hands-on materials, tools and technology devices. Akin to this principle of learning, all the participant-teachers in this study struck a balance between various kinds of learning practice, including formal lesson and free play, group and individual SLAs, and inside and outside learning environments (see Figure 5.1).

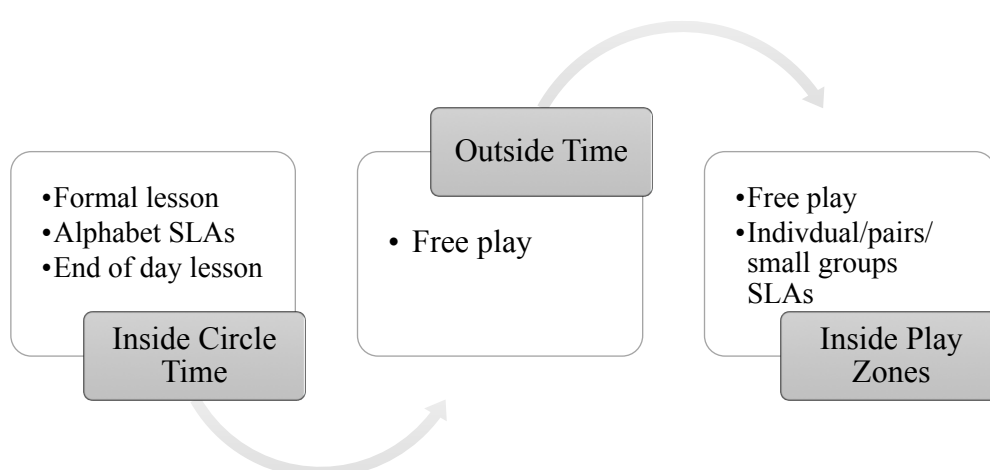


Figure 5. 1: The daily learning practice in Saudi preschools

Circle Time: As shown in Figure 5.1, Saudi early childhood learning practice has a formally directed lesson inside the classroom during which teachers and students sit in a circle. During this learning session, which is also known as Inside Circle Time, students start their learning with an organised lesson led by the teacher. This study's participant-teachers confirmed their face to face interactions with their students on a daily basis. They usually started these sessions by introducing the topic of the day before moving on to alphabet learning that relied on different SLAs. The twelve participant-teachers believed that students need to engage with a variety of SLAs regarding the alphabet learning. All interviewees ended their alphabet learning by assigning the SLA for students to interact with a worksheet exercise related to the new letter.

The Play Zone: hands-on experience was also viewed by participant-teachers as an important tool of learning. All interviewees believed that students should take responsibility for their own learning. They encouraged their students to take part in the work assigned to them in the form of different SLAs (see Figure 5.1 above). As for the early childhood teachers, the participants highlighted the teachers' responsibility for encouraging their students to experience these SLAs. This perception aligns with Kolb's (1984) experiential learning theory, which portrays a student as a producer and a teacher as an expert guide.

The twelve participant-teachers believed that learning could be organised with a variety of SLAs, in which the students performed a role in their own learning process. This principle is based on the development of appropriate practices/activities inside early childhood classrooms. The method used by all interviewees was to engage students in several semi-private learning zones in order to distribute individual or cooperative learning experiences of developmental learning areas, such as art; science; language and literacy; and numeracy, in the form of SLAs (see Figure 5.1). According to T5, these SLAs are distributed in various learning zones included:

an artwork zone, exploration zone, library zone (reading and writing), construction zone (blocks), house zone (role play), relaxing zone, cognitive learning zone and individual learning zone (T5, C2, Grade 3).

As has been shown in the above comment, Early childhood learners practiced with various forms of play, such as arts, music, reading stories and exploration, that were distributed among different learning zones. Participating teachers in this study used the MOE's curriculum adapted from the experiential learning theory, which emphasises the transformation or construction of SLAs that strike a balance between the developmental learning areas and relaxation.

In organising these activities, the main considerations were space, furniture and item sizes. Notably, classrooms were divided into small learning zones that included a variety of tables and chairs or carpet as well as different learning materials, such as toys and whiteboards. For example,

in the art zone, there were four tables and chairs along with cabinets for storing white and coloured papers, pens, pencils, coloured sand, etc. In the construction zone, there were carpets with cabinets for storing various blocks while in the individual learning zone, there was one table and chair (T2, C1, Grade 3).

As has shown in the comment, participating teachers organised and prepared the SLAs with various learning materials that were readily available in their environment. In addition, interviewees perceived the use of a variety of teacher-made learning materials as an integral part of their learning practice as T5 noted:

I design and use my own learning materials when I teach a particular topic ... a worksheet or a game of letter recognition (T5, C2, Grade 3).

The above comment demonstrates that in specific learning situations, the early childhood teacher had applied SLAs with teacher-made learning materials to engage students in SLAs on language and literacy.

Generally, interviewees believed learning to be a journey in one zone to another within a limited time, and that starts when students play a part in their own learning. This is achieved by engaging in prepared SLAs that include appropriate learning materials and whatever early childhood teachers can offer to encourage student participation. The

twelve teachers distributed various SLAs that were suitable for each learning zone using both natural, toys and teacher-made learning materials to aid the learning process in each zone. These participant-teachers said they used learning materials, such as “a handmade letters game in the cognitive learning zone” (as indicated by T8, C3, Grade 3) and “a small water tank in the exploration zone” (mentioned by T9, C5, Grade 2). This was evident in the classroom observations of all classes. Classes were organised and prepared with tables, chairs and various learning materials that were child-sized, durable, tactile and safe for use by students (all classes, Observations 1 and 2).

The interviewees perceived the core of these learning zones as the establishment of learning environment that relied on free playing, with the aim of supporting the students’ independent decision-making. Here, “Students have the opportunity to learn in a sophisticated and innovative educational environment” (T1, C1, Grade 3). Such learning process, resulting in the provision of various SLAs, places a strong emphasis on the freedom to choose in order to support students to decide by themselves and take full responsibility for their own choices. Learners are expected to experience and discover this learning environment independently. For example, “four students can enter the artwork zone and start their learning by exploring the learning materials that were prepared for them in advance” (T3, C4, Grade 2) while “.... . another six learners can enter the construction zone and start by exploring the learning materials within the cabinet to select the learning materials with which they want to perform an SLA” (T8, C3, Grade 3).

According to the twelve participants who led these initiatives, the act of performance was evidence that students had gained experience in thinking and understanding with a set of self-selected learning activities, in which they could freely learn by following the information delivered to them by their teachers. According to T7,

I presented a variety of information to students in, for example, the construction zone. I told the four students in the zone to cooperate with each other to build a tower using blocks. Then, under my mentoring, each student freely did the exercise during the time they had left before moving to another learning zone (T7, C3, Grade 3).

T7 continued her explanation of her role during SLAs as an observer, who observes students' engagement with various types of activity in each zone while evaluating their work in order to ensure their progress. Feedback is required for each learning exercise and for the progression of the learning process. One participant stated that:

We observed students who were engaging in activities in each learning zone in order to offer them help when needed. At the end of each activity, we would comment on students' work by saying things like, 'Wow, this is a beautiful tower.' Sometimes, I would follow up by asking them to talk about their work (T8, C3, Grade 3).

As shown by the above comments, even though participant-teachers were allowed free play during SLAs, sometimes, students needed their teachers to guide the instruction, conversation and activities. After introducing their prepared SLAs in each learning zone and informing the students of what to do in their zones, these participants found that they needed to provide guidance in some learning zones to achieve a learning goal, as mentioned by one participant:

In some learning zones, such as the artwork zone or the cognitive learning zone, instruction is needed to produce satisfactory learning outcomes. For example, during the artwork zone I would tell my students to use what they have in the zone, such as "please use the yellow clay to create your basket." After they made the basket, I would tell them to use red clay to make a specific number of strawberries (T8, C3, Grade 3).

Here, the participants' conceptualisation of SLAs places early childhood teachers in the position of expert guides who lead their students to the proper destination. Leading students through the process of learning, while making them responsible for working on their own learning, is the main thrust of teaching. A common belief between participant-teachers about their teaching responsibilities during SLAs is that "the most important thing about engaging students with exercises is still managing the learning process with instructions" (T12, C6, Grade 2).

Particularly, for students to engage with language and literacy; and numeracy activities, participant-teachers believed that clarity of explanation and teaching instruction is of the utmost necessity. Hence, the informants insisted that the tasks of learning should be explained step by step. It is primarily the teachers who view face-to-face instruction as an opportunity for the students to undertake a task that is assigned to them, and the responsibility of teachers to check the student's comprehension of the subject matter. Perhaps this is because of the nature of the discipline of some SLAs, for example, in literacy (reading and writing) and mathematics accurate skills are essential qualities that early childhood students should eventually acquire. Additionally, the fact that the participant-teachers understood the importance of teaching instruction highlights their view that early childhood teachers are experts and learners are the raw materials for these experts to transform into finished products.

Although the conventional way of teaching, namely, face-to-face instruction, might entail a slow learning process, it is perceived to be effective as it bestows the students with time "to follow their teacher" (T2, C1, Grade 3). The expression "follow the teacher" might suggest a lack of active involvement on the students' part, but this might not be the intention. As T11 (C6, Grade 2) elaborated, "following a teacher means the students have to pursue her thinking, that is, to think alone with their teacher in the course of a learning zone." The teacher creates learning situations with small, routine segments of instruction and the students interact with what they see. For example, the way the SLA prepared in each zone is worked out. According to T7 (C3, Grade 3) early childhood teachers have to introduce the SLAs by "Telling students the purpose and goals of the activity and then guiding them to make progress demands that students listen and imitate what they see."

Here, learning practice seems to be a one-way transmission of the subject knowledge content as a product from teachers to learners. Participant-teachers felt that the core task of an early childhood teacher was to impart knowledge. Fundamentally, the teacher is the provider of knowledge who guides students to make progress in their learning. This teaching strategy seems to consider the teacher as somebody who provides learning contents and materials while giving a lot of information to learners, and this might be seen as "a one-way type of traffic" (T7, C3, Grade 3), which might make "teaching and learning boring" (T11, C6, Grade 2).

Here, in the minds of all participant–teachers, the early childhood teacher must not simply follow the conventional way of learning, but should think of ways to make the learning of subject knowledge interesting every time they communicate it. Participants indicated that it was the responsibility of early childhood teachers to turn knowledge into something that students would find appealing and therefore pay attention to. Their point of view was that students would be open to the learning experience when attracted to the information. For early childhood teachers, making learning meaningful is the important concern in their class preparation. Hence, participants with a variety of experience (see Table 5.1) teaching early childhood students suggest that teachers should think of enhancing their learning practice in order to attract students’ attention.

All interviewees but T9 and T10 generally agreed that technology was a good medium for attracting students’ attention to learn. Throughout their careers, ten of the teachers (T1, T2, T3, T4, T5, T6, T7, T8, T11 and T12) had used various technologies, including EAs as new providers of knowledge and are aimed at guiding SLAs on language, literacy and numeracy. According to these participants, leading early childhood learners is one of the teacher’s responsibilities yet this seemed to have been replaced by these EAs. Although this process was not performed by the teacher actively instructing her students, the subject knowledge content and EAs were nevertheless determined and used by that teacher.

5.2.1 The potential of EAs for learning

When interviewees were asked about their current use of the tablet computer in their classrooms, 10 of them reported that the use of EAs in the alphabet SLAs provided them with easy access to subject-specific learning content. They still considered the use of technology to be a one way transmission of learning from a teacher to the learners. At the primary level, the teacher is “a guide of instruction and activities” (T8, C3, Grade 3).

Of the participant–teachers, eight (T1, T2, T4, T5, T6, T7, T8 and T11) stimulated their students’ interest by asking them to guess the day’s letter after displaying the alphabet song accessed from EAs. T11 described her practice this way:

I use a literacy-specific EA to play a song of my new letter to get my students into paired discussions in which they aim to respond to the prompts: please select the correct letter that you have heard and please match the letter to the correct word (T11, C6, Grade 2).

As can be seen from the above statement, the seven teachers expressed strong views that teaching effort was needed to facilitate the acquisition of information and knowledge, which was possible with the use of EAs. This aligns with Skinner's (1986) approach to teaching, which uses a stimulus-response pattern of face-to-face interactions. When these participant-teachers were asked about the reasoning behind such an approach, they stated that the function of EAs to engage students with subject knowledge was acknowledged in terms of encouraging them towards understanding the subject. According to T6, "Introducing a new concept, using EAs, is very useful in engaging my students in a dialogue on the new concept" (T6, C2, Grade 3).

It is interesting that teachers were aware that making a small amount of change in their teaching would benefit the learning process inside the classroom. This suggests that teachers adopted teaching approaches that placed students at the heart of the learning process. That is, students are believed to benefit more from learning when they contribute to it, as T6 contributed to her students in a dialogue.

Here, we see seven participants (T2, T4, T5, T6, T7, T8 and T11) using literacy-specific EAs in their classrooms as the only means of providing alphabet knowledge. In another case, T1, T3 and T12 used these EAs to bring variety in their teaching aids. T1 offered the example below.

During the alphabet learning, I used fresh vegetables, such as celery and cucumber supported by handmade vegetable-cards to introduce today's letter (C). I then supported this by playing a song from an EA of a child character pronouncing the letter and word. In the delivery, I could see how well students developed their skills, such as vocabulary and phonic, that was being taught with various learning materials (T1, C1, Grade 3).

As shown by the above comments, ten teachers viewed EAs as an effective tool that supported their students' learning of alphabet knowledge. These teachers perceived EAs as a tool that provided the key affordances of convenience and easy access to the learning content. It is apparent that these teachers considered EAs to be a one-way transmission of subject knowledge, conducted by an early childhood teacher for the enrichment of the students' minds. This aligns with the Piaget's (2001) way of learning in which tools are used to shift thinking processes.

Meanwhile, T9 and T10 refused to use technology by themselves during face to face interaction because of their lack of knowledge of how to operate and use the device in the classroom. As indicated by T10 (C5, Grade 2), "I did not use EAs to support my teaching. Honestly, I do not know how to use any technological devices to aid my presentations."

This was confirmed by all classroom observations of all participants; ten of the teachers (T1, T2, T3, T4, T5, T6, T7, T8, T11 and T12) used a literacy-specific EA as a presentation tool to facilitate face to face interaction and communication by providing visual impact to gain students' attention, while the remaining two teachers (T9 and T10) did not use technology at all.

The ten participant-teachers felt that the main purpose of using technologies during face-to-face interaction session (circle time) was for teachers to impart subject knowledge. At the basic level, an early childhood teacher is a "mediator of learning" (T8, C3, Grade 3). This understanding of teaching as a mediation of subject-specific learning is evident from the way participants described technology, with its different features, as a teaching tool providing the main affordance of convenience and easy access to information, but what about the learners' use?

Although ten participant-teachers still perceived technology to be complementary to teaching, there seemed to be a new desire to develop a learning environment that builds on meeting students' needs through digital SLAs. These activities were developed through using technology to change the conventional method of learning, which in turn, changes the nature of learning. Nevertheless, these participant-teachers acknowledged the possibilities of EAs that offer the affordance of a smooth navigation sequence,

tracking ability, access to early childhood subject knowledge and easy access for repeated learning at the learners' own pace for early childhood students.

The starting point for using EAs was reforming the individual SLA to include EAs. Participating teachers stated that in addition to the previous learning zones mentioned above, they had to create a new learning zone, namely the individual learning zone for a digital SLA in which a single student used the EAs. T8 confirmed that “the establishment of the individual learning zone in the classroom for providing learning exercises using EAs was the core objective” (C3, Grade 3). Here, the learning principle was based on an individual experience that linked the development of learning to an appropriate activity by using technology to replace teachers, as T5 expressed:

The digital SLA aimed to improve the quality of the individual learning in our school by establishing several principles, including enabling students to freely and dependably engage with EAs that would replace me in terms of guiding them to accomplish the learning objectives (T5, C2, Grade 3).

From the comment above, participant-teachers have to add an individual learning zone to include several EAs. This was recognised as an important source from which students could acquire help to increase their knowledge acquisition.

Through direct observation, I confirmed that teachers did establish a specific zone for the digital SLA in their classrooms. The zone consisted of one tablet computer, one chair and one table. I noted that several EAs had already been installed on the device (all classes, Observations 1 and 2). Description regarding the process of teaching and learning within this new zone are provided in detailed in Chapter 6.

Regarding their views on employing EAs for students' use, the interviewees perceived EAs to be useful because they could enable the student to adjust to his/her own learning pace. For example, “some learners may need to spend extra time going over several SLAs on literacy and mathematics until they understand” (T3, C2, Grade 3). All participants reported applying the digital SLA, which aligns with Kolb's (1984) experiential learning theory to facilitate experiences that improve the students' learning. The participants had a strong belief in the importance of practice and experience in

enhancing and developing students' skills. To them, EAs were "powerful tools" (T2, C1, Grade 3; T3 and T4, C4, Grade 2; T6, C2, Grade 3; T11 and T12, C6, Grade 2) that students could use to increase their knowledge while simultaneously improving their skills.

All participants had recently started to put the device in their students' hands to access a variety of EAs. The tablet computer had been incorporated into the classroom and consisted of many EAs, which gave them opportunities to put the device in the hands of learners in order for them to gain experience of performing appropriate digital SLAs on language and literacy, and numeracy, using EAs. Indeed, T4 said,

... opportunity to provide a new way of literacy and mathematics activities has come. Now, students can freely access EAs on their own to do exercises, resulting in the achievement of the learning goal (T4, C2, Grade 3).

Classroom observation offered evidence that ten teachers not only used EAs as a presentation tool, but also as new tools for students' use to undertake an acceptable exercise (C1, C2, C3, C4 and C6, Observation 1 and 2). Meanwhile, T9 and T10 still refused to use the tablet computer by themselves because of their lack of knowledge. However, they did provide the device for students' use in SLAs, which could be also confirmed from classroom observation (C5, Observations 1 and 2). On a daily basis, participant-teachers used 45 minutes of lesson time (the time allocated for the play zone) for digital SLAs.

The comments above demonstrate that there is a perception regarding EAs held by participant-teachers that they provide a chance for practice and experience. Unlike the previous use of EAs, in which students were passive, that is not able to obtain the teaching and learning materials for themselves, this method of using them is active, as students can visit EAs voluntarily. That is, students visit EAs that assess how they are grasping the literacy and mathematics knowledge. This action can be undertaken by the students themselves because EAs can replace the teachers' explanation of the SLAs step by step. This seems to concur with Skinner's (2003) theory of educational machines, in

which teaching is considered as a means of transmitting literacy and mathematics knowledge between EAs and learners.

From the above, it can be deduced that early childhood teachers had started to improve the individual SLA regarding language and literacy and numeracy to include EAs. This study asked participant-teachers how long they had been permitting their students to engage with these EAs. Of the twelve participants, ten (T1, T2, T3, T5, T6, T7, T8, T9, T10 and T12) had been doing so for approximately two years, while two (T11 and T4) had only been using them for one year. The main reason for this was that T11 and T4 had only recently been employed by their current school and their previous schools did not provide tablet computers. Consequently, several enablers, such as external forces and availability of devices in the school, appeared to assist teachers in using EAs, particularly during the initial stages of the application of EAs in Saudi early childhood classrooms.

5.3 Factors Affecting the Use of EAs

As education is critical to the economic development of KSA, the kingdom's MOE has made it a priority to develop and enhance teaching and learning in pre-schools. In 2016, the policy on integrating technology was introduced as part of the Aljwdah Project (a new educational project that was introduced to Saudi preschools in 2014). All participant-teachers identified this national policy as a key factor in their application of EAs for students' use. They mentioned that two years ago their school had participated in the kingdom's improvement project, which was established by the MOE (2020a). Indeed, according to T7,

Our school was one of a few preschools in the Alhsa city that was selected to participate in the Aljwdah Project. This project aims to develop the school in various ways, including the educational processes inside our classrooms (T7, C3, Grade 3).

Under the Aljwdah Project, the preschool had been asked to use various EAs. "The project consists of several policies" said T1 (C1, Grade 3), and "one of them is the application of specific EAs for students' use during SLAs regarding alphabet, numbers and shapes exercises" indicated T2 (C1, Grade 3). This usage was compulsory, as noted

by T3 (C4, Grade 2): “The use of these EAs was imposed on us to provide opportunities for students to do the SLA digitally.”

Because of this, I concluded that pre-schools were trying to make their learning practices useful to all students by using EAs to conduct a new type of SLAs. One of the project’s principles and quality standards was the belief in students taking responsibility for their own learning. In particular, interviewees who supported this policy viewed four- or five-year-old learners to be capable of guiding themselves when given the right tools.

The starting point to apply this policy was to reform the individual SLA to include EAs. When participant-teachers were asked about their installation of these EAs, they indicated that the MOE had recommended several EAs to be downloaded on the devices to assist early childhood teachers in the process of creating optimal digital SLAs. The aim of these EAs was to develop students’ literacy and mathematical skills. According to T7,

Under the principles of the Aljwdah Project, I used the various Arabic EAs related to alphabets, numbers and shapes that were already on the device when I first received it (T7, C3, Grade 3).

Even though the project recommended the use of specific EAs related to two developmental learning areas: language and literacy; and numeracy in the individual learning zone, teachers had the flexibility to implement them in different learning zones as they saw fit. T8 emphasised that:

Recently, I sometimes transfer the device to the cognitive learning zone to provide opportunities for students to freely select whether to engage with my hand-made learning games or with an EA (T8, C3, Grade 3).

T8 felt that diversifying in SLAs for a single concept was useful in overcoming the difficulties of learning the new alphabet knowledge to students, as they absorbed information and concepts more easily when working with these different types of teaching tools in one learning zone. However, in the classroom observation, I noted that

all participants only used EAs in the individual learning zone, which was evidence that they did not employ a diversity of SLAs in one learning zone but only offered a digital SLA in the individual learning zone (all classes, Observations 1 and 2).

Based on my data, participant-teachers need support when implementing policy recommendations into their classrooms. The school's administration could provide this support, such as in the form of making devices available and providing a workshop on how to use them in SLAs in order to encourage teachers. Four of the participants (T1, T3, T7 and T10) noted that their principal offered direct support by providing one tablet computer per classroom. Below is a sample comment regarding the provision of this support.

Two years ago, I got a device with several EAs downloaded on it and with the recommendation to introduce a new learning zone for digital SLAs. Also, I attended the workshop arranged by our teachers to introduce such a new way of teaching, which encouraged me to use EAs in my class (T10, C5, Grade2).

This comment demonstrates that the attitude of management towards the adoption of technology for the use of students could be considered as a factor that influences early childhood teachers' application of EAs in their classrooms. The attitude of management seems to be perceived as the support it gives to the faculty, which, in the comment was illustrated by receiving easy access to devices. Generally, the participant-teachers' level of satisfaction reinforced the fact that having the devices and being granted ready access to them are essential elements in supporting early childhood teachers' use of EAs. The presence of the device in the classroom was important for enhancing and changing learning practice. One could argue that once early childhood teachers had tablet computers in their classrooms, they would spend time learning how to use them in order to create new ways of providing SLAs. Interestingly, T4 and T11 focused on the process of implementing EAs for a student's use with indirect support from the principal. "It was nice to use everything available in the classroom to gain new experience and expand my horizons" said T11 (C6, Grade 2). The introduction of EAs was necessary for them to engage students with the new individual SLAs, as shown by T4's comment below.

Since my transfer to this pre-school a year ago, I had a learning zone creating specially for students to interact with EAs in my class, and that has motivated me to try and engage my students with two type of SLAs digitally or conventionally (T4, C4, Grade 2).

Further, related to the issue of support, T1, T2, T3, T7, T8, T10 and T11 said it was helpful when a teacher, who was also working for management, downloaded EAs that had been developed for literacy (letters) and mathematics (numbers and shapes), which was prescribed by the Aljwdah Project, before distributing the tablet computers to the classes. “Various literacy-specific and numeracy-specific EAs were already downloaded by T12 when we first introduced the digital SLAs in the individual learning zone” said T3 (42, Grade 2).

Interestingly, participant-teachers’ comments reflected on the nature of management support with regard to having adequate facilities and helping with issues such as installation, which supported their EA-assisted teaching. Interviewees reflected on the requirements of installing several EAs that were appropriate and supportive of SLAs. The device is a place for learning, so the support worker should install EAs on it.

As the designated management support-worker, T12 noted that even though there was a limited availability of EAs in Arabic, a significant number of EAs for Arabic literacy and mathematics were available to support digital SLAs.

When I searched Google Play to install EAs that were requested by the MOE’s new project, it was not really hard. Although most EAs were in English, I found some Arabic EAs related to letters, numbers and shapes (T12. C6, Grade 2).

This comment seems to consider the availability of a few EAs for Arabic literacy and mathematics as a factor supporting their use in the classroom, rather than considering the lack of Arabic EAs as a problem. This is because the aim of the project was to provide opportunities for teachers to improve their SLAs by including EAs for students’ use, and these literacy-specific and mathematics-specific EAs were sufficient. Interviewees felt that using these different EAs was satisfactory, as their students could

engage in both conventional and digital SLAs related to the same concepts, and that was in line with the principles of the new project. Table 5.3 provides a description of a selection of EAs that were downloaded by T12.

Table 5. 3: Example of EAs used by most students, who were observed

EAs	Description
Arabic Letter and Word	A literacy-specific EA displaying three tests of letters or words along with three pictures of animal characters accompanied by a human voice pronouncing the letter or word.
Abjad	A literacy-specific EA displaying two options: (1) learning to pronounce a letter using a song or learning how to write it, and (2) playing exercises – distinguishing forms of letters or recognising letters and words using searching or memory games. This app is displayed with cartoon characters accompanied by a voice.
Shapes Learning	A mathematics-specific EA displaying three exercises to distinguish between shapes by performing. The app is displayed by a panda character and accompanied by a voice telling students what to do.
Number Learning for Kids	A mathematics-specific EA displaying options to distinguish between numbers from 1 to 10. Students learn the form of the number based on instructions explaining how to count ducks, which are accompanied by sound. It also offers two different exercises to help students learn how to count and to test whether they know numbers.

As can be seen in Table 5.3, participant–teachers applied EAs that were downloaded by T12 to engage their students with digital SLAs in their classrooms. The key function of these EAs seemed to be their potential to help early childhood students to obtain literacy and numeracy knowledge. What is interesting in the table is that this type of EA can be considered as an instructor whose role is to engage her students with various learning contents. Even though these EAs had been installed on the devices by T12 (management support-worker), participant–teachers still had the flexibility to install more useful EAs, according to T1, T2, T7, T8 and T12.

Moreover, teachers still had the freedom to temporarily reject EAs, as had been done by T9 and T10. They explained that they had to reject EAs until they understood their value. These two participants emphasised the importance of Internal support (refers to the assistance from other teachers in the school) in gaining an understanding of the overlaps between EAs, the individual learning zone and the teaching process. This internal support increased their confidence to try using EAs in their classrooms. When asked to describe the nature of this internal support, T10 explained:

I really do not understand how to use EAs or how they can make the learning process more successful, but my colleagues were very supportive when we started using them during SLAs. They helped me gain a general understanding of the value of these EAs inside the classroom, such as improving students' reading and writing of letters and numbers (T10, C5, Grade 2).

T9 and T10 understood that using EAs required an understanding of the ability of those EAs to bring change to the current SLAs. This is good enough for the classroom's use because the new generation of students are more familiar with using technology. The two participant-teachers understood that there was no need to explain the function of these EAs, which they still do not fully understand, because their students had already learned how to use the device at home. As T9 elaborated "sometimes my students teach us how these EAs work so all my colleague and I have to do is provide a suitable time for students to work with these EAs" (T9, C5, Grade 2).

This statement was confirmed when I observed T9 and T10's classrooms, where they used the assigned 45 minutes of lesson time to provide an opportunity for students to individually learn with EAs. As this time was also allotted to the period of the play zone, the two teachers assigned their students to engage in different learning zones, including digital learning (C5, Observation 1 and 2).

These two participant-teachers had no experience using EAs before the tablet computer was provided in the classroom and gained just a little knowledge about how and why EAs were used for digital SLAs. Once the device was introduced, they depended on other teachers to help them understand how to apply EAs in their classrooms.

Therefore, teachers' experience with EAs has been suggested as an enabler of using EAs in preschool classrooms. Interviewees considered the importance and effect of their own understanding of students' learning with EAs as having a key impact on their decision to continue using them. For example, T5 said,

My understanding of the function of the EAs is that they can be used to provide basic learning, such as shapes and letters, and this changed my mind about using them (T5, C2, Grade 3).

This statement confirmed that applying EAs without the appropriate understanding of what early childhood teachers would like to achieve from them, especially where young students ages four and five are involved, could lead the early childhood teachers to apply EAs inappropriately, which "could damage the learning environment" (T6, C2, Grade 3). An example of such a use is the introduction of an EA for older learners aged six to eight aiming to accomplish the skip counting skill. This lack of understanding on how to use EAs in the classroom might make early childhood teachers hesitant to use them in their classrooms.

Another teacher confirmed the importance of her knowledge: "I have to understand how an EA can change the process of SLAs so I can be fully prepared when planning my lessons" said T1 (C1, Grade 3). After using these EAs in her classrooms, T7 (C3, Grade 3) noticed and understood "the ability of EAs is to make the teaching and learning process more attractive and that made me decide to continue using them."

These data show that a good understanding regarding the affordance of EAs to enhance teaching and learning helps early childhood teachers to become more skilful and confident when adopting these EAs. T9 and T10 provided an example of how a teacher is also a learner. When the MOE requested that EAs be used, but did not offer the help needed to resolve the teachers' lack of knowledge about the technology, the teachers did not give up. Instead, they sought help from their colleagues and found that in the process of adopting EAs, their own knowledge on the way of teaching students through planning SLAs grew. This is expressed by T10,

I learnt in the process of doing. At the end of the process, I felt satisfied that from a non-specialist in technology, I had become someone who understands something about offering chances to engage my students with SLAs conventionally and digitally (T10, C5, Grade 2).

Participants' awareness of the possibilities for diversifying SLAs was also an important enabler that emerged from the data. Data from the interviews revealed that all participant-teachers came around to acknowledging the idea of having different types of learning materials for SLAs in different learning zones, which motivated them to include EAs. T9 emphasised her decision to apply conventional and digital SLAs to create a better environment for learning:

I was motivated to make my students do the letter or number activity using EAs in the individual learning zone, followed by the drawing activity involving the same letter or number in the artwork zone during the inside play time (T9, C5, Grade 2).

From this experience, T9 realised that students learn using either or both conventional and digital learning materials, resulting in the development of their language and literacy or mathematical skills. As it was possible to provide two different types of SLA based on the same content, students, now had the ability to undertake learning exercises using teacher-made learning games, toys, whiteboard, etc and then moving on to the individual learning zone to do the same exercises using EAs.

As has been demonstrated in the comments above, the understanding of early childhood teachers regarding how EAs can be used in their classrooms led them to give students the opportunity to use two types of SLA to learn a new concept. Teachers started to change their learning practice by including EAs in order to develop students' knowledge in different ways. They focused on students engaging with different type of SLA inside the classroom to explore and experience a new concept and, eventually, increase their understanding of it.

Eventually, participant-teachers established digital learning environments to meet early childhood students' needs and enable them to improve their learning of literacy and

mathematics. T1, T2 and T8 focused on the importance of properly preparing the individual learning zone, which should sometimes be based on what student need to improve, like their lack of literacy skills, as indicated by T8,

I always provide the students with the opportunity to do SLAs with various literacy-specific EAs, especially those who have problems with pronunciation (T8, C3, Grade 3).

T1 confirmed this by saying,

If I find out a student has a difficulty in writing a letter, I then make this student do several writing exercises in the individual learning zone using various literacy-specific EAs (T1, C1, Grade 3).

The comments above demonstrate that participant-teachers focussed on engaging students with digital SLAs to overcome their difficulty in reading and writing. However, I did not observe this measure, as none of the students in either classroom demonstrated any difficulties in learning such skills (C1 and C3, Observation 1).

As may be expected, the use of EAs was limited to a form of individual SLAs, in which participant-teachers could address the learning concepts of literacy and mathematics. This is the second aspect of EAs that interviewees valued: students engaging in the basics of learning literacy (letters) and mathematics (numbers and shapes). In order for early childhood teachers to attain interactivity with convenience, a literacy- or mathematics- specific EA was essential.

To sum up, the data revealed that policies and support directly influence the application of EAs in classrooms and that they have indirect effects on knowledge and experience, which in turn impacts on the perceptions of teachers about implementing them for students' use. When asked about whether the use of EAs had changed their perceptions about providing the SLA digitally, T3, T7, T9 and T12 said that they had.

I have never thought of the possibility of putting technological tools in the hands of students to do SLAs because they might be exposed to

inappropriate information. However, with EAs, applying digital SLAs has become very secure (T7, C3, Grade 3).

This comment illustrated that it had been impossible for teachers to provide devices to students because of the need for Internet connection. However, with the innovation of a specific type of EA that “does not require the connection when they are used by students” (T12, C6, Grade 2), it became more acceptable to provide digital SLAs. Interviewees believed that students engaging with technology-based teaching meant that learning content should take the form of a game with an educational purpose, decreasing teachers “efforts during SLAs” (T5, C2, Grade 3). The importance of changing the classroom routine to one of digital learning supports early childhood students to engage with SLAs, whilst being monitored by teachers.

In contrast, T4 and T8 were not certain of their views, as they had not thought about the issue before. However, T2 indicated that her views were unchanged:

I was one of those who supported the applying of such EAs for students’ use. Before I was a teacher, I was a mother, and my children used such EAs a lot at home, so I had experience with them. I am aware of their importance for young students (T2, C1, Grade 3).

Of the 12 participant-teachers, eight (T1, T2, T3, T4, T5, T6, T8 and T11) appeared to have a clear view of the affordances of EAs in learning practice, which was based on their past experiences (before the formal request) of allowing students to undertake digital SLAs using a laptop. As T1 asserted,

With my convictions on the importance of students’ learning, I was dissatisfied with the way SLAs were conducted - only using conventional learning materials. So, during my training period, I tried to introduce the change by using laptops, but I failed to introduce such a change and still had to deliver instructions to students. However, with the innovation of EAs, I was able to put the device in my students’ hands with ease (T1, C1, Grade 3).

Meanwhile, T7, T9, T10 and T12 seemed to develop a clear view of applying EAs for students' use, which was based on their current experience of using them in their classrooms after the formal request. After implementing these EAs and understanding how they could benefit students, these four teachers changed their views on the optimal approaches for students engaging in literacy and mathematics activities. The following is a principle of learning as stated by T7 (C3, Grade 3): "A student learns better though engaging with digital SLAs, as these depend on the student's effort, which is what we call 'self-learning'."

Indeed, this study has shown that policy, school support, and teachers' perceptions all have a direct impact on the presence and usage of EAs in classrooms. The Saudi MOE chose a few preschools to participate in the Aljwdah Project that aimed to develop students' learning using various EAs. Due to the project's size, all participating schools had adequate access to tablet computers. Even though it was possible for teachers to refuse to incorporate this new technology into their classrooms, as was the case with T9 and T10 before the study period, all 12 participant-teachers confirmed that they were using EAs at the time of study. However, the potential problems of using technological devices are a source of concern among early childhood teachers. Thus, in the following section, we turn our attention to the participant-teachers' perceptions of the challenges of using EAs.

5.4 Challenges in Using EAs

Interviewees were asked about challenges affecting the use of EAs in their classrooms. Some highlighted the initial challenges they faced when switching to digital SLAs. For T9 and T10, who had more experience using physical learning materials and methods to prepare SLAs for students who receive their knowledge about these activities from their teachers (see table 5.1 above), changing their learning practices could be difficult. T10 said that:

Having taught my students with face-to-face interactions in which SLAs had for a long time been managed by my instructions – for 22 years – the change to a new learning tool was a real challenge (T10, C5, Grade 2).

Her comment showed that because of their long experience in teaching without technology, and their resulting lack of knowledge, early childhood teachers might be more comfortable avoiding these EAs when their usage was not necessary. However, T9 and T10 felt that openness towards engaging their students with a new SLA was motivation for the use of EAs. For example, the MOE's interest in EAs can itself become a motivator for them to apply digital SLAs. For T10, an early childhood teacher's commitment to adopt EAs would eventually show results, so it is not necessarily the technical know-how that is helpful, but the belief and open-mindedness towards EAs. According to this teacher,

I think the most essential factor when facing a new thing is to be open-minded even with the possibility of barriers. In my case, I have a long experience of teaching early childhood students without using any equipment at all... Once I bypassed that, I started to enter the world of technology for the first time (T10, C5, Grade 2).

I confirmed this by observing the participant-teachers applying various EAs for students' use in the individual learning zone during the period of the play zone. In their class, T9 and T10 put a fully charged tablet computer on the table while allowing a student to perform digital learning exercises within the zone (C5, Observation 1 and 2).

T3 noted that another challenge was the MOE's teaching programme, which covered a considerable amount of information, including what learning materials should be used. She said that

The MOE set up several daily learning objectives that needed to be accomplished. One such objective was to help students to increase their writing skills through the preparation of several letter's activities in the play zone: (1) Students write the letter on the whiteboard within the library zone. (2) Five students cooperate to build a name (selected by the teacher) that has the new letter using blocks in the construction zone. (3) Four students individually draw the letter using white paper and colours in the artwork zone (T3, C4, Grade 2).

As shown in the comments, early childhood teachers tended to prepared their lessons following the MOE's guidance. Accomplishing the objectives set by the MOE was considered challenging. Such challenges led T3 to believe that changing her SLAs would actually be beneficial in self-evaluating her performance. However, T6 disagreed, as she pointed out that early childhood teachers' levels of satisfaction with regards to the MOE's principle seemed to be on a downward trajectory. For T6, the main objective of teaching and learning in early childhood classrooms is always to ascertain how beneficial they are for students. She believes that conventional teaching alone cannot support SLAs. She said:

As an early childhood teacher, I feel that conventional SLAs alone are not enough to provide satisfactory outcomes, so introducing new learning materials has brought more benefits to my students (T6, C2, Grade 3).

This comment reflects on teachers' use of EAs as a new mode of learning. Perhaps "digital teaching strategies," as T6 calls them, have to be officially included in the MOE's early childhood teaching programme. This illustrates the core role of the Aljwdah Project and the need for it to be merged into the teaching programme to keep other early childhood teachers updated on the latest teaching strategies required for teaching and learning purposes.

Three of the participants (T4, T7 and T12) mentioned another challenge related to the difficulties they faced when first using EAs in their classrooms. At first, students had problems operating the device. T7 mentioned that:

At the beginning, several of my students faced a problem with how to run the device and EAs. This was because some of them had used an Apple tablet computer at home, but our school provided a Samsung tablet computer. There is a difference in terms of operating them and how to navigate an EA, making it difficult for these students to use the devices that had been provided. (T7, C3, Grade 3).

This comment pointed to the possibility that several students may lack skills when using EAs. Interviewees believed that such a problem may be time-consuming as an early

childhood teacher may have to explain the function of EAs to each of these students. To overcome this problem, participant-teachers gave presentations on how to use the device; they then helped those students who were still struggling. T4 explained the actions taken before using EAs in the classroom:

I started by telling my students how to care for the devices. Then, I made a small presentation about how to work with the tablet computer and how to access an EA (T4, C4, Grade 2).

The problem of students' lack of digital capability seems to have appeared only at the initial stage of the adoption of EAs. The informants' concerns seemed to have disappeared after a period of good teacher support and student training. It is interesting that the rest of the participant-teachers seemed to admit that they had overcome such problems after some time. "Currently, there are no challenges or difficulties using EAs that have been installed on the tablet computer, even for students" (T8, C3, Grade 3). Here, interviewees believed that students no longer had any trouble working with EAs because they already had prior knowledge of using them.

This was confirmed in the classroom observations in which all the participant-students seemed to understand how to start and operate EAs (all classes, Observations 1 and 2).

Of the participant-teachers, T3, T6, T7 and T11 noted that another challenge was the limited availability of EAs in Arabic, as indicated by T6 (C3, Grade 3) "when I searched Google Play to install EAs other than literacy or mathematics, it was difficult as most EAs were in English." However, this was not a major problem, as indicated by T12, because the aim of using EAs was to apply the project's principle of providing opportunities for teachers to extend their SLAs by including EAs for students' use, and these three types of EAs were sufficient. T12 felt that using the literacy-specific and-mathematics-specific EAs was satisfactory, as her students could engage with both conventional and digital SLAs related to the same concepts, and that was in line with the principles of the new project.

Additionally, T5, T7, T8 and T12 identified the large number of students in class as a challenge, saying the availability of only one device in a classroom was a problem:

There are 30 students in my class. They all have the desire to learn with EAs, but because of time restrictions for the play zone (45 minutes), only up to five of these students can participate in digital SLAs within the individual learning zone. With this desire and time restrictions, there were conflicts between students, as each of them wanted to do their learning exercises with EAs (T12, C6, Grade 2).

This comment indicated that having one device with time-constraints was considered an issue by early childhood teachers. To overcome this issue, the participant-teachers set a limited time for working with EAs, a tactic that was used by all teachers. According to these participants, each student was allowed to use the device once a week, or twice a week in cases where all students had already participated once that week. Additionally, all students who participated in the digital SLAs were allowed up to 15 minutes inside the individual learning zone before being required to move to another learning zone.

Additionally, implementing the tablet computer in the classroom was expected to be problematic, as was the case in other contexts that did the same. However, the findings of this study suggest that teachers rarely faced technical problems when using tablet computer to access EAs for students' learning. Two examples were mentioned by T2 and T12, respectively: "I have not encountered any difficulties or challenges because it is very easy to deal with these EAs" (T2, C1, Grade 3) and "I did not encounter any problems in terms of hardware or other failures" (T12, C6, Grade 2). Furthermore, T1, T6, T9, T10 and T11 explained that their students rarely encountered technical problems when using EAs, and T9, T10 and T11 noted that their students overcame problems by themselves when the EAs did not work properly, as explained by T9,

One of my students was working with a literacy-specific EA inside the individual learning zone. He restarted the device by turning it off and on again, when he faced a problem. He confidently told me that he could use it (T9, C5, Grade 2).

As has been shown in the comment above, when early childhood students face problems with EAs, they do not resort to their teachers for help but try to solve the problems by themselves. This was confirmed in one of the classroom observations where an early

childhood learner could not operate in EAs because the power had run out so she went to put the device on charge (C3, observation 1).

Indeed, the various concerns that influence early childhood teachers' decision to use EAs in their teaching have been analysed in terms of their long experience with conventional teaching methods and materials, the MOE's teaching programme, operation of the device, limitation of Arabic EAs and class size. However, such problems have been acknowledged to have a minimum level of influence on their decision-making. Here, EAs are considered to be new teaching tools that have to be included in the teaching programme to facilitate their use in early childhood classrooms. The introduction of a new way of teaching is important to facilitate the learning process. In addition, the limitation of the Arabic version of EAs is not a concern at all as the available EAs are considered sufficient. Finally, class size seems to be perceived as a solution rather than a problem. This will be explained later in Chapter 7.

5.5 Summary

To conclude, this chapter has discussed the participant-teachers' thoughts about their application of EAs in two developmental learning areas: literacy and mathematics. Some factors, such as the accessibility of devices and the installation of EAs in schools, seem to play a part in influencing early childhood teachers' decisions to enhance their SLAs using these EAs. However, several concerns, including their long experiences with conventional teaching methods and materials, the MOE's teaching programme, and operation of the device, were manifested at the initial stage of adopting EAs, but the participant-teachers either devised solutions to the issues or did not consider them as concerns at all.

Next, the study discusses how EAs were applied in the individual learning zone. Chapter 6 reports the participant-teachers' perceptions and use of EAs to engage their students with digital SLAs, and their thoughts on their roles that are closely related to their understanding of teaching. The classroom observations lasted for one day for each interviewee to confirm the findings from the interviews. Using the observation sheet (Appendix G, p. 261), I took notes on the digital SLAs inside the classroom. Whenever the participant-teachers used EAs to promote SLAs, I made a note of the changes in the learning practices and students' interactions. These participants conducted individual

and alphabet learning digitally using EAs to promote learning at some point during each observed activity. This is explored in the next chapter.

Chapter 6: Data Analysis: The Digital Self-learning Activities (SLAs)

Educational apps (EAs) have the potential to change the conventional approach to letters, numbers and shapes to one that is supported by digital technology. The affordance of these EAs is assessed to see whether it aligns with Skinner's (2003) theory of educational machines. The data collected through semi-structured interviews and day-long observations for each teacher were combined to analyse how twelve teachers applied EAs. The teachers were asked about the extent to which SLAs had changed following their use of EAs. This change is pivotal to engage with subject knowledge content and instructions. In this chapter, how participant-teachers planned and conducted their lessons using EAs is captured. These insights will put a spotlight on RQ2: What are the changes occurred in early childhood SLAs when using EAs?

6.1 Preparation Stage

The first aspect to be considered is how early childhood teachers planned and prepared their classroom practice for the assigned SLAs at the scheduled time. The strategy adopted by the informants in the facilitation of the digital SLA put early childhood teachers into the position of facilitators to the learning process. The participant-teachers saw their roles as guides whose job was to direct students to return to the right track when they deviated from it. Here, they perceived their role as facilitators who arranged SLAs by assigning suitable several learning exercises to their learning zones.

Before students' use of EAs, interviewees indicated that early childhood teachers should undertake the job of organiser who should make four types of preparation. The first was to match the SLA with the appropriate EAs. Although these interviewees perceived an EA as a type of subject-specific activity, they still acknowledged their potential to contribute to the growth of learners. To them, EAs were "effective tools" (T5, C2, Grade 3) that students could use to develop reading and writing, and mathematical learning skills. However, The possibility of the devices shutting down due to the lack of battery power was a source of concern for the participating teachers. This was raised by T3, T5, T6, T7, T8 and T12, who emphasised the importance of preparing the digital SLA before the start of their daily programme. For example, participant-teachers ensured that the tablet computer was on the table and fully charged and contained the

suitable EAs. T3 (C4, Grade 2) mentioned that “The learning exercises could be disturbed if there was a sudden power outage.”

I confirmed this during classroom observations in which all participants but T8 placed one fully charged tablet computer on the table in the individual learning zone (all classes, Observation 1 and Observation 2). T8 neglected to charge the tablet and this resulted in the device shutting down during the activity session. The student’s work was lost, and she noticeably lost interest in the activity (C3, Observation 1).

Interviewees also shared their concern that the time-constraints established to manage the digital SLA might not have always been kept by early childhood students, that is, learners might have spent too much time on the EAs. Thus, participant–teachers also emphasised the importance of balancing lesson time with the time available for SLAs in order to allow students to cover multiple tasks in the lesson plan. According to T11,

I try to strike a balance between how many minutes a student needs to complete the exercises and overall class time for the sake of carrying out all daily tasks (T11, C6, Grade 2).

With time-management, the benefit is evident – all interviewees reported that using EAs benefitted early childhood students who were able to learn by both conventional and digital methods. For example, T4 (C4, Grade 2) commented that “a student does an exercise using blocks in the construction zone for a limited time, then he or she moves to the individual learning zone to learn with EAs.” Here, in order to ensure students engaged with different types of SLA, these students were allowed to undertake learning exercises digitally for up to 15 minutes before being moved to another learning zone to undertake the conventional SLA. However, because of the possibility of technology impacting on learners, EAs were provided to students for the digital SLA “once or twice a week” (T5, C2, Grade 3).

The second preparatory decision was only reported by T2. She focused on a learning objective when preparing and planning the digital SLA:

When I decide to use EAs, I take into consideration the learning aim and the particular criterion for accomplishing that aim... I also predict what skills students need to focus on in the individual learning zone (T2, C1, Grade 3).

T2 further explained that EAs were part of the SLAs that were applied to help students achieve learning objectives related to improving their reading and writing, and counting skills. Here, the teacher reported the importance of having literacy and mathematical learning objectives when planning digital SLAs. Interestingly, even though the other interviewees did not share similar information, in observing their classrooms I confirmed that ten of the participant-teachers had set up a learning goal of engaging students with EAs. For instance, in T11's class, the fruit and vegetable topic was discussed in conjunction with the new letter. T11 stated that various learning objectives related to the letter. She wrote these objectives on the whiteboard, identifying and writing the letter. Before one of her student started to work with an EA, she reminded him of the learning objectives written on the whiteboard (C6, Observation 1).

Interviewees said that the use of EAs were related to the learning objectives that they intended to accomplish. Thus, they believed that knowing which EAs were appropriate to the exercise was important. This approach was central to T12's work, as she was responsible for downloading most EAs, as mentioned in Chapter 5, section 5.3. For example, T11 explained that she only used the pre-installed literacy-specific EAs for students to practice their letters once they had been formally taught to them:

I only use the installed EAs in the individual learning zone... I keep the suitable EAs that are in line with my daily topics that have been downloaded by my colleague (T11, C6, Grade 2).

In line with this, T12 indicated that her choice of EAs was ascribed to their characteristic of being accessible teaching tools for early childhood students. Thus, she selected "EAs that have the ability to engage students with early language and literacy, and numeracy concepts, aiming to develop the reading and writing of letters, shapes and numbers" (T12, C6, Grade 2). This statement from T12 suggests that the affordance of EAs is portrayed in a positive light, that is, offering the convenience of easy access to subject knowledge. As productivity tools, EAs take the pressure off the teachers in

terms of developing learning skills. For example, EAs designed for learning language and literacy are downloaded as needed. For all these, EAs have been prepared as teaching tools that make teaching easier and learning more effective.

The third preparatory decision to make was a consideration of how many students should be allowed to partake in the digital SLA at a time. All interviewees allowed just one student to do an exercise with EAs due to the availability of one tablet computer. This resulted in five students taking turns to learn with these EAs every day. Each of these five students had to take turns in participating in the digital SLAs during the day for a limited time in the play zone. The usage of the EAs was limited to just one student for each activity and for a specific period of time. Participant-teachers said the main reason for this was that only one device was available in each class, as stated by T1,

Most of the EAs are developed to engage one student in their exercises, so with only one tablet computer, only one student can do a digital SLA at a particular time (T1, C1, Grade 3).

This was confirmed in classroom observations. Ten participants stated that they allowed one student at a time to participate in digital SLAs for up to 15 minutes while the other students engaged in conventional SLAs that had been prepared in other learning zones (all classes, Observation 1 and Observation 2).

The fourth preparatory decision was the setting of specific rules for learning with EAs. Five of the teachers (T2, T5, T7, T8, T9 and T11) said that the learning rules for the digital SLA were different from those for other type of SLAs. For instance, T5 said,

I have set up a specific rule for learning with EAs, with a specific physical distance that should be maintained between the student and the tablet computer (T5, C2, Grade 3).

However, even though they established a new rule for learning with EAs, T2, T5, T7 and T9 applied the general rule of the learning session. They explained that their learning rules were extended to include a specific rule for the digital SLA, saying that students learn with EAs while following the period's rules, such as "displaying the

colourful paper card for each learning zone, which was one yellow card for individual learning zone and students had to play quietly” (T7, C3, Grade3). The four teachers then indicated the new rules that they had included in the digital SLAs, such as “the tablet computer should not be moved from the table and a distance should be maintained between the student and the device” (T9, C5, Grade 2).

I confirmed this via classroom observations in which participant-teachers set up their learning rules for each learning zone before the learning rules for the digital SLAs. For example, T1 (C1, Grade 3) and T11 (C6, Grade 2) began by reminding students of the general rule of learning within zones and then explained the new rules for working with the device. At the start of the activity, teachers reminded their students of the rules for EAs. Students in both classes mentioned some of the general rules that had previously been taught to them in which they were required to work in all learning zones before moving to the specific rule for digital learning (C1 and C6, Observation 1). However, T11 also said the following to her students, “you mixed up the rules for all learning zones with the rules for digital learning, so let’s identify our rules for only digital learning.” After that, she reminded students by identifying the rules, which were “carefully play with the device, do not move it from the table, and close it when you are finished.”

To summarise, this section on teachers’ preparation of applying EAs in their learning practice has explored early childhood teachers’ preparations of digital learning. These were matching the SLA regarding language and literacy, and numeracy with the appropriate EAs and setting up the learning objectives of digital SLAs, the student size within these digital SLAs, and the rules of learning with EAs. It has shown how teachers’ conceptions of and effort in each preparation match their understanding of digital SLAs. For example, some informants felt that one student should be assigned literacy-specific EAs to develop his/her reading skills by achieving alphabet knowledge.

After preparing the learning environment for digital SLAs in the individual learning zones, the next step focused on how EAs were used.

6.2 Usage Stage

In response to this study's question on the ways in which EAs were used, interviewees reported that they used EAs to facilitate an individual SLA on language and literacy, and numeracy that took the form of questions and answers. Following the learning objectives of improving reading and writing as well as mathematical skills, EAs were only used for individual learning and alphabet learning, which were part of the plans for the two main lessons. Table 6.1 presents a summary of participating teachers' usage of EAs in their classrooms.

Table 6. 1: Summary of teachers' application of EAs in their classrooms

SLAs	Teachers' responses about using EAs in learning	Teachers' use	Students' use
Individual learning zone	Students engaged in relevant and self-access SLAs using various EAs.	Daily	Up to 3 students learning with EAs separately once or twice per week
Alphabet learning	Teachers apply literacy-specific EAs at the end of the alphabet learning to promote students' innovative thinking. Students engage with alphabet test that assesses their letter and vocabulary knowledge.	Twice a week	Up to 5 students learn with EAs separately once every 2 or 3 weeks

When asked about the use of EAs in their classrooms, interviewees confirmed the application of EAs specifically to engage their students with individual SLAs.

Accordingly, the tablet computer had been placed in the individual learning zone as part of the play zone to enable students to gain experience using various EAs. The key function of EAs is to assess how students understand the subject knowledge. Thus, EAs are considered as instructors who have the ability to engage early childhood students with information. This understanding of teaching as a test of knowledge was evident in the way participant-teachers described their use of EAs to support learning by helping students to identify a new concept related to literacy and mathematics. T1 mentioned the following example:

I use various EAs to provide exercises for students to do SLAs electronically. My aim is to foster individual learning using literacy- and mathematics- specific EAs. I put out the device for a student to do the individual SLA by accessing any EA developed specifically for developing reading and writing, and counting (T1, C1, Grade 3).

As shown in this comment, participant-teachers used EAs to engage students with digital SLAs on literacy and mathematics. Two specific ways of engaging these students with digital SLAs have been shown by the interviewees to be related to their understanding of alphabet learning and individual learning development, as well as their associated teaching methods. The first use of EAs was followed by T1, T2, T4, T6 and T11, who allowed their learners to use only literacy-specific EAs during their time in the individual learning zone when introducing a new letter during alphabet learning. In contrast, they applied various literacy- and mathematics- specific EAs when teaching lessons on a letter they had previously introduced (see Table 6.2 below). T4 explained,

Today, I let few students do digital SLAs using Abjad Apps and Arabic Letter and Word Apps in the individual learning zone as my students have just learnt a new letter during the alphabet learning. However, tomorrow we were planning on engaging our students with various literacy- and mathematics- specific EAs because we tend to teach the same letter for three days (T4, C4, Grade 2).

This was confirmed by classroom observation. For example, during the first day of C1 Observation 1, with T1 as a key teacher and T2 as an assistant teacher, a new letter was introduced during alphabet learning. T1 prepared the Abjad App and the Arabic Letter and Word App for students to use in the individual learning zone during the period of the play zone. In contrast, C1 Observation 2, with T2 as a key teacher and T1 as an assistant teacher, the same letter was reviewed. T2 prepared the Abjad App, the Arabic Letter and Word App, the Shapes Learning App, the Number Learning for Kids App and other EAs for digital SLAs (C1, Observation 1 and Observation 2).

On the other hand, seven teachers (T3, T5, T7, T8, T9, T10 and T12) disagreed with the other informants, as they pointed to their daily use of literacy- and mathematics-

specific EAs that had already been downloaded to the device (see Table 6.2 below). The seven interviewees viewed these EAs as strong tools for learning language and literacy, and numeracy, believing that they have the potential to assist early childhood students to understand a variety of knowledge because of their affordance of convenience and easy access to information. T3 said:

I put the tablet computer, which consisted of the Shapes Learning Apps, the Abjad App, the Number Learning for Kids App and other literacy- and mathematics- specific EAs, in the individual learning zone every day. I encourage my student in the zone to do digital SLAs using any of these EAs (T3, C4, Grade 2).

This comment demonstrates that several participant-teachers applied EAs for language and numeracy development in the individual learning on a daily basis. Interviewees believed in the function of these EAs to conveniently assist their students to enhance their knowledge on letters, numbers and shapes. This was confirmed by classroom observations. T5, T9 and T12 introduced a new letter, while both T8 and T10 reviewed the previous day's letter. All teachers prepared a variety of literacy- and mathematics-specific EAs for students to perform digital SLAs during their time in the individual learning zone (C2 and C3, Observation 1; C5 and C6, Observation 2).

When all 12 interviewees were asked about the reasons behind their usage of these EAs for individual learning, T5, T6, T11 praised the function of them as self-contained and very simple to navigate. For example, T5 said,

... learning content of letters, numbers and shapes are displayed to students by the EAs while leading students to accomplish the exercises ... these EAs guide students all the way to the end of the task. Of course, such EAs are suitable for engaging students with the individual SLAs digitally (T5, C2, Grade 3).

This comment indicated that when students logged onto an EA, it signified a step in the learning process. Tutorials about the selected subject knowledge content are expected to teach, for instance literacy-specific tutorials are expected to teach phonological

awareness. Providing the information to facilitate the learning task is the responsibility of the EA. With this information stored in EAs, learners can conveniently go through the tutorial site to test their knowledge of the subject. According to the informants, the value of EAs lies in their function as tutorial/guiding platforms that provide opportunities for the exploration of knowledge to stimulate and encourage the achievement of the learning purposes. Here, the interviewees believed that for the students' part, learning with EAs that had been developed to help them grasp subject knowledge was one way to attain learning.

The use of EAs was not only limited to individual learning during the period of the play zone. Few participants tried to extend their usage to apply a digital SLA in another learning session. Two interviewees perceived that a limitation on students' understanding of literacy information could be a mean through which knowledge was delivered. With conventional approach to learn, the teachers are "the delivery person of the lesson material, the person who gives a lot of information to the students" (T2, C1, Grade 3). This might make learning "boring" (T11, C6, Grade 2). Therefore, T2 and T11 endeavoured to employ alphabet- specific EAs as new mode of learning the alphabet during face to face interaction in the period of the circle time twice a week to promote students' thinking about new letters. Three participants (T1, T2 and T11) had only been using EAs with the aim of supporting literacy tasks, such as practices during the alphabet learning that were assigned at the end of the period of circle time, since 2018. T11 said,

After a year of using EAs in the individual learning zone to provide a digital approach to learning letters and words in the play zone, the idea of using literacy-specific EAs to provide the digital SLA in the time of alphabet learning came to mind (T11, C6, Grade 2).

As shown in the above comment, after a year of using EAs in the individual learning zone to engage students with digital SLAs on language and literacy, the three teachers came up with the idea of using literacy-specific EAs on alphabet learning. In the minds of these three participant-teachers, there was a personal desire to enhance their learning practice, which in turn would bring an improvement to student learning. Therefore, their use of EAs in the classroom evolved, as explained by three interviewees who indicated

that EAs could be used effectively in the classroom when following a suitable strategy. For example, by engaging students with the SLA in diverse and interesting ways that support students' thinking, technology in general can achieve this goal of "setting up a digital SLA using literacy-specific EAs to assess students' learning of the new letter" (T2, C1, Grade 3). To do this, T1 shared her approach:

At the end of the alphabet learning, I engaged three of my students individually with the Arabic Letter and Word App to assess how these students were grasping the new knowledge. I used one of the App's tests because I wanted to provide the SLA that was helpful in supporting students' thinking (T1, C1, Grade 3).

This comment demonstrated that T1, T2 and T11 had developed the idea of using literacy-specific EAs to provide an end-of-lesson activity for alphabet learning (see Table 2 below). What is interesting in this comment is the suggestion that early childhood teachers could use EAs to provide digital learning exercises at the end of alphabet learning to test the learners' understanding of previous or new knowledge. Interestingly, using these EAs to provide a digital SLA during alphabet learning when introducing the new letter gave early childhood students the opportunity to practice their learning in different ways.

In addition, T1 and T11 indicated that they could present a variety of information using these EAs in easy and clear ways with less effort and time. They reflected on their understanding of how to engage their students with different learning materials and with less effort for the letter activity. As a result, early childhood teachers "no longer need to make a variety of conventional teaching aids to introduce the new letter" (T1, C1, Grade 3).

Generally, all three participant-teachers confirmed that they preferred to use the literacy-specific EAs in alphabet learning because it diversified their teaching aids. "I want to present my learning in diverse ways ... and EAs can achieve this goal" said T2 (C1, Grade 3). Some of the early childhood students practiced the new letter with a cognitive game that offered a hands-on experience designed and prepared by the teacher, while other students practiced with literacy-specific EAs.

I confirmed this by observing the use of a literacy-specific EA during alphabet learning in T1 and T11's classrooms. In their classes, alphabet learning included the introduction of a new letter. At the end of the learning session, three participant-students were selected to perform an alphabet test using a literacy-specific EA, while the rest of the students ended their letter activity by doing a worksheet exercise. Teachers used the Arabic Letters and Words App that displayed a test for the letter placed above three pictures of animal characters accompanied by a human voice pronouncing the letter. A student was requested to match the correct picture to the letter pronounced loudly by the app in order to move on to the next letter. The three participant-students took turns using the app and completed the test for four to six of the previously learned letters until they reached the new letter. During the exercises, the teachers maintained their distance from the student who was performing the task. They quietly observed the students working with the EAs, starting from the selection of the letter until the exercises were finished. To encourage the rest of the class, both teachers reminded all students that they could repeat this activity using this EA in the individual learning during the play zone (C1 and C6, Observation 1).

Table 6. 2: Teachers' use of EAs for digital learning

Teachers	SLAs	Alphabet learning	EAs
T1, T2, T4, T6 and T11	Individual learning	New letter	Literacy
		Previous letter	Literacy and mathematics
T3, T5, T7, T8, T9, T10 and T12		New/previous letter	
T1, T2 and T11	Alphabet learning	New letter	Literacy
		Previous letter	-
T3, T4, T5, T6, T7, T8, T9, T10 and T12		New/previous letter	-

Table 6.2 summarises teachers' use of EAs in the classroom in two different learning sessions to provide opportunities for their students to undertake SLAs using different types of teaching aids. Three participant-teachers used literacy-specific EAs during

alphabet learning, while all teachers used a variety of literacy- and mathematics-specific EAs in individual learning. Participants found these EAs very useful in conducting SLAs regarding language and literacy, and mathematical skills focused on phonics and counting. No other type of EA was installed on the tablet computer, as voluntarily shown by ten participant-teachers during classroom observations.

In line with the results so far, interviewees reflected on the way that subject knowledge was taught to students by organising digital SLAs in both individual and alphabet learning. According to these teachers, even though students undertook the learning exercises freely inside the classroom, they “still need instructions to make sure they accomplish an educational goal. However, when using EAs, there is no more need for my instructions” (T3, C4, Grade 2). Here, the data revealed that these EAs were preserved as vehicles for teaching providing the key affordance of convenience was to modify teachers’ methods of approaching SLAs. Interviewees reflected on the changes that occurred in their teaching when they used literacy-and mathematics-specific EAs, chief among them being the reduction in the need for early childhood teachers to deliver lessons or provide further instructions. Clearly, the strategy adopted by these informants in the facilitation of digital SLAs during alphabet and individual learning was to stay away from the student for a while so that he or she could freely participate in the task. They compared themselves to “a guide” (T2, C1, Grade 3) whose job was to steer the students towards the task and bring them back when they went off track (T12, C6, Grade 2).

The data showed that the interviewees considered all the installed EAs as vehicles for teaching, in which an EA was used as part of an educational strategy to engage students with learning content. They perceived the advantages of EAs (that is, convenience and the accessibility of subject knowledge and learning content) to be the reason for the change from the conventional way of learning, with the subject knowledge and information having been displayed by EAs instead of early childhood teachers. Here, the participant-teachers believed that EAs were productivity tools that could take the responsibilities of guiding the process of learning language and numeracy knowledge away from early childhood teachers. For example, an EA is “partly responsible for students achieving an understanding and comprehension of what has been taught,” as stated by T7 (C3, Grade 3).

Interviewees reported that the function of these EAs was perfectly suited to SLAs in pre-school classrooms. Five participants (T3, T4, T6, T7 and T9) commented on how such EAs had the ability to facilitate their work during individual learning because their learning function was “very supportive of students’ independence in making progress” (T4, C4, Grade 2). As a result, teachers were “less prominent in the learning zone” (T9, C5, Grade 2). T3, T6 and T7 described these learning processes as helpful in the creation of the individual SLA. EAs seemed to have the ability to enable early childhood teachers to focus more on other learning zones in which students might need guidance to accomplish learning goals. This was also noted by T10, who acknowledged her limited knowledge of EAs:

EAs fit with the function of free play. Since I have used them in my class, I have not had any problems with students using them, even though I do not understand how to use them properly (T10, C5, Grade 2).

The above comment illustrates that using EAs was found to be very helpful in making progress in the learning process as an individual student had the opportunity to select his/her preferred EA to learn a new concept of either language and literacy, or numeracy. Then, the learner was able to become “familiar with the learning content and how the learning is processed” (T12, C6, Grade 2). This statement demonstrates that participant-teachers acknowledged the function of EAs as teaching tools that facilitated the access to subject knowledge. Teachers were using EAs that benefited the learning process in which the aim of learning was effectively met. T3 provided an example of students’ engaging with these EAs:

... students access the Abjad App during individual learning. Of course, once they open the app, the options for learning and related exercises are shown in attractive ways through an animal character and voice that tells them what to do to ‘match the letters.’ So, students did as they were told to progress to another set of exercises (T3, C4, Grade 2).

Observing the classrooms of ten of the participants (T1, T2, T4, T5, T6, T8, T9, T10, T11 and T12) also provided evidence of students freely engaging with EAs. Students chose two to three EAs from a selection, either learning and completing exercises or

simply completing exercises. They began by undertaking various exercises in an EA and then moved to another EA without any interventions from the teacher. The learning exercises and content were taught through these EAs with the aim of helping students to gain more knowledge of letters, words, numbers and shapes. The digital learning exercises were centred around correctly answering a question before moving on to another exercise. Table 6.3 illustrates students engaging with these EAs (all classes, Observation 1 and 2).

Table 6. 3 Early childhood students engaging with EAs

Activity	EAs	Students' work with EAs
Alphabet Learning	Arabic Letter and Word	Up to three students were tested. Each student was asked about their knowledge of letters. The last student did five previous letters and continued using the app for the new letter. He made a successful selection in his first or second attempt when he was tested.
Individual learning	Abjad	Up to six students used this app. They moved between learning and playing during a period of four to ten minutes. When carrying out cognitive exercises, students could not progress to the next stage until they provided a correct answer. The students made successful progressions on their first, second or third attempts.
	Learning Shapes	Up to six students used this app. They moved between two to three types of shape exercises during a period of five to 10 minutes. Students could not progress unless they provide the correct answers. They made successful progressions on their first, second or third attempts.
	Number Learning for Kids	Up to four students used this app. They moved between learning and exercises during a period of four to six minutes. When learning with cognitive exercises, they could not progress until they provided the correct answers. They made successful progressions on their first or second attempts.

The discussion now moves on to participant–teachers’ reflections on using EAs to facilitate the learning processes. As is shown in table 6.3, EAs have the potential to enhance students’ skills regarding language and numeracy, which T5 (C2, Grade 3) described as “the perfect scenario to effectively enhance learning skills.” Interviewees stated that an EA is a program that allowed students’ actions to be supported by technology, which is the most essential aspect of fulfilling the objective of SLAs. Without EAs, teachers would not be able to fulfil their teaching responsibilities, as these EAs are not only vehicles for learning subject matter but also a means of evaluating students’ work. Thus, there was no further need for teachers to evaluate students’ learning, as indicated by T8:

The most important aspect of these EAs is the evaluation of students’ performance... the responsibility of the assistant teacher and I is now to provide any help needed by students when they are using an EA (T8, C3, Grade 3).

The informants reiterated that even though EAs help to engage students with learning, the teachers should decide on the appropriateness of their use. The appropriateness of EAs is related to the perspectives of teaching and learning. The data showed that offering EAs is a way to strengthen the learning process effectively by providing students with the correct answers “even after they have made a mistake” (T7, C3, Grade 3). Interviewees expressed their satisfaction with how this function of EAs assisted students during their engagement with SLAs digitally. Participant–teachers perceived EAs as an opportunity for students to acquire correct educational information in a different format, while also reiterating previously taught information. Learners might feel that “their knowledge is being challenged, as they have to get the correct answer” (T2, C1, Grade 3), while learning from their errors to enable them to move on. T1 explained it thus:

When students respond correctly, an encouraging voice leads them to the next exercise: ‘excellent,’ ‘well done,’ ‘great’; sometimes, it is the sound of clapping. However, when students answer incorrectly, a sound indicates the error. The sound indicates that the answer is wrong, meaning that the

student must redo the same exercise until the correct answer is provided (T1, C1, Grade 3).

As illustrated in the comment above, participant-teachers believed that this feature of feedback was helpful for learners to acquire knowledge. According to the interviewees, the responsibility of these EAs was to help early childhood students to understand their subject knowledge. The focus of EAs is on leading students to understand the subject matter and this is closely related to their thought processes. They provided all the necessary materials required to learn the subject; these were presented in a particular sequence, which was expected to lead students through an appropriate reasoning process. EAs are therefore useful in the development of students' thinking, "as they had to think about the information provided so that they could reach the correct answer, resulting in an increase in their literacy and mathematics knowledge" (T1, C1, Grade 3).

In line with this result, informants seemed to believe in the benefit of EAs for improving students' literacy and mathematics knowledge. Data illustrated that when a learner used an EA, he/she would acquire various educational concepts over "a short period of time" (T2, C1, Grade 3). For example, students who access Abjad App and Arabia Letter and Word App, "they directly practice known and unknown letters, which results in gaining letter recognition that has not yet been officially introduced" (T1, C1, Grade 3). Here, interviewees believed that EAs could be used most effectively when they offered learning in tandem with practice so that early childhood students could obtain new knowledge related to the recognition of numbers, shapes and the spelling of letters.

When participant-teachers were asked about the disadvantages of these EAs in their classrooms, all except two (T5 and T10) said that such programmes had no disadvantages because they offered a feedback function. T1 argued, "all EAs that we have used thus far have had no disadvantages at all." Thus, the informants perceived this type of EA as a useful tool that could provide support and assistance to the students when contemplating their errors, while re-trying the task in order to select the correct answer. Such affordance of EAs is perceived to be very useful and convenient in avoiding a repetition of the same errors when they repeat an exercise, and that is "very helpful in students' acquisition of information" (T1, C1, Grade 3).

Here, participant-teachers viewed EAs as expert guides that would lead students to the desired learning outcomes, which aligns with Skinner's (2003) theory of educational machines. In particular, interviewees simultaneously perceived EAs as tools that changed their learning practices as well as believing they were necessary for students' interactions. Participants' perceptions and uses of EAs corresponded with Piaget's (2001) theory of teaching, which states that students acquire new knowledge when they are given the opportunity to apply that knowledge.

6.3 Summary

To conclude, this chapter has shown how twelve early childhood teachers used EAs in their individual and alphabet SLAs. Here, the teachers went through two stages in their applications of EAs in the classrooms, (1) the preparation stage and (2) the usage stage. These stages were closely related to the teachers' views of the changes EAs could bring to the SLAs. The teachers' perceptions of potential of these apps to enhance learning as well as the ways in which these apps were applied by the teachers, are the first two objectives of this study. As introducing change in the process of teaching and learning can have an impact on young students, examining the impact of these EAs on student is the last objective of this study, which is discussed in the following chapter.

Chapter 7: Data Analysis: Teachers' perceptions of EAs' impact on students

The impact of EAs on students' interactions with SLAs might have an effect on the decisions that the teachers make about their teaching. This chapter focuses on how EAs influence the way that young students learn. The following discussion relies entirely on teachers, as no data were collected from the students for two main reasons. Firstly, it is unlikely to obtain permission from the MOE to conduct interviews with students aged four and five. Secondly, the time available to visit the school was limited, as mentioned in the methodology chapter and secondly, it was difficult to obtain consent from the parents. Additionally, the teachers reported that the use of EAs in their learning practice was the result of their views on how they could be useful in improving and supporting the students' independence in learning environments. During the data analysis of the interviews, it was repeatedly found that teachers viewed the capability of EAs in motivating students to learn resulting in affecting these learners' achievements and behaviour. Thus, this chapter focuses on how interviewees perceived the impact of EAs in the context of the student, which can be assessed by investigating the impact of technology on learning, motivation and behaviour. The data from classroom observations would be used to complement the interview data. The focus of these insights is to answer the RQ 3: How do teachers perceive the capability of EAs vis-à-vis early childhood students' engagement with SLAs?

7.1 EAs and Learning

The analysis of the data suggested that EAs were not only helpful in supporting teaching, but also in engaging students with digital SLAs. When asked about their perceptions of the impact of these EAs on students, participating teachers expressed that the use of digital SLAs depended on whether subject knowledge could be accessed from an EA on a tablet computer with or without an internet connection.

When comparing these EAs to other technological tools and resources, participant-teachers believed that technologies such as YouTube require a live Internet connectivity to access subject knowledge and information. An interviewee acknowledged that "Internet is the quickest way to find out about any things of interest to teachers and students" (T3, C4, Grade 2). However, T6 reported two possible barriers to placing such technology in the hands of students. The first was the issue of Internet disconnection,

which, when it occurs could hamper the efforts of early childhood students, causing them to leave the exercises. Hence, the digital SLAs may be disrupted and learning would be negatively influenced. The second barrier was the presence of non-educational materials. This is seen in the following example:

Students might access a non-educational activity, such as anime or a non-educational game... students might also be exposed to some harmful and inappropriate content when they access YouTube (T6, C2, Grade 3).

As shown in the comment above, interviewees believed that as they were working with very young students at sensitive ages, it was inappropriate to allow them to access SLAs via the Internet, as this might bring harm to them by exposing them to inappropriate materials and allowing them to access non-educational content, such as playing video games. However, T7 rejected this claim offering a different view:

There is not really a difference between engaging my students with digital SLAs that require an internet connection, such as YouTube, and digital SLAs using EAs that do not require an internet connection, such as the Abjad app and the Shapes Learning app (T7, C3, Grade 3).

However, all classroom observations demonstrated that the internet was useful for teachers in their presentations but only in a complementary or supplementary way (All classes, Observation 1 and 2).

Seven interviewees (T2, T3, T5, T6, T8, T11 and T12) nevertheless acknowledged that having early childhood students do digital SLAs that required Internet connection was out of question. However, EAs that have the ability to function without the need of the Internet were perceived by all interviewees as powerful teaching tools allowing early childhood teachers to be unconcerned with putting these EAs into the hands of learners. Participant-teachers highlighted the ability of EAs to provide appropriate language and numeracy activities results in the safe acquisition of knowledge for students, without worrying about external interference. As shown in the comment below, T1 compared Internet and non-Internet learning resources,

Digital SLAs that require the use of the Internet have the potential to engage students with good and bad content, learning or entertainment. But if EAs are used in school under the mentoring of teachers, I can be certain that students have access to educational content that relates to the early childhood developmental areas, including language and literacy (T1, C1, Grade 3).

As shown in the comment above, interviewees were not concerned with applying EAs for students' use as these EAs, which did not require an Internet connection for full functionality, had the ability to engage students with digital learning. The consolation of using these EAs created the possibility of putting the device in students' hands "without having any concerns" (T12, C6, Grade 2) when early childhood teachers used them appropriately, as indicated by T1, T2 T3, T5, T10 and T12. These teachers denied the existence of negative impacts related to the application of EAs for students' use in preschool classrooms. This was the opinion of all interviewees, even T9 and T10, who claimed to have a limited knowledge of EAs. As indicated by T10,

... I do not think there is any negative impact of engaging my students with EAs in school, because they only provide educational exercises... students are really attracted to using them.... In my view, these EAs have only a positive effect on students, as they increase their desire to learn (T10, C5, Grade 2).

Classroom observation provided evidence that ten participant-teachers engaged their students in the learning process during individual or alphabet learning using only literacy- and mathematics-specific EAs (all classes, Observation 1 and 2). All participants, including T9 and T10 who claimed to have limited knowledge of EAs, believed that engaging their students in digital SLAs using these EAs was a good thing.

The comments above suggest considerable differences in how participant-teachers perceived digital SLAs the impact of using technology with an Internet connection and EAs on early childhood learners. Nonetheless, all held positive views about the appropriate use of EAs in order for students to benefit from learning. However, T11 expressed a negative view regarding the inappropriate use of EAs, as this could impact

on students' development and concentration. She pointed to the inconvenience of depending too much on EAs. Whilst acknowledging the supportive role of these EAs in learning. She suggested that early childhood teachers should not rely on them entirely "because, depending on the situation, students sometimes need more individualised instructions" (T11, C5, Grade 2).

I believed that this was considered by all teachers as noticed during observations of all the classrooms. Participant-teachers seemed to expend every effort to eliminate the possible negative effects of the use of EAs. For example, the number of students per class, with the availability of only one device per classroom, led to limitations in students' learning with EAs (all classes, Observation 1 and 2)

The data show that generally, EAs play a certain role in helping early childhood teachers to provide a host of SLAs to enhance learners' participation in individual learning regarding literacy and mathematics. One reason for the success of these EAs might be that they boost students' confidence. Interviewees reported that using EAs affected students' self-reliance, which was the primary goal of all learning zones, as these students had to rely on themselves to complete the activities. However, T3 viewed this impact on self-reliance somewhat differently:

I do not think that EAs have very much influence on students' confidence, because these EAs work in tandem with other types of SLA that are distributed in various learning zones. All of these activities noticeably influence students' confidence (T3, C4, Grade 2).

However, T6 and T7 seemed to be in disagreement with T3, as stated:

When a shy student performed an exercise properly, she confidently started a conversation to talk about her exercise. The student told her classmates confidently that she did the whole set of shapes and the panda praised her, which had never happened before (T7, C3, Grade 3).

This comment suggests that EAs play an important role in increasing early childhood learners' productivity by giving them tools that they can use to help them become more

successful. They function as motivators when these students perform well, thereby resulting in increased confidence.

Additionally, participant-teachers were constantly conscious of the potential negative effects of the device, so they limited students' use to individual and alphabet learning, with the tablet computer primarily used in individual learning. T5 agreed that the use of these EAs in the individual learning zone was appropriate, as she focused "on the quality of EAs provided to students... and what makes them harmful or useful" within a specific scheduled time. Interviewees said that their preschool's administration shared their concerns: "our school asked us to only use EAs that have the potential to engage students with subject knowledge" (T8, C3, Grade 3).

To assure the faculty that EAs were not threats, an alternative perspective could be adopted, which was that EAs were support tools instead of being used to totally replace the teacher. Faculties who wanted to provide an effective learning needed to see that engaging with quality subject knowledge using EAs could, in turn, boost educational quality. More importantly, they needed to note that EAs encourage learners' participation in digital SLAs. One way of encouraging early childhood students is to provide the right motivation. The following section explores the effect of EAs on students' motivation in the context of digital SLAs.

7.2 Early Childhood Students' Motivation

Interviewees reported that the way that subject knowledge was displayed by EAs might have been the main motivator for early childhood students to learn because the content was displayed "through animation, sounds and colours" (T1, C1, Grade 3), and "transfers information to the minds of students" (T6, C2, Grade 3), through the provision of several exercises related to the same subject in a "varied and attractive way" (T7, C3, Grade 3). As a result of these attractive learning processes, participant-teachers said they were satisfied with learning outcomes. For example, using literacy-specific EAs has the potential to "increase students' understandings of phonemic awareness and alphabet principles" (T9, C5, Grade 2), resulting in the "acquisition of knowledge and the development of students' intelligence" (T12, C6, Grade 2).

For the development of language and literacy, and mathematics, early childhood teachers believed that they can easily exemplify letters, numbers and shapes through animation for better understanding among four- and five-year-old students. It would be better if there was also animation when teaching other developmental learning areas, such as personal, social, and emotional; cultural; and aesthetic and creative. Resembling the patterns of EAs, all participant-teachers observed that early childhood students' motivation to learn and to increase their subject knowledge was the result of animations that worked well with the learning of the alphabet, numbers and shapes.

The observation of all classes demonstrated that early childhood students were significantly more motivated to do SLAs when they learnt visually and auditorily. Indeed, visual learners could benefit from using EAs that produced a visual aid, such as an animation character, to help them understand the content of literacy and mathematics. The animation character was always accompanied by a voice pronouncing the content and instruction of the learning exercises in term of letters, words, numbers and shapes. This function is beneficial for auditory learners, who “learn through hearing” (T6, C2, Grade 3). Learning by seeing and hearing from an animation character seemed to encourage early childhood students to learn the Arabic letters and numbers, “which tend to be the most difficult part of early childhood learning” (T12, C6, Grade 2).

Hence, students found learning through visual and audio presentations in the form of EAs to be highly desirable. This is because EAs motivated these students to learn literacy and mathematical skills, such as phonemic awareness and numeracy skills, by remembering the information they saw and heard in interesting ways. This was notably perceived by T3, T6 and T12 who noticed a high preference among their students to learn in the individual learning zone (digitally) rather than other learning zones (conventionally). “Students only competed to enter the individual learning zone at the beginning of the play zone” said T3 (C4, Grade 2). That was the result of applying EAs only in the individual learning so “it would be nice to apply EAs in more than one learning zone to increase students' motivation” said T6 (C2, Grade 3). Interviewees noticed that after introducing these EAs, students asked to be allowed to do digital SLAs to write letters during their time in the individual learning zone instead of using

paper and pens in the writing zone. T12 illustrated students' enthusiasm to learn with EAs:

In the past, only three or four students tended to volunteer to do letter exercises in the writing zone or the cognitive learning zone - not too many would practice them. But now, each student has a daily desire to participate in the individual learning zone to do various exercises using EAs (T12, C6, Grade2).

Although the use of EAs was generally seen to be helpful, as deduced from the comment above, interviewees saw the benefit of maintaining a balance between undertaking digital learning via EAs and providing exercises in literacy and mathematics created by the teachers. However, it is possible that some students would show an unwillingness to perform SLAs related to letters and numbers using teacher-made learning games. This was acknowledged by T7, who noticed a recent reduction in students' rejection to undertake SLAs using physical learning materials. According to T7, since the application of EAs, "many students tuned into technology to do SLAs of letters and numbers" (T7, C3, Grade 3). She believed that instructing students to only undertake digital SLAs on literacy and numeracy, and individually, could create a barrier to the learning process. She expressed this as,

This is the right time for these students to build the skills that they will need in the future, such as social and emotional skills. I do not want little students to always sit in front of device...so I think early learning needs to be more hands-on (T7, C3, Grade 3).

In general, interviewees said that with the appropriate use of EAs, accompanied by exercises handmade by the teacher, a number of students were increasingly motivated to learn literacy and numeracy and that led to a satisfying result. Thus, informants agreed that EAs were useful for producing satisfactory results in increasing students' knowledge of letters, numbers and shapes. T1, T10 and T12 provided detailed explanations of the importance of EAs in increasing students' knowledge by outlining examples of their experiences. Specifically, T10 said,

EAs were very useful, as students accessed them to do various literacy and mathematics activities that improved their knowledge in terms of reading, writing and counting (T10, C5, Grade 2).

After using EAs, T2 noticed progress in students' knowledge of literacy and mathematics:

Students who have the opportunity to learn using EAs become more aware of various letters, words and numbers much faster than those who do not (T2, C1, Grade 3).

As has shown in the comment, some of the informants generally agreed that EAs have a good impact on students, especially for language and literacy in terms of these students' progress. T1, T3, T4, T6 and T10 believed that literacy-specific EAs could stimulate students' brains to store various letters in the form of literacy skills. "Students' knowledge of the Arabic alphabet has noticeably improved in terms of pronunciation" said T1 (C1, Grade 3). Here, early childhood students could learn the correct pronunciation of the letters (T6, C2, Grade 3).

This was illustrated in the classroom observation of T1, in which students could identify and pronounce the new letter before the teacher introduced it to them. These students seemed able to provide a word using the new letter as it was included in their name or a family member's name (C1, Observation 1).

Here, early childhood students could increase their acquisition of literacy knowledge, resulting in the development of various aspects related to students' learning skills, such as identification of the alphabet; phonological awareness; vocabulary acquisition; and print awareness. T4 suggested the importance of using EAs that displayed letters to facilitate the process of reading and writing.,

EAs that display alphabet content exposed students to 24 Arabic letters in various words, which helped these learners develop their pronunciation of letters and words that they had not yet been taught (T4, C4, Grade 2).

T4 also noticed that EAs helped some of her students to overcome problems associated with alphabet learning:

I have a student who had difficulties pronouncing letters. After a period of time working with literacy-specific EAs in school and at home, she began to pronounce them correctly. She figured out a way to learn the letters through songs by accessing them through these EAs. She became more active and more focused on learning (T4, C4, Grade 2).

Hence, interviewees were satisfied with how EAs were used in the classroom to attract students' attention by providing learning content in an interesting way. In some respects, EAs appeared almost indispensable to SLAs. As T7 put it, one could easily enhance the quality of teaching and learning with EAs because they increased students' interactions with content, and if used appropriately, negative effects could be reduced.

Although the increase in motivation seemed to be helpful, not all participant-teachers agreed. T1, T2, T4, T5 and T11 thought that high motivation brought with it a few concerns, "especially when students become more dependent on these EAs to learn" (T5, C2, Grade 3). Therefore, interviewees perceived that "increases in students' motivation to learn by technology may be counterproductive" (T11, C6, Grade 2). Some participants were concerned about the amount of time students were spending on the device, particularly when the time they spent playing with their own devices at home was factored into the equation. T6 claimed that:

Even though we provide these EAs for a short period of time, we cannot ignore learners using them at home as well (T6, C2, Grade 3).

As has illustrated in the comment, early childhood teachers may not permit their students to work with the devices for long periods of time due to their negative impacts on students. This concern was also raised by T12, who said that "students' addiction to the device might increase, which is shown in their desire to only practice with EAs" (T12, C6, Grade 2). For example, a student who worked with EAs in the individual learning zone might "refuse to leave when their time is up, causing chaos in the class" (T2, C1, Grade 3). These learners, then, became overly dependent on learning with EAs

and refused to perform exercises in the learning zones characterised by learning materials, such as “teacher-made learning games or toys” (T4, C4, Grade 2), T4 stated that:

one of my students only desired to work with EAs. She stayed seated in the circle at the start of the learning session every day. When I asked her to enter a learning zone, she refused to enter any zone other than the individual learning zone (T4, C4, Grade 2).

I observed a student in C1 who wanted to continue only doing digital SLAs. The student stayed seated in the individual learning zone and refused to move to perform other SLAs. This became apparent when her teacher asked her to move to another learning zone and she refused to work with other learning materials than EAs (C1, observation 2).

Thus, early childhood teachers kept in mind that young students must not become overly dependent on these devices. If students become more dependent on technology instead of teachers, they might experience negative consequences, as reported by T5 and T6. The former pointed out that some students might be “addicted to devices” as a result of “introversion and isolation” (T5, C2, Grade 3). These students faced difficulties adapting to conventional SLAs, as they mainly depended on EAs. The latter added that spending a long time on digital SLAs:

might cause students to become lonely, as they depend on the device to get information while ignoring the enjoyment they can get from interacting with others (T6, C2, Grade 3).

Interviewees suggested possible solutions to avoid this problem by implementing a specific rule limiting use of EAs to a short period of time, only letting their students use EAs for 10-15 minutes a week. This limitation was adopted by all participant-teachers, as noted in interviews and classroom observations (all classes, Observation 1 and 2). Specific times were set aside for students to perform digital SLAs. Thus, class size is again perceived by the interviewees to be a solution to avoiding long periods of time

working with these EAs. However, when such problems arose, the participant–teachers intervened and discussed possible solutions with the students, as in the case with T2.

I noticed that the teacher tried to convince her student to move on to another learning zone, by asking the student to discover what she had prepared in the next learning zone. To motivate this student, the teacher loudly announced the end of the digital SLA and requested the learner move to another learning zone, while calling the waiting student to enter the individual learning zone (C1, Observation 2).

As has been shown in the data, students had a high desire to learn with EAs, and that seemed to raise teachers’ concerns regarding the use of these EAs in their classrooms. As explained by T12, this was particularly concerning:

I really worry about students’ concentration when they work for a long time with EAs. I have noticed that a few of my students do not focus very well during the other lessons, which makes me repeat the information more than once. This was rare before introducing the tablet computer, but now it has become the norm in many cases in our school (T12, C6, Grade 2).

Thus far, based on the data, it can be considered that strong motivation can cause EAs to become double-edged swords. When used appropriately, EAs can serve as effective tools in learning subject knowledge content. However, interviewees found that although these EAs have the potential to make learning more accessible, they still have a negative influence on early childhood students, as shown in the comments above. Being overly connected to EAs can cause students to become addicted to their usage, which can harm their communication skills. EAs may also cause psychological issues such as “distraction and depression” (T8, C3, Grade 3). The following section, therefore, examines the impact of EAs on the behaviour of students in the context of digital SLAs.

7.3 Early childhood Students’ Behaviour

The data show that generally, EAs play a certain role in helping early childhood teachers to provide a host of SLAs to promoting a good behaviour in classroom. As has mentioned by seven of the interviewees (T6, T7, T8, T9, T10, T11 and T12), the slight impact caused by using EAs was the result of students becoming independent learners.

For example, T7 said “students’ use of EAs is very helpful for early childhood learners as they become more independent” (T7, C3, Grade 3).

Interviewees viewed students’ independent work as a process of “trial and error to reach the right answer and continue the educational exercises” (T11, C6, Grade 3). Students, as T11 mentioned, depended on themselves to do exercises in the EAs, which guided them to successfully finish the exercises without the need of assistance. Thus, they developed their self-monitoring, which noticeably increased, in which they focus on the digital task and completing their digital SLAs.

This was noticed in all classroom observations, in which all participant–students in all the individual learning zones were able to operate the devices to access an EA. They then began performing the exercises under their teacher’s observation, who was helping other students while also keeping an eye on the individual learning (all classes, Observation 1 and 2).

However, not all teachers viewed this independence positively. T5, T6 and T10 indicated that such independence may lead to unsatisfactory results because students might be excessively exposed to technology. According to these teachers, early childhood students might become over-dependent on learning with these EAs and that could lead to a significant impact on their wellbeing. As expressed by T5:

The challenge I experienced due to students’ use of EAs was decreasing the opportunities for physical tasks, such as writing and holding small items for letters and numbers (T5, C2, Grade 3).

T5 saw the lack of physical activity as a limitation of EAs. She posited that physical learning materials were necessary in the process of SLAs for the development of the students. This seems to be in agreement with other early childhood teachers, who believed that using EAs for writing letters might affect students’ ability to hold the pen properly, as noticed by T8 (C3, Grade 3). T8 stated that a significant number of early childhood teachers may refuse to use EAs with their students because they believe such activity might negatively impact four- and five-year olds. However, T8 does not believe EAs will harm learners. She believed that,

EAs do not bring any harm to our students because we also apply other types of SLA alongside the digital learning. This addresses such a problem (T8, C3, Grade 3).

This comment seems to suggest that early childhood teachers are certain of their ability to avoid such a problem, as these teachers gave their students a similar exercise in two different learning zones using different types of teaching aids. This seems to be in agreement with T1, T3 and T8, who also said that running the digital SLA in the individual learning zone had no effect on students' physical development if they engaged with conventional SLAs in another learning zone. A clear explanation was provided by T1, who indicated that during the play zone, students moved from one learning zone to another in a limited period of time. That is, they moved from learning exercises with EAs to conventional SLAs on the same concept in another learning zone. For example,

writing a letter - a student writes the letter by touching the device in the individual learning zone and then moves on to the cognitive learning zone to do literacy exercises using games that I have created (T1, C1, Grade 3).

The comment above demonstrates participant-teachers' preference to provide SLAs digitally and conventionally in classrooms for students' engagement with different learning exercises. However, students' health was another concern that T8 and T11 linked to students engaging with digital SLAs. T8 explained that having students sit for a long period while working with the device may cause some health problems, especially regarding their "sight, as they work with the device in close proximity" (T8, C3, Grade 3). Thus, taking some measures to counter this when dealing with EAs was necessary, a notion agreed to by all interviewees. Students engaging with EAs were expected to put the device on the table while sitting on chairs to maintain distance, as illustrated by a teacher's request that students "maintain a proper distance from the device" (T11, C6, Grade 2).

Observations of all classes confirmed that participant-students put the device on the table and undertook the digital SLAs while keeping their distance (all classes, Observation 1 and 2).

However, T9 and T12 viewed this measure as insufficient because students may have been too close to their device at home. T12 elaborated:

After communicating with my students' mothers, I discovered many students have a personal tablet computer, spending most of their time at home playing with them (T12, C6, Grade 2).

The comment above shows that the issue of the impact of technology on students might be related to home use rather than preschool use, but this still has implications for teaching strategies, as teachers must always consider whether their approaches work well with students completing SLAs.

When interviewees were asked about their general perceptions regarding the effect of EAs on students' interactions, T1, T2, T3, T7 and T12 indicated that the way these EAs were used determined whether they had positive or negative effects on students during SLAs. For instance, one of the informants perceived that the effects of these EAs on increasing students' knowledge "are noticed because of how they have been used" (T7, C3, Grade 3). Regarding the use of these EAs, another teacher concluded that "EAs are used correctly and with a clear educational aim" (T2, C1, Grade 3), instead of leaving students to spend a long time working with educational content, which might be the case at home. participant-teachers' usage of EAs, in accordance with school regulations related to time restrictions, may limit or reduce the negative effects of using EAs, but cooperation at home is required, as indicated by T3 (C4, Grade 2).

However, participant-teachers could not entirely address the negative effects of home use. One of the participants said that "using technology at home has a major or core influence on students becoming over-dependending on technology" (T1, C1, Grade 3). Most of the negative effects that students experienced were believed by T7 and T8 to be caused by home use. Thus, T8 expressed her rejection of using technology at home:

I prefer not to use it at home with my child, while supporting the use of EAs at school. As a teacher, I really support them because of the limited use inside the classroom (T8, C3, Grade 3).

This comment demonstrated that early childhood teachers perceived EAs either positively or negatively depending on how they were used either at school or at home. Most of the informants were concerned about how technology was used by students at home because they had observed a decline in students' improvement, wellbeing, and skills, which they believed caused a decrease in their use of EAs in their classroom. The school had also considered the problematic use of technological devices at home, as reported by T11:

Our school has prepared a parent programme related to the technological benefits and drawbacks for students so their mothers are aware of these issues (T11, C6, Grade 2).

To conclude, the above section on teachers' perceptions of the impact of EAs on students' engagement with digital SLAs showed how these EAs can be used as vehicles for learning subject knowledge, and their impact on students' interactions with SLAs in terms of achievements, motivation and independence.

7.4 Summary

This chapter reported on the perceptions of teachers regarding the impact of EAs on students' engagement with digital SLAs on literacy and mathematics. The results demonstrate that all participant-teachers perceived EAs as having an influence on students' performance and interactions in the areas of achievement, motivation and independence. However, the findings also suggest cautious awareness of high levels of motivation, as these may lead to counterproductive effects. For instance, students may be overly keen to learn through EAs and refuse hands-on exercises. To avoid such problems, teachers set time-limits on the usage of EAs. Generally, the results suggest that teachers perceived the use of EAs in preschool positively, while rejecting their use at home when not used for educational purposes and for limited periods.

Chapter 8: Discussion

In this study, data analysis was divided into three chapters. Chapter 5 reported the perceptions of early childhood teachers on the affordance of EAs in early childhood learning practice. The analysis of the data suggests that teachers' views were closely related to the potential of EAs to promote the learning developments for young students. That is, EAs were perceived by the twelve teachers as places students visit to engage with literacy and numeracy concepts, and as instructors who have the potential to assess students' grasping of that knowledge and skills. The results of this study found there to be several factors that had resulted in the formation of these perceptions. External policy, planning, and the school administration's role in making tablet computers available and installing EAs, were found to be the core enablers in applying EAs in the early childhood learning.

Chapter 6 discussed the ways in which these teachers applied EAs during their learning sessions. Little knowledge was provided on how students engaged with digital SLAs. The evidence suggests that EAs could assist students' learning, which, in turn, could affect their experiences and performance. Based on the interviews and classroom observations, participants' usage of these EAs varied between literacy- or mathematics-specific EAs used in the six classrooms for engaging students with digital SLAs. These EAs were used by participants to change the way instructions and feedback were given to students. As a result, teachers' roles and responsibilities during the digital SLAs became that of facilitators, though they continued to observe the learning process.

Chapter 7 examined the impact of these EAs on students, which can affect teachers' decisions to let their students use EAs. The data shows that the preference of students to engage with digital SLAs might have been the main motivator persuading participant-teachers to support the application of EAs in pre-schools. In addition to this, these EAs also had the potential to influence students' performance and interactions in the areas of achievements, motivation and independence. However, the results reveal the importance of being cautious regarding the high levels of motivation, as this could be counterproductive. For example, early childhood learners may be overly interested in undertaking digital SLAs at the expense of other types of self-learning exercise.

Figure 8.1 below illustrates the conditions that influence Saudi teachers' adoption of EAs: the Saudi MOE has introduced the technology-integrated policy recommending that students aged four and five years use tablet computers to access EAs, and teachers use tablet computers to facilitate digital SLAs. However, changes in the teaching and learning process cannot occur simply because of the devices becoming more available in classrooms. Figure 8.1 demonstrates that the use of EAs in classrooms is determined by whether teachers took on the responsibility for the effective or ineffective use of EAs. Therefore, the theoretical basis that was used is Gibson's (1986) theory of affordance, which has been applied to examines the relationship between individuals and the actions. This is fundamental to the idea of exploring teachers' abilities to act appropriately with EAs while responding to their affordance. The aim was to explore the relationship between teachers' views and actions in classrooms, including their interest to improve students' learning.

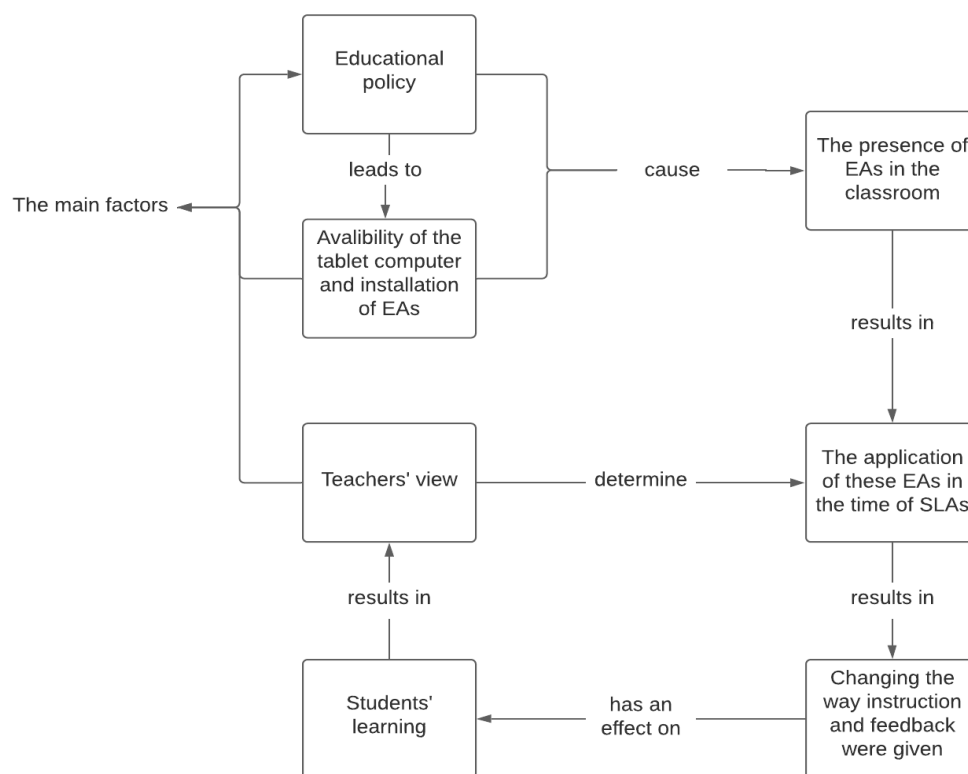


Figure 8. 1. Study results

Figure 8.1 shows the results of the study discussed in Chapters 5, 6 and 7. The relevant area of investigation was the early childhood teachers' point of views regarding

teaching and learning reflected by their use of EAs in the light of their understanding of what these EAs affords for early childhood students' learning. The current study deals with relevant aspects related to the presence of EAs in early childhood classrooms, especially considering the principles of experiential learning and digital affordance. The portable nature of EAs enables learners to interact with information and exercises that are relevant to early childhood education. This interaction supports the engagement of the current early childhood learning, underpinned by experiential learning principles. In capturing these experiences, Kolb's (1984) experiential learning enables students to encounter new knowledge through relying on sensing the concrete world, that is, *concrete experience* or they rise a new idea from their experience, that is, *abstract conceptualisation*. In the same vein, when processing experience, students apply their ideas to the world around them to see what happens, that is, *active experimentation*. Here, a learner is portrayed as a producer, who acquires and applies knowledge and skills in an immediate and relevant setting. EAs is a typical example of experiential learning in portraying student as producers, who engage with learning contents without the physical presence of a teacher.

This study's findings are summarised in Figure 8.1 above. Firstly, teachers' perceive EAs as a tool that help improve students' reading and writing of words or counting the number of objects. This finding is in line with the theory of affordance, which focuses on providing details on how factors, including teachers' perceptions of EAs' affordances have influenced teachers' decision to use EAs in their teaching. Secondly, SLAs were enhanced through the use of the different type of EAs. This finding shed light on the participants' recognition of EAs' affordances of convenience, accessibility and availability to benefit early childhood learning practice. This result is in line with the conceptual framework developed in Chapter 2, which focused on the technological features of EAs that support experiential learning such as offline mode, animations, understandable content that targets a specific age group, control and test the user's knowledge, as well as monitor and evaluate learners' work.

These findings will be discussed in this chapter in light of the RQs, literature review in Chapter 2 and 3 and the new insights derived from this study. The discussion mainly

addresses perceptions and practices of early childhood teachers and is guided by the three RQs.

1. What perceptions do Saudi teachers have in relation to the affordance of EAs in early childhood learning?
2. How do these teachers at the pre-school use EAs in their learning practice?
3. How do teachers perceive the capability of EAs vis-à-vis early childhood students' engagement with SLAs?

This chapter, firstly, discusses teachers' perceptions of the potential of EAs for early childhood learning responding to RQ1. Teachers' viewpoints of EAs' affordance for students' use seemed to be influenced by factors and challenges. Thus, perceptions are divided into three sub-heading: the affordances of EAs, factors affecting teachers' decisions to use these EAs, and challenges that impede the application of EAs for students' use. Secondly, it describes teachers and students' practices, in terms of how these EAs are used in the process of early childhood learning to answer RQ2. Studying the process of applying EAs is focus on lesson planning, digital SLAs, and early childhood students' engagements. Lastly, in regard to RQ3, the chapter reports the perceptions of these teachers about the impacts of EAs on students from two positions, i.e. one that supports the use of EAs in schools and the other that rejects their use at home.

8.1 Teachers' Perceptions about the Use of EAs in Early Childhood Learning

Revisiting early childhood learning (see Sections 2.2 and 2.3) at this stage serves as a reminder that learning practices in the KSA have not seen much change for many years. In fact, Saudi pre-schools have been applying the Saudi MOE programme of early childhood education that consists of the same teaching methods and materials (Hammed, 2014), which do not include the application of technology for students' use in their teaching guide (MOE, 2016) and this may account for the lack of change. Furthermore, this lack of change, over a long period of time, undoubtedly presents serious challenges and resistance to change and modernisation among teachers (Alnahdi & Abdulaziz, 2014). For instance, many schools may have failed to meet the new requirement of MOE in terms of applying technology for students' use (See Appendix E, p. 258) because on the whole most teachers still use physical learning materials, such

as such as whiteboards, pen and toys (Aldhafeeri, Palaiologou & Folorunsho, 2016). However, according to (MOE, 2020), using conventional learning practices may be no longer sufficient to prepare students at the age of four and five to join the next stage of formal educational, primary school.

The results of this study as shown in Chapter 6 have demonstrated that early childhood teachers have started to change their ways of using technology in their classrooms, that is, the tablet computer has been put in the hands of students to access several EAs. It is evident that using these EAs Saudi early childhood classrooms plays an important role in improving SLAs, especially in the context of language and literacy, and numeracy. Here, early childhood students have opportunities to engage with language and literacy, and numeracy, concepts digitally and independently, instead of relying on their teachers to be their main source of information, as has been shown in the data analysis (see Section 6.2).

However, as illustrated by the results in Chapter 5, in order to bring EAs to classrooms, these EAs should be understood, accepted and embedded for their ability to support teaching and enhance students' engagement with their SLAs so that early childhood teachers are ready to apply them in their classrooms. Throughout the exploration of teachers' perceptions, evidence can be shown of their awareness of what EAs may have to offer when learning certain subject matter (Hirsh-Pasek et al., 2015; Kyriakides, Meletiou-Mavrotheris & Prodromou, 2016; Lu et al., 2017). This corresponds to Borghi et al.'s (2012) theory of affordance, which examines the relationship between individuals and the actions that are available in their environment, especially what their environment provides them with—either good or ill. In the case of EAs, the notion of affordance offers a means of considering the relationship between EAs and early childhood teachers, who can determine how these EAs could be used in the classroom. The current study sought to establish how EAs are regarded and applied by teachers for students' use.

In the following subsections, teachers' viewpoints are divided into the following three topics:

1. The affordances of EAs,
2. Factors affecting teachers' decisions to use these EAs, and

3. Challenges that impede the application of EAs for students' use.

Table 8.1 summarises the discussion points of these three key findings covering in this section in relation to RQ1: What perceptions do Saudi teachers have in relation to the affordance of EAs in early childhood learning?

Table 8. 1: Summary of the discussion points shedding some lights on RQ1.

Key findings	Discussion points
The affordance of EAs	As a place used to offer an opportunity for students to engage with subject knowledge
	As an instructor who has the potential to assess students' grasping of that knowledge
factors affecting teachers' decisions to use these EAs	Educational policy
	Institutional support
	Teachers' knowledge and experience
	Teachers' understanding of students' learning with EAs
challenges that impede the application of EAs for students' use	Teachers' resistance to change due to either extensive conventional teaching experience or not seeing the usefulness of the technology
	Unfamiliar operating system
	Limited availability of EAs in Arabic

8.1.1 The affordance of EAs

Compared with previous studies (e.g., Alharbi, 2013; Al-Faleh, 2012; Aldhafeeri, Palaiologou & Folorunsho, 2016), this study has demonstrated that participant-teachers perceive EAs as a new medium that has the ability to make change in learning practices. The findings in Section 5.2 suggest that teaching efforts should focus on facilitating the learning process of subjects through engaging students with several learning tasks, which is possible with EAs. Vorkapic and Milovanovic (2014) argue that teachers are likely to adopt these EAs after recognising their potential to learn subject knowledge. This section discusses participant-teachers' perceptions towards identifying the affordances of EAs that promote subject knowledge.

The data illustrate that participants view EAs as follows:

1. *As places.* The data analysis shows that EAs were perceived as spaces that provide smooth navigation, tracking ability, access to subject knowledge, and easy access for repeated and self-paced learning. The ability to adjust students to their own learning pace is deemed necessary for a successful transition of early childhood SLAs to digital learning (Liu, Toki & Pange, 2014; Papadakis, Kalogiannakis & Zaranis, 2018b). This study found that teachers considered EAs to be part of a process in which students could take the initiative in learning. The understanding of EAs as a place used to offer an opportunity for self-paced learning is evidenced by the way teachers see the learning process, with EAs being undertaken by early childhood students themselves. This corresponds to Skinner's (2003) theory of educational machines, in which teaching is conceived of as a way to transmit subject knowledge from EAs to learners.
2. *As instructors.* The data shows that EAs were also perceived as effective tools that assisted early childhood students' ability to grasp subject knowledge. Although such a process does not involve teachers actively instructing their students, the subject content knowledge and materials are chosen and used by the teachers (Hirsh-Pasek et al., 2015). A smooth process of information appears to be the responsibility of EAs and involves getting students to engage more with the topics. This loosely corresponds with Piaget's (2001) theory of using teaching tools to shift thinking processes.

Domingo and Badia's (2016) studies on early childhood teachers who chose to apply EAs in their classrooms found that their thoughts about these EAs influenced their readiness to apply them for students' use. Linked to their use, early childhood teachers considered the possible impact on their roles and responsibilities. The data shows that participant-teachers, who had been, or have just begun, using EAs considered themselves to be expert guides who no longer mainly delivered instructions. Equally, students no longer relied only on teachers for all their learning. Having access to EAs, learners followed what these EAs told them to do without teachers' interventions (Falloon, 2013). The role of such technology is to assist early childhood students who are working on developing their learning skills that involve memorising, drilling, and practicing (Lu et al., 2017). This contrasts with Flewitt, Messer, and Kucirkova (2015)

and Lynch and Redpath (2014), who found such EAs to be unsatisfactory due to students becoming mere passive receivers of instructions. In their studies, they recommended using different type of EAs that encourage learners to construct their own contents.

8.1.2 Factors affecting teachers' decisions to use these EAs

As shown in Section 5.3, this study has discovered that the participant-teachers' perceptions of EAs as places or as instructors could result from the influence of contextual factors. Firstly, the results have illustrated that teachers' reasons for using EAs was to keep up with the advances of technology in education made by the MOE. In line with previous studies (e.g. Hsin, Li & Tsai, 2014; Nikolopoulou & Gialamas, 2015), this study reports the establishment of a new educational policy, known as the Aljwdah Project, that aims to use technology to redefine some of SLAs in pre-schools. This policy explains what changes the school management and teachers need to implement and how they should be manifested in classrooms (Dong & Newman, 2016). The findings of this study illustrated that the policy's intention is to change early childhood learning practices by using several recommended EAs for engaging students with digital SLAs on literacy and mathematics activities.

Secondly, in contrast to Almalki, Finger and Zagami (2013), who reported on Saudi pre-schools having no proper technological infrastructures, this study reported on a preschool that had the financial support to provide a tablet computer in each classroom. Under the new policy, the school administrators were encouraged to purchase a significant number of tablet computers to encourage teachers to apply EAs with the ability to engage early childhood students with SLAs. This highlights the point that school administration should provide support to teachers for the successful application of technology for use in the classroom (Chang, 2016; Hsin, Li & Tsai, 2014). This is further indicated by a few of the participants, who were previously employed by schools that had not enrolled in the project; a lack of support prevented their use of any EAs in their classrooms. It is clear that schools' lack of tablet computers seemed to prevent early childhood teachers from applying technology for students' use (Hew & Brush, 2006).

It is evident that there was consensus among participant–teachers that the reason for their use of EAs was to meet the authorities’ requirements. Generally, these teachers were satisfied with the management support that they had received so far, such as having adequate facilities and support in terms of accessibility and installation. Access to Arabic language EAs was considered necessary for successful integration of digital SLAs (Ali, 2013), but participant–teachers found that they were in short supply. Thirdly, regarding teachers’ readiness to adopt EAs in pre-school classrooms, this study considered how teachers’ knowledge affected their perceptions towards digital SLAs (Oppell & Aldridge, 2015). According to Prestridge (2012), early childhood teachers’ knowledge is shaped by their experiences, which together influence their learning practice. However, the data analysis in Section 5.3 demonstrates that few of the participants did not have prior experience with these EAs for students’ use. This lack of experience results in EAs being even more relevant for filling this knowledge gap in teachers’ awareness and understanding of digital SLAs.

The findings from the interviews reveal that teachers’ awareness of using EAs and their experiences have influenced their knowledge and learning practices. They reported that changing their learning practice to include these EAs increased their understanding of the potential of this technology for students’ use, which enabled them to use EAs freely in their classes. Vorkapic & Milovanovic (2014) emphasised the importance of first-hand experience with EAs for improving teachers’ knowledge and use of digital SLAs. This first-hand experience is essential to change their learning practices (Flewitt, Messer & Kucirkova, 2015), and helps teachers to evaluate the effects of such changes on learning (Lynch & Redpath, 2014).

Lack of knowledge and experience regarding the use of EAs that have the potential to facilitate SLAs across range of literacy and mathematics contents seemed to be perceived as an issue that might lead to the prevention of the application of digital SLAs in class (Oppell & Aldridge, 2015). However, the results of the interviews show that two of the participants were able to receive help from their colleagues in terms of understanding the function of EAs for students’ use and this encouraged them to take the first step in applying these EAs to engage their students with digital literacy and mathematics activities. My argument here is that teachers working together appears to be important for helping an early childhood teacher to make change in their classrooms.

Evidence has shown that early childhood teachers could benefit from the experiences of others and collaboratively construct their knowledge (Camilleri & Camilleri, 2017). As has been shown in section 5.3, after gaining some understanding of digital SLAs, participant-teachers were keen to continue using EAs in their classrooms. This highlights the importance of interacting with colleagues, which appears to have increased knowledge and improved learning practices (ibid). These interactions among early childhood teachers enabled them to improve their understanding and teaching skills by discussing issues related to teaching, learning and EAs.

Having knowledgeable individuals is considered necessary to facilitate an appropriate SLA. This study, therefore, investigated participants' understanding that had developed from their experience of engaging their students with EAs, which is related to the potential for these EAs to be used as follows:

1. *To change the way that subject knowledge is taught.* SLAs focus on experiential and theoretical aspects of learning through interaction (see Section 2.2), in which early childhood students should take responsibility for their own learning (Kolb, 1984). Learners need to follow a well-planned SLA that consists of carefully sequenced tasks, repetitions, practices, and reviews of the basic learning skills that are embedded in everyday learning exercises (Keating, 2002). However, these activities seem to be teacher-guided (Sjoerdsma, 2016). Even though leading learners during SLAs is one of the teacher's responsibilities, this is apparently being changed due to the application of tablet computers (Almalki, Finger & Zagami, 2013). Similar to the findings of Almalki, Finger and Zagami, there is evidence in section 5.3 for participants recognising the usefulness of various EAs as instructors.
2. *To change hands-on experience during SLAs.* This, in turn, changes the nature of teaching and learning, and EAs are deemed necessary for making the learning process more convenient and for providing diverse learning exercises to help learners enhance their learning skills (Oliemat, Ihmeideh & Alkhawaldeh, 2018).

Overall, even though EAs seem to be important for leading teachers to a new understanding and for facilitating behavioural change, such changes depend on their prior experiences (Kaymakamoglu, 2018) and their perceptions, which can determine

whether EAs are successfully implemented in their early childhood classrooms (Zaranis & Oikonomidis, 2016). The results found that some teachers had experience of using technology for learning during their learning sessions, whereas few teachers had not used any technology at all until they had received a formal request to adopt them in their classrooms. This demonstrates that, even though there was a variation in the teachers' years of experience with the use of technology, the participants perceived EAs as a tool for active learning. However, using them in the classroom with students for the first time seemed to present some challenges.

8.1.3 Initial difficulties of EAs' use in the classrooms

Although participant-teachers have changed their teaching styles to include EAs, several technological problems continued to be a source of concern. In KSA, Most preschools primarily have applied conventional SLAs that focus on engaging young students with learning tasks using several physical learning materials, such as toys or teacher-made learning games with the support of teachers' instructions (MOE, 2020). However, the Aljwdah Project, which was developed by the MOE in the Kingdom where this study took place, sought to develop learning using EAs to improve the quality of SLAs. The results suggested that such a change posed some difficulties to teachers, particularly in the initial phase of using EAs in the classroom. Thus, in contrast to previous studies (Kokkalia, Drigas & Economou, 2016; Levy & Sinclair, 2017) that focused on exploring the nature of using EAs, this study highlighted a few issues that participants faced when adopting EAs in their classrooms.

Firstly, the transition from teacher-guided to digital SLAs seems to have been an issue for a few participant-teachers who had significant experience teaching conventionally. Transitioning from something they were familiar with to something they were less familiar with seemed to generate insecurity among early childhood teachers regarding their performance, which could cause them to feel less confident when carrying out tasks and adopting this new approach (Aldhafeeri, Palaiologou & Folorunsho, 2016). It is important to consider these reactions, since they might lead to resistance to changing learning practices (Fullan, 2007). Even though such resistance was observed in a few participants, there is still a gap in the early childhood education literature about teachers' initial reactions to developing their teaching methods and materials such as in KSA, where such resistance is more noticeable (see Appendix E, p. 258).

Secondly, early childhood teachers seemed to struggle to see the point of change EAs can bring to the teaching and learning process, especially since their usual learning practices still ensured that lesson aims were achieved. Comprehensive information regarding how EAs support both teaching and SLAs seemed to be essential for teachers to feel confidence in changing their learning practices and could result in preventing their resistance to the change (Almalki, Finger & Zagami, 2013). Having the Aljwdah Project can be considered enough to prevent early childhood teachers from resisting the change.

Thirdly, participant-teachers believed that using EAs could disrupt classroom learning because early childhood students would not know how to use tablet computers or EAs that differed from those that they used at home. This concern may have arisen from having used conventional teaching approaches and materials in SLAs for a long time or having used unfamiliar learning practice (Hammed, 2014). Participants mitigated these concerns by showing students how to operate the device and assisting those who still struggled. Plowman, Stephen and McPake (2010), however, were concerned that early childhood teachers may not have sufficient time to teach students how to use technology.

Fourthly, the limited availability of EAs in Arabic seemed to be another barrier to the introduction of new EAs. Ali (2013) argued that the lack of Arabic EAs might hinder their use. This highlighted the need to develop Arabic EAs for facilitating the teaching and learning process of a variety of early subjects (Qureshi et al., 2012). Participant-teachers in this study, however, did not consider this to be a major issue, as Arabic EAs of language and literacy, and numeracy were available.

8.1.4 Overall discussion of the findings in relation to RQ1

The purpose of RQ1 is to identify the perceptions of participating teachers on the potential of the use of EAs to perform SLAs digitally. This section shows how EAs were perceived as places used to access subject knowledge, and as instructors used to assist students' with their understanding of subject knowledge. Previous studies (e.g. Dong, 2018a; Papadakis, Kalogiannakis & Zaranis, 2018a; Vorkapic & Milovanovic, 2014) have suggested that these perceptions are the result of teachers' evaluations of the

approach they use (e.g. digital SLAs) and their understanding of the potential of this approach to produce a better learning environment.

Compared with the findings of previous studies (e.g. Meyer, 2013; Papadakis, Kalogiannakis & Zaranis, 2018a), this study's results emphasised that Saudi early childhood teachers were encouraged to apply EAs for students' use. Unlike previous studies (e.g. Blackwell, 2014;), this study shows that contextual factors (e.g. external forces and school management) were the main factors that induced participant-teachers to apply digital SLAs (Dong & Newman, 2016; Sulaymani, Flear & Chapman, 2018). Thus, these factors should not be ignored, as they influenced the decisions these teachers made.

Early childhood teachers described their views on the affordances of EAs, the current learning materials used in the class, and how learning practices changed when using these EAs. The study findings are consistent with the existing literature on digital learning, which suggests that EAs have the ability to provide students with access to subject knowledge, which in turn has changed students' learning. The present study highlighted participant-teachers' aspirations to improve their teaching in the context of SLAs. There was evidence that these teachers were aware of and satisfied with the ability of EAs as a new means of guiding students when they interact with SLAs, and this seemed to narrow the gap between their aspirations and their actual practice.

Participant-teachers reported seamless usage of tablet comports to access EAs for teaching and learning, focusing on empowering their students to become independent learners. They felt supported by local and national administration, and once EAs were used, the teachers were satisfied with the process and outcome. These teachers then agreed that EAs should be part of their learning practice. EAs were viewed as an opportunity for innovation in their approaches to SLAs, which for them meant improving students' learning by placing the device in their hands. The teaching and learning theory that underlies such perspectives is Kolb's (1984) experiential learning theory.

8.2 Teachers' Application of EAs for Students' Use

The application of tablet computers in classrooms can generally enhance the quality of SLAs when they are used appropriately (Comi et al., 2017), especially in conventional learning contexts, such as in KSA. This can occur when educational authorities, school management, and teachers cooperate in applying EAs, which was the case in this study. In fact, digital SLAs have the potential to create a new kind of learning environment, as suggested by Neumann and Neumann (2017). This can be seen when participant-teachers incorporated EAs for learning language and literacy, and numeracy, as illustrated by the data analysis in Chapter 6. The data also shows that by applying these EAs, early childhood students had the chance to engage with digital SLAs.

In the following subsections, the process of applying EAs for students to undertake digital SLAs are divided into the following three topics:

1. Lesson plans,
2. Digital LAs, and
3. Students' engagement.

Table 8.2 summarises the discussion points of these key results that covered in this section in regard to RQ 2: How do these teachers at the pre-school use EAs in their learning practice?

Table 8. 2: Summary of the discussion points that put a spotlight on RQ2

Key findings	Discussion points
Lesson plan	Including learning objectives
	Setting up a specific new learning area/zone for the digital SLAs
	Time management
	Number of students
	Setting up a specific rule for working with technology
Digital SLAs	EAs have been used to replace teachers' instruction
	Function of EAs
	Engaging in education: immersive and entertaining experiences
	Features of EAs: feedback
Students' engagement	Stimulated students' experiences with SLAs on literacy and mathematics

8.2.1 Lesson plan

Participant-teachers' appeared to understand EAs to be places that could be used to offer an opportunity for students to access subject knowledge, as well as being used as instructors that could assist in embedding that knowledge. They also believed that their role as facilitators was to prepare appropriate tasks that learners could work through while the teacher monitored their performance. Planning for digital tasks seems to be necessary before applying digital SLAs (Ramirez et al., 2017). The data analysis in Section 6.1 has shown that early childhood teachers take great care in planning and preparing digital SLAs.

Firstly, a daily lesson plan was set up by participant-teachers to guide their teaching, including a specific learning objective, which was an important step (Hirsh-Pasek et al., 2015). Improving students' performance digitally seemed to be perceived by teachers as the main learning objective when applying suitable EAs. Facilitating better SLAs could not be the only objective, as indicated by Papadaki, Kalogiannakis and Zaranis (2018a) who believed that EAs could also achieve the objectives of subject-specific learning goals. Compared to previous studies (Geng, Disney & Mason, 2016; Price, Jewitt &

Crescenzi, 2015), this study's findings illustrated that EAs were used to assist students' acquiring of language and literacy, and numeracy, such as identifying a new letter or shape. This highlights the point that EAs can be considered appropriate if they have the ability to enable students to achieve learning goals (McLean, 2017).

Generally, understanding and knowing how EAs can support the attainment of literacy and mathematical learning objectives results in developing early childhood students' knowledge (Dennis, 2016). Consequently, participant-teachers started to use these EAs to move beyond letters, numbers, and shapes knowledge to develop reading, writing, and counting skills. Preparing a digital SLA that aims to improve students' subject knowledge and skills is deemed necessary for early childhood teachers to change the learning practices (Alzannan, 2015). As a new SLA with the aim of improving students' subject knowledge and skills, EAs were applied by all participant-teachers in the individual learning during the period of the play zone, while a few of these teachers tried to extend their use by engaging their students with literacy-specific digital SLAs at the end of the alphabet learning during the circle time.

Secondly, in contrast to previous studies (e.g. Alzannan, 2015; Reeves, Gunter & Lacey, 2017), the data in Section 6.1 shows that all participant-teachers had smoothly transitioned SLAs to digital learning by establishing a specific new learning area/zone for students to undertake only digital SLAs on language and literacy, and numeracy. This highlights the need to develop appropriate activities using various learning materials to improve students' learning skills (Patchan & Puranik, 2016). A mixed-methods teaching approach where both conventional and digital learning coexist seems to be effective.

Thirdly, compared to Sehnalová (2014), who was concerned that spending a long time working with technologies would negatively impact early childhood students, the current study found that participant-teachers limited students' use of EAs. Time management seems to be a crucial aspect of preparing digital SLAs (Saxena & Hew, 2016). This is particularly relevant to teachers working with EAs in pre-schools, since they should maintain a balance between providing students enough time to engage with SLAs both digitally and conventionally. This highlights the possibility for learners to use a variety of learning materials for the same topic but in different learning zones.

Fourthly, all participant–teachers agreed that only one student should be allowed to engage with EAs at a time to manage the digital SLAs. In contrast with previous studies (Beschoner & Hutchison, 2013; Carr, 2012) that investigated the use of tablet computers by students in early childhood learning in a 1:1 ratio, the current study found that only one tablet computer was available per classroom resulting in students being engaged with individual activities. This is in line with Carr (2012) but contrasts with Beschoner and Hutchison (2013) and Falloon and Khoo (2014), who mentioned that up to two students should be working with EAs at a time. This inconsistency may be due to the fact that taking turns is disadvantageous to many learners if there is not enough time for all students in an early childhood classroom to undertake digital SLAs (Beschoner & Hutchison, 2013). However, the data seem to illustrate teachers’ ignorance of cooperative learning features, which enable early childhood learners to help each other to understand digital tasks (Falloon & Khoo, 2014). Unlike Falloon and Khoo’s study, participant–teachers generally believe that exercises with EAs can contribute to the individual engagement and help build new knowledge.

Fifthly, participant–teachers set up specific rules for working with technology. These included taking care when using the tablet computer, keeping a good distance between the student and the device, and keeping the device on the table. Such rules can protect and manage the digital learning experience while also teaching self-discipline (Gecawich, 2018; Sanders, 2015). Digital SLAs are therefore an important aspect to consider when preparing lessons with the tablet computer. In particular, placing the digital device in the hands of students was a new approach of learning and thus warranted new rules. This contrasts with other researchers (e.g. Falloon & Khoo, 2014; Patchan and Puranik, 2016) who were only focusing on how EAs could be used to support students’ emergent writing and reading, counting or communication skills.

Having so many factors to consider when changing their learning practices, early childhood teachers need to devote more time to reflecting on and thinking about the design and organisation of their lessons prior to executing them. The findings have suggested that lesson planning and preparation enabled teachers to deliver effective digital SLAs. Such thought and reflection, however, should not only apply to lesson planning, but also to promoting digital SLAs, which is discussed in the next subsection.

8.2.2 Digital SLAs

The participant-teachers used four types of EAs (described in Section 4.3)—*Abjad App*, *Arabic Letter and Word App*, *Learning Shapes App*, and *Number Learning for Kids App*. They appear to have used these in two different ways to offer digital SLAs in literacy and mathematics (see Section 6.2). One of the ways of using these EAs was illustrated by all participants, who recognised that the potential of EAs could not only enhance learning, but also take over some function from the early childhood teacher. In the context of individual learning, using EAs has the affordances of convenience, accessibility, and transmissibility to access visual subject matter to allow learners to discover, decide, and realise the consequences of their actions (Dennis, 2016). The other way was applied by a few participant-teachers, who thought of using the *Arabic Letter and Word App* to supplement their conventional teaching in the alphabet learning. This not only promoted learning of language and literacy but also diversified the ways students learned by including digital SLAs.

Next, the data analysis reveals that the functions of the four EAs (used by all participants) could be described as accessing literacy or mathematical knowledge in a learning sequence using multiple communication channels, such as animation, moving text, rollover effects, and sounds. The use of these features was deemed necessary for efficiently delivering high-quality digital SLAs (Outhwaite & Faulder, 2019), as information, tasks, and instructions were displayed in ways that were appropriate for early childhood students (Radesky, Schumacher & Zuckerman, 2015). For example, in using the *Abjad App*, knowledge about the names and sounds of Arabic alphabets were displayed through a visual, auditory, and tactile experience, which involved linking the shapes of letters with their sounds.

Because of the way the data analysis was carried out, it was possible to determine how EAs were used as substitute teachers. Teachers providing opportunities to their students to engage with such EAs is a typical example of experiential learning theory (Carr, 2012), and this perspective was taken into account when analysing the data collected through classroom observations.

Throughout classroom observations, all the EAs combine learning and entertainment exercises to support a specific learning purpose. These EAs were developed based on

drill-and-practice with tutorials. Most of the exercises consisted of selected/matched response (e.g. multiple-choice) questions. Additionally, all the EAs focused on engaging students with tasks, such as matching, tracing, and shaping of letters, numbers, and shapes. This highlights the potential of the EAs that were recommended to participant-teachers to improve students' literacy and mathematical skills (Noorhidawati, Ghalebani & Hajar, 2015). Digital SLAs seem to promote basic learning skills such as reading, writing, and counting in fun ways (Kucirkova et al., 2014). The following are illustrative of the objectives of the four EAs that were used by participants:

1. The *Abjad App* and the *Arabic Letter and Word App* have the potential to develop literacy skills, including the alphabetic principle and reading comprehension (Neumann, 2018).
2. The *Shapes Learning App* have the ability to improve the identification of shapes.
3. The *Number Learning for Kids App* have the potential to enhance numeracy skills, such as identifying numbers and learning to count.

This is in contrast with previous research (Henderson & Yeow, 2012; Kucirkova et al., 2014; Lynch & Redpath, 2014) that used an EA that allowed the creation of self-made text while ignoring the potential of digital SLAs to support subject knowledge. Unlike these studies, the current research found that teachers were convinced of the affordances of these EAs in developing the ability of students to answer multiple questions, follow instructions, drag objects and tap the screen at certain times (Noorhidawati et al., 2015; Outhwaite & Faulder, 2019).

Finally, the data analysis in Section 6.2 indicates that EAs that can offer feedback to students can support SLAs. *Immediate feedback* (this applies to the situation where EAs suggest changes that enable learners to continue and finish the activity (Falloon, 2013)) was expected from these EAs in order for early childhood students to correctly learn the different aspects of concepts i.e. letters, numbers, and shapes. Evaluating students' work (immediately) gave students an opportunity to rethink and correct errors/mistakes. Correcting errors as they happened seemed to help learners to adjust their mental

representations of subject knowledge while supporting their performance during individual and alphabet learning (Flewitt, Messer & Kucirkova, 2015; Kiili et al., 2014).

According to the participant-teachers, feedback gave students time to acquire new knowledge and develop learning and memory skills, as the EAs suggested changes and actions that enabled learners to continue their work and finish the exercise without teacher intervention (Falloon, 2013). This *built-in knowledge* (this applies to the process of improving and increasing students' knowledge of language and literacy, and numeracy (Flewitt, Messer & Kucirkova, 2015)) can be considered another feature of EAs that helps students to identify new information and learning concepts (Brown & Englehardt, 2017). In contrast to these findings, Henderson and Yeow (2012) found such functions to be unsatisfactory because feedback only offers and receives results that help learners to enhance their ability to answer questions, follow instructions, drag objects, and tap the screen at certain times, which neglects learning that results from creating original content.

8.2.3 Students' engagement

The data analysis in Section 6.2 suggests that early childhood students who engage with EAs have the opportunity to stimulate their experiences with language and literacy, and numeracy activities digitally. These learners seemed to enjoy watching the animated characters while touching letters, numbers, and shapes; dragging them to match the correct letter to the empty space in the word; putting the correct shapes in the box; or matching numbers with animated characters. This helped participant-students to develop different concepts, including direction (left to right), alphabets, words, numeracy, and shapes. Matching, searching, or dragging while hearing sounds of the abovementioned concepts helped improve early childhood students' knowledge of sounds and provided them with a multisensory experience to learn their shapes. Students practiced a particular skill and were rewarded with tokens for achievements and progress.

Overall, students' engagement with EAs seemed to effectively enhance their vocabulary, phonics, and numeracy, but these learners were positioned as receivers of knowledge rather than creators or producers. The data analysis demonstrates that EAs were given to students for improving subject knowledge and skills, providing

mechanical learning and memorisation techniques based on repetition (Goodwin, 2012). However, Papadakis and Kalogiannakis (2017) claimed that such rote learning in the digital learning environment ceased to be an issue because EAs had no way of developing students' creativity through play. Using other types of EAs seemed to be acknowledged by researchers, such as Kucirkova et al. (2014) and Lynch and Redpath (2014) as suitable for encouraging early childhood students to engage with SLAs that aim to construct their own learning content.

8.2.4 Overall discussion of the results in relation to RQ2

Whilst the findings of the present study might be relevant to achieving early learning goals (e.g. reading, writing and counting), previous studies have focused on applying EAs for creative learning (Flewitt, Messer & Kucirkova, 2015; Lynch & Redpath, 2014) and communication (Fallon & Khoo, 2014). Much of their data concentrated on combining different ways of applying digital SLAs. However, such a focus on using EAs for creative learning and communication was not found in the current study; instead, the results seem to be inconsistent with the studies on digital SLAs that focus on creativity and communication.

In this study, initially EAs seemed to be incorporated into SLAs to help students with alphabet and numeracy concepts. This development of appropriate digital SLAs provided students with opportunities to learn in an entertaining learning environment. This study found that early childhood students had access to, on average, four EAs in their individual learning. These can be identified here as suitable EAs for students aged four and five due to their entertaining and educational features, which are designed to develop learning and memory skills.

In this study, the accessibility of EAs was found to be associated with how these four EAs had the ability to assist students to grasp subject knowledge through determining learning goals and instructions. It is reasonable to expect EAs to provide appropriate support that allows students under six to be educated in a reasonably independent manner. Unlike Henderson and Yeow (2012), the results of this study seem to indicate that the most valuable features of EAs were text to sound and immediate feedback. The former helped students during their SLAs to understand what they had to do, while

feedback helped them to understand what they had done so that they could develop new knowledge.

8.3 Teachers' Perceptions about the Impact of EAs on Early Childhood Students

The perceptions of early childhood teachers on the impact of EAs on student engagement via SLAs is highlighted in RQ3. Previous studies (e.g. Geng, Disney & Mason, 2016; Kerckaert, Vanderlinde & Van Braak, 2015; Nikolopoulou & Gialamas, 2015) have pointed out fierce debates in the field of early childhood education regarding the impact of using technology in the classroom. The results of this study, as demonstrated in Chapter 7, shed light on theoretical and empirical issues and contribute to the arguments surrounding the field of applying EAs for students' use in pre-school classrooms based on teachers' viewpoints.

When discussing the findings from teachers' interviews, their perspectives are grouped into two main areas:

1. Supporting the use of EAs at pre-schools, and
2. Rejecting their use at home.

Table 8.3 summarises the discussion points of these two key findings covering to shed some lights on RQ3: How do teachers perceive the capability of EAs vis-à-vis early childhood students' engagement with digital SLAs?

Table 8. 3: Summary of the discussion points to answer RQ3

Key findings	Discussion points
Supporting the Use of EAs at pre-schools	Solving the concern of connectivity
	Improve students' academic abilities
	Proper use of technology improves students' knowledge and understanding
	Increasingly motivated students to learn
	Considerations are made to ensure a proper use of technology to limit any possible counterproductive issue
Rejecting the use of EAs at home	A decline in students' improvement, wellbeing, and skills can be shown

8.3.1 Supporting the use of EAs in pre-schools

Linked to participant–teachers' understanding of the potential of EAs to enable early childhood students to learn and support teaching is the matter of facilitating access to subject knowledge, and that results in engaging these learners with digital SLAs (Alade et al., 2016; Kiili et al., 2014). Previous studies (e.g. Bidin & Ziden, 2013; Sehnalová, 2014) have highlighted how engaging students with digital SLAs may raise a few issues of concern. Thus, the data analysis in Chapter 7 contributes to the advancement of knowledge about the extent to which EAs can influence students in pre-schools.

Firstly, in contrast to Ferguson and Oigara (2019), who found the benefit of technologies for classroom use in their potential for connectivity, the results of this study reveal (Section 7.1) that a few of the participant–teachers were reluctant to apply digital SLAs because of the Internet connection. This highlights the possibility of students accessing to non-educational elements, which could positively or negatively affect their learning (Bebell, Russell & O'Dwyer, 2004). However, unlike teachers in the study of Bebell et al. (2004) who used hardware (devices), early childhood teachers in the current study were generally satisfied with the ease of use and the ability of EAs to attract the attention of students aged four and five. According to early childhood teachers, good digital SLAs were created due to the ability of these EAs to engage

learners with educational gaming exercises digitally without an internet connection (Almalki et al., 2013; Castek & Beach, 2013).

Secondly, this study found stability in how early childhood teacher used EAs that were recommended to them. All participant-teachers seem to only perceive the benefits of EAs for students to learn subject knowledge, resulting in developing diversity in SLAs, in which early childhood students had the chance to undertake learning exercises/tasks both digitally and conventionally. The results from the previous section suggest that teachers engaged their students with digital SLAs only when doing activities of language and literacy, and numeracy (Noorhidawati, Ghalebani & Hajar, 2015). This highlights the point in Section 7.1, which reflects on participant-teachers' convictions regarding having variety in SLAs to improve students' learning abilities.

With regard to digital SLAs, students were found to be deeply engaged with literacy-specific EAs with animal-related scenes, in which they completed letter and word activities. Some participant-teachers confirmed the possible benefits of these EAs, in which learners were exposed to all twenty-four Arabic characters in words, which develop students' literacy skills at an early stage. These teachers agreed that a digital SLA contributes to the developments of early childhood learning, since learners noticeably increase their knowledge of letters in a short time. This, according to Bebell and Pedulla (2015), increases productivity and improves learning outcomes.

Thirdly, compared with Bebell and Pedulla (2015), the data analysis in Section 7.1 illustrates that participant-teachers also perceived the potential of EAs to improve students' knowledge and understanding when they were used properly. However, unlike Bebell and Pedulla (2015), their proper use seemed to revolve around setting up time limits with the EAs (a maximum of fifteen minutes per student) and only allowing an individual student to undertake digital SLAs in the individual learning zone with suitable learning content. This finding is consistent with results from another study conducted by Hirsh-Pasek et al. (2015).

Fourthly, the present study reveals that, apart from using EAs to combine teaching instruction and learning practices, participant-teachers have personalised the use of these EAs to reduce the risk of learners being 'constrained' within their learning

environments. The learners' motivations seemed to significantly influence teachers' readiness and willingness to integrate digital SLAs into their classrooms (Fleer, 2018). The evidence from Section 7.2 demonstrates that the potential of EAs for students to undertake digital SLAs was acknowledged by participants to have increased students' motivation to learn. The following was expressed by participant-teachers, supported by classroom observation:

1. The digital learning interactions appeared to encourage students to do SLAs. Students at the age of four and five particularly enjoyed the option of evaluating their work (and getting immediate feedback). This reduced the frequency of errors and improved their confidence (Flewitt, Messer & Kucirkova, 2015).
2. Participant-students seemed to prefer using digital SLAs over corresponding conventional learning exercises (e.g. writing the new letter on the whiteboard). Most of these learners were more likely to volunteer to do letter writing exercises with literacy-specific EAs than conventional learning materials (e.g. whiteboard).

It seems that, given the interactive nature of digital SLAs, motivation seems to play a big part in getting learners to engage with EAs (Price, Jewitt & Crecenzi, 2015). This in turn could improve their understanding of learning content and help them become independent learners (Couse & Chen, 2010). Here, the results indicate that students could carry out exercises with EAs successfully and without needing assistance. However, a few of the participant-teachers were concerned that these students might become overly dependent on the EAs and even become addicted to the technology, becoming lonely and isolated, as has been mentioned in previous studies (Garduno, 2016; House, 2012; Sehnalová, 2014).

In contrast, this study demonstrates that participant-teachers tried to make every possible effort to eliminate such counterproductive uses of EAs by, for example, setting up time limits. Unlike these previous studies, participant-teachers had positive attitudes toward using EAs for preschool students when these EAs were used properly.

8.3.2 Rejecting the use of EAs at home

An unexpected finding of this study (Section 7.3) is that few of the participant-teachers highlighted the relationship between students' use of EAs at home and negative effects

of technology use. Unlike Comi et al. (2017), who focused on discovering the proper use of technology in schools to reduce the negative effects of using them in the classroom, this study found that some participant-teachers were more concerned with how technologies were used at home. Generally, these participants criticised the way technologies were used at home and highlighted the need to raise parents' awareness of this issue. The preschool was therefore preparing a parent programme focusing on the use of digital technology at home, as expressed by participants.

8.3.3 Overall discussion of the findings in relation to RQ3

The debate about applying EAs in classrooms and their effects on students' engagement with their digital SLAs in the pre-school was investigated by Comi et al. (2017). They argued that the way digital technologies are used certainly influences teaching and learning practices within the classroom, which is in agreement with the current study. The students demonstrated a good knowledge of relevant concepts when using EAs that provided easy access to subject matter with self-access learning exercises supported by immediate feedback. This seemed to motivate students to learn, increase their confidence, and helped them to become more independent. The results of the study seem to support the argument in favour of using EAs in preschools, as they encourage students to engage with different type of SLAs. However, the study found that early childhood teachers had several concerns pertaining to digital technology use at home.

8.4 Summary

This chapter presented a discussion of the research results collected via interviews and classroom observations and considered both teachers' points of view and the researcher's field notes with previous studies in accordance with RQs. In this study, EAs seem to have the potential to support the SLAs' dimension of the early childhood curriculum (Section 2.2). That is, EAs have the potential to improve the natural ways of teaching and learning through engaging students with digital SLAs in the classroom, but it seems this process of change depends on early childhood teachers' perceptions. With a positive view, as is the case in this study, teachers could improve students' ways of learning subject knowledge by including EAs, which in turn seemed to affect students' interactions with SLAs. In general, the data revealed that EAs are deemed necessary to successfully harness digital SLAs in classrooms in pre-schools. Changing to digital learning can provide teachers with new knowledge and experience, which have an

influence on their perceptions and learning practices. The results of this study are consistent with the existing literature on technology, particularly EAs, used in pre-school classrooms.

Chapter 9: Conclusion

This thesis was undertaken to uncover the potential of EAs to facilitate SLAs without the guidance of teachers. This, in turn, may impact learning in preschools. The present research was carried out in one pre-school in KSA. Twelve early childhood teachers who had been using EAs during the previous one to two years, and eight of their students age four and five, participated in this study. The perspectives of these teachers were sought through conducting face-to-face, individual, semi-structured interviews. These were then followed by whole day classroom observations to collect qualitative data on the classroom interactions between an EA, students and teachers during the students' use of digital SLAs.

The current research study used an interpretivist inquiry approach (qualitative), and aims to answer the following three RQs:

1. What perceptions do Saudi teachers have in relation to the affordance of EAs in early childhood learning?
2. How do these teachers at the pre-school use EAs in their learning practice?
3. How do teachers perceive the capability of EAs vis-à-vis early childhood students' engagement with SLAs?

These proposed three RQs proved to be suitable for this research on teachers' perceptions since the answers shows how the teachers' perceptions are related to the application of digital SLAs in the classroom. The questions focused on the potential of EAs to transform teachers' ways of supporting students' SLAs with information and instruction to EAs, and the impact of such a change on students' engagement. Early childhood teachers' views demonstrated that through the transition from physical learning materials (e.g. whiteboard and pen) to the use of EAs, the ways in which students learn language and literacy and numeracy could be developed. Such results were supported by taking field notes covering the potential of EAs for language and literacy, and numeracy activities.

This chapter presents a summary of the main results answering the three RQs regarding teachers' perceptions and digital learning when using EAs along with a discussion of their contribution to knowledge. This is followed by a discussion of some implications

and the provision of several recommendations to policy-makers, researchers and practitioners in the field of early childhood education. Several recommendations are also made for further research studies. In this chapter, I also discuss some limitations of the current research for changing learning practice. Lastly, the means of disseminating the results and ideas that have emerged from the current study are considered.

9.1 The key Findings and Contributions of this Study

This study is unique in that it unites two crucial aspects. Firstly, it examined teachers' perspectives on the potential of EAs to enable early childhood learners to interact with SLAs without their teachers' guidance; and secondly, the fact that such a learning practice takes place in conventional classrooms in which the teacher is the main source of information and support. Another contribution addresses the specific way in which tablet computers and EAs were used. Firstly, a top-down approach was implemented regarding the use of tablet computers in classrooms. In this approach, early childhood learners received knowledge from, and got that knowledge tested, through games in EAs. Secondly, one tablet computer was available per classroom resulting in the incorporation of digital SLAs in one learning zone which was created for students to interact with EAs. The research approach and results, thus, might be relevant in countries where a top-down approach is common as well as in countries with limited resources as one tablet computer was used in classrooms rather than the use of one tablet per student.

The objective was to capture early childhood teachers' thoughts and practice regarding the application of EAs for students' use. Teachers' perceptions of enhance learning practice were found by Blackwell, Lauricella and Wartella (2014) to be related to the application of digital SLAs in their classrooms. By reviewing their study, I believed in the importance of shedding light on early childhood teachers' thoughts about digital SLAs, as well as whether these teachers believed in the impact of EAs in learning due to their influence on the way EAs were used.

One of the features that distinguishes the current study is its focus on Saudi early childhood teachers' perceptions, and their actual classroom practices. Unlike most studies in the field of tablet computers conducted in Arab countries (e.g. Ali, 2013; Almalki, Finger and Zagami 2013), the current investigation focused on teachers'

perceptions that are built on experiences, alongside learning practice. Additionally, this study addresses the gap in the literature on technology use in early childhood education, and builds on the contributions of earlier research studies by considering the application of EAs. The primary contribution of this study is to outline the opportunities and the ways of applying EAs by teachers to enhance teaching and learning resulting in engaging students with digital SLAs in preschool classrooms in the KSA. Thus, the results of the present study are potentially useful to pre-schools that wish to bring diversity to their SLAs.

Moreover, this study investigated the use of EAs in the Saudi early childhood setting, and was heavily based on Kolb's (1984) experiential learning theory. The findings of this research can be transferable to other pre-schools in the KSA because all schools in the Kingdom follow a similar learning programme, curriculum (see Chapter 2), and teaching guide (MOE, 2016). Furthermore, the results could also be transferable to other early childhood learning contexts similar to KSA. The main purpose of this study was to explore the perspectives of Saudi teachers who applied EAs in an experiential learning context and to explore how students learned with these EAs in the classroom.

This study is in line with previous studies (e.g. Beschorner & Hutchison, 2013; Blackwell, Lauricella & Wartella, 2016; Sehnalová, 2014) that were concerned with the use of EAs in classrooms in pre-schools. Compared with previous studies, this research demonstrates that early childhood teachers' perceptions and experiences influenced the change that they may make in their learning practices. A number of key findings emerged as answers to the RQs on teachers' perceptions and use of EAs' affordance. They are summarised in the following subsections.

9.1.1 Teachers' perceptions of the affordance of EAs for learning (RQ1 and RQ3)

The literature review on EAs in early childhood learning reported their availability for classroom use (Geng et al., 2016; Lee & Cherner, 2015; Neumann & Neumann, 2017). Most previous studies focused on investigating the ability of EAs to aid in the learning process, especially students' interactions with SLAs on language and literacy (D'Agostino et al., 2016; Dennis, 2016) and mathematical (Kyriakides et al., 2016). However, only a few of these studies have been carried out in the Middle East (Ali, 2013) and the KSA in particular (Almalki, Finger & Zagami, 2013), and only a few

international studies (Kim et al., 2016; Lynch and Redpath, 2014) have addressed early childhood teachers' perceptions. Thus, Saudi teachers' views on the potential of EAs to impact learning practices and the effects of such an impact on students' learning as well as teachers' applications of EAs to enable their students engage with digital SLAs, were interesting topics to explore.

Perceptions about changing learning practice using EAs

with regard to RQ1, which is concerned with teachers' views to use EAs for early childhood students' learning, participant-teachers recognised EAs as integral teaching tools to promote the learning developments of language and literacy, and numeracy for young students. This resulted in them to change to digital SLAs when learning literacy and mathematics. In answering RQ1, the current study identified the affordances of EAs available on tablet computers that enhance teaching and improve the ability of early childhood students to learn. The data illustrates that participant-teachers perceived EAs as places and instructors. These perceptions are derived from analysis of the way participants (teachers) described their use of EAs. Two key findings are emerging from studying teachers' views:

Firstly, the data illustrated that participant-teachers viewed EAs as places that facilitate easy access to literacy and mathematical knowledge content, human-to-machine interactions, and self-access to knowledge, which serve to engage students with digital SLAs. This corresponds with Skinner's (2003) theory of educational machines which states that focus should be given to the possibility for learners to move through lessons at their own pace. In the case of EAs, early childhood students have the ability to freely move from one EA to another or from an exercise within an EA to another. Additionally, Skinner noted the ability of the machines to pose questions then provide rewards (usually in form of encouragement) for answering questions correctly. This is exactly the case with EAs, which pose multiple questions with feedback to reward the correct answer or correct the wrong answer.

Secondly, the data shows that these participants also viewed EAs as instructors assisting early childhood students to obtain that knowledge with instructions to stimulate learners' thinking. This is loosely in line with Piaget's (2001) theory of using teaching tools to shift thinking processes. His theory concentrated on helping students to draw on

their existing knowledge, experiences and problem-solving skills (e.g., comparing between different forms of letters, numbers and shapes). This is exactly the case in EAs, which provide chances for learners to build their knowledge on language and literacy and numeracy based on what they already know. For example, early childhood students working with literacy-specific EAs were engaged with various exercises that were aimed at increasing their alphabet and vocabulary knowledge.

The findings constitute evidence for how these two perceptions of EAs as places and instructors can be recognised due to the impact of the following six factors.

Factors

Firstly, the data demonstrates that the first step of implementing EAs for early childhood students' use in the classroom was taken because of the efforts made by those who organised and applied the Aljwdah Project in a number of pre-schools in the KSA. This highlights the point that the power of applying EAs is within the educational community, which can provide a collective vision that it shares for redefining learning practice (Hsin, Li & Tsai, 2014; Nikolopoulou & Gialamas, 2015).

Secondly, participant-teachers were generally satisfied with the management support they had received so far, i.e. having adequate facilities and help with issues such as accessibility and installation, but they desired more management support with technical knowledge. It would appear that devices were given to teachers with internal support, which was deemed necessary and sufficient to experiment with and adopt several EAs for engaging learning with digital SLAs on language and literacy, and numeracy.

Thirdly, Arabic EAs were given to teachers to integrate into their SLAs were considered essential for the successful use of EAs. This was the main resource that participant-teachers found to be in too short a supply.

Fourthly, teachers' understanding and awareness of applying technology in early childhood learning contexts, as well as familiarity and experience with EAs, seems to have improved their use of this new teaching method in a natural context. This highlights the importance of improving teachers' knowledge on the proper use of EAs

for engaging students with appropriate digital SLAs. Getting involved in interactions with colleagues appeared to increase knowledge and improve learning practices.

Fifthly, a diversity in SLAs both conventionally and digitally seemed to develop students' knowledge, which played a big part in early childhood teachers' decisions to use EAs in their classrooms. Teachers' use of these EAs seemed to emanate from their efforts to expand students' opportunities to develop knowledge through both conventional and digital teaching methods. Motivation was necessary for teachers to be willing to explore new technologies and become more comfortable with integrating them into their practices.

Sixthly, EAs that were able to function without an Internet connection seemed to play a big role in getting teachers to explore new technologies for students' use. This indicates that teachers' attitudes towards the use of technology by early childhood students can change as they become more experienced and comfortable with integrating it into their practices, especially when EAs do not require an Internet connection (Castek & Beach, 2013). It would appear that EAs, which had been recommended to participant-teachers for applying in their classrooms, were more positively perceived by these teachers than other technologies that required an Internet connection.

By recognising these factors, our understanding of the curricula can influence early childhood teachers' decision-making regarding the use of EAs, because the learning model for the use of technology in pre-schools does not account for applying EAs for students' use, especially in a conventional early childhood education context such as KSA. Although providing opportunities for students to use EAs has been discussed by a number of researchers, applying them for use in the classroom is still not fully understood in the early childhood learning literature. The findings of this study have addressed teachers' decisions to apply EAs for learning language and literacy, and numeracy, which was influenced by three factors - supporter and organisation, adaptation, and cognitive development. These three factors are in line with Piaget's (2001) theory of developing appropriate practices. This has not previously been broadly discussed in the literature, and this study, hence, presents this discussion as an attempt to contribute to our understanding of the issue.

Next, although participant–teachers seemed to be satisfied with the change in the way that subject knowledge was taught to students due to their application of EAs, they had few concerns about the devices. The results of this research study may contribute to the advancement of knowledge about the challenges that early childhood teachers might face during the initial stage of using EAs in their classroom.

Challenges of applying EAs

Firstly, participant–teachers with considerable experience with conventional learning found transitioning few SLAs to digital learning particularly challenging. Their reactions to the use of EAs are important to consider, as resistance to change can be a limiting factor (Fullan, 2007). Although this has been reported by other researchers, little is known about teachers’ resistance to change in conventional early childhood learning contexts such as KSA. The Aljwdah Project aims to reduce this resistance and facilitate the application of digital SLAs to improve students’ learning skills.

Secondly, the considerable amount of subject-specific learning concepts that teachers need to cover in SLAs cannot be achieved as there seems to be limited availability of EAs in Arabic for such a young age group (four and five years old). This issue relating to the EAs’ processing of learning content has not been suggested in previous international studies (e.g. Lynch & Redbath, 2014; Falloon, 2013), although it has been found in a study conducted in the Arabic context by Ali (2013).

Thirdly, class size seemed to be a hindrance when using EAs, especially with the availability of only one tablet computer. A large early childhood class size can create challenges when considering the time available for SLAs. For example, learning in the zone was set up for 45 minutes per day, with digital SLAs for 10-15 minutes per student. However, participant–teachers reflected positively on this limitation, as it could reduce the negative effects of early childhood students interacting with EAs.

By grasping these three challenges, this study also tries to contribute to our understanding of how, generally, these barriers to digital SLAs can be overcome in a conventional early childhood learning context. Even though this has been discussed by a number of researchers, it is still not fully understood in the early childhood education

literature how teachers can overcome the difficulties of changing their existing SLAs to digital learning. Hence, this study may contribute to our understanding of the issue.

Another aspect highlighted by this research is the impact of EAs on students' engagement in order to answer RQ3. The findings of this study also endeavour to contribute to the advancement of knowledge about to what extent EAs can influence students' learning within classrooms in pre-schools.

The impact of EAs on students' engagement with SLAs

Firstly, participant-teachers were generally satisfied with engaging their students with EAs because of their ability to improve the student experience by:

- Improving understanding of concepts;
- Widening knowledge base;
- Improving performance and achievements; and
- Increasing motivation, independence, and confidence.

Changing to digital SLAs seems to be beneficial to early childhood students at the age of four and five (Geer et al., 2017), and to the development of learning practices (Hinostroza, Labbe & Matamala, 2013; Noorhidawati, Ghalebanti & Hajar, 2015). Thus, introducing these EAs to the classroom may be required to enhance the quality of learning, which may foster independent lifelong learning.

Secondly, participant-teachers were more willing to use EAs when they saw the correlation between early childhood students' use and their learning achievements. However, there was often a concern that students might come to prefer learning exclusively with EAs and be less inclined to use physical learning materials (e.g. whiteboard, pen or teacher-made learning games). Resolving such controversies might be essential to encouraging teachers to use EAs meaningfully in their classrooms in pre-schools. Although there may be a perception that the use of EAs' in classrooms needs preventing, the results of this study suggest instead that giving consideration to how they are actually used is the real issue.

By gaining an awareness of teachers' thoughts on the impact of EAs on students' learning, the current study may contribute to our understanding of how, generally, the digital features of EAs can enhance early childhood learners' comprehension of various concepts. These concepts are not good or bad, but they could promote understanding and increase knowledge if the features of technology allowed interactions between learners and texts. Although a considerable amount of research has been published on this issue, controversies still persist in the early childhood education literature. This study, therefore, has attempted to contribute to our understanding of the issue.

9.1.2 The digital SLAs (RQ2)

In answering RQ2, this study has yielded the two following insights into the use of EAs in the classroom:

1. Roles and responsibilities within the classroom and the dynamics of learning appear to change as a result of applying EAs for students' use. Early childhood teachers are considered to be key agents responsible for leading the learning process with instructions. However, when using EAs for learning language and literacy, and mathematical knowledge, the delivery of knowledge content and instruction was delegated to these EAs instead of teachers.
2. As this study was conducted in an early childhood learning context that applied Kolb's (1984) experiential learning theory (see section 2.2), EAs could be used in this context to focus on understanding the experiences of subject-specific SLAs. These EAs were well established in the field of early childhood learning as promoters of language and literacy, and numeracy, aiming to support students' learning performance, independence and individual accountability.

From the way participant-teachers verbalised their understanding of teaching and learning, it is apparent that they recognised the affordances of EAs, such as convenience accessing to learning content and the potential for enhancing SLAs. The data illustrated the following:

1. Lesson planning for digital SLAs is deemed necessary, especially assigning suitable exercises, identifying learning goals, and limiting students' use of EAs.
2. The adoption of a mixed-methods teaching approach, where both conventional and digital learning materials coexist, seemed to be effective.

This study has tried to contribute to our understanding of how early childhood teachers plan their digital SLAs. Although this has been discussed by few researchers, it may still not be understood. In particular, limiting the use of EAs and the adoption of a mixed-methods teaching approach appears to have not been previously reported on in early childhood literature in the field of SLAs. This contribution can be specifically related to lesson planning since it might not be clear from the literature how a teacher should plan learning practices that incorporate EAs.

Next, participant-teachers were generally satisfied with how EAs could influence the teaching and learning process:

1. Learners' ability to do learning exercises individually seemed to be considered essential for achieving learning outcomes. This points to the potential of EAs to engage early childhood students with the learning content and to provide feedback on these students' work. This contribution might provide the opportunity to slightly increase our understanding of the relationship between early childhood teachers' digital learning procedures and students' performance, which can ultimately enhance students' academic learning.
2. The foundation of digital SLAs should be considered when this teaching approach is introduced. The structure of digital learning is well established in the field of technological devices in early childhood education, but it is not very clear in relation to EAs. In this field, EAs seem to have been identified as digital SLAs because they provide several supplementary needs of learning, such as feedback and the tracking of students' performances (Beschoner & Hutchison, 2013; Flewitt, Messer & Kucirkova, 2015).

Overall, the findings indicated that, in the context of early childhood learning, students' interactions with SLAs using physical learning materials, such as writing letters on the whiteboard or engaging with teacher-made alphabet matching games, are slightly different from their interactions with the same activities using EAs. Students worked with these physical learning materials under their teachers' guidance. However, for learners using EAs,

1. their learning process appeared to be guided by these EAs, which helped them to complete the task (positive independence);

2. their learning tasks seemed to be carried out as directed by the selected EAs, which suggests that students worked independently, receiving help from the EAs to learn the content (individual accountability); and
3. the features of these EAs seemed to be demonstrated via students' interactions with the content, such as instructions, error correction, and progress with their work (promotive interactions). All these features are essential for SLAs.

These findings are based on classroom observations in which EAs were used.

9.2 Implications and Recommendations

This research explored early childhood teachers' perspectives and practices in relation to EAs that have the potential to change the process of teaching and learning within early childhood classrooms. Thus, it can contribute to our understanding of the application of these EAs in classrooms to engage learners at the age of four and five with digital SLAs. Based on the findings of this study, several implications and recommendations could be made for Saudi policy-makers and educators.

Firstly, the findings of this study could contribute to the development of the way in which teachers facilitate digital SLAs by enabling early childhood students to use EAs. This development appears to have been recognised because of the influence of the Aljwdah Project. This study highlights the recommendation within this Project to adopt EAs that are developed for learning language and literacy, and numeracy. Such digital technology can help modernise and change the teaching and learning process in Saudi early childhood classes, which is paramount to enhancing the quality of SLAs. However, the data demonstrates that early childhood teachers might have a lack of knowledge and experience about how to use EAs to facilitate digital SLAs. One implication of this is that teachers are most likely prefer only applying conventional SLAs.

Based on this study, early childhood teachers need knowledge and experiences regarding digital learning, and this can be gained through interaction with their colleagues who are experts in using technology in their learning practices. There could also be a need to develop an educational event that addresses some of the needs and issues that teachers are likely to encounter, and which could influence their intentions to

adopt digital SLAs in their classrooms. For example, information about how to promote students' digital experiences using EAs. Furthermore, it might be useful to provide early childhood teachers, who lack knowledge and experience in using technology for students' use, with training and even practical experiences on using EAs in classrooms. These steps would ensure, as confirmed by the participant-teachers, the smooth application of digital SLAs in classrooms.

This study also suggests that changes can be made in the early childhood teacher education curriculum in order to change perceptions and practices while increasing knowledge and understanding in relation to the use of EAs. In choosing or developing a quality learning curriculum and deciding on how best to use EAs to support early childhood learning, early childhood teachers' training should consider the following:

1. Demonstrating the functions of suitable EAs that support SLAs;
2. Explaining the reasons for pre-teachers to use EAs in order to engage early childhood students with cognitive process digitally;
3. Comparing digital versus non-digital SLAs; and
4. Embedding digital learning strategies in the early childhood material to support the cognitive process by using EAs for remembering, thinking or problem-solving.

Secondly, the results showed that teachers might face initial difficulties and challenges when they enhance their SLAs through the use of EAs. The findings of this study suggested that early childhood teachers might be resistant to the use of these EAs in Saudi preschools. Strategies to change teachers' views might involve support of the pre-school's principal and other staff, training events about digital SLAs, and teacher's observations with individualised feedback. Another reasonable strategy to tackle this issue, teachers could be given enough time to become familiar with and gain experience in using EAs that have the ability to provide learners with access to subject-specific learning areas. This will lead to the engagement of these students with digital SLAs. These strategies could help teachers to overcome the initial challenges and support them when using EAs to provide students with accessing to language and literacy, and numeracy contents.

Thirdly, the study's findings raised the need to have comprehensive information regarding the potential of EAs to support teaching and enhance SLAs in pre-schools. This finding suggests that the early childhood curriculum and teacher guide needs to be revised as they only include a significant amount of information and concepts that are required to be taught using physical learning materials (MOE, 2020). For example, the facilitation of learning language and literacy or numeracy through engaging young students with printable sequencing cards. These results call for the MOE to modernise the curriculum and teacher guidelines to include information regarding the use of EAs in teaching and learning in preschools.

Fourthly, early childhood teachers' ought to strengthen students' digital learning. One finding of the present study is that participant-teachers applied only one tablet computer for one student at a time, with up to five students using it individually each day. The classes have an average of 30 students, and the SLAs are scheduled during the Inside Play in the Zone for over 45 minutes. However, this is a significant amount of time per SLA as less time is spent on language and literacy, and numeracy activities when digital teaching methods and materials are used. This result appears to support the suggestion that pre-schools should consider providing more tablet computers per class (at least five devices) so that more students have the opportunity to engage with digital SLAs alongside other type of learning for each concept (e.g. writing a letter or number using EAs, then moving on to use pen and paper).

Another finding in this study is the use of EAs to support language and literacy, and mathematical skills among early childhood students in the individual learning zone. However, the presence of one learning zone that exclusively applies digital SLAs may discourage students from engaging with other type of SLAs in other zones. The data reported here appear to support the assumption that students may become over-dependent on technology and refuse to learn using other means. These results recommend that early childhood teachers plan to use SLAs conventionally and digitally in the same learning zone, instead of separating them into different learning zones so that students can partake in different type of exercises on the same topic.

This study has demonstrated that using a mixture of teaching methods and materials can be effective in improving students' learning, and reducing the effects of EAs on these

learners. This requires teachers to spend more time and effort planning each learning zone to combine different SLAs. This is certainly necessary, but as highlighted in this study, there is limited availability of EAs in Arabic, which can support the development of language and literacy, and numeracy skills among Saudi students. Thus, there is an opportunity for technology developers to develop EAs that have the potential to provide access to other developmental learning areas, including personal, social and emotional, cultural and aesthetic and creative areas, targeting students in Arabic-speaking countries.

The results also indicate the ability of EAs to improve students' learning performance, and in a way, revolutionise the teaching process given that the context of SLAs is mainly conventional. The current study suggest that there may be a link between EAs that are developed to support teaching and learning through drill and practice and learners' attainment of learning skills, such as writing and counting skills. However, these EAs do not enable knowledge construction and do not enable collaborative learning. A reasonable approach to tackle the issue of knowledge construction could be the application of Goodwin's (2012) classification of 'constructive,' a typical example of which is known as creative apps that have the potential to enable students to set up their learning content. Another reasonable approach to tackle the issue of collaborative learning could be to have two learners work with EAs at a time.

It is important to note that collaborative learning can be supported by technology, and this would be useful to equip early childhood students with the necessary skills that enable these learners to work with others. Many researchers have explored collaboration in a digital learning context (e.g. Beschorner & Hutchison, 2013; Lynch and Redpath, 2014) and emphasised the importance of such an approach for preparing learners to be useful members of the modern world. However, the findings of the present study show that all participant-teachers engaged their students with individual digital SLAs, without realising the potential of these activities to develop students' interactions, collaboration, communication and negotiation skills (Falloon & Khoo, 2014). Students at the age of four and five can certainly help each other to complete a learning task, if given the opportunity, for example through making suggestions.

Fifthly, the results of this study highlight early childhood teachers support of using digital SLAs in pre-schools. The present study provided insight on the link between facilitating access to subject knowledge using EAs and students' engagement with SLAs. The findings from this study suggest that EAs can have an effect on encouraging students to undertake language and literacy, and numeracy activities. However, concerns might arise regarding the application of digital SLAs on students at the Saudi pre-school. For instance, learners may prefer to learn exclusively with EAs and be less inclined to use conventional SLAs. Strategies to reduce the impact of EAs might involve using a mixture of SLAs (conventionally and digitally), time restrictions (up to fifteen minutes once or twice a week), and establishing rules about device handling.

An unexpected result found in this study was the indirect influence of technology on students because of home use. The data reported here appear to support the assumption that raising parents' awareness about the issue may be essential to guarantee technology is used appropriately by young learners all the time. A reasonable approach to tackle this issue could be to involve parents in debates and conversations about the effect of using digital technology on early childhood students. Another reasonable approach to tackle this issue could be through events and workshops to raise parents' awareness through providing appropriate guidance on safe and healthy technology use at home.

9.3 Limitations of the Study

Although the current research study explored important issues that had not been previously researched in the early childhood field or the literature on Saudi learning, a number of limitations have to be acknowledged. The first key limitation is the recruitment of participants which only targeted teachers who had experience of using EAs in pre-school classes for at least one year. This resulted in only a small number of participant-teachers who met the inclusion criteria. Furthermore, the participating pre-school employed twelve teachers who used EAs in class, and eight of their students agreed to take part in the study. However, although targeting a bigger number of pre-schools may have increased the potential number of participants, and strengthened the findings of the study, this may not have been feasible due to the low number of Saudi teachers who used EAs in their classes (19 teachers in private pre-schools and 31 teachers in public pre-schools, see Appendix E, p. 258).

Another limitation to consider is the fact that this study only recruited teachers and students from the pre-school. Involving other stakeholders such as those who are in charge of applying the Aljwdah Project in pre-schools, the school principal, the teachers' supervisor and educators at Saudi universities, could offer a more comprehensive assessment of the issue under investigation. However, due to the time constraints of both the research and the target individuals, this was not possible.

Additionally, there are key limitations to consider regarding the approach used by the early childhood teachers in their classrooms.

1. Only one tablet computer was available per class.
2. Each student was allocated a limited time with digital SLAs of up to fifteen minutes.
3. Each student engaged in their SLAs independently.

Even though these three conditions suggest an unusual application of tablet computers in early childhood learning, the approach of one tablet computer per classroom might be useful in countries where financial resources are limited. However, the results of the current study suggested the provision of more tablet computers (at least five devices) when conducting future studies in early childhood learning to avoid these limitations.

Another limitation is that this study implies that using EAs positively affects students' engagement with their SLAs. However, this assessment is based solely on teachers' perspectives, as reported by the teachers themselves in this study. An experimental research approach to compare students' performance when using EAs with their performance when using other materials will outline the specific impact of using these EAs. Also, the fact that teachers supported the use of EAs in class, but rejected their use at home, warrants further investigation, as this finding was only highlighted by teachers and not parents. It may also help to conduct a survey to report that the majority of early childhood teachers are changing their way of facilitating SLAs in language and literacy, and numeracy, with the use of EAs. Statistic data supported by details of several of these teachers' perceptions about the issue might have made my argument stronger.

As previously suggested, the main aim of this study is to explore the perspectives and practices of teachers in relation to the potential of EAs for students' use in a Saudi early

childhood learning setting. The study attempted to access data on students' performance, in order to provide empirical evidence of the impact of these EAs on students' achievements. However, this was not possible as during data collection the school was anticipating an inspection visit to monitor the usage of the Aljwdah Project Recommendations. The school administration staff could not allocate time and resources to provide data access, as they were busy preparing for the inspection. Another limitation of this study is the focus on teachers' perspectives of the change EAs have brought to the learning practice and the impact of such change on students' learning. More insights may be provided by investigating students' learning, which is beyond the scope of this study. Future studies could observe students' interaction with digital SLAs from the perspectives of these learners.

The final limitation relates to the methodology used in the study. A longitudinal ethnographic research design would have been more appropriate, where a researcher collects descriptive and detailed data, through observing more learning lessons where EAs are used, and becomes immersed in the learning environment and the school's day to day tasks. Also, spending more time in the pre-school collecting data might be beneficial in case another interview with each teacher is needed. This would provide a deeper understanding of how EAs can be used in early childhood learning settings (Corbin and Strauss, 2008). However, this was not possible because of time restrictions imposed by my scholarship terms, and access restrictions imposed by the school. The triangulation of collecting the research data from teachers using two different data collection instruments (interviews and classroom observation) may compensate for this limitation.

9.4 Future Research

Based on the study contributions and limitations, several suggestions for future research on digital SLAs, especially in the Saudi early childhood learning context, are discussed in this section. The study shows that teachers can change their language and literacy, and mathematics activities from only using conventional teaching methods and materials to also using EAs. However, further research is needed to extend this work, especially in relation to students' use of the device. Firstly, conducting a large-scale research study in order to examine the phenomenon in a range of early childhood learning settings, involving public and private pre-schools. Secondly, involving other

stakeholders such as the school principal, teachers' supervisor and parents of students could provide supportive and detailed information about the issue under investigation. Furthermore, studies involving more teachers and students could strengthen the findings of this study and offer a more comprehensive picture of digital SLAs in classrooms. Thirdly, conducting experimental research studies to investigate the use of other types of EAs (mentioned in Chapter 1, section 1.2).

This is a case study exploring the perspectives and practices of early childhood teachers who are using EAs, with learners aged four and five, in the classroom. However, conducting similar research with early childhood students with disabilities, or primary school students, might offer further insights into the perceptions and usage of these EAs in various school stages. It is important to explore different educational stages, different students' capacities, and different age groups to understand the use of EAs, since age and ability can influence students' progress. The current study was conducted in a pre-school with regular students at the ages of four and five. Further research may be conducted with students with disabilities, to identify any similarities and differences between the findings in relation to students' characteristics.

Moreover, the study findings highlight that immediate feedback is a key feature in EAs, especially for beginners who are starting to learn letters, numbers and shapes. Feedback guides and helps students to minimise errors and therefore enhance their learning performance. However, further research is needed to examine how students can learn best from this feedback, and what sort of support they need.

Additional, teachers had an unexpected view on how technology was used at home. The inappropriate use of technology at home might make teachers hesitant to assign digital SLAs to students. Thus, conducting a survey involving teachers to explore this issue in a range of early childhood contexts, might offer detailed information on the relationship between students' use of digital technology in preschool and at home. In addition, research involving parents of students could provide a more comprehensive picture of how students use technology at home.

Finally, once the practice of the use of EAs alongside other digital technologies in pre-schools in KSA matures and becomes routine, research can be conducted to explore:

1. To what extent digital SLAs can influence the Saudi early childhood education;
2. The correlation and differences between digital SLAs and conventional learning exercises; and
3. The comparison between Goodwin's (2012) classification of 'instructive' and 'constructive' EAs.

9.5 Dissemination

The dissemination of the study's findings is important in order to inform early childhood communities, teachers and educators, policy-makers, and other researchers of the potential of applying EAs in classrooms for engaging students with digital SLAs, and their use in a conventional learning context such as KSA. The study's findings could be transferred to other pre-schools in the Kingdom or in early childhood communities in contexts similar to KSA. Thus, the findings of the study will be communicated to the stakeholders. A copy of the final report of the study will be sent to the Saudi Cultural Bureau in London as they sponsored this study. Additionally, a summary of the results (in Arabic) without quotes from teachers will be made available for the school principal, participant-teachers, and the parents of participant-students attending the participating school. Furthermore, some of the study findings have already been presented at the Annual Research and Scholarship Conference in Leicester on 15th July 2019 (School of Education, University of Leicester) and the 7th International Conference on Education and Social Sciences (INTCESS) in Dubai 20th – 22nd January 2020 (OCERINT International Organisation Center of Academic Research). The findings will also be disseminated to the academic community through peer-reviewed journal publications.

APPENDIX A – Local Education Department letter of consent



School of Education

University of Leicester
21 University Road
Leicester
LE1 7RF
+44 116 252 3688

Research Project – Letter of Consent

Project Title: Early childhood students’ use of educational apps: A case study of Saudi teachers’ perceptions and practice.

Researcher: Sarah Alarfaj, Ph.D. student, University of Leicester, UK

Project Description: This study is part of a Doctor of Philosophy degree at the University of Leicester in the United Kingdom. I am a doctoral student and the supervisor of my thesis is Dr. Palitha Edirisingha. My study would consist of an analysis of early childhood teachers’ perceptions of using a specific group of educational apps in their classrooms in the context of pre-school in the city of Alhsa in the Kingdom of Saudi Arabia.

Permission is requested from the Local Department of Education, located in Alhsa, to visit the chosen school to collect research data. A sample of teachers would be asked to participate in face-to-face interviews and classroom observations. I would provide informed consent letters for all participants.

Regarding research honesty, I would anonymise the collected data and use it solely for educational and research purposes. To ensure that the data is handled confidentiality, an expert supervisor with extensive research experience would assume the role of conductor. In addition, the research would follow the strict ethical standards of the University of Leicester.

I, as a researcher, understand that this study and its results are oriented towards society and education. Therefore, the data that results from this study would only be used for educational purposes. It would not be used for commercial purposes.

University of Leicester, August 2018

APPENDIX B – The Letter from Local Education Department to School

المملكة العربية السعودية
وزارة التعليم
الإدارة العامة للتعليم بمحافظة الأحساء
إدارة التخطيط والتطوير
قسم البحوث التربوية

بسم الله الرحمن الرحيم

الرقم :
التاريخ : ١٧ / ١٢ / ١٤٣٩ هـ
المرفقات :

وزارة التعليم
Ministry of Education

إلى : قائدة الروضة
من : مساعدة مدير إدارة التخطيط والتطوير
السلام عليكم ورحمة الله وبركاته ، ، ،

حفظها الله

بناء على خطاب الملحقية الثقافية السعودية في جامعة ليستر بلندن وتاريخ ٢٤ / ٢ / ٢٠١٧ م بشأن تسهيل مهمة الباحثة سارة بنت نبيل العرفج والتي تعد دراسة بحثية بعنوان " تعليم الأطفال مع تطبيقات تربوية محددة : دراسة حالة من آراء المعلمات المستخدمات للتكنولوجيا " .
عليه نأمل التكرم بتسهيل مهمة الباحثة اعلاه والفسح لها بزيارة روضتكم خلال الفترة ما بين ٢٣ / ٢ / ١٤٤٠ هـ إلى ٢٣ / ٧ / ١٤٤٠ هـ الموافق ١ / ١١ / ٢٠١٨ م إلى ٣٠ / ٣ / ٢٠١٩ م لاستكمال تطبيق مادتها البحثية .

والسلام عليكم ورحمة الله وبركاته

١٤١٣
حياة بنت عبدالعزيز الملحم

وزارة التربية والتعليم
الإدارة العامة للتربية والتعليم بمحافظة الأحساء

ال / الطيبلي

إدارة التخطيط والتطوير / ٥٩٩١٣١٧

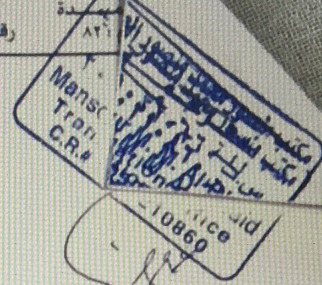
Mansour M.M. Al-Obaid Office

For Authorized Translation
Licence No.: 82

رقم اشتراك الغرفة التجارية ١٩٢٢١٥

منصور العبيد

مكتب



Kingdom of Saudi Arabia
Ministry of Education
General Directorate of Education
In Al Ahsa Governorate
Planning & Development Administration
Educational Researches Department

Date : 1/12/1439H (12th August 2018)

To Principal of the Kindergarten
From Assistant Director of Planning & Development Administration

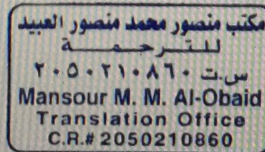
Dear Sir

Based on the letter of the Saudi Cultural Attach in London dated 20/2/2017 for facilitating the assignment of the researcher: SARA NABIL ALARFAJ who is preparing study titled "Children learning with Literacy-Specific Apps: A case study of technology-using teachers' perceptions and practice".

Therefore, we kindly request you to facilitate the assignment of above mentioned researcher and permitting her to visit your kindergarten during the period from 23/2/1440H to 23/7/1440H corresponding 1/11/2018 to 30/3/2019 for completing her research subject matter.

Best regards

Hayat Abdul Aziz Al Mulhim
(Official Seal & Signature)



هاتف : ٨٣٣٣٧٤٠ - ص.ب ١٠٧٨ - الدمام ٣١٤٣١ - المملكة العربية السعودية
Tel.: 833 3740 - P.O. Box 1078 - Dammam 31431 - Kingdom of Saudi Arabia

APPENDIX C – Teacher Consent Letter



School of Education
University of Leicester
21 University Road
Leicester
LE1 7RF
+44 116 252 3688

INFORMED CONSENT

Project Title: Early childhood students' use of educational apps: A case study of Saudi teachers' perceptions and practice.

Researcher: Sarah Alarfaj, Ph.D. student, University of Leicester, UK.

Invitation: You are invited to take part in an educational research. Before you decide whether or not to be involved, it is important for you to understand why this research is being done and what it would involve. Please take time to carefully read the following information before you decide whether or not you wish to take part in this project. You are welcome to discuss this project with others before making your decision.

Project Description: This study is part of a Doctor of Philosophy degree at the University of Leicester in the United Kingdom. I am a doctoral student and the supervisor of my thesis is Dr. Palitha Edirisingha. My study would consist of an analysis of early childhood teachers' perceptions of using a specific group of educational apps in the in-classroom activities in the context of early childhood school in the city of Alhsa in the Kingdom of Saudi Arabia.

My study is a qualitative case study, which aims to collect information related to your perceptive in combining technology, teaching practices and self-learning activities as part of my research. Your perceptions of development, enhancement, difficulties and challenges in your teaching that occur because of the use of educational apps to facilitate digital learning would be considered, as well as information regarding the

factors that influence your acceptance or rejection of using these educational apps in your classroom. Generally speaking, your perceptions are very significant to the focus and completion of this study.

Procedure: I would collect information by conducting individual interviews and classroom observations.

Anonymity and Confidentiality: Participation in this study is voluntary. You are not obliged to take part in this research, and you have the right to withdraw at any stage without any consequences. If you choose to be involved in this study, you should participate in a face-to-face interview for approximately 60 minutes in length, in accordance with the permission of early childhood school. With your permission, the interview would be audio-recorded for the sake of facilitating the collection of data. Shortly after completion of the interviews, I would send you a copy of the Arabic transcript of your interview. Therefore, you would have a chance to certify the accuracy of our interview conversation. In addition, you would be given full freedom to omit any uncomfortable questions, as well as clarify or delete any points from the transcript. Lastly, a reliable analysis translator would translate the data from English to Arabic. I would also conduct a classroom observation twice and the observation note would be available if you request.

According to research policy, your personal information and identity would remain absolutely confidential. I may quote some of the interview responses within the study, and, in order to uphold the principle of anonymity, codes would be used to refer to these responses. In other words, your identification would be kept private. Also, you can contact me if you have any concerns regarding the use of your information for research purposes. You can also contact me in order to request the destruction of your responses after the data gathering has been completed. I would undoubtedly comply with all of your requests up to the stage of aggregating the data for analysis. All data would be handled confidentiality, without the involvement of a third party.

Risks or Potential Reasons for Annoyance: No participant risks would be involved in my study.

Benefits to Participation: As my study relates to education, there are no rewards for participation; however, if you like, a resulting publication digest of your interview can be sent to you.

Persons to Contact in Case of Questions: Sarah Alarfaj (snma1@le.ac.uk) and Dr. Edirisingha Palitha (pe27@leicester.ac.uk).

Thank you, in advance, for your participation in this project.

Please check the boxes below as appropriate:

1. I completely agree to take part in this study after reading all the aforementioned information.
Yes ☐ No ☐
2. I completely agree to be interviewed and to have my interview audio-recorded.
Yes ☐ No ☐
3. I completely agree to the use of an anonymous quotation from my interview in this study.
Yes ☐ No ☐
4. I completely agree to have classroom observations.
Yes ☐ No ☐

Participant's Name: _____ Signature: _____ Date: _____

APPENDIX D – Parents’ Consent Letter



School of Education
University of Leicester
21 University Road
Leicester
LE1 7RF
+44 116 252 3688

INFORMED CONSENT

Project Title: Early childhood students’ use of educational apps: A case study of Saudi teachers’ perceptions and practice.

Researcher: Sarah Alarfaj, Ph.D. student, University of Leicester, UK.

Invitation: Your child is invited to take part in an educational research. Before you decide whether or not for your child to be involved, it is important for you to fully understand why this research is being done and what it would involve. Please take time to carefully read the following information before you decide whether or not you wish for your child to take part in this project. You are welcome to discuss this project with others before making your decision.

Project Description: This study is part of a Doctor of Philosophy degree at the University of Leicester in the United Kingdom. I am a doctoral student and the supervisor of my thesis is Dr. Palitha Edirisingha. My study would consist of an analysis of early childhood teachers’ perceptions of using a specific group of educational apps in the in-classroom activities in the context of early childhood school in the city of Alhsa in the Kingdom of Saudi Arabia.

The study is a qualitative case study, which aims to explore the classroom to collect information related to the ability of educational apps to support students’ learning resulting in providing an opportunity to engage early childhood students with digital self-learning activities. As part of my research, the digital learning process is needed so

students' use of EAs inside the classroom would be investigated. Your child engagement with digital learning activities is very important to complete this study.

Procedure: I would collect information by conducting classroom observations.

Anonymity and Confidentiality: Participation in this study is voluntary. Your child is not obliged to take part in this research, and can withdraw at any stage without any consequences. If you choose to let your child to be involved in this study, he/she would participate in a classroom observation twice and the observation note would be available if you request.

According to research policy, all personal information and identity would remain absolutely confidential. Codes would be used to refer to children's information. In other words, your child identification would be kept private. Also, you can contact me if you have any concerns regarding the use of your child information for research purposes. You can also contact me in order to request the destruction of your child's information after the data gathering has been completed. I would undoubtedly comply with all of your requests up to the stage of aggregating the data for analysis. All data would be handled confidentiality, without the involvement of a third party.

Risks or Potential Reasons for Annoyance: No participant risks would be involved in my study.

Benefits to Participation: As my study relates to education, there are no rewards for participation.

Persons to Contact in Case of Questions: Sarah Alarfaj (snma1@le.ac.uk) and Dr. Edirisingha Palitha (pe27@leicester.ac.uk).

Thank you, in advance, for you and for your child participation in this project.

Please check the boxes below as appropriate:

1. I have read all the given information and I fully understand the purpose of my child participation.

Yes ☐

No ☐

2. I completely agree for my child to participant in classroom observations.

Yes ☐

No ☐

Parent's Name: _____

Child's Name: _____

Signature: _____

Date: _____

APPENDIX E – Statistical information about the number of early childhood teachers who used EAs

A survey was conducted at the end of 2016 to measure the progress of the Aljwdah Project, which was in the initial stage of implementation in preschools in the Kingdom of Saudi Arabia. Few preschools were selected to take part in the experiment of the use of tablet computers by students during their SLAs.

Early childhood schools		The number of teachers
Five private pre-school	High Generation	4
	Tomorrow's Leaders	4
	The Light of the Walkers	3
	Fun Science	7
	Roses	1
Six public pre-schools (PPSs)	PPS 1	4
	PPS 2	4
	PPS 3 (had been selected to participant in this study)	17
	PPS 4	4
	PPS 5	1
	PPS 6	2

Sources: Al Tubaali, A. A., (meu4@hasaedu.info), 22 November 2017. *Statistical information about the number of early childhood teachers who used EAs*. e-mail to: Alarfaj, S, (snma1@leicetser.ac.uk).

APPENDIX F – Semi-structured Interview

Background information (Teaching experience)

Q1. Could you briefly talk about yourself and your teaching experiences?

Probes: How long have you been teaching?

Q2. Could you briefly talk about your teaching?

Probes: What teaching tools have you been used so far? Have you used technology in your teaching?

First point – The development of learning practice (perceptions)

The potential of EAs for learning (Technology experience)

Q3. Could you tell me about your current use of technology for students?

Probes: What technology devices do you use now? How long have you been using them?

Q4. Did you use any educational apps? why?

Q5. How would you define these EAs? (this question to clarify that the type of EAs teachers have used is matched with this study)

Probes: you may think about EAs as objects or activities, so if you were to describe these EAs in this way, what would they be?

Q6. What are your views of these EAs for students' use? Are your current views different from before? If so, how? Why/Why not??

Factors affecting the use of EAs (The started point for the development)

Q7. What factors do you think contributed on the existence of these EAs inside the classroom?

Probes: Do you think your own knowledge on; and opinions of the overlaps between EAs, learning practice (e.g. literacy and math) and teaching approach have any impacts on your use?

Q8. What challenges or difficulties do you face when using EAs? How do you overcome these challenges?

Following up –the digital self-learning activities (practice)

Preparation stage

Q9. How do you plan the digital self-learning activities using EAs?

Probes: How many students did you put in each activity? why?

Usage stage

Q10. How do you use these EAs?

Probes: In which learning lesson do you use EAs? Why? What EAs have you been used?

Q11. Can you tell me about the teaching process when EAs were used?

Probes: it may help to think about a simile, for example, it has been said that chocolate is rich, sweet and satisfying coming in different forms. What, then learning with EAs? Think about it as filling in the blank: learning within EAs is like _____.

Q12. In your opinion, what do you think the most important aspect of this approach to work well with students in the classroom?

Probes: Is their providing of feedback consider one of the aspect? Do you think this feedback is helpful for students' learning? How?

Q13. In your opinion, what are the disadvantages of this teaching approach? If any, how do you deal with them?

Q14. How would you describe the role of teacher?

Q15. What is your perceptions of this learning development?

Probes: Do you think these EAs are helpful for students' learning? Why (not)?

End part: The effect of EAs on students' interactions (perceptions)

EAs and students' learning (Technology-affected learning)

Q16. What is the obvious effects of using EAs on students and their learning and how these selected EAs support them?

Probes: Can you provide an explanation of the changes that occur on students when they interact with EAs? How do EAs affect students' motivation to learn? How do these apps affect students' behaviours?

Q17. What is your opinion of these effects of EAs on students and their learning?

APPENDIX G – Actual classroom practice (Classroom observation sheet)

Date:	Time:
School:	Class:
Teacher's name:	Number of children:

Observational categories	Details
Activity	
The objective of the activity (e.g. self-learning and improve learning skills)	
Arrange the activity (e.g. educational apps and number of students)	
The description of the activity (the focus and description of app feature, characteristic, learning content and students' engagements)	
Teaching strategies (approaching to learning activities, students' interaction, teachers' role: monitoring and intervening)	

APPENDIX H – University Ethics Committee Ethical Approval



University Ethics Sub-Committee for
Criminology and school of education

25/09/2018

Ethics Reference: 17640-snma1-ss: education, school of

TO:

Name of Researcher Applicant: Sara Alarfaj

Department: Education

Research Project Title: Children Learning with Literacy-Specific Apps: A case Study of
Technology-Using Teachers Perceptions and practice

Dear Sara Alarfaj,

RE: Ethics review of Research Study application

The University Ethics Sub-Committee for Criminology and School of Education has
reviewed and discussed the above application.

1. Ethical opinion

The Sub-Committee grants ethical approval to the above research project on the basis
described in the application form and supporting documentation, subject to the
conditions specified below.

2. Summary of ethics review discussion

The Committee noted the following issues:

All relevant ethical issues have been considered.

3. General conditions of the ethical approval

The ethics approval is subject to the following general conditions being met prior to the start of the project:

As the Principal Investigator, you are expected to deliver the research project in accordance with the University's policies and procedures, which includes the University's Research Code of Conduct and the University's Research Ethics Policy.

If relevant, management permission or approval (gate keeper role) must be obtained from host organisation prior to the start of the study at the site concerned.

4. Reporting requirements after ethical approval

You are expected to notify the Sub-Committee about:

- Significant amendments to the project
- Serious breaches of the protocol
- Annual progress reports
- Notifying the end of the study

5. Use of application information

Details from your ethics application will be stored on the University Ethics Online System. With your permission, the Sub-Committee may wish to use parts of the application in an anonymised format for training or sharing best practice. Please let me know if you do not want the application details to be used in this manner.

Best wishes for the success of this research project.

Yours sincerely,

Matthew Tonkin

Chair

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