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INFORMATION AND COMMUNICATION TECHNOLOGY IN KINDERGARTEN

A MASTER'S THESIS
SUBMITTED TO THE FACULTY
OF BETHEL UNIVERSITY

BY
RUCHI CHALAK

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INFORMATION AND COMMUNICATION TECHNOLOGY IN KINDERGARTEN

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APPROVED

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Abstract

Information and communication technology (ICT) is an integral part of the present world and is also making a huge impact in the field of education, including kindergarten. This literature review comprises a brief overview of different international studies from the years 2006-2017. In order to successfully meet the challenge of developing a knowledge based society, and equipping the student with the 21st century skills, there is a need to leverage the potential of ICT. This literature review analyses the way ICT can provide quality learning experiences and enhance learning outcomes for kindergarten students. The attitudes of the teachers can significantly impact the incorporation of ICT into curriculum practices as well as the quality of classroom teaching. The research also highlights the importance of appropriate training and professional development, for the teachers to efficiently synergize the elements of pedagogy and content knowledge along with technology to support student learning experiences. These findings suggests that appropriate integration of ICT with the curriculum, can be instrumental in narrowing the achievement gap, and enhancing the learning experiences of the kindergarten students.

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CHAPTER I: INTRODUCTION

This literature review aims to study the growing impact of Information and Communication Technology (ICT) in the Kindergarten classroom by exploring the representative studies of the past decade (2006-2017). It includes a literature analysis on the integration of ICT with curriculum and teaching practices in Kindergarten, teachers' roles and attitudes concerning ICT integration, areas of concerns regarding the implementation of ICT, ways ICT can support learning, the importance of choosing the right technology, student attitudes surrounding ICT, teacher training and professional development in ICT, interplay of Technology with Pedagogical Content Knowledge (TPACK), and technology in play in Kindergarten.

What is ICT and why is it important in Kindergarten?

Student education has evolved with the passage of time, and Information and Communication Technology (ICT) has revolutionized the education scenario with the potential to greatly benefit student learning and narrow the achievement gap. The objective of this study stems from the current education environment which is very dynamic due to the way technology is influencing teaching and learning in kindergarten. Children born today have access to technology from the time of birth. The question is not whether ICT should be incorporated into the kindergarten classroom, but rather in what ways can kindergarten educators and the administration be supported with the changes in the digital environment to benefit of the future generation (Kayode & Olaronke, 2014; Plowman et al., 2010).

ICT can be defined as “the computers and peripherals to encompass technologies that are better suited to the needs of young children” (Cheng, 2016, p. 1). In early childhood education (ECE), the term ICT can include computer hardware and software, digital cameras and video cameras, the Internet, telecommunication tools, programmable toys and many other devices and resources (Bolstad, 2004).

According to UNESCO (2011), the basic requirement for education in the 21st century is to prepare learners for participation in a knowledge-based economy. Technologies can improve the teaching/learning process by enhancing the quality of learning, transforming conventional delivery systems, sustaining lifelong learning and improving institutional management.

The onset of technology has revolutionized the present day, with digital information and communication technologies driving the modern societies to depend greatly on information and knowledge. Since technology is here to stay, it is important for educators to harness the potential that technology brings in order to maximize student learning (Billington, 2016; Oluwadare, 2015; Nives et al., 2016; Willman, 2017). Integrating technology into teaching is a powerful tool to enhance student learning and promote development in the domains of literacy, mathematics and science; it is known to have better outcomes when compared to traditional teaching methods (Athanasios & Georgia, 2014; Clark, 2013; Zaranis et al., 2013) .

In order to successfully meet the challenges of developing a knowledge-based society and a global market, the European Union has set eight core competences for lifelong learning, including Digital Competence. According to Nives et al. (2017), Digital

Competence refers to the safe and critical use of ICT in personal and social life and in communication. Its key elements include basic ICT skills and abilities, the use of computers to retrieve, assess, store, create, display and exchange information, and the development of collaborative network via the Internet.

Integration of ICT in Kindergarten

This literature review examines different international research studies which focus on factors affecting the integration of ICT in kindergarten. It is well understood that teaching is a complex practice that requires the interplay of many different domains of proficient skillsets. Effective teaching requires access to integrated knowledge of diverse student strengths, learning styles, content knowledge and increasingly, an understanding of technology. It is widely understood that teachers lack sufficient training and professional development to efficiently incorporate technology into their teaching practices (Blackwell, 2014; Kayode & Olaronke, 2014; McKenney & Voogt, 2017; White, 2010).

The views and attitudes of early childhood educators regarding the integration of ICT in kindergarten have been investigated (Athanasios & Georgia, 2014; Charalambidis, 2014; Cviko et al., 2015; Kaindio & Wagithunu, 2014; Nives et al., 2017), keeping in perspective the way their opinions towards ICT can impact the technical choices in practice as well as the quality of classroom teaching. This highlights the need for proper guidance about the opportunities that ICT creates to sustain and enhance student learning and play experiences. There is a clear understanding in the study that technology needs to be supported with proper adult guidance for effective student

learning experiences; if not, implementation could lead to issues like lower attention span and developmental delays (Espiritu, 2016). There is also a change required in the mindsets of teachers from expecting students to be compliant to providing them more flexibility to control their activities; teachers must encourage creativity and innovation in their students' learning (Lindahl & Folkesson, 2012).

This literature review investigates the importance of keeping up-to-date with the technological changes in the teaching/learning environment. With the current one-size-fits-all attitude of educators and little to no training on how to differentiate teaching using technology, it is challenging for educators to effectively integrate ICT into their teaching practices (Kayode & Olaronke, 2014). It is important for practitioners to have effective training in content, pedagogy and technology in order to be competent and make informed choices; this training, in turn, will enhance different aspects of early childhood education practices to equip the students with the 21st century skills they will need in the future (Charalambidis, 2014).

Mishra and Kohler (2006) expanded the PCK framework (Pedagogical Content Knowledge) created by Shulman (1984) by integrating the element of technology in it creating the Technological Pedagogical and Content Knowledge namely the TPACK framework. The TPACK framework has been explored in this study in great detail. According to Mishra and Kohler (2009), successful technology integration requires educators to develop new ways of comprehending and accommodating the complexity that arises from integrating teaching with technology. The TPACK framework describes the complex interaction among three bodies of knowledge: content, pedagogy, and

technology. The interaction of these bodies of knowledge, both theoretically and in practice, produces the types of flexible knowledge needed to successfully integrate technology use into teaching which can be helpful for educators in kindergarten (Mishra & Kohler, 2009). Research by various authors towards the implementation of TPACK (Baran et al., 2011; Cheng, 2016; Voogt & McKenney, 2017) has been examined.

The aim of the literature review is to understand whether and how ICT supports student development and learning experiences? What would be the factors which would affect the implementation of ICT in kindergarten? In addition, how can educators be supported through professional development to successfully integrate ICT with pedagogy and content knowledge to plan quality learning experiences? What kind of support can ICT provide to enhance learning experiences for students from diversity? In what way can ICT provide quality learning experiences for students and support development through play?

This literature review aims to explore different kinds of research investigating the above queries in order to provide insight to support and guide kindergarten educators in their teaching and learning practices in regards to ICT.

CHAPTER II: LITERATURE REVIEW

Literature Search Procedures

To locate the literature for this thesis, the following key words were searched: Kindergarten, Information and Communication Technology (ICT), ICT content early childhood literacy, professional development content literacy, and math literacy. The chapter evaluates literature regarding Information and Communication Technology, in kindergarten classrooms in three sections: ICT in kindergarten, Factors impacting ICT integration, and; Framework for effective ICT integration in kindergarten – Technological Pedagogical Content Knowledge (TPACK).

ICT in Kindergarten

Information and Communication Technology (ICT) has revolutionized the way the world works, and its impact is equally felt in the field of education, including the kindergarten classroom. ICT is increasingly being viewed as an integral part of future classrooms, specifically to help equip students with 21st century skills (Charalambidis, 2014). It is a tool that goes beyond the incorporation of computer hardware, software, digital cameras, video cameras and telecommunication into classrooms (Kainido & Wagithunu, 2014); this tool pushes to integrate technology with the education policy, pedagogy and curriculum.

Role and attitude of Teachers' in ICT integration

Nives, Gordana and Damir (2017) analyzed the approach and mindset of kindergarten teachers in early ICT integrated kindergartens. They surveyed 46 female educators at an Early Childhood Education Institution in the Croatia's capital city, which

had 486 children enrolled. The results showed that only a small number of educators were negative (2.17% were very against, 2.17% reported a generally against) on the usage of ICT by children; 15.22% of educators were neutral; 26.09% were generally positive; and 54.17% were very positive on this issue. The positive attitudes of the educators correlated with familiarizing children with ICT. The authors examined the views of the educators, highlighting the result that the educators' opinions affected their classroom teaching and their ICT usage; more specifically, their opinions depended on their present values, technical skills, and pedagogical knowledge. The authors pointed out that since the educators started using ICT as adults, many held some amount of reluctance to use technology in early childhood education. Therefore, they suggested adding ICT training as part of the professional development of educators in order to demonstrate its effectiveness.

A similar study was conducted by Athanasios and Georgia (2014), which focused upon national and international publications and research of the last decade (2003-2013), to review if and how ICT can support specific learning areas in the kindergarten classroom. The authors examined the competence of ICT in special education and gifted children in standard kindergarten. They also reviewed the attitudes of kindergarten teachers towards ICT. The authors noted the increasing emphasis of educating kindergarten children with the support of ICT. The literature review focused on the relationship of ICT and the important areas in kindergarten classes, namely literature (language, communication, vocabulary); early mathematics (numbers, arithmetic problem solving, spatial syllogism, and general geometric knowledge); cognitive skills,

socio-emotional skills, creativity, and subjects of special education and gifted children.

The authors noted the significant role of teachers in the incorporation of ICT with traditional teaching methods and considered it as crucial in special education and gifted children, however, they noted the need for further research in the domain. The researchers concluded that incorporating ICT in combination with traditional methods can greatly benefit kindergartners in education and can contribute positively in many areas of child development and at the same time, teacher's role in such situations where ICT is used in combination with traditional methods is equally important and needs to be clearly specified.

Teachers' involvement in curriculum design can make a huge impact on curriculum implementation. This in turn can impact pupil learning outcomes (Cviko, McKenney & Voogt, 2015). This varying degree of involvement could also have a differential impact on teachers' perceptions concerning the viability of curriculum activities, co-ownership and curriculum implementation. Cviko et al. (2015) based their research on how the various teachers' roles – executor only, re-designer, and co-designer- in curriculum design could impact the ICT –rich environment. In the in the executor-only role, the teachers solely work towards effective implementation of the activities, in the re-designer role, teachers collaborate to adapt activities and materials for the existing curriculum before implementation, the co-designer role requires that teachers collaborate in crafting learning activities and resources for their curriculums followed by implementation.

The study (Cviko et al., 2015) based in Dutch kindergarten, studied teachers' various roles and levels of involvement in curriculum design and implementation of PictoPal activities, an ICT- rich on- and-off activity for early literacy. The research was conducted using individual case studies and a cross analysis to compare the executor only, re-designer, and co-designer roles based on a common set of measures in order to understand the impact on student progress. The findings from the study suggested that student progress was not directly related to the degree of integration, however contribution of teachers in design process led to greater degree of teacher involvement. The co-designer role of teachers generated high degree of incorporation and readiness to implement PictoPal activities, highlighting the fact that it was the best suited to implement ICT-rich learning programs effectively in the early literacy classroom.

The present society is increasingly being called Information Society, due to the way it has rapidly transformed in terms of economic, political and cultural society due to the onset of ICT. It is important to study the impact and readiness of developing nations to keep abreast with these technological changes in the education system. Incorporation of ICT in core curriculum helps meet the individual learning needs of the children in attractive and fun way while promoting independence and access to a wide range of information (Kaindio & Wagithunu, 2014).

Kaindio and Wagithunu (2014), studied the readiness and mindset of early childhood teachers in preschools in Kenya, Africa towards incorporating ICT as a part of the curriculum in order to enhance learning. The descriptive design questionnaire was provided to 52 participating teachers who were from both public and private schools.

The data analysis indicated that 56% of the teachers were not formally trained in ICT, 42% of teachers were certified in ICT training and remaining 2% were diploma holders in ICT training and worked for private schools. There were no computers in the majority of the schools and the few that had them used them exclusively for examination and marking purposes. The authors also found that 75% of the early childhood schools did not have electricity and 71% of the participant teachers did not promote the use of technology for teaching and learning in preschools. Furthermore, 56% were against the idea that ICT increased students' interest in learning. Based on the above results, the authors concluded that Kenya was unprepared to incorporate ICT in schools due to numerous factors like lack of basic facilities like electricity, poverty, lack of trained professionals, and teachers' negative attitude towards incorporation of technology.

Based on his experience in the Greek schooling system, Charalambidis (2014) noted that the educational system in Greece, focuses on pushing students to attain higher grades on exams, in order, to enroll in more competitive higher educational institutions. He found that this academic culture deprives students and teachers of engaging in innovation, oftentimes resulting in highly educated but under- skilled professionals. In contrast, innovative schools step further than standard methodology and measures of success and work towards equipping students with essential academic as well as 21st century skills. Charalambidis (2014) based his literature research on how the world would change twenty years from now for a student enrolling in kindergarten. His research focused on the following four questions: What would the world be like twenty years from the present day when a child completes schooling? What skills would

this child need in order to be successful in a world twenty years from now? What skills would schools entail from their staff to attain innovative goals? What would teaching and learning be like if it were designed and implemented around the answers to the first three questions? Charalambidis (2014) highlighted that students need digital proficiencies like digital literacy, inventive thinking, global awareness, creativity and risk taking, teamwork, and learning to learn, to succeed in a digital world. According to Charalambidis (2014), knowledge is going beyond the 'stuff' that is developed and stored in the minds of experts, oftentimes represented in books and classified into disciplines; rather, knowledge should be defined as a form of energy or a system of networks that flow and are, valued- not for what it is but what it can do. This research underlines the need for the education system to be pragmatic and create learning opportunities to equip students for future scenarios wherein technology will play a big role.

Areas of Concern

There is a growing awareness and understanding among educators that ICT can provide opportunities to engage students, enhance learning, and prepare students for the necessary 21st century skills. But there is also another school of thought which believes that technology could provide distractions and hamper student learning leading to issues like lack of social skills, lower attention span, and developmental delays (Espiritu, 2016).

Students' attention span plays an important role in their development and learning. Espiritu (2016) examined the impact of mobile media, specifically active iPad

use, in comparison to TV and passive iPad use on early childhood cognitive development. Visual spatial attention span is defined as maintenance of attention over time in regards to specific stimuli in a visual environment (Espiritu, 2016). Attention helps children manage selection and gather data needed to learn about the world around them, an essential task as children tend to have underdeveloped linguistic and motor abilities during early childhood. Espiritu (2016) proposed a study which focused on the extent of media use, content of early childhood iPad use and their impact on the growth of visual spatial attention span. The research comprised 160 participants, three to six years old, half male and half female, living households with two parents and were exposed to media usage at ages of three or younger. The study included an assessment tool to measure visual spatial attention span, along with child's age, to record the average amount of media use, pervasiveness and context and content of media usage. The assessment used a rapid serial visual presentation (RSVP) subtest method to analyze the data collected.

Espiritu (2016) predicted that when compared to TV, early interactions with iPad would result in a shorter visual attention span. She suggested doing away with the use of mobile media to manage child behaviour, allotting fixed time, and reducing weekly limits to using mobile media, as ways to counter the negative impact of iPads on visual attention span in early childhood.

However, the view that mobile media and technology are detrimental to children is increasingly being replaced with the understanding that effective integration of ICT in early childhood is essential. Having a strong perspective of the purpose,

practice and the social setting of technology in the classroom could transform learning for young students.

Lindahl and Folkesson (2012) studied the extensive debate regarding the introduction of ICT into preschool practice in Sweden. The integration of ICT into curriculum is leading to different interpretations and standards. This can lead to resistance among educators as their ideas might conflict with the norms prescribed by the curricula. With proper guidance from educators, the incorporation of computers into curricula could create added opportunities for learning among students, however active participation is required by the teachers to ensure the effectiveness of the change. There is a change required in the mind set of teachers from expecting compliance from the students to being flexible towards the students regarding control of activities, thus creating innovative possibilities for learning and progress. Lindahl and Folkesson (2012) studied the resistance towards changes in the pedagogical practices to have a better understanding of the difficulties in introducing new pedagogical tools into present practices. Lindahl and Folkesson (2012) used quantitative data to understand what standards educators connect to when planning for computer usage in preschool practice. The research also focused on how rules established in preschool practice prevents or sustains change in the curriculum. The participants of the study were 31 preschool teachers in Sweden who had attended courses covering Swedish preschool curriculum with data collected from 62 preschools from children between the ages of two to six years. Naturalistic data was collected and analyzed for experiences of using a digital learning program during practicum time which was recorded as texts. The results

of the data, unveiled two opposing arguments: one supporting the new technology, and the other rejecting technology. The research discovered the need for the educators to manage their expectations regarding degree of control over student activities; it also recognized the importance to provide a balance between students' independence and their need for guidance.

Using ICT to support learning

Furthermore, children's reading achievement scores in the United States have been falling below proficient levels, which calls for educators to not only focus on the core curriculum, but also use differentiated strategies for students not meeting literacy levels. Willman (2017) investigated the incorporation of instructional technology programs for teachers to further students' skill levels. Willman's (2017) qualitative research was based on instrumental case study design. This study was aimed to understand how technology was being used in the classroom by teachers, the way technology tools impact student performance and engagement, and how educators and administrators could incorporate technology based instruction in the classroom. Participants for this study included eight teachers and four administrators with more than three years of experience. All participants worked, in a south eastern U.S. school implementing technology programs. Willman (2017) collected textual data by interviewing the participants and collected field notes through observation.

The findings pointed to the fact that all participating teachers used technology on a daily basis in their classrooms, but the purpose and type of the programs conducted varied. Willman (2017) noted that technology was commonly used as a tool to

differentiate teaching as well as, for assessment purposes in small group interactions and that the teachers' grade level teaching experiences affected their integration of technology in the reading curriculum. Based on the results from this study, the teachers pointed to challenges with limited technical support, insufficient time or technological resources, but largely they agreed on the positive impact that technology has on reading instruction, learning outcomes and student engagement and the potential implementation of technology based differentiation strategies have to improve reading instruction at the early childhood levels.

Billington (2016) emphasized extending the term literacy to communication, language and literacy (CLL). He emphasized on the crucial role of communication and language for the development of literacy. The author noted that touchscreens were intuitive in nature making them user friendly, and were increasingly being used in the homes even with the youngest of children. Billington (2016) in collaboration with National Literacy Trust, UK, researched how digital technologies, in particular touch screens, could be an efficient teaching tool for the educators. He highlighted the need for the teachers to improve their teaching by better assimilation of technology in the learning environment, to help them broaden young children's knowledge in the areas of communication, language and literacy.

Billington (2016) intended to understand how digital technology could be applied to effectively build better partnerships with parents in order to support their child's communication and language development as well as to engage them to actively participate in the child's learning journey. Billington (2016) noticed concurrent themes

emerging – the need for educators to be efficiently trained in the field of technology so that they carry the confidence to integrate it in the classroom, and the need for establishment to provide educators with the flexibility to use their technological skills in a diverse ways – like a toy or a tool. Billington (2016) also noted that technology couldn't be a substitute for adult intervention, once activities or apps were decided on, student's required adequate support for exploration to maximize learning.

To meet some of the gaps that the study, the researchers developed an app guide – literacyapps.org. This app guide, built in partnership with BookTrust, Open University and support of Natalia Kucirkova (Manchester Metropolitan University), provides quality options to families and practitioners, in terms of apps and activities as learning strategies, to foster communication language and literacy in young students.

Zaranis, Kalogiannakis, and Papadakis (2013) did preliminary research based on the integration of mobile devices for teaching of mathematical concepts in kindergarten classrooms. Learning platforms provided interactive activities that could be utilized as a powerful tool to enhance mathematical learning and promote development in the domains of mathematics and science.

The applications, developed by the authors, aimed at teaching fundamental mathematical concepts to children aged 4 to 6 years in Greek kindergarten schools, were grounded on three levels of Realistic Mathematics Education (RME). The first level consisted of context-bound counting with numbers up to ten, and introduction of basic addition and subtraction. The second level involved 1:1 correspondence counting, focusing on quantitative aspect, which arouse in simple mathematical problems. In the

third level, which consisted of pure counting and calculating, real numbers instead of objects were incorporated with use of missing variable.

Zaranis et al. (2013) created the mobile applications according to the behaviorist perspective or the constructivist teaching methods. The behaviorist method incorporated providing quick and immediate response of the outcome to the questions, while constructivist method of mobile applications provided open ended learning experience for the students. Being visual and audible in nature, the responses provided were easily understood by the students. Based on the preliminary study, the authors recommended the software to be user friendly for easy navigation by the students, minus any need of reading or writing knowledge, to make it suitable for the preschool age group, and have a combination of animation and sound to provide instructions to students. The authors concluded that educational software using tablets have resulted in better learning outcomes than compared to the traditional methods like Greek Cross Thematic Curriculum based framework. However, as the sample size of this study was small, the authors aimed to expand their future research using a larger sample size that is properly weighed for kindergarten students located around Greece.

Using ICT to support children development in Plowman, Stephen, and McPake (2010) conducted two empirical investigations, to compare the ways in which children's interaction, aged 3 and 4 years, with technology was supported in the different home and preschool environments, in Scotland. According to the authors, technology supports three areas of learning – expanding the awareness of the world around us, attaining operational competence and developing an attitude to learn and in addition, an

important aspect was understanding correlation between the role of technology and the cultural values of their home country.

Plowman et al (2010) used the sociocultural framework and guided interaction to focus on the discussion as a part of their study. In the first part of the study, practitioners implemented two interventions which incorporated learning with technology in eight preschools, which included video examination, interviews with practitioners and procedure of guided inquiry. In the second part, 346 parents were surveyed and five visits to the homes were conducted in a time frame of fifteen months to the first twenty-four selected families.

The authors acknowledged the limitations which preschools have in terms of technology availability, as well as lack of staff experience in using technology, and noted that children might have awareness of diverse operational competencies of technology due to their exposure in their home. Plowman et al. (2010) highlighted the need for schools to value and build upon the existing prior knowledge and experiences which the children carry, from the home and preschools. This would enable the schools to extend the learning in the technological competencies and support preschoolers appropriately for the increasingly technologized education that future learning requires.

Oluwadare (2015) examined the efficacy of incorporating ICT for instructing students over students being taught without ICT. The study was conducted using the main concepts in natural sciences and mathematics in 16 classes in preschools in Ekiti state – Nigeria. 260 randomly selected students aged four to six years, were tested using the Early Mathematics and Science Achievement Test (EMSAT) based on solubility,

recycling, and semi structured interviews. This task oriented test, developed for Kindergarten, measures the level of early mathematical competence and consisted of forty items, split into eight parts with tasks designed in groups of five. The experimental and control groups were from the classes from the same participating schools. The author used the paired t-test, using grades for comparison purposes between the pre and post-tests of both the control and experimental groups of the scores and conducted an independent sample t- test to study the difference of scores in the experimental and control groups.

The author noted that during the course of the entire study, the experimental group showed greater achievement than the control group; however, both the groups showed great progress from the starting point to the final results. The results confirmed the positive effect ICT had on student learning based on the interactive nature of the learning and teaching. ICT provided an interactive medium for the students to learn and investigate concepts of science; it also engaged the students in more ways than what the traditional teaching methods did. Oluwadare highlighted that appropriate use of ICT is essential for early childhood education and teachers need to be trained for effective incorporation of ICT with curriculum.

DST storytelling (DST) is the process of developing a multimodal narrative, it comprises of pictures, sound effects, video, music or text, and digital tools. (Nives, Gordona, & Damir, 2016). Unlike many developed countries where ICT is closely integrated into curriculum, many developing countries are still grappling to integrate ICT in schools, preschools included. Nives et al., (2016) focused their research on one of the

developing countries in Eastern Europe, Croatia, to understand the importance of introducing ICT through using digital storytelling in preschool education. In their literature review, the authors noted that based on publications, the impact of ICT implementation in preschool education has been positive. They used statistical analysis to conduct a study using students aged six to seven years from Milan Sachs kindergarten in Croatia to study the impact of Digital story telling (DST) on children's progress in mathematics and computer literacy skills.. The purpose also extended to evaluate student motivation, collaboration and engagement with those of children in DST and storytelling activities , that used only raw materials. The researchers studied the differences in learning in mathematics between a control group, which used traditional storytelling (N= 29) and the experimental group (N= 26), which used digital storytelling techniques. The T-test results showed that the experimental group showed statistically noteworthy progress in their computer literacy skills, as well as their mathematical literacy skills in comparison to students following the traditional method of learning. The research and findings of the studies above suggested the benefits of technology and pointed to the need of training teachers in integrating technology with learning, to make learning experiences constructive, as well as provide additional opportunities for growth and development of kindergarten students.

Similar results were also recorded by Clark (2013), the author noted that minority population in United States is growing continuously, and schools are being growing increasingly multicultural with people of different language, ethnicity, cultures and socio economic backgrounds coming together. The literacies are constantly evolving

and education is strongly influenced by communication styles of social groups for community interactions. Clark (2013), conducted an action research project using the Theory of New literacy studies to investigate whether the use of iPad application (Vocabulary Builder) is a suitable instrument to strengthen the vocabulary skills of English language learners (ELLs) versus the traditional tool using teacher made worksheets. A literature review was conducted in addition to an action research project. This research was conducted on five English Language Learners (ELLs), three male and two female students aged six to seven years and were indiscriminately assigned the control and experimental groups respectively. There were 12 sessions in all, conducted for 30 minute daily. The initial two sessions were for collecting pre assessment data and the last one session was for collection of post assessment data. In addition, student and teacher interviews were conducted. The research focused on using technology to help vocabulary instruction, in order to lower the gap between in and out of school literacies. It also studied the impact of technology on student engagement and motivation with regards to ELLs. In the end Clark (2013) explored the concept of learner autonomy, and how technology supports student centered learning environment to promote this concept. The findings highlighted the benefit of using a combination of technology with explicit instruction to increase language skills, enhance vocabulary knowledge among students while enhancing social, language and cognitive abilities in the ELL and pointed out to the need of training teachers in integrating technology with learning, to make learning experiences constructive, as well as provide additional opportunities for growth and development of kindergarten students.

Choosing the right technology

Blackwell (2014) based his study on the increasing practice of using tablet computers across the United States. The author used Orlikowski's Duality of Technology Framework, which focuses on the three branches Orlikowski's model— institutional structure, agent and technology – to examine the interactions among schools, educators and technology in early childhood classrooms with iPads.

Blackwell (2014) used a qualitative research design approach in four classrooms— three kindergarten and one preschool. The research conducted for a total of 53 hours was administered as 20-30 minute semi-structured teacher interviews with the nine educators, four of whom joined the classroom observations. The interview questions addressed how the strands of Orlikowski's model aided or restricted teachers and their practices with technology.

Blackwell (2014) noted that on a larger scale, transforming the American education system to make it student-centric would be an arduous and slow process. On a smaller scale, the author suggested the need for increased teacher training and support, in order to effectively incorporate tablets into preschool curriculum, and to change the teacher mind-set to more student-centric philosophy. This shift in the teacher mindset would help them leverage on the potential of the tablet computer. Blackwell (2014) also advocated for having specific examples of best practices to help teachers grasp the unique features of iPad and effectively integrate them into classroom environment.

White (2015) noted that there was limited evidence of early childhood teachers using developmentally appropriate practices (DAP), to implement computer application in their teaching practices in the classrooms. These technological implementations by the teachers in the classroom were based on their own technical skills and prior experiences with technology. Their level of information, combined with the limited infrastructure and resources available in the schools, led to an uneven implementation of DAP across early childhood classrooms.

White (2015) identified early childhood teachers' views about developmentally appropriate computer applications in the early childhood classes. The author also aimed to understand the opinion of the educators towards implementing strategies for greater integration of developmentally appropriate computer applications in the curriculum. The qualitative study was based on Joseph and Reigeluth's conceptual framework of systemic change processes. This framework is instrumental in providing teachers with a foundation to achieve sustainable changes (White, 2017).

The research gathered data about potential strategies teachers used to effectively implement the changes towards incorporation of technology with DAP using semi structured interviews. Participants were identified from a large urban school district in United States and, included 10 teachers, seven were early childhood special education teachers and the rest three being early childhood teachers. The findings from the research pointed to the need for incorporation of more developmentally appropriate computer technology in the classroom as well the need for teacher to be appropriately trained in DAP for effective integration of technology in the classroom.

White (2015), also highlighted the need for schools to invest in more technological resources as well as increased stakeholder involvement in school to enhance instruction and student learning to improve the efficacy and support individual students' needs.

Student Attitudes and ICT

Humans are stimulated through the five senses, sight, hearing, smell, taste and touch. However, technology does not use senses like touch and smell, but it uses other communicative features like sound and visuals. Human interaction via technology implies interactions between the user and the technology. The most commonly used term to define the use of interactive technology for education is one-to-one technology-enhanced learning (Hendriks, 2016).

Hendriks (2016) explored the attitudes of 24 students, age six to eight years old, towards ICT integration in a Dutch elementary school over a period of three weeks. Interviews were conducted with the principal and four teachers of the school, to understand how the school management and the teachers perceive the application of interactive technology in the classrooms. The research compared the learning outcomes of both traditional and digital learning methods. Hendriks (2016) found that students held a more favorable attitude towards using digital learning methods, while the students taught by traditional learning methods performed significantly better than an interactive tablet based learning method; however, further research was required to understand the preference of one method over another. The researcher discovered that the integration of technology was not affected by the mindsets of either students or teachers. The teacher interviews highlighted the positive approach teachers had

towards technology but were of the opinion that teachers would still carry a central role towards education and technology could not substitute for the important role of the teachers' like monitoring students' socioemotional development or behavioral disorders.

Teacher training and professional development in ICT

According to research by Kayode and Olaronke (2014), children born in the present era of technology are exposed to ICT materials right from their time of birth. They experience a broad range of digital tools and begin to manipulate ICT materials from a very young age. ICT- learning experiences are required to aid the holistic development of children and in order to achieve that, early childhood educators need to be optimistic about the role of ICT in children's progress (Kayode and Olaronke, 2014).

Kayode and Olaronke (2014) conducted research in Nigeria to study the viewpoints of students and early childhood educators about the importance of teacher development for the changing educational needs. There were 310 participants to the research, comprised of 300 students and 10 lecturers selected from the Department of Early Childhood Care and Education in Adeyemi College of Education, Ondo, Ondo state, Nigeria. The study adopted a descriptive survey design method which comprised of one validated questionnaire. The survey used (0.83) questionnaire on Information and Communication Technology. The questionnaire had sections based on the demographic information of the respondents, cognitive experiences, and physical experiences, socio-emotional interactions that could be created for the children by teachers, using ICT and how teachers could use ICT activities to motivate students and engage them in their

learning. The information was examined by percentage, mean and standard deviation.

The study was also replicated in Ekiti State College of Education, Nigeria.

Based on the results, Kayode and Olaronke (2014) concluded that the perception of early childhood lecturers and students towards training teachers using ICT was positive as they felt that ICT could help them foster children's cognitive, physical and socio-emotional development. Kayode and Olaronke (2014) recommended adequate training for lecturers in the use of ICT as well as equipping the departments of early childhood education in Nigerian Colleges of Education and Universities with appropriate ICT resources.

Technological Pedagogical Content Knowledge (TPACK)

The studies above highlight the need for educators to have the required understanding of integrating ICT effectively with students learning in terms of content knowledge and pedagogy to enhance student learning. Charalambidis (2014) raised a question regarding how the world would change twenty years from now for a student joining kindergarten this year. The research underlined the need for the education system to be pragmatic and create learning opportunities to equip the students for the future scenarios wherein technology would play a big role. Integrating technology with instruction is complex and teachers find it difficult to fit technology into their teaching, often compromising on the effectiveness of the learning experience (Voogt & McKenney, 2017).

Technology can be a powerful tool to enhance achievement in the field of early literacy, as long as the teachers are well equipped with the skills required to tap into the

potential that technology brings. McKenney and Voogt (2017) studied the essential attributes the Dutch speaking, junior and senior kindergarten teachers required to implement technology effectively in their teaching. The authors used the Delphi technique, which is widely used in the field of health care research that originated at the Rand Corporation decades ago. The technique is designed in a structured way where the coordinators provide precise, anonymous inputs, in consecutive rounds of communication, for expert feedback. The McKenney and Voogt (2017) aimed to utilize the resulting information in by teacher education programs to improve their efficacy in the field of early childhood, with a specific focus on literacy.

The sample size consisted of 24 respondents (n =24), a combination of Dutch and Belgian specialists from the domains of technology, language instruction and early literacy. The study consisted of three rounds with questions focused on their formal work title, ranking of their level of proficiency in the fields of technology, early literacy and pedagogical knowledge (TPACK) as well as their understanding in context to the TPACK domain (the interplay of technology with language learning), in early literacy. The first round consisted of an open ended questionnaire exploring the views of the respondents on the knowledge and skills, preservice teachers needed to tap on technology effectively for early literacy. In the second round, the participants were asked to rank the views presented and the viewpoint from a literature review sequentially in terms of importance for the preservice teacher curriculum. In the third round participants were asked to identify the importance of each skill they included with the reason of the specific ranking they indicated.

Based on the findings, McKenney and Voogt (2017) concluded that the preservice teachers would benefit from further development of pedagogical content knowledge (PCK) combined with opportunities to develop technological pedagogical content knowledge (TPCK) in language teaching. This ability of the preservice teachers to identify applications that correspond to the learning objectives with pedagogical knowledge would enable them to meet the Dutch National interim targets set, for the diverse needs of young learners in early literacy.

In developed nations like Sweden, the focus has moved from whether or not ICT can positively influence the learning of children, to how best to incorporate ICT in preschool education to maximize the benefits to learning. Masoumi (2015) studied ICT integration in Swedish preschools to address the topic of development in practical terms of professional practice rather than just theoretical thinking. The study was conducted in three preschools in Sweden which were very different from each other in terms of their size, learner profile and pedagogical orientation. All three preschools concentrated on the ICT integration in their practices, which was typical of preschools in Sweden. Six teachers, two from each school, participated in the study. Semi structured interviews were conducted to understand teachers' personal views regarding implementation of ICT.

Many researchers generate, illustrate, and classify data based on the meanings of data collected using the Marshall and Rossman data analysis strategies. This data is without any standard template and includes field notes, transcribed interviews and supplementary photographs. Masoumi's (2015) analysis focused on the three key

aspects: preschool teachers' actions; crucial interventions in using technology; and/or technology- enhancing pedagogical practices. The data was further examined and analyzed to have a better understanding of how ICT is incorporated in preschool curriculum and consequently categorized to focus on emerging thematic concerns. Masoumi (2015) explored the types of ICT integration in the different preschools and concluded that overall the teachers were positive towards employing ICT in their classroom in multiple ways as a tool for documentation and enrichment of the existing practices, but did not apply it as an integral part of the curriculum to a large extent due to their existing approach, technical expertise and pedagogical knowledge.

Mishra and Kohler (2006), in their 5 years of study, focused on the professional training and development of teachers, and development of faculty for higher education. The research, based on design experiment, focused on the essential attributes that teachers require to integrate technology in teaching and on the complex combination of the essential elements of the learning environment – content, pedagogy, and technology. Technology is increasingly becoming a crucial aspect of teaching and learning, however, Mishra and Kohler (2006) noted that the element of technology was considered independent from the elements of pedagogy and content knowledge. Mishra and Kohler (2006) studied the interplay of the elements of pedagogy, content and knowledge (PCK) in terms of their relationships, between content knowledge (CK), pedagogical knowledge (PK), pedagogical content knowledge (PCK), technological knowledge (TK), technological content knowledge (TCK), technological pedagogical knowledge (TPK), and technological pedagogical knowledge (TCPK).

According to Mishra and Kohler (2006), instead of considering the elements of pedagogy, content knowledge and technology as independent elements, there was a need to combine technology with PCK to create effective learning strategies. The authors conducted three research studies – case studies of design teams, analyzing design based activities, and developing and administering a survey, to understand the impact of combining TPCK, on student and faculty participants. Based on the positive findings, Mishra and Kohler (2006) advocated the need for educators to design strategies to thoughtfully blend pedagogy content knowledge with technology to maximize student learning. They created a framework which expanded on Shulman's (1986) formulation of 'pedagogical content knowledge' (PCK) and combined technology with PCK thus developing TPCK in teachers, which they emphasized was essential for successful teaching and learning. The research highlighted the requirement for thoughtful pedagogical uses of technology by incorporating it at three levels: theoretical, pedagogical and methodological.

Digital technology has transformed the world and has become an intricate part of the learning and teaching. The TPACK framework aims to integrate teachers' content, pedagogical and technological knowledge to maximize student learning and development (Mishra & Kohler, 2006). Baran, Chuang, and Thomson (2011) conducted a study evaluating the technological integration and strength of the TPACK framework in research. Using the TPACK framework, the teachers were able to adapt technology in the learning environment creatively and effectively towards enhance learning outcomes.

In a study conducted by Baran et al. (2011) in Taiwan, the relationship between the degrees of childhood teachers' TPACK was examined. A total of 355 early childhood teachers from Taiwan participated in the study, which was qualitative in nature. Five survey respondents were followed up for interviews. Major themes that emerged pointed to the need for technology modeling during the teacher education including transfer of modeling experiences as well as learning to select suitable technological aids for current practices.

Baran et al. (2011) also examined the introductory technology program taken by all preservice teachers in Iowa State University which is based on the TPACK framework. The course was taught in preservice teacher education program for over 25 years and had evolved from teaching teachers to use computer and computer aided technology to that of training preservice teachers in designing and implementation of content based lessons using technological tools. In another study in the United States by Baran et al. (2011), K-12 school districts were designing and structuring their technology integration programs, by building on the TPACK framework. Baran et al. (2011) concluded that TPACK framework is being adapted with enthusiasm in the United States, both among researchers as well as practitioners. It has been perceived as a useful tool equally for designing of teacher education practices as well as for evaluating teacher knowledge in the field of technological integration. In addition, the TPACK framework was also viewed to be generating interest in various international teacher education settings for designing and assessing teacher knowledge indicating a wider impact in the world as an evolving tool for teacher educators.

Cheng (2016) aimed to understand the views of preschool teachers in Hong Kong towards ICT, the ways they implement ICT in their teaching application and they're of technological, pedagogical and content knowledge (TPACK) levels. In addition, the study also aimed to understand the challenges that influence their decision making in relation to ICT usage in the curriculum.

Cheng's research utilized qualitative case studies designs and was conducted in two preschools in Hong Kong respectively. The study comprised of focus group interviews, non-participant observation, semi-structured interviews. The interviews were based observation of 15 preschool teachers. The semi structured interviews were conducted with four teachers in the two schools. TPACK framework was instrumental to understand the teachers' level of TPACK and their ICT implementation in the classrooms. The results indicated the willingness of the teachers to incorporate ICT into their curriculum, the effectiveness of the assimilation of ICT in the class environment depended on the teachers' level of TPACK. The teachers commonly used the technology of internet, YouTube and PowerPoint, however they also faced many barriers and challenges for smooth integration of ICT into the curriculum which could be reduced by strategies like having cooperative curriculum design and school networking establishment. Cheng (2016) suggested the education programs should consider adding the TPACK model to professional training courses and recommended the need for future research as the study adopted only a small sample size and in addition, recommended collecting principals' views on the administrators' role on implementation and incorporation of ICT in teaching and learning.

Equipping educators with the skillset to blend the elements of content knowledge, pedagogy, and technology (TPACK) would be essential for effective teaching and learning. Voogt and McKenney (2017) examined if and how five teachers' educational institutes (TEI) in the Netherlands were preparing the future teachers to extend their technological pedagogical content knowledge required for efficiently utilizing technology in early literacy, using the focus group interview method. A total of 12 teacher educators participated in the study, with two to three teacher educators from each TEI from differing areas of proficiency - realm of early literacy in the area of technology in curriculum; overview of the curriculum as a whole. The findings highlight that TEIs are currently not developing teachers to combine technology with early literacy in the current program, as a part of their four year bachelor's program. This was due to the fact that technology is not a mandatory subject in primary education. The focus instead, was on getting the pre-service teachers to cultivate an understanding of early literacy in the syllabus. The TEI's acknowledged the importance of technology in education but accepted that pre-service teachers were not taught to use technology in pedagogically appropriate ways. This leads to doubts among teachers towards integrating technology in the classroom, mainly due to the reason that the preservice teachers themselves consider their knowledge and skills in technology to be limited and have restricted understanding of merging technology with pedagogy and content knowledge (TPACK). Voogt and McKenney (2017) recommended the need to develop TPACK of teacher educators to help prepare the new teachers in technology for early literacy in for effective student learning.

Technology in play. Childhood play has hugely transformed with the onset of technology, with children spending less time outside with traditional toys and more time indoors with digital media. Companies too, are increasingly reformulating the childhood experience by designing the toys commonly structured around indoor play with digital technology.

Gephart (2015) investigated the effect of exposure of digital technology on the imagination and creativity of students aged three to eight years of age, through case study method. The study conducted every Sunday in Church of the Brethren in Modesto, California, had an average attendance of two to three children between the ages of three to eight years.

Gephart (2015) based his research on the Blumer theory of symbolic Interactionism, which is an exploration method of inspection to understand the creative and imaginative meaning. Gephart wanted to understand how children decipher information from traditional toys as well as digital technology. This method enabled the researchers to interpret the meaning children gather through social interaction as well as interpretation of objects, events and behaviours (Gephart, 2015). The author studied data gathered through observation and interviews of the children and documented the frequency with which the children mentioned traditional toys and digital technology. The investigators also observed the behaviours of the children to gauge their imagination and creativity. Based on Blumer's theory of symbolic interactionism, Gephart (2015) concluded that there was no major difference between age and time spent with digital technology versus the traditional toys, however the children

interacted with either of the toys and based on the meanings they could connect with. His study also established that children's imagination and creativity weren't substantially hindered by the digital technology.

Sylla, Coutinho, Branco and Muller (2015) conducted research that combined physical elements of manipulation with virtual elements of technology, to understand their impact on supporting literacy as well as language development versus applications which solely ran on computers or touch technology. Sylla et al. (2015) used Touch, Organize, Create (TOK), a tangible technology where students could use physical blocks to manipulate virtual story elements. They aimed to examine whether such digital manipulative system, TOK, could be used as an aid to support oral language development and literacy, to enhance student achievement in the class. The research was led in two parts, the first part focused on applications architecture and implementation to ensure usability. Participants' included six preschool classes with students aged five years, and six preschool teachers. The implementation was followed by the observation of student interaction with the application during play time to understand how the students interacted with the system. The second phase consisted of examining the amount of progress made by students in the development of their language abilities due to the digital manipulative system. Finally Sylla et al. (2015) studied the records produced by 27 pairs of students during their interactions with the application for six months.

Sylla et al (2015) concluded that benefits of TOK and broadly of measurable technology over the computer or touch technology was the flexibility the users get to

manipulate and experience the physical elements, thus creating opportunities for collaboration among the users. The result highlighted that children used digital manipulative system to play language games and create stories, such activities helps to stimulate oral language development and promotes literacy skills.

Cooper and Cordery (2017) conducted a study in Australia to understand how the young students interact with programmable digital technology during free play at school. The researchers aimed to find out whether the student interactions with programmable technology was helpful to achieve the learning outcomes set for the subject of Digital technology in the Australian curriculum. The study took a two phased approach and was conducted in two early childhood classes in a time frame of two years (Cooper & Cordery, 2017). There were two teachers and 25 students aged four to six years from the two classes, in non- government schools in Australia, who participated in the study. A kindergarten class from a single gender school participated in the first phase. The second class had 25 students from kindergarten and pre-primary classes from a coeducational system with a few of the students moving on to the second phase of research. Beebot – a programmable device resembling a bee, embodies buttons which the user could program in order to execute a set of instructions. Sphero, the second device, is a Bluetooth ball which is programmable and can be controlled by Apple iPad devices. The students in the first phase were encouraged to interact with the devices during play time by using manipulatives like blocks as well as maps drawn on paper. In the first phase, the interactions of the students with the programmable Digital toys- the Sphero and the Beebot were noted and analyzed based on a behavior checklist

by team of three researchers over a time span of seven weeks. Parameters like exploration, problem solving, skill acquisition, symbolic and well as innovation were analyzed.

The second phase consisted of three one hour sessions of the 25 students using each of the devices for a period of six weeks. The sessions were planned to encourage students to achieve specific outcomes by using thinking skills to program the device. Based on the findings, Cooper and Cordery (2017) concluded that the students were able to use the toys easily. In order to achieve curriculum outcomes as well as use the devices meaningfully, there was a need of additional support in terms of explicit scaffolding. Cooper and Cordery (2017) pointed out to the limited evidence of students achieving learning outcomes set by the Digital Technologies curriculum in Australia, in spite of the possible potential that the digital toys provide. However the authors noted the limitation of their research due to the small sample size and recommended for more extensive research to explore the possibility of balancing free play with differentiated learning in terms of scaffolding, to achieve better learning outcomes for most of the kids.

CHAPTER III: DISCUSSION AND SUMMARY

Summary of Literature

The advent of Information and Communication Technology (ICT) has changed the face of education and is having a far reaching impact on the lives of students, including kindergarteners. ICT goes beyond the incorporation of computer hardware, software and technology and is largely a tool which combines technology with education policy, pedagogy and curriculum to help equip students with the 21st century skills (Charalambidis, 2014; Kainido & Wagithunu, 2014).

Students' attention span is very important for their development and learning (Espiritu, 2016). Improper use of technology can lead to distraction and overuse from both students and teachers. There is a need for educators to carefully select appropriate ICT tools to engage students' higher order thinking skills (Wajszczyk, 2014). However, digital technologies can be efficient learning tools for young students, as touchscreens are intuitive in nature making them user-friendly (Billington, 2016). ICT has a positive effect on student learning based on the interactive nature of teaching and learning, and educational software using tablets have resulted in better learning outcomes compared to traditional methods (Zaranis et al, 2013; Oluwadare, 2015; Athanasios & Georgia, 2014). Hendriks (2016) found that students hold a more favorable attitude towards digital learning methods, while students taught by traditional learning methods performed significantly better.

Athanasios and Georgia (2014) emphasized the important role that teachers play in incorporating ICT with traditional methods of teaching in an effort to maximize

student learning in the kindergarten classroom. A significant number of educators in Croatia have started using ICT as adults, leading to disinclination towards the incorporation of technology in their teaching practices (Nives et al., 2017). There is a need to shift the teacher mind set to a more student centric philosophy. This would help leverage on the potential of technology by creating additional learning opportunities for development of kindergarten students (Blackwell, 2014).

Technology isn't a substitute for adult intervention and students need to be effectively supported in their use of technology. Early childhood educators need to improve their teaching practices by better assimilating technology into the learning environment (Billington, 2016; Nives et al., 2016; Oluwadare, 2015; Zaranis et al., 2013). Teachers' involvement in curriculum design can influence curriculum implementation, which in turn, can impact pupil learning outcomes (Cviko et al., 2015).

Children born in the present era of technology are exposed to ICT materials from their time of birth and early childhood educators need to be optimistic about the role of ICT in children's progress (Kayode & Olaronke, 2014). Plowman et al. (2010) highlighted the need for schools in Scotland to value and build upon the existing prior knowledge and experiences of the children. This would enable the schools to extend their learning in the technological competencies, and support kindergarten students appropriately for the increasingly technologized education that future learning requires. In the United States, there is limited evidence of early childhood teachers using developmentally appropriate practices (DAP) to implement computer applications in their teaching practices (White, 2015). Teachers also point to challenges in terms of

limited technical support, insufficient time or technological resources to integrate ICT into the curriculum (Willman, 2017).

In Sweden, the integration of ICT into curriculum is leading to different interpretations and standards which potentially can create conflict with the norms prescribed by curricula, largely due to the existing approach, technical expertise and pedagogical knowledge of the teachers (Lindahl & Folkesson, 2012; Masoumi, 2015).

There is a need for the education system to be pragmatic and teachers need to create learning opportunities to equip students for future scenarios wherein technology would play a big role (Charalambidis, 2014). In spite of the fact that technology is increasingly becoming a critical part of teaching and learning, the element of technology is considered independent from the elements of pedagogy and content knowledge (Mishra & Kohler, 2006). A major contributing factor is that integrating technology with instruction is complex and teachers find it challenging to assimilate technology into their teaching, often compromising on the effectiveness of the learning experience. Teachers need the skillset to blend elements of content knowledge, pedagogy and technology for effective teaching and learning (Voogt & McKenney, 2017).

Mishra and Kohler designed a framework based on Shulman's (1986) formulation of 'pedagogical content knowledge' (PCK), and integrated technology with essential elements of student pedagogy and content knowledge (TPACK). This enables the teachers to adapt their use of technology in the classroom creatively and effectively, to enhance learning outcomes. Education programs need to consider adding TPACK

model to professional teacher training courses to tap on the potential of technology in the field of early childhood (Baran et al., 2011; Cheng, 2016; McKenney & Voogt, 2017)).

In addition to being efficiently trained in the field of technology, to confidently integrate it into the classroom, there is a need for establishment to provide educators with the flexibility to use their technological skills in diverse ways – like a toy or a tool (Billington, 2016). Children acquire skills and develop through quality interactions and play. Their imagination and creativity is equally stimulated by both digital play as well as traditional play (Gephart, 2015). However, using digital play to create opportunities for students to touch, manipulate and create (TOK), provides children opportunity to experience physical elements, collaboration, and stimulates oral language development while promotes literacy skills (Syla, et al., 2015). Teachers need to actively support the learning opportunities created by interplay of technology and traditional play, by explicit scaffolding in order to achieve curriculum outcomes (Cooper & Cordery, 2017; Gephart, 2015; Syla et al., 2015).

Limitations of the Research

The main aim of the study was to investigate how information and communication technology can support teaching and learning in the kindergarten. In addition, the study also reviewed the roles and attitudes of educators towards integration of ICT in the kindergarten environment as well as the important elements that impact the effectiveness of ICT integration, to enhance the student development and learning outcomes. The representative research studies of over the past decade (years 2006 -2017) have been investigated for the review. To access the literature for

this thesis, the following key words were searched: Information and communication technology (ICT), kindergarten, ICT content early childhood literacy, teacher's role, digital tools, technology and pedagogy, diversity. ICT and play, technology and pedagogy. This study has selected samples on research happening around the world, in the US, Europe (Greece, Netherlands, Sweden, Scotland, UK), Africa (Kenya, Nigeria), Asia (Hong Kong, Taiwan), and Australia to understand the developments and challenges in terms of ICT integration in the Kindergartens.

The world is changing rapidly and becoming increasingly interconnected. Alongside this, classrooms, including kindergartens, are increasingly becoming more diverse in their nature. It is essential for teachers to be able to address and support the unique strengths of the diverse group of learners in the kindergarten classroom. The students from diverse cultures and ethnicities, would benefit from further engagement in terms of connecting their prior knowledge and experiences to build on their unique strengths. However, there are limited research studies available on ICT interventions and tools to scaffold learning in multicultural kindergarten classrooms which can contribute positively into integrating these students and narrowing achievement gaps. The role educators in integrating ICT to develop and contribute towards culturally responsive teaching strategies which would help to enhance student learning in the kindergarten classrooms also calls for more research.

This literature review is completely reliant on previously published research which is an important limitation. Another important limitation would be the key words used for search of the studies for the procedure of selection/ exclusion of the research

studies. In addition, the present study did not examine the use of ICT for student assessment in terms of formative and summative assessment as well as the digital tools and techniques to scaffold learning for kindergarten students from diverse cultural backgrounds due to the limitation of the amount of scholarly articles addressing the issue.

Implications for Future Research

ICT can contribute to student development in many areas, and this calls for more research to understand how ICT could be used in the kindergarten setting to provide appropriate scaffolding and support in order to benefit students from diverse cultural backgrounds and languages. What are the existing ICT resources and tools available to support students from diversity, and how could these tools be applied in the early childhood education settings?

Another area where the research could extend to, would be, on how ICT can be leveraged on to capture student learning and development, using formative and summative assessment techniques in the kindergarten and how the educators can utilize this information to maximise student learning and potential.

Implications for Professional Application

Technology has revolutionized the way the world works, and education too has been deeply impacted by this revolution. Every change brings some positive and negative implications, being educators we need to be ahead of the change. There is a need to tap on the potential of technology and to harness its power to bring value to our present day students and the future world citizens.

Early childhood sets the foundation of child development and student learning and is known to have profound and lasting consequences for a child's lifetime. To equip our students with the 21st century skills, there is a need to start young. This research aims to study the recent developments in the field of ICT and kindergarten and evaluates them in order to provide direction and guidance for the kindergarten educators. The research examines key issues from literature studies about ICT integration in the kindergarten setup. It investigates questions like: Does ICT support student development and learning experiences? What factors affect implementation of ICT in kindergarten? How can educators be supported in terms of professional development, for integration of ICT with pedagogy and content knowledge to plan quality learning experiences. Can ICT support learning and development by quality interactions in terms of play?

This study examines literature studies from around the world, which focuses on ICT integration, challenges educators have, perceptions and mind-sets of educators towards ICT integration and selection of appropriate digital tools to maximize student engagement and learning. In addition, the study briefly explores play and technology and also explores areas of concern that improper use of ICT could generate.

This aim of this study is to as an educator, have information about the choice, analysis, use and evaluation of technology for students to maximize learning. Technological practices to support learning and development needs an interplay with elements of student pedagogical knowledge and content knowledge, by having data about recent developments, educators including myself can make an informed decision

regarding appropriate skills sets and ability to utilize technology and interactive media for the benefit of student learning experiences.

As educators, there is a need for professional judgment about what is developmentally and culturally appropriate for the students, with the research conducted, educators can, in addition to early literacy and mathematics, extend the judgment to the field of children's play. This study also focuses on professional development and skills required by educators to integrate technology into curriculum appropriately. The strategies suggested as a part of this research, to integrate technology with pedagogical and content knowledge can help direct and guide teachers', as well as teachers' in training to enhance their teaching expertise.

Conclusion

The scope of this study was to present if and how Information and Communication technology (ICT) can support specific skills in the kindergarten. The findings of the studies examined, highlights that kindergarteners show active engagement and interest in the lessons as well as during play, when ICT is used. However, the students need appropriate adult supervision and scaffolding to achieve their learning potential. The teachers play a very important role in the way technology can be fostered to enhance learning. The framework to incorporate ICT in the right balance with pedagogical knowledge and content knowledge (TPACK) to maximize student learning and development is also discussed. There is a general consensus that this adopting this framework would help teacher and teachers- in-training in integrating technology with the curriculum efficiently. There is overall consensus on the

understanding that appropriate, incorporation of ICT with curriculum would be instrumental in fostering better learning experiences and benefit student development in the Kindergarten.

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