ISSN: 2581-8422, Vol. 08, No. (1) 2025, Pg. 83-101

Current Research Journal of Social Sciences and Humanities

journalofsocialsciences.org

Exploring the Readiness of Early Childhood Development Environments to Integrate ICT: Assessing Stakeholder Capacity

HENRY CHINHARA[1]* and ALICE KUYAYAMA[2]

[1]Department of Educational Foundations, Bindura University of Science Education, Bindura, Zimbabwe.
[2]Department of Early Childhood Development and Materials Production, University of Zimbabwe, Harare, Zimbabwe.

Abstract

The paper explored the integration processes and challenges of Information Communication Technologies (ICT) in early childhood development (ECD) curriculum. The developmentally appropriate practice theory was employed to uncover procedures and challenges of ICT integration in early childhood development environments. The focus was on the barriers that early childhood development institutions face in their efforts to integrate ICT in the ECD curriculum and to uncover pockets of good practices that are experienced in the institutions. Researchers used the Mixed method research approaches to uncover issues of ICT integration in ECD institutions. Semi-structured questionnaires were administered to collect quantitative data, while face-to-face interviews and observation schedules were used to gather qualitative data on the readiness and capacities of ECD institutions to integrate information communication technology in the curriculum. The study uncovered numerous barriers that hindered full integration of ICT in the ECD curriculum. Institutional challenges include the lack of capacities for teachers, school heads and parents. In spite of the global and national policies that call for the exploration of integration of ICT in all facets of the curriculum, challenges continue to haunt young children's learning. The identified barriers went beyond inadequate or poor ICT resources, to include lack of ICT competencies among teachers, school heads, and parents who were expected to assist learners in acquisition of the desired skills. The challenges impacted heavily on ICT integration as the young learners failed to get the requisite assistance from others.

Article History
Received: 29 January 2025
Accepted: 09 June 2025

Keywords
Early Childhood Development;
Information Communication Technology;
Knowledge Economy;
Developmentally Appropriate Practices;
Institutional Capacity.

CONTACT Henry Chinhara chinharah@gmail.com Department of Educational Foundations, Bindura University of Science Education, Bindura, Zimbabwe.

Doi: https://dx.doi.org/10.12944/CRJSSH.8.1.08

Researchers further noted that ECD institutions lacked support from both public and private sectors for continuous professional development of teachers and school heads to enhance capacities and opportunities for effective ICT integration. Findings show some good ICT integration practices across the sampled schools, such as educational exchange programmes for teachers, which improved networking opportunities for those involved. The paper concluded that because of limited private and public commitment to support ICT integration in the ECD sector, government efforts are not fulfilled. Researchers recommend a holistic ICT integration roadmap at ECD level that supports the learners, teachers, school heads, and parents, enabled by policy reforms, and a multiplicity of teacher training models. There should be improved funding from the business community, targeting efforts to improve ICT integration in the ECD sector programme. Attention to these issues allows ECD learners to have a strong foundation for information communication technology, and opens avenues for support from critical stakeholders.

Introduction

Embracing Information Communication Technology (ICT) across all educational levels is enshrined in the World Summit on Information Society (WSIS) held in 2005 (Pyati, 2005). The treaty urges governments to commit to the achievement of an inclusive information society. While in the WSIS auspices ten targets were identified, only two of these targets made reference to primary and secondary school education systems. Nothing was mentioned about the children in the formative years classes of the early childhood development. Pyati (2005) states that; Target 2, of the World Summit on Information Society implored schools to have radios and televisions endowed with educational programmes and apps for learners. It further directed schools to ensure learners have reasonable learner to computer ratios, to ensure ICT integration is maximised. Notwithstanding, Target 2 does not mention how ICT integration should be utilised to benefit learners in early childhood development (ECD) institutions. Hence, Ogegbo and Aina (2020) observed that while policies that encourage integration of ICT in ECD environments are in place, teachers are often under-informed and lack confidence. In the same vein, Manhibi (2019) claimed that ICT integration in Zimbabwe, was marred by a severe lack of ICT resources, infrastructure, competence and funding challenges. Kuyayama and Nkomo (2021) however, stated that some young children from affluent families often bring to ECD institutions some exceptional knowledge which show they already know how to operate ICT gadgets. If ECD teachers had capacities, they could exploit the young learners' skills and knowledge to make ICT integration in early childhood development curriculum easier.

Young learners in the formative years are best positioned to learn, interact and discover with the various types of digital media. Therefore, schools should lead in the creation of an information rich society for the development of a technological rich nation. Recently the SDGs goal number 4 put Educational Technology at the heart of quality early childhood development education (UN General Assembly, 2015). Livingstone (2015) noted critical reflection on how technology is integrated in educational settings, advocating for more consistent strategies that align technological tools with educational objectives. The conclusion made in that study was that there is need for research into effective ICT implementation which require a more orderly conceptualisation of key issues in integrating technology into curricula, to ensure curricula is enhanced. As noted, issues surrounding integration of Educational Technology in early childhood development require serious inquiry to open pathways that promote the knowledge economy across the early childhood development curriculum. In this paper Information Communication Technology refers to interactive media which include, but not limited to the various types of media digitals, which permit users to influence other organs through the content they receive. Examples of such types

of media include, but also not limited to; social media platforms, online quizzes and surveys, as well as other kinds of apps, that can provide video games. The World Summit on Information Society urges all primary and secondary schools to adapt curricula that meet the needs of information communication society (Partnership on Measuring ICT for Development 2011), to enable the integration of subjects.

Integration of Educational technology in early childhood curriculum is significant for total early stimulation in the development of active brain advancement, which is experienced when these young learners work across the multiple subject areas. The integration processes of ICT allow the education system to take advantage of the raw technological knowledge that young learners bring to school to advance issues of ICT at the early stage of development. To unpack concerns of ICT integration in the different aspects of subjects, it is critical that there is an understanding of issues surrounding the integration procedures.

Policies about the Integration of Information Communication Technology

International conventions mandate governments to put in place specific budgets to support the development of ICT in schools. For example, the United Kingdom set aside £2.5 billion on educational ICT from 2008-09 (Nut, 2010). In the same context, New Zealand spends over $410 million every year on schools' ICT infrastructure (Totimeh, 2012). Hong Kong government has invested a vast amount of resources to ICT education development through four major ICT strategies (Education and Manpower Bureau 1998-2004; Education Bureau, 2008). In the same vein, the Hong Kong government launched a 5-year plan to integrate ICT into the school curricula at both primary and secondary school level (Li, 2006). These statistics show that successful implementation of ICT require establishment of policies and financial support from government and private partners (Kerckaet *et al*., 2015; Salehi & Salehi, 2012).

To make integration more successful, the South African Department of Education provides provinces and districts with both professional and technical support as well as offering teacher accreditation to enhance capacity to integrate ICT across the curriculum. The Department of Basic Education (Van Niekerk, & Blignaut 2014), deploys dedicated trained teachers to support ICT integration across all levels of learning, including at early childhood development level. The e-Education policy empowers school managers and administrators to equip schools with resources that support ICT integration. For ICT integration to be considered a 'transformative tool at ECD level, a lot of support services should be provided from various stakeholders (Kerckaet, *et al*., 2015; Salehi & Salehi 2012).

The above information illustrates that funding is important for schools to initiate computer-assisted instruction (CAI) and promote interactive and child-centred learning methods. Funding assists educational institutions to acquire user-friendly ICT gadgets for both teachers and pupils (Totimeh, 2012). Successful ICT integration depends to a greater extent on sufficient exposure to CAI in early childhood development environments, and ensuring schools have reasonable learner-computer ratios. However, in the majority of developing countries, some schools may not even have a radio, a television set, a cell phone, a desktop, l*et al*one a laptop to demonstrate what computers look like, how they function and how to utilise each of these devices for effective ICT integration.

Zimbabwe policy on ICT Integration at ECD level

Zimbabwe adopted a National ICT Policy in 2005, informed by the Harvard University guided e-readiness survey. There followed a host of general and sectoral ICT policies including Vision 2020, the national science and technology policy to ensure ICT was treasured in the education sector, starting at ECD-A to university level. The current 2015-2022 Ministry of Primary and Secondary Education ECD curriculum embraces the computer and appliance play topics in its ICT syllabus. It is a sign of seriousness of the government as it adopted the e-readiness intonation. It should be noted that the amended Ministry of Primary and Secondary Education (MoPSE) policy on ICT integration emphasises the following:

Technical Infrastructure

(MOPSE) (2015-2022) instructs all schools to be connected to the wide area network (WAN) and high-speed Broadband internet so that learners are provided with daily access to ICT and adaptive

technologies that support their learning. It is clear from earlier research findings that, a host of schools are not able to implement ICT integration in the schools, yet the age-group worst affected is the early childhood development level (Dzinotyiwei & Taddese 2020).

E-Resources

The 2020 MOPSE document, further states that there should be universal access to high-quality digital learning resources in all schools to meet the needs of all learners. It also states that ICT should be integrated and applied across the entire education curriculum and at all levels for all learners (Dzinotyiwei & Taddese 2020). Accordingly, the above statement implies that learners at early childhood development should benefit as well. However, it requires investigations to find out if all children enrolled in ECD environments have access to high quality digital learning resources as proposed in the document.

Capacity Building

The 2015-2022 MOPSE document states that teachers and school administrators are expected to be proficient in the use of ICT in their work; and that such ICT tools should be used by all learners to support e-learning and all teaching and learning activities. It is clear that the Ministry expects schools to integrate ICT in all education levels including at early childhood development level. However, successful integration of ICT strictly requires capacitation of teachers, availability of infrastructure and adequacy of ICT gadgets in schools, which this study sought to determine. Hence, the study was exploring the readiness of ECD institutions to effectively integrate ICT in the young learners' curriculum.

Sustainability

Further to the above, the 2015-2022 MOPSE document urges schools to engage in Public-private partnerships so that the entities support and ensure effective ICT use in schools (Dzinotyiwei & Taddese 2020). It is against the above background that the study was contacted to establish whether there was a partnership that supported ICT integration.

Requirements for effective Integration of ICT at ECD Level

To effectively integrate ICT in curriculum, teachers should have an understanding of the developmentally appropriate practice (DAP) curriculum so that they support learning goals for individual learners (Copple, *et al*., (Eds.). (2013). An appreciation of DAP curriculum provides enough guidance for teachers to generate ICT activities that match interactional patterns whilst tailor-made for young learners' age and developmental needs; as these will effectively enable children to interact and construct knowledge through use of ICT gadgets. Teachers are therefore, expected to direct children's learning activities in ways that are driven by their self-interests and ability. Integrating ICT to master knowledge, competencies and skills across the entire curriculum requires differentiation of learning processes, whilst at the same time fostering critical thinking and holistic development, through a combination of hands on, visual and mental engagement in learning activities (Fisher, *et al*., 2001).

Rationale, Strategies and Activities for Integrating Ict in Ecd Curriculum

Integrating Information Communication Technology in the curriculum, assists young learners to redirect their learning experiences in ways that show individuality and creativity, since the processes of ICT integration allow learners to engage in hands on activities. ICT integration offers a multiplicity of specific domain development advantages to the young children. These include; critical thinking, language development, creativity, social interaction, turn taking and improvement of concentration span on learning activities (Haugland, 2000). Hatherly (2006) also establishes that integration of ICT in young children's curriculum improves language learning, respect of one another, social interaction, and the various aspects of cognitive development which incorporate reasoning, emotionality and democratisation of learning experiences. Furthermore, the integration of ICT in learning experiences enables young children to monitor their own learning and allows young learners to reflect on what they have learnt. In so doing the young learners enjoy flexibility of learning experiences.

When there is effective integration of ICT in the ECD curriculum, young children learn to produce, create and recreate new ideas which necessitate meaningful learning outcomes. This is evidenced by the seriousness of young children when they are working on pre-language, pre-mathematics and pre-scientific activities (Nikolopoulou, 2015).

Integrating ICT in early childhood development programmes is critical for a knowledge-based economy (Young, 2012; Li, 2006), because it enables the young learners to develop ICT skills which is an improvement of the knowledge-base and it contributes to the economy of the nation, in this highly technological world. One of the observation by Kuyayama and Nkomo (2021) was that ICT integration in the ECD curriculum is that it assists teachers to become ongoing learners as they directly engage and observe children's continued use of ICT gadgets. Careful integration of ICT can facilitate the acquisition of relevant life skills to both teachers and learners, that buttress the total development process of skills. However, literature shows that there is little tangible progress on how effective ICT integration could be at early childhood development level. For instance, a previous study focused on teachers' perceptions on ICT integration at early childhood development level (Hori and Fujii 2021). Some few studies have focused on experiences that early childhood development centres encounter in their efforts to integrate ICT in the ECD curriculum (Shykyryynska *et al*., 2024; Timothy & Xiong 2022). Thus, the issues that impede ICT integration require investigations to unearth and then offer guidance to the education system to nurture teachers and young learners' information communication technology capacity.

Successful integration of ICT in the early childhood development curriculum depend on strengthening ICT networking capacities and availing staff development programmes that enhance interest and knowledge (Flewitt, *et al*., 2015). These require enormous funding and stakeholder commitment. Effective ICT integration at early childhood development level hinges on mandatory awareness programmes to both the new and seasoned teachers to acquaint them with the demands of the new technological era.

Significant support should come from the government through the curriculum development department which should design policies that support ICT integration across the education continuum. An example is in Hong Kong where the government introduced the Guide to Pre-Primary Curriculum which lays down formal educational guidelines that directs the ECD curriculum on what and how to implement ICT integration (Curriculum Development Council, 2006). Kuyayama and Nkomo (2021) riposte that government initiatives to rope in private organisations to support ICT integration is a critical support mechanism. When the government is at the centre of ICT integration reforms, the education system is bound to improve learning, teaching and assessment of ICT integration processes (Dan Lu & Ya-Nau, 2024). Successful ICT integration at early childhood development level depends on a number of factors which include; competencies of teachers, preparedness of ECD centres to adapt to new technologies, commitment to support the integration processes and the adequacy of learning and guiding materials.

To enhance the integration process, Early childhood development programmes should have an array of activities such as computer games, which provide both competition and fun, but also develop new skills such as spatial awareness and working with peers (socialisation). Take an example of the oral, visual and pictorial nature of video games, which are critical learning modes during ICT integration activities which enhance language, critical and creative thinking, as well as an improvement of the concentration span of learners. Further to that the activities improve patience and endurance. All these promote diverse pathways for ECD communities to nurture holistic development of the young learners (Ihmeideh, 2009).

Challenges to Integrate ICT in ECD Programmes

Despite the discerned positives brought by the integration of ICT to teaching and learning, several studies have shown that ECD teachers face the toughest challenges to implement effective integration. They lack understanding of implementing developmentally and technologically appropriate curriculum (DAT), specifically for learners under five years (Stephen & McPake, 2010). Ihmeideh and Maadadi (2018), claim that conceptions on play are central to young children's development and learning. ECD teachers should guide learners, when they plan the integration of ICT in young children's

curriculum. Naturally this will lead to effective integration of ICT in the learning environments, to enhance holistic development of young learners. Teachers are expected to maximise developmentally appropriate practices that are led by the ages and capacities of the young learners. To gain more, teachers should utilise guided play methods to uncover the knowledge and skills which can be integrated to the young learners. The implication is that schools should have both computers assisted instruction (CAI), and Internet-assisted instruction (IAI) to enhance the concept of ICT integration (Dang, 2018).

In developing countries, the integration of ICT might not have been universally accepted by stakeholders especially at ECD level. Whilst the blue-print on policy formulation makes it mandatory, what is on the ground is very different. Integration of ICT in early childhood curriculum is buttressed by National Association for the Education of Young Children and Fred Rodgers Center (NAEYC & Fred Rodgers Center, 2012) provides guidelines on appropriateness of inclusion of (computers, televisions, cell-phones, radios) as forms of information communication technology in early childhood classrooms. The study investigated whether ECD environments had the necessary resources to make the integration of ICT in the curriculum effective.

Statement of the Problem

Zimbabwe has an e-Education policy to achieve integration of ICT at all levels of the education sector by 2030. However, stakeholders query the progress made to integrate ICT at early childhood development level in schools, arguing that most schools have no laboratories, gadgets and qualified teachers to effectively implement the integration process. There are numerous challenges that maybe key to the derailment of ICT integration at national, provincial and district levels especially at ECD level (Tran, 2018). Hence, this study investigated the preparedness of ECD institutions to effectively integrate ICT at ECD level to enhance children's digital literacy as enshrined in the constitution and the national education policy.

Research Objectives

The study was guided by two research objectives which are as to:

1. Investigate preparedness of institutions to integrate ICT in the ECD curriculum as a means to transform practices.
2. Find out pockets of good practices that are in the schools to facilitate ICT integration at early childhood development level.

Delimitation of the Study

The study was delimited to twenty early childhood development institutions in Bindura urban, Mashonaland Central province. Only school heads, teachers and parents from the selected schools were major sources of data to this study. School heads were interviewed as key informants. Meanwhile, teachers completed semi-structured questionnaires, and parents engaged in focus-group discussions on ICT integration. Researchers further observed lessons on ICT integration in early childhood development classrooms.

Limitation

The study encountered a number of limitations. Chief among them was financial constraints. Researchers would have wanted to cover the whole of Bindura district early childhood development institutions. However, given the limitations of their finances it became difficulty to do so. Furthermore, the study could have been more intensive if researchers had involved learners in interviews or focus-group discussions. This could have provided the study with a holistic picture of integration processes which teachers do. Nonetheless, the general conclusion was the study was an eye-opener on issues in ICT integration at early childhood development level.

Theoretical Framework

Researchers adopted a developmentally appropriate (DAP) curriculum, as a theoretical framework whose lens guided this study. The developmentally appropriate curriculum originated from NAEYC, and it supports and provides guidelines for the integration of computers in early childhood classrooms. In its position statement 'Technology and Young Children: Ages 3 through 8' (1996), it is argued that the appropriate use of ICT at early childhood development level, supports and extends curriculum in many valuable ways which allow learners to develop holistically. Integration of ICT in early childhood curriculum, requires educators to be

knowledgeable about children's development and familiar with theories of learning.

In practice ICT integration aid to what and how the content is taught, and does not replace activities and materials that seek to develop children holistically. The implication is that learning centres, such as the art and design corner, block and manipulative centre, sand and water areas, the book and library area and the dramatic areas would remain useful (NAEYC, 1996), by bridging and extending their digital experiences into practice (Voogt & McKenney, 2017; Plowman *et al*., 2011).

Materials and Methods

This study adopted a descriptive survey carried out in twenty ECD centres in Bindura, Mashonaland Central province of Zimbabwe. It adopted a post-positivism paradigm rooted in the mixed research approach. Data was obtained from twenty randomly selected ECD teachers. The twenty teachers completed questionnaires on ICT integration in early childhood development curriculum issues. Furthermore, school heads were purposively sampled as key informants interviewed to provide in-depth qualitative data on ICT integration in early childhood development environments.

Validity/ Reliability/Credibility and Trustworthiness of Data

To authenticate the results obtained, researchers triangulated data collected through the three different research instruments on ICT integration in the ECD curriculum. Trustworthiness of data was assured as noted by triangulating the instruments (Creswell, 2014). The data collected through questionnaires, interviews and observation guides necessitated a complimentary role, which made such data credible. Credibility of data was assured through a number of processes, which included pilot testing the instruments, member checking and where necessary calling the members to confirm their earlier responses (Maree, 2016). Furthermore, member checking was used to verify if informants' data was captured well, by going back to the moles with the collected data, re-asking and verifying the data in case something had been missed.

ECD lecturers were given research instruments, before the tools were employed in the field of study, first to proofread and recommend areas for corrections and ensure they were clearly interpreted. The lecturers were chosen because, researchers assumed they understood ICT integration in the ECD curriculum.

What one instrument missed was to be taken care-of by the other tools. Thus, the measure of validity/ credibility and reliability/trustworthiness hinged on triangulation of the instruments as (Cohen & Manion, 2013; Maree, 2016) note that the data obtained by three or more instruments confirm accurateness and transferability.

Data Analysis

Quantitative data was analysed through use of the SPSS software. The analysed data assisted researchers to make conclusions and predictions on the results. In addition, qualitative data was coded and organised as related themes and sub-themes which augmented quantitative statistical data.

Results

This section shows results obtained through questionnaires, observations and interviews on integrating information, communication and technology in ten ECD centres in Bindura Urban, Mashonaland Central Province in Zimbabwe. Ten school heads were interviewed, while twenty ECD teachers completed the questionnaire. Furthermore, ten ECD classes were observed during the delivery of lessons. The results of the questionnaires, interviews and observations were presented under the themes that came from the findings.

Availability of ICT gadgets in ECD Centres

The objective was to find out if the ECD teachers had adequate ICT gadgets at their disposal which they use for integration to teach. Participants also noted that computer-pupil ratios were bad in most of ECD centres. Table 1 shows quantitative responses on the adequacy of computer gadgets in ECD classrooms.

According to table 1, all participants indicated that the ICT gadgets were not adequate for learners to use and for successful integration of the curriculum. Qualitative data showed that ICT gadgets were not user friendly as they said that in some classes, the learner to gadget ratios were too big to necessitate meaningful learning. Tr. G said:

Table 1: Adequacy of ICT gadgets in ECD classrooms

Responses	Frequencies	Percentages
Yes	0	0
No	20	100

We have few computers in each of the classrooms. The situation is made worse because some of the ICT gadgets at the centre are not working. In a class of 20 learners, only 2 desk-top computers are working.

Teacher C also said that:

We do not have enough ICT gadgets for our classes. Teachers use their own cell-phones. We only have 2 model computers which we use for teaching purposes. Children's access to information communication technology gadgets is limited because ECD centres do not have enough of the ICT gadgets. Proper integration of ICT requires adequate computers for hands on activities.

Below is Tr. A's responses on the inadequacy of computers:

At the ECD centres we have child-sized computers, a radio, a TV set and mini-lap-tops. However, these are not enough and teachers end up theorising the content which must be learnt through direct experiences.

Researchers observed classrooms in private ECD centres had somewhat adequate ICT gadgets. However, in the majority of cases classes had one big TV screen, where the whole class watched and listened to different stories.

From the responses the majority of early childhood development centres did not have adequate ICT gadgets; and the situation hindered implementation of ICT curriculum integration. However, in some ECD centres there were adequate ICT gadgets that promoted integration of ICT in teaching. This implies that education stakeholders should ensure the adequacy of ICT gadgets, to allow the effective use of ICT in teaching and development of skills in the young learners. In the next question researchers wanted to find out whether the ECD practitioners had the competencies to integrate ICT in teaching.

Table 2: Competencies of ECD practitioners

Responses	Frequencies	Percentages
Yes	2	20
No	18	80

Participants indicated few teachers had knowledge and skills to support young learners in acquiring the desired skills on ICT integration. The following was a response from Tr. C who acknowledged that:

We know little about ICT integration. When we try to integrate ICT in different subjects we have observed that both teachers and learners have challenges. Teachers do not have the skills to demonstrate use of ICT integration which benefit the young learners.

The above was buttressed by H.3 who said:

The majority of teachers were not trained to use ICT to enhance the learning of young learners. Teachers who expertly integrate information communication technologies have had the skills through workshops or short courses, offered by individuals or private entities and universities. However, only a few teachers have attended the short courses because of financial challenges. This has left the majority of teachers in dire need of ICT integration skills.

Researcher observed that some ECD classes had ICT gadgets, which were user-friendly. The observation was buttressed by Tr. 6 who said:

We have user-friendly early childhood computer soft-ware which assist our learners to learn to draw shapes, colour inside shapes, and do problem solving projects on language and socialisation tasks. For example, during story-telling time, learners engage in activities that test mental alertness, teaching phonics and matching activities. This process allows learners to reason, and think critically.

Researchers' lesson observations, buttressed the idea saying, that teachers lacked skills to integrate ICT in teaching. The lessons were narrations, from start to finish. Learners never used ICT gadgets, the skills which is needed very much in ICT integration. In few situations teachers expertly integrated ICT to improve young learners' understanding of concepts in subjects taught. Researchers noted that such scenarios of good practices, were isolated and were only in private and affluent ECD centres.

Findings of the study show that most teachers do not have the expert knowledge to integrate information communication technology to ECD curriculum. Teachers did not have an understanding of ICT integration to the curriculum, which deterred the use of these gadgets to improve teaching. In that respect, teachers could not apply integration as a result of lack of knowledge. Teachers lack the know-how practices to integrate ICT to improve understanding in the ECD curriculum.

Teachers lacked training that would have provided integration of ICT at various teacher development levels. This has ripple effects on the delivery of lessons as noted by H. 3 who held that:

Teachers lack ICT integration skills and this should be addressed, if this philosophy of ICT integration is to be addressed in the schools.

Without suitable pre-service or subsequently in-service training on ways to integrate ICT in the curriculum teachers may not sufficiently do so.

In the next question, researchers implored participants to provide information on strategies they were using to integrate ICT in ECD curriculum. Table 3 below shows the responses.

Table 3: Strategies employed to integrate ICT to teaching ECD curriculum

Responses	Frequencies	Percentages
Yes	2	20
No	18	80

Table 3 shows that the majority of teachers hardly had varied strategies to integrate ICT in teaching. As noted in proceeding paragraphs, the majority of the teachers did not have the strategies which promote effective ICT integration in the ECD curriculum. The above was buttressed by Tr. 4 who indicated that:

Our learners engage in experimenting with ICT gadgets which enable them to learn a variety of skills. As teachers we task learners to discover what ICT gadgets can offer and how it improves their own understanding. We note that during some experiments, the young learners think and reason on what they would have discovered. As teachers we want learners to appreciate that ICT gadgets are learning aids. This is crucial as it enables young learners to make new discoveries, and learn of new ways of problem solving.

In support of the above, H. 2 buttressed that idea saying:

Some teachers employ different developmentally appropriate computer teaching strategies that ensure learners' understanding of concepts by the discovering what ICT gadgets offer. We ensure learners engage in games and Art activities (painting, drawing, and colouring) sometimes competitive but not always. Sometimes these young learners simply do these activities for fun. However, these activities enhance fine-motor skills, coordination of the eye and hands/fingers. This way learners participate and

concentrate on the skills teachers want developed.

When asked the exact activities that the young learners do to achieve the desired skills,

Tr. 9 identified the following activities:

They do colouring, naming of objects, storytelling, drawing and engaging in video games as some of the activities etc. When we interrogate the young learners during the activities we note that the young learners are learning something by the way they reason and form hypothesis on whatever they will be working on.

Further responses on strategies teachers were provided by Tr.13 who explained that:

We allow the young learners to use YouTube to learn activities that are done by other young learners. This way we ensure the learners become investigative, as they learn on their own even when they are at home. We also share with parents such websites where learners can benefit. However, we make sure the software we use is learner friendly.

In the same context H. 1 explained:

We have child-friendly ICT software for young learners to use. We share with learners developmentally appropriate software with the aim of enhancing holistic development of learners. For example there is the software know as TATE UK (https://www.tate.org.uk/kids)

Meanwhile Tr. 10 said:

The software is downloaded as recommended under the ECD learning protocols.

Integration of ICT at early childhood development level is guided by developmental appropriateness of the software to the age level of learners. To effectively integrate ICT at early childhood level, networking of early childhood practitioners allows effective sharing of relevant software, and strategies to improve. Researchers further wanted to know if there were common activities teachers engaged learners in during ICT integration in the curriculum. In response to that Tr. 3 said:

We engage in interactive activities, where learners interact with ICT applications and which instruct learners on what content to learn. For example, some interactive software gadgets teach correct pronunciation of words and some provide instructions on how to play computer assisted games. They also teach mathematical concepts of colour, shapes, drawing and classifications, to name a few.

Adding her voice to the responses, Tr. 4 stated that:

We use a wider approach to learning, which provides freedom of learning through use of ICT. This is done by ensuring that each learner engages in an activity of his/her choice. We allow learners to experiment with ICT gadgets utilising on topics that are in their syllabus. We use YouTube website, to encourage learners to do activities shown on the website. They listen to instructions as they do the activities.

It is critical that in selecting ICT devices for integration, especially at ECD level teachers consider instructive ICT software which provide instructions to learners. Researchers also observed that in some classrooms where teachers appreciated integrating ICT to the curriculum, the nature of activities and learning were characterised by hands on and interactive instruction. Learners were showcasing different skills as demanded by the syllabus but this was done by planning specific for topics to be learnt through ICT devices.

The responses show that, participants employed different strategies to integrate ICT with the ECD curriculum. Some teachers used ICT gadgets a to reinforce what they teach in teacher directed activities.

In the next section, researchers investigated availability of policies, statutes, and circulars to guide teachers to integrate ICT to ECD curriculum.

In her view H. 4 said:

We do not have a national document (s) that guides teachers on the processes of integrating ICT to the ECD curriculum. For instance, we do not know how to integrate ICT in the 0-4-year-old curriculum. This is very difficult for teachers who do not appreciate

use of ICT, as you know the majority of our teachers are old school teachers.

Without a national syllabus document to guide teachers on the procedures of integrating, it may be difficult for teachers to sufficiently integrate ICT in the ECD curriculum. The national document is critical in providing teachers with the direction; vision, mission, goals, objectives materials and the methods, as well as different ways to integrate ICT to teach the different subject disciplines. The responses then led the researchers to investigate the nature of challenges that ECD centres encountered in attempting to integrate ICT to the early childhood development curriculum.

Table 4: Availability of policies, statutes and circulars to guide teachers

Responses	Frequencies	Percentages
Yes	10	50
No	10	50

Table 5: Challenges teachers encounter to integrate ICT into the ECD curriculum

Identification of challenges	Number of responses indicating challenges faced in ECD institutions	
No eComputer Gadgets	x x x x x x x x x xxxx xxx	17
No Electricity	x x x xxx	6
laboratories to use in e-computer learning	xxx xxx xxx xxx xxx xxx x	19
No books to guide integration	xxx xxx xxx xxx xxx	15
No qualified teachers with the knowledge to integrate	xxx xxx xxx xxx xxx xxx	18

Table 5 shows, the majority of early childhood centres hardly had adequate e-Computers to facilitate the integration of ICT in teaching. For instance, in the twenty sampled ECD centres, only three had adequate computer gadgets. Without adequate ICT gadgets it was difficulty to integrate ICT, in subjects done by the young learners as they require hands-on learning. ECD learners require enough learning gadgets that allow them to have clear experiences. Furthermore, six participants showed ECD centres lacked electricity for internet connectivity and effective ICT integration. Thus, lessons lacked meaningful practical work which deterred real educational ICT integration. Nineteen ECD centres did not have computer laboratories, thus it was a challenge to meaningfully integrate ICT at ECD level. Furthermore, eighteen participants stated that they were not comfortable with the integration processes, since they lacked ideas on how to integrate ICT.

From the responses, participants had a lot of barriers that side-tracked the integration of ICT at early childhood development level. Most challenges were school-based, as ECD institutions lacked resources and learner friendly gadgets. Qualitative data solicited confirmed that there were a lot of barriers and a lack of capacity for teachers and school heads. All these, obstructed attempts to integrate ICT at early childhood development level. This was confirmed by H.3 who said:

We do not have funding to purchase learner-friendly ICT gadgets. Young learners need learner-sized computers which are easy to operate and should be introduced to appropriate soft-ware, that serve education purposes.

Meanwhile H. 2 alleged that:

One of the major challenges that hinders integrating ICT in early childhood development curriculum is funding. We are not given any assistance to buy ICT gadgets and assist with capacitation programmes.

Experiences of researchers was that in some classes, ICT gadgets were not matching the number of learners. Effective ICT integration requires hands on approach. This implies that, actual ICT integration is possible when ICT gadgets are sufficient to enable each learner to experience what and how to learn and to operate the gadgets. In the scenarios observed and reported, researchers observed that barriers to ICT integration were numerous. In the face of the aforementioned challenges researchers then wanted to find out if there were support services provided to teachers, learners and school heads to assist to ensure they complied with ICT curriculum integration policies. A response from Focus group 1 was that:

In the majority of ECD centres there is no electricity, hence ICT gadgets available, such as smart-phones that learners brought to schools are not efficiently used for learning purposes because most of the time the batteries are flat with no power. The schools do not have back-up power to support ICT integration. In a nutshell, power outrage is the worst challenge which affect effective ICT integration.

From the responses cited, it is clear that there were many challenges that deterred effective integration of ICT in early childhood development classes. With the challenges, it was not possible to meet that demands anticipated by the both the national and international policies on ICT integration across all education sectors.

On table 6, five teachers indicated that certain schools received support services. In the same context fifteen teachers indicated they were not receiving any support services either from the public or the private domain. The following was a qualitative response given by H 8:

Table 6: Support services for teachers

Responses	Frequencies	Percentages
Yes	5	25
No	15	75

The school and the district put in place a range of in-service programmes. These in-service programmes are based on the gaps identified during ICT integration in the curriculum. These become needs for teachers. However, only a few teachers benefit from the continuous professional courses, as only few the teachers attend the in- service course. Most schools do not send teachers because of lack of funding.

In the same vein Tr 19 said:

Supporting ICT integration is a necessity, but the schools do not have the means, in terms of sending teachers for in-service courses and buying the user-friendly gadgets. The senior teachers whom we also expect to assist junior teachers, equally require continuous professional development. However, the parents who are major funders do not have the means too.

The responses indicated that the district and ECD centres planned workshops to support teachers and centre directors to understand ICT integration in the ECD curriculum. While. it turned to be some positive contributions towards ICT integration, for workshop organisation at district and school level, as it allowed teachers to adopt a similar way of integrating ICT in the curriculum. However, the major hindrance was funding which impacted on the attendance of those who deserved the knowledge. Finally, researchers wanted to find out which model were ECD centres using to implement the ECD integration process.

Below the excerpt from H. 4 who states that:

We have a single block for ICT lesson, which lasts 30 minutes a week. During that lesson, ICT teachers teach ECD learners how to use ICT devices, activities which learners should do. However, the high teacher pupil ratios, and

the shortages of ICT appliances is often a major hindrance to effective ICT integration teach the young learners.

While there are varied models of ICT integration at early childhood development level, it depends on a number of qualified personnel, their knowledge of the different integration processes and the availability of the gadgets. It was clear the number of ICT tools and the knowledge of teachers manning the classroom were the major factors that deterred ICT integration model. If teachers do not have appropriate computer literacy skills, coupled with no meaningful computer resources, ICT integration at any level of education is compromised.

Discussion

The article investigated the challenges and the capacity of ECD environments to integrate information communication technology in the ECD curriculum. There was consensus that understanding, and the ability to integrate ICT at the ECD level of education is crucial for the transformation of the early childhood development sector programme. Such skills enhance the methods used in the delivery of content, the activities that learners do with the information communication gadgets while creating easy access to information, and developing competencies that both teachers and learners require.

The study indicated that schools that integrated ICT in learner curriculum engaged the young learners in activities which include creating pictures, developing and designing shapes, painting, which were all precursors for innovative minds. It was noted that in such schools, the young learners were able to communicate their new inventions and discoveries as they work with ICT gadgets. Such findings are underlined by Ihmeideh and AlMaadadi (2018), who acknowledge that teachers who engage in ICT integration at ECD level are important in their nurturing of creativity and critical thinking. The findings further revealed that the young learners completed assigned tasks which include solving of problems using computer gadgets. The same observation was made by Ogobo and Aina (2024) who say that ICT integration assists learners to engage in multitask activities which is good for the development of critical thinking coming through self-discoveries.

Whilst the majority of ECD centres integrated (ICT) with some limited successes, others acknowledged facing multiple barriers to integrate ICT in teaching various learning area requirements. The majority of the ECD institutions noted that the prevailing barriers were shortage of resources, specifically noting that they lacked user friendly ICT gadgets which young learners would use successfully. Participants also mentioned lack of teacher competences to navigate and substantiate the integration processes. Thus Dodge *et al*., (2015) has encouraged teachers to have the requisite skills that allow the young learners to learn and demonstrate the desired competencies. Without the necessary skills teachers were not able to assist the young learners to perfectly integrate ICT in their curriculum. Furthermore, participants noted that schools had no national syllabus, which is a number one teaching resource and critical to guide teachers on the national goals, aims, and methods to use in the processes of integration. Overall, ECD institutions had no model to learn about the good integration practices, which presented direct challenges to enhance integration of the implementation. The following were themes and sub-themes that came from the findings which are discussed.

Scarcity of ICT resources to Stimulate Integration

Early Childhood Development classes had challenges to integrate information communication technology. The ECD school environment had a dearth of reliable, modern, user-friendly ICT equipment, which was a major challenge to fully apply the principles of ICT integration. Participants evidenced the inadequacy of information communication gadgets which ECD classes experienced. The ratios of ICT gadgets to learners was too high, given that the nature of ICT integration requires hands on activities. With limited ICT gadgets, it was impossible to successfully practice integration meaningfully. The ideal technological establishment as proposed by Dzinotyiweyi & Taddese (2020) has not been claimed in schools because of resource shortages which continue to hound most preschool environments. The situation has proved a perennial barrier to successful implement ICT integration, because without infrastructure, ICT gadgets and laboratories with the relevant software, sensitive to young children the concept, remains an illusion. It should be noted that the nature of young children's learning is characterised by the

principle of learning by doing. Other scholars like Kuyayama and Nkomo (2021) also concluded that successful ICT integration at any level of education requires full investment of ICT gadgets that suffice the number of learners. The principle of adequacy of ICT gadgets is a pragmatic curriculum philosophy at early childhood development level. Successful ICT integration should allow each learner a gadget to reduce passivity and submissiveness during learner activities (NAYEC, 1996). This is buttressed by Afshari *et al*., (2009) who emphasised that ICT integration across the education curriculum can only succeed if the education leadership has the vision to inspire teachers by supplying adequate and efficient ICT learner sized gadgets. As observed, this was a major missing link in the ECD classes and it proved to be a critical challenge. This is further braced by Piaget, who noted that since pre-scholars are at the pre-operational and operational levels for successful learning, they need to be engaged through learning by doing. School management should ensure ECD classes have enough ICT gadgets to ease ICT integration and also to make learning more meaningful.

Teachers as Barriers to ICT Integration

The responses indicated teachers lacked competencies to understand ICT integration conceptions in early childhood development classes. One issue that emanated from the responses was lack of teacher competencies which is a critical aspect required in the bulk of professional abilities, because they drive the desire to learn and the motive to discover what ICT gadgets can do. The crucial role of teacher competencies is better evidenced at early childhood development level because learning at that level requires teachers who have the skills to demonstrate what can be achieved with ICT gadgets. ECD teachers should have competencies to provide clear instructions and strategies in handling ICT gadgets for educational purposes.

The principle of ICT integration is that teachers should design curriculum which is flexible and in harmony with the nature of the young children, considering the developmental age and skills of learners (Li, 2025). At early childhood development level, learning should be coined on the 'how' concepts are developed, and at the same time ensuring that practice is central to whatever the learners do (Moganashwari & Parilch 2013). As advocated, by Piaget, Bruner and Vygotsky the nature of young learners is centred around the teachers' ability to provide the necessary facilitation to the learners, allowing them to create their own knowledge. However, it was noted that in circumstances where teachers lacked the expert knowledge, the novice learners could not acquire the necessary skills. Pelgrum (2008), also observed that teachers' lack of continuous professional development opportunities in integrating ICT in the curriculum highlighted why there was the lack of teaching strategies which was a major barrier to competent teaching. The issue is further put on the spotlight by Singh, *et al*., (2014) who affirm that poor teacher competencies was a top barrier that militates against integration of ICT.

Lack of a National Syllabus

The majority of ECD institutions did not have the national syllabi from which to draw ICT integration goals, aims, strategies and possible content. The non-availability of the national document defied the fit for purpose in integrating ICT in teaching. Chris (2015) stressed the role of a national syllabus in provisioning the direction to attain quality teaching.

Researchers noted that, most teachers had no basic understanding of advantages that come with ICT integration training. To appreciate the integration better, teachers, should have the national syllabus document, to use for referral purposes (Kozma, & Vota, 2014: Li 2025). Availing national syllabus promotes harmonisation of activities, handling of learners and offers the general approaches to teach learners to achieve standards discerned by the educational system to integrate ICT (Ploman *et al*., 2011). Notwithstanding, when teachers experience the dearth of ICT national syllabus, they can hardly achieve learning objectives at any level of their teaching.

Pockets of Good Practice in Ict Integration

This study had a lot of positive practices learned which other educationists may be interested to put in practice. The pockets of good practices include networking and use of developmentally appropriate action This is critical to initiate and encourage continuous professional development programmes. These are discussed in the next section.

Networking Opportunities

The researchers noted that, nnetworking opportunities were vital that ensured professional sharing of skills and knowledge that support work ethics of personnel working in the same field. Evidence indicated that ECD institution management encouraged teachers to network with their counterparts, to gain knowledge on activities which support ICT integration (Yang & Dong, 2024). This is supported by NAYEC (2012) who encourages, networking of early childhood professionals and sees it as crucial for assisting children's critical and creative thinking. The ECD teachers networked and were sharing appropriate software as well as engaging in exchange programmes which improved ICT integration for teachers. This greatly helped teachers to embrace new technologies in the curriculum.

Developmentally Appropriateness Activities

Evidence, further show that application of ICT integration was developmentally and technologically appropriate which enable the young learners to navigate the early childhood development curriculum in totality. Selection of teaching strategies was carefully selected, ensuring that the software used was in harmony and suitable to young children's mental, physical, age, technological development which stimulated the interest of the learners. From a NAYEC (1996) position, whatever young children learn, it should be developmentally appropriate, implying that it should be in harmony with both their mental capacity and the desire towards learning that subject matter. Evidence on the ground showed that learning activities were age appropriate, and they continued to enable children to remain in control of ICT gadgets, software throughout directed learning activities.

In-Service Staff Development Programmes

Plowman & Stephen (2005) identified support given to teachers to improve ICT integration skills as critical in school-based curriculum. To support the integration of ICT in ECD curriculum, institutions engaged in staff development programmes, aiming to equip teachers with ICT skills and competencies (Makgato, 2014). In the current study, there were robust in-service programmes at school and district-level for teachers, designed to empower them to become ICT compliant (Pohio, 2011).

The majority of early childhood development environments; experienced scarce ICT tools which deterred successful integration. The situation seriously deterred the teachers' pedagogical practices to integrate ICT. Hori and Fujii, (2021), highlighted that in-service teacher training programmes could be a solution to ICT integration in many schools. In the same vein, Afshari *et al*., (2009) observed that ICT integration across the education curriculum could succeed if the education leadership has a vision to inspire teachers, by supplying them with adequate and efficient ICT learner-sized gadgets which could necessitate a multiplicity of hands on activities. This was found to be a missing link in the schools.

Areas that Need Attention from Teachers

Furthermore, evidence showed that much of activities and the designed content were not compatible to the level of learners' cognitive, physical and emotional levels. This was a hindrance to ICT integration. Li, (2025) stressed that for ICT integration to be successful, curriculum should hinge on the ability of teachers to design content and activities that match learners' capacities. To this end, teachers showed lack of appropriate skills. NAEYC (2012) further proposes that integrating technology and interactive media in early childhood programmes is built upon solid developmentally appropriate foundations. This points to the ability to match the desired competencies of teachers and their understanding of the principles of integration at early childhood development level. For instance, as a critical pillar, the principle of ICT integration requires teachers to consider both the curriculum structure and the developmental stage of young learners. This is an area which requires attention if early childhood education has to improve technologically.

As emphasised in the prefatory paragraphs, ICT integration at early childhood level should take into consideration that the curriculum should hinge on children's developmental ages and their interests to learn particular ICT activities. While some teachers were aware that children's success lie in their ability to plan developmentally appropriate curriculum, in the majority of cases it was not done. This was aggravated by the shortage of ICT hardware, and the teachers' competencies to design stimulating

activities which were major hindrance as also noted by (Goktas, *et al*., 2009).

Conclusion

The study concluded that the majority of ECD teachers are not yet competent and institutions have not made the requisite investments to successfully integrate ICT in the curriculum. However, it must be brought to the readers' attention that effective integration of ICT into the educational system at any level is not a one-day event but a complex, multifaceted process that requires support from multiple stakeholders. There must be adequate capital, for both initial and on-going training of teachers to facilitate institutional readiness and teacher competencies. In this current study, integrating ICT lacked the necessary pillars of ICT integration at any curriculum level. Specifically, support from stakeholders to fund initial purchase of the much needed resources and on-going-training, especially in a community where digital technology has not been universally taken aboard in the majority of ECD institution.

Recommendations

- In the face of lack of pedagogic and didactic training for ECD teachers, there is need to deliberate with stakeholders on the correct ICT teacher training model for pre-service trainee teachers as well as in-service teacher training opportunities.
- Stakeholder capacity need to be harnessed to fund ICT integration in young children's curriculum. This can inform workshop facilitation, funding for the purchase of digital technology and other services that facilitate ICT integration.
- The national syllabus must be availed in all early childhood institutions to ensure teachers understand what should be done regarding use of ICT in teaching and learning.

Acknowledgement

The authors would like to acknowledge the assistance that came from the district education offices who allowed this project to succeed. Further acknowledgement goes to the author's families who were forever encouraging to make sure that this paper was completed and published.

Funding Sources

The authors received no financial support for the research, authorship, and/or publication of this article.

Conflict of Interest

The authors do not have any conflict of interest.

Data Availability Statement

This statement does not apply to this article.

Ethics Statement

This research did not involve human participants, animal subjects or any material that require ethical approval

Informed Consent Statement

The informed consent was obtained and it confirms to the standards currently applied in Zimbabwe.

Permission to Reproduce Material from Other Sources

No material was reproduced from any other source

Author Contributions

- **Henry Chinhara:** Conceptualization, Methodology, writing draft, data collection, analysis and writing final draft
- **Alice Kuyayama:** Project administration and supervision

References

1. Pyati, A. (2005). The World Summit on the Information Society (WSIS): Geneva
2. Ogegbo, A. A. & Aina, A. (2020). Early childhood development teachers' perceptions on the use of technology in teaching young children. *South African Journal of Childhood Education,* 10(1), 1-10. https://doi.org/10.4102/sajce.v10i1.880
3. Manhibi, R. (2019). Information and Communication Technologies Integration into Early Childhood Development Education in Masvingo Province, Zimbabwe: *A Critical*

Analysis. University of Kwazulu Natal

4. Kuyayama, A. & Nkomo, N. (2021). Learning about or with and through ICTs: A Dilemma of Preschool Education in Zimbabwe. *International Journal of Studies in Education and Science*. Vol.2, Issue 2. Pgs102-119
5. UN General Assembly (2015). Transforming our world: the 2030 Agenda for Sustainable Development, A/RES/70/1, https://www.refworld.org/legal/resolution/unga/2015/en/111816.
6. Livingstone, S. (2013). Online Risk, Harm and Vulnerability: Reflections on the Evidence Base for Child Internet Safety Policy. ZER: *Journal of Communication Studies* 18: 13–28. http://www.ehu.eus/zer/hemeroteca/pdfs/zer35-01- livingstone.pdf
7. Partnership on Measuring ICT for Development (2011). Proposal of e-Government Indicators Report: Draft (unpublished).
8. Nut, J. (2010). Professional educators and the evolving role of ICT in schools: *Perspective report*. http://www.ictliteracy.info/rf.pdf/ICTinSchools.pdf.
9. Totimeh, F. (2012). Teachers' innovative use of computer technologies in classroom: A case of selected Ghanaian schools Charles Buabeng-Andoh Pentecost University College, Ghana. *International Journal of Education and Development using Information and Communication Technology,* 8(3), 22-34.
10. Li (2006). Sang, G., Valcke, M., Van Braak, J., & Tondeur, J. (2010). Student teachers' thinking processes and ICT integration: Predictors of prospective teaching behaviours with educational technology. *Computers & Education,* 54(1), 103- 112.
11. Kerckaet, S., Vanderlinde, R., and Van Braak (2015). The role of ICT in Early childhood education: Scale development and research on ICT use and influencing factors. *European Early Childhood Education Research Journal,* 23(2) ,183-199.
12. Salehi, H., & Salehi, Z. (2012). Integration of ICT in language teaching: Challenges a n d barriers. In Proceedings of the 3rd International Conference on e-Education, e- Business, *e-Management and e-Learning* (IC4E, 2012), IPEDR (Vol. 27, pp. 215- 219).
13. Van Niekerk, M., & Blignaut, S. (2014). A framework for information and communication technology integration in schools through teacher professional development. *Africa Education Review,* 11(2), 236-253.
14. Ministry of Primary and Secondary Education (Zimbabwe). (2019a). *ICT Policy for Primary and Secondary Education* (2015—2023).
15. Dzinotyiweyi, M, and Taddese, A. (2020). Edtech in Zimbabwe: A Rapid Scan. (edtech Hub Country Scan). DOI: 10.5281/zenodo.3903838. Available from https://docs.edtechhub.org/lib/G4UUX5P3.
16. Copple, C., Bredekamp, S., Koralek, D., & Charner, K. (Eds.). (2013). Developmentally appropriate practice. *National Association for the Education of Young Children.*
17. Fisher, D. L., Aldridge, J. M., Fraser, B. J., & Wood, D. (2001). Development, Validation and Use of a Questionnaire to Assess Students' Perceptions of Outcomes-Focused, Technology-Rich Learning Environments. The Annual Conference of the Australian Association for Research in Education, Perth.
18. Haugland, S. W. (2009). What role should technology play in young children's learning? Part 2. Early childhood classrooms in the 21st century: using computers to maximize learning. *Young Children,* 55(1), 12–18.
19. Hatherly, A., Ham, V., & Evans, L. (2009). Effective learning in early childhood education. A synthesis report.
20. Nikolopoulou, K. (2014). ICT integration in preschool classes: Examples of practices in Greece. *Creative Education*, 5(6), 402-410.
21. Young, D. K. (2012). Teachers' perceived barriers to technology integration as prescribed by 21st century learning skills. A Doctoral Study Submitted in Partial Fulfilment of the Requirements for the Degree of Doctor of Education Administrative Leadership for Teacher Learning, Walden University
22. Hori, R.; Fujii, M. (2021). Impact of Using ICT for Learning Purposes on Self-Efficacy and Persistence: Evidence from Pisa 2018. *Sustainability* 2021, 13, 6463. https://doi.org/10.3390/su13116463
23. Lee Yong Tay, Thaslim Begum Aiyoob, Terence Buan Kiong Chua, Kalaivani Ramachandran & Michael Yong Hwa Chia

(2021). Pre-schoolers' use of technology and digital media in Singapore: entertainment indulgence and/or learning engagement? *Educational Media International*, 58 (1), 1-20.

24. Timothy Ntorukiri Bariu & Xiong Chun (2022). Influence of teachers attitude on ICT implementation in kenyan universities. Cogent Education 9:1.
25. Flewitt, R., Messer, D., & Kucirkova, N. (2015). New directions for early literacy in a digital age: The iPad. *Journal of Early Childhood Literacy*, 15(3), 289-310.
26. Curriculum Development Council (2006). Guide to the Pre-Primary Curriculum. The Education Bureau HKSAR. Available at:http://www.edb.gov.hk/attachment/en/edu- system/pre-primary-kindergarten/overview/pre-primaryguide-net_en_928.pdf.
27. Dan Lu, and Ya-Nan Xie, (2024). The application of educational technology to develop problem-solving skills: A systematic review. *Thinking Skills and Creativity,* 51, e101454, https://doi.org/10.1016/j.tsc.2023.101454.
28. Ihmeideh, M. (2009). Barriers to the use of technology in Jordanian pre-school settings. *Technology, Pedagogy and Education*, 18(3), 325–341.
29. Plowman L, Stephen C., and McPake, J. (2010). Growing Up with Technology: Young children learning in a digital world. *Routledge,* 978-0-415-46892-3
30. Ihmeideh, F., and Al-Maadadi, F. (2018). Towards Improving Kindergarten Teachers' Practices Regarding the Integration of ICT into Early Years Settings. *The Asia-Pacific Education Researcher*, 27(1), 65-78.
31. Dong, C. (2018). Preschool teachers' perceptions and pedagogical practices: young children's use of ICT. *Early Child Development and Care,* 188:6, 635-650.
32. NAEYC and Fred Rogers Center. (2012). A joint position statement: Technology and interactive media as tools in early childhood programs serving children from birth through age 8. http://www.naeyc.org/files/naeyc/file/positions/PS_technology_WEB2.p pdf.
33. Fu, J. S., *et. al* (2021). Trends in educational technology research: A review of international peer-reviewed journals from 2001 to 2020 and implications for future research directions. *Computers& Education*, 171, e104262.
34. National Association for the Education of Young Children. (1996). Position statement on technology and young children—ages three through eight. urn:lcp:developmentallya00bred:lcpdf:7a40b83f-0a7b-4b2b-987e-c0c5d7ab765b
35. Voogt, J., & McKenney, S. (2017). TPACK in teacher education: are we preparing teachers to use technology for early literacy? *Technology, Pedagogy And Education*, 26(1), 69-83.
36. Plowman, L., Stevenson, O., McPake, J., Stephen, C., & Adey, C. (2011). Parents, pre-schoolers and learning with technology at home: some implications for policy. *Journal Of Computer Assisted Learning,* 27(4), 361-371.
37. Creswell, J. W. (2014). Research Design: Qualitative, Quantitative and Mixed Methods Approaches. (4th ed.). SAGE.
38. Maree K. (2016). Maree, K. (Ed). (2016). *First Steps in Research* (2nd Ed). Van Schaik Publishers.
39. Cohen, L., L. Manion, Manion, K. (2013). Research Methods in Education. *Taylor and Francis.*
40. Dodge, D. T., Berke, K., Rudick, S., Baker, H., Sparling, J., Lewis, I., & Teaching Strategies, Inc. (2015). The creative curriculum for infants, toddlers & twos. [Kit]. Teaching Strategies.
41. Afshari, M., Bakar, K. A., Su Luan, W., Samah, B. A., & Fooi, F. S. (2009). Factors Affecting Teachers' Use of Information and Communication Technology. *International Journal of Instruction*, 2, 77-104. http://eric.ed.gov/?id=ED524156.
42. Moganashwari, K., & Parilah, M. S. (2013). Knowledge, Attitude and Use of ICT among ESL Teachers. In Proceeding of the Global Summit on Education (pp. 185-199). Organised by WorldConferences.net.

Pelgrum, W. J. (2008). The effectiveness of ICT in schools: Current trends and future prospects discussion paper. [Paper presentation]. OECD Japan seminar: Teachers, teacher policies and ICT. url={https://api.semanticscholar.org/CorpusID:20141566}

43. Singh, T. K. R., & Chan, S. (2014). Teacher Readiness on ICT Integration in Teaching-Learning: A Malaysian Case Study. *International Journal of Asian Social Science,* 4, 874-885.
44. Chris, L. A. (2015). Barriers hindering implementation, innovation and adoption of ICT in primary schools in Kenya*. International Journal of Innovative Research and Development* 4(2).
45. Kozma, R. B., & Vota, W. S. (2014). ICT in developing countries: Policies, implementation, and impact. In J. Michael Spector., D. David Merill. Jan Elen & M . J Bishop (Eds.), *Handbook of research on educational communications and technology* (pp. 885-894). Springer.
46. Li, H. (2025). Integrating ICT in education: A scoping review of pre-service teachers' ICT beliefs; PLoS ONE 20(2): e0317591. https://doi.org/10.1371/journal.pone.0317591 48.
47. Plowman, L., & Stephen, C. (2001). A 'benign addition'? Research on ICT and preschool children. *Journal of Computer Assisted Learning,* 19(2), 149-164.
49. Makgato, M. (2014). Challenges contributing to poor integration of educational technology at some schools in South Africa. *Mediterranean Journal of social sciences*, 5(20), 1285.
50. Pohio, L. (2009). The implementation and integration of information and communication technologiees in early childhood education: Teachers' perspectives. Unpublished thesis submitted in partial fulfilment of the degree of Master of Education, *Unitec Institute of Technology,* New Zealand.
51. Goktas, Y.; Yildirim, S. & Z. Yildirim, Z. (2009). Main Barriers and Possible Enablers of ICTs Integration into Pre-service Teacher Education Programs, *Educational Technology & Society,* 12(1), 193-204.