Implementing Technology in an Early Years Program: Teachers and Students as Metacognitive Thinkers

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Abstract

Programs for children who are 4-5 years old and in the K-12 school system are referred to as Early Years programs or Early Childhood Education (ECE) programs. Internationally, there is a trend for these Early Years programs to have less of a subject-specific orientation (e.g., literacy, numeracy, or science) and instead become more oriented toward the development of the whole child. This change in program focus includes an increased emphasis on play as well as more attention focused on metacognition - encouraging even young children to think about their thinking. In Ontario, Canada, two Early Years classes were at the point of implementing a new mandated Early Years curriculum policy while at the same time considering the deliberate introduction of technology into the Early Years classes. The Early Years educators involved engaged in an action research project involving two classes of early years’ students, the teachers and ECE assistants. One of the authors participated as one of the two Early Years teachers and as a teacher-researchers. She systematically recorded and analyzed their program planning, assessment, and student interactions with the technology. The findings from this study provide new insight into the barriers faced with technology implementation classrooms as well as recommendations for future Early Years teachers who want to introduce more child-centered, technology-focused programs in Early Years classrooms.

1. Introduction

With a shift in international Early Years programs from subject-based to a more child-centered, holistic view of learning, teachers need to adapt their pedagogical approaches accordingly to emphasize less subject-based learning and more learning through play. Increased technology use by young children in their homes necessitates that Early Years educators keep up with innovations, also. This study follows the action research of two Early Years teachers studying how iPads can support a new, play-based Early Years curriculum policy introduced in Ontario, Canada.

According to the new Early Years curriculum policy, learning tasks need to be empowering, play-based, and individualized to apply to each student’s unique interests and allow each student his or her own creative voice. The Early Years teachers who participated in this study sought to determine how technology could be implemented into an Early Years curriculum.

Some literature exists on Early Years students and technology, which indicates that children under five use many different digital technologies in their homes, and their parents feel that technological literacy is an important skill for children to learn at school [1]. By the time they enter school, children have developed ideas about technology in their environment and how to use it [2].

There are, however, gaps in the literature on Early Years programs and technology. Much of the research on technology use in kindergarten reports positive findings but focuses mostly on iPad use in language and mathematics learning [3],[4],[5]. Research to date on technology use in Kindergarten has focused on language learning; multiple studies find that iPads help students develop literacy skills such as learning about reading, print, printing letters and phonemic awareness [3],[4],[5]. Applications such as digital books give children different types of literacy experiences and increase engagement with print [6]. Studies on the success of mathematical Apps as a tool for improving numeracy skills report positive results also [7],[8]. Little research has been reported on the relationship between iPad use and play, or the effectiveness of iPads to develop skills in other areas such as self-regulation skills or problem solving.

Rates of technology adoption in kindergarten classes are not available but technology is generally reported to be under-used in early year’s classrooms [9]. Some researchers raise concerns that children are experiencing more technology in their out-of-school lives than in the classroom [9], [10]. Technology
The new curriculum policy for Kindergarten includes some significant shifts in thinking about the early years. Early childhood educators are encouraged to think about broader domains of holistic child development rather than development in discrete subject areas. Developing the whole child, and capitalizing on children’s natural curiosity and the authentic learning that occurs during play are important aspects of the new Kindergarten curriculum policy.

![Figure 1. The Four Frames of Kindergarten Connect to the Four Foundational Conditions to Learn [13].](image)

Recent changes to the Early Years curriculum policy in Ontario do not, however, offer the teachers direction about how to integrate technology into a play-based learning environment [18]. This is consistent with findings internationally that many Early Years programs separate play and digital
technologies [19]. This is important to consider in light of the reported lack of evidence that Kindergarten teachers are integrating technology into their classrooms effectively, and that when they do use technology it is often used for teaching purposes rather than for student use [9],[10],[20]. The study reported here aims to provide research about technology and play in an attempt to fill this gap in the research. The research is intended to have significance for parents, early childhood educators, and researchers.

2.1. Barriers to tech implementation in Kindergarten

There are likely multiple reasons why Early Years teachers do not report high levels of technology use. Ertmer classifies barriers to technology integration as first- or second-order barriers [21]. First-order barriers include environmental conditions to inhibit technology use such as inadequate wireless internet, lack of technology access for teachers and students, and possibly unsupportive administration or school boards. Having a supportive administration, and the provisions of professional development and support for teachers do play a role in how teachers feel about technology [22],[23],[24],[25]. Second-order barriers refer to attitudes, beliefs, knowledge, confidence and skill level. These barriers are the more difficult to overcome because, even when the infrastructure is available in schools, if teachers are not positively disposed to the role of technology in the classroom, they will likely not choose its use as an educational tool [21].

When educators have student-centred beliefs, this is reflected in their classroom practice [23]. Technology implementation is most successful when the teacher believes that technology is important to student learning and can help children learn [9],[22],[23]. For this to happen, though, the technology needs to be in the hands of the students.

Second-order barriers can have a significant impact on the success of technology implementation [21]. Teachers who receive professional development that focuses on using technology at their students’ level are more likely to use iPads in the classroom; as the frequency of targeted professional development increases, so does teacher use [23]. When teachers have training and access to iPads, their attitudes about the benefits of using them in the classroom increase [24]. As school boards spend increased amounts of money on technology, it is important to ensure that teachers are receiving an adequate amount of support and there is a strong technology vision in place [9].

2.2. Types of educator involvement in play

According to Plowman and Stephen, when technology is introduced into early childhood learning environments, educators often take a hands-off approach, only intervening when a problem arises such as children arguing over who gets to use the device [26]. As a result, children receive little guidance on how to use the technology and their learning experiences are limited, especially for those with little prior technology experience. Early Years educators can provide reactive supervision to problems that arise during play such as turn-taking or they can use guided interaction to help the students learn about technology, but this type of interaction is rare in Early Years settings [26]. A hybrid approach to educator involvement in computer play is to provide some direction on how to use the technology and then, once children know the basics, provide guided instruction for those that need it and reactive supervision for the other children. Although a reactive approach to technology supervision has been the one most commonly observed, a hybrid approach would likely be more beneficial in a play-based setting for young learners [26].

2.3. Theoretical framework: Inquiry cycle

Though multiple models provide direction for educators when choosing learning experiences on iPads, none specifically address the needs of Early Years teachers as they navigate technology in a play-based learning environment. There is a need for research that will help the Early Years community with best practices for technology implementation for this specific population [27]. The action research study described here documents the journey of two Early Years educators implementing iPads in the Early Years classroom to meet multiple learning goals in a child-centered curriculum. The teachers were given time to work collaboratively following the teaching as inquiry model as a framework for action research, seeking to discover how Early Years teachers can use iPads to meet multiple early learning goals across a holistic curriculum.

According to Timperley, teachers assess student knowledge using formal and informal assessments in order to determine students’ needs [28]. As teachers reflect upon student needs, they are also reflective about what professional learning is needed to improve learning for students. As teachers learn new skills, they again return to the assessment of student learning. This cyclical approach to teacher learning mirrors the learning of the students [28]. The research described here provides insight into the complexities of using technology with young learners in a play-
based setting and helps to identify best practices for iPads in Early Years classrooms. (See Figure 2: Inquiry Cycle).

Figure 2. Teaching as inquiry cycle [28]

Blackwell’s research [9] draws upon Orlikowski’s Duality of Technology model [29] to explain how teacher attitudes and practices are affected by the implementation of iPads into early childhood education settings. Orlikowski suggests the duality of technology as a way to frame the relationship between an organization, agents and technology. The agents, in this case are the educators who apply the rules, social norms and resources of the organization and of the larger society. Their actions have the ability to change the structures within an organization. Along with the relationship between the organization and the agents, the addition of technology used in innovative ways by the agents can also change larger institutional structures [29]. Blackwell’s application of this theory to education, where teachers are the agents, schools are the organization and iPads are the technology is one framework that is used in this study to examine how pedagogical changes happen and affect the greater educational community [9]. For the purposes of this study, the institution was the school, including the other Kindergarten teachers within the school board. Since Kindergarten is such a specialized learning environment, the results of changes in teacher attitudes and practices in the present study will likely be most applicable for other Kindergarten classes.

3. Methodology

The teacher researchers, (one of whom is the first author), engaged in collaborative learning through teacher action research [30] which is a purposeful examination of teacher practice to improve teacher performance and student learning. With this process, educators use the inquiry process to challenge their own practices [31]. In particular, the knowledge of the first author as an experienced kindergarten teacher was viewed as a benefit for the study, because very little research has been done to date on the issue of technology and Early Years programs. Action research aims to solve specific problems that arise within practical situations for teachers, who collect data through various methods and then reflect upon the data and implement change based on the findings. These changes can improve the educational organization or setting. Unlike large-scale educational research, action research allows educators to research their unique situations and work to foster collaborative learning. Through action research, educators engage in a dynamic process moving between collection of data, reflection and action. This process does not necessarily occur in a linear order [30].

Action research gives voice to teachers who may not always be heard in decisions that are made in the public policy arena. The first author felt that, as a teacher, she was uniquely qualified to do the research that specifically would meet the needs of her students in her classroom. Ruddock and Hopkins compare the difference between a teacher-researcher and a large-scale educational researcher to the difference between a large-scale agricultural business and a backyard gardener. To the large-scale agricultural business, as long as crops are favourable overall, they do not focus on whether or not the individual plants succeed, whereas to the attentive gardener caring for his/her backyard garden, success matters for each and every one of those plants - each can be treated differently based on its needs [32]. This was significant for the teacher-researcher because she realized that what she and her teaching partner would find would be different from other classes, based on the variables of each learning environment. Also, because little similar research could be located that dealt specifically with challenges to Ontario teachers, she hoped that this research would give ideas to kindergarten teachers in her community and herself, including strategies to use iPads effectively in play-based kindergarten settings to meet the goals of the new Ontario curriculum. She also felt that research conducted by a kindergarten teacher who understands the complexities of the classroom would provide helpful insights for teachers. Since action research is an effective method of creating change in the educator’s own practices as well as organization and community practices, this was the research method chosen.
4. Data Collection

This study took place in two Early Years classrooms, each with a teacher and EC educator. Each used an iPad for documentation and assessment. Five additional iPads were shared between the two classrooms. During each research meeting the teachers focused on the same specific pre-determined questions related to the study. Discussions were recorded verbatim using an iPhone recorder as well as a handheld recorder as a backup, then transcribed and analyzed as a whole to determine the findings of the study. The teachers discussed which apps to use with students and how to implement them. Between meetings, teachers integrated iPads into their classrooms and maintained anecdotal written observations of student learning and teacher practice.

Initially the teachers chose four apps to implement. *Handwriting Without Tears*, was selected to help students develop printing skills of letters and numbers as well as to help students with fine motor skills. The second apps were a package called *Bugs and Buttons*, purchased as a bundle because the graphics and design of this app are very attractive and all the learning opportunities are games. This was chosen to interest students and engage them in math and language games. The third app was *PicCollage*, selected for documenting student learning and as a writing tool for students. This mix of apps was intended to provide a broad range of iPad use in the Early Years classroom.

4.1. Data analysis

The researcher coded the transcripts of the teacher discussions, highlighting themes and key words linked to the research question [33]. The data analysis revealed key ideas and verbatim quotes that were extrapolated to form the key findings. Narratives from the teacher-researcher were also included. Lichtman identifies narratives as a way of making sense of the data and adding stories underlying each theme. Because the first author conducted the research and acted as the teacher, interviewer and interviewee during this study, all of the findings are filtered through the perceptions of the researcher. This perspective is considered valuable in qualitative research [33].

5. Findings

In this section of the paper, the authors present the findings thematically, matching the themes that emerged during the qualitative data analysis. The findings are not presented in any specific order.

Making decisions visible: At the first meeting, the teachers chose the apps to use but it was not until the second meeting that they realized they had chosen apps focused only on language and mathematics skills. Despite the new curriculum, they perceived that the other areas of growth were less important for students to learn. This prompted the teachers to examine how curriculum goals in all four frames (such as self-regulation) could be met using iPads.

Play: The teachers began with very rigid ideas of how the iPad would be used in the classroom. The iPad use was organized so that students were in guided groups with the teacher and advised on which apps to use and for how long. The teachers perceived that they needed to be present for the learning to occur and they were worried that the students would become addicted to iPad games. They generally had some scepticism about play as the primary vehicle for learning. This was evident in comments like, “quality learning” as opposed to “exploratory”, or certain enjoyable games as, “mind-numbing activities.” Though the teachers thought they followed a play-based pedagogy, when they examined their practices more deeply, their programming decisions and opinions indicated otherwise.

Through action research and careful documentation of student learning using the iPads, the teachers had opportunities to observe and reflect upon what was happening in the learning environment. As the teachers gave the children greater freedom with the iPads, the students were observed making choices with iPads that demonstrated their learning in all four areas of holistic growth. This increased the teachers’ confidence in play-based learning, resulting in changes to pedagogical practices to better support iPad use in a playful way. As the study progressed, the teachers’ comments reflected more clarity on their role to support children’s play as this teacher’s comments indicate:

One of the things I realized is that I need to kind of get out of the way. I was really gatekeeping what the kids could do, how long they were going to do it for...I think sometimes we have to be cognizant of not disrupting their play. Because sometimes, if I’m doing something and I’m really into it, I don’t want to talk to someone about it either. I think we also need to step back.

This ability to step back and observe, trusting that children are learning through play, also gave the teachers more opportunities to document learning during play using iPads.

Technological Literacy: The teachers found that immersing themselves in learning about the technology with the students gave them many
opportunities to see the importance of technological literacy learning for students.

As the teachers progressed through the study, their definition of literacy expanded to include technological literacy. When the study began, the teachers identified literacy learning with letter matching apps or reading sight words. During the study, they observed that students using an iPad are learning about print. For example, one student who was not able to follow the handwriting app was only able sustain attention in Minecraft. He enjoyed walking through the world and was excited when he saw animals like horses. One day while he was on Minecraft he ended up on a page that asked him to type in his username and password. The teacher realized that he was using early literacy learning skills, practising using letters to communicate meaning. For the teacher, this was an observation previously connected only with traditional text, but now expanded to digital literacy skills.

Teacher Time: Since there are often many things happening at once in a play-based Kindergarten classroom, a teacher commented that, “I think being quick is of the essence in Kindergarten.” Time is always at a premium.

One of the time factors was that the teachers struggled with connectivity issues at the beginning of this study. Since many iPad apps rely on wireless connection, inadequate wireless connectivity was a distinct barrier and time was wasted putting in help tickets to get support. Also, the teachers felt that they had insufficient time to explore the apps, add apps to the devices and maintain the devices. They also found that they had little time to interact with the students using the devices due to the many other demands of a Kindergarten classroom. The provision of release time for the teachers in the study was instrumental in supporting teacher learning for all of these reasons.

Another finding with respect to the teachers was that they found that the iPads eliminated or changed some of the previously labour-intensive tasks (such as preparing chalkboards for children to practice printing). These tasks were replaced by the iPad and with much less time and effort. This also allowed the teachers more time to observe the students.

A similar finding was that the teachers did not have to photocopy work sheets, and all of the supplies were on one iPad. For example, the app Magnet Letters allows the child or teacher to pick out the letters on the iPad that are the focus of the lesson. Then the teacher can go through the instructions with students without needing to do all the preparatory work that they would have to do the traditional way. This made it a far more attractive option for the teachers and it was a time saver. The teachers also observed that some children seemed to perform better on the iPad because they had more interest in the technology. iPads also provided a variety of learning activities at different levels, allowing the teachers to scaffold instruction easily.

Shifts in the Teacher Role: The teachers discovered that students had different preferences for different learning activities using the technology. As the study began the teachers were more directive, but gradually, as the study progressed, they allowed students more freedom to choose their learning opportunities on the iPads. When all of the students were instructed to do the same activity, the need for teacher direction increased. Often, this was the result of the teacher reminding students to stay on task. Also, student frustration increased because the students in some cases did not want to do the prescribed activity or it was too difficult or too easy for them. When students were allowed to make their own choices about how to use the iPads, these issues were minimized. At these points, the teachers observed students engaged in activities that interested them and were at their level. Some students were not that interested in playing with iPads and would do it only when their friends were there and for brief amounts of time or with the teacher. The students treated the iPads like any other center in the Early Years classroom – depending on interests at the time.

Community of Learners: The teachers found that some students were very proficient at navigating certain games and could teach not only the other students but the educators in the classroom. Students were encouraged to take on leadership roles, showing others how to use the technology. One teacher commented, saying,

I’m staying away from being the expert on them and I think that’s powerful for them. I think that… too many times kids are always going to the teacher for the answer. They need to start to look within themselves and persevere to find the answer.

Minecraft and Innovation: When the teachers reviewed all of the areas of the curriculum that the iPad activities were helping students to develop, they realized that the apps chosen were not supporting the children’s development of innovation skills. One teacher for example had used Minecraft with her daughter from a young age and found it to be an incredible learning tool to allow children to make connections from learning on the iPads to the play the they were doing in class. The other teacher was apprehensive about using Minecraft because she didn’t feel that she knew enough about it but was open to the idea of trying it. The teachers found when they introduced Minecraft that many of the students were really excited because it was a link between home and school. Some had older siblings that
played **Minecraft**, their parents had **Minecraft**, or they had seen advertisements about it. They seemed to know it was something culturally important. Students made comments like, “We have this at home!” or “We get to play **Minecraft**!”

As students started using the app there were many different levels of expertise. One student had experience playing **Minecraft** at home and knew a lot more than the teachers. He could help other students discover things about it. The rest of the students had not played **Minecraft** though they knew of it. Some could build things fairly quickly and for others building structures was too difficult and they needed teacher support to create things.

One student who was not able to sit and play with apps that required focus and rule following was able to play **Minecraft**. When it was dark, he and the teacher found torches or made openings in the earth to give light. The teacher found it created opportunities to talk about light and windows. The student who was familiar with **Minecraft** was also able to bring in some of the vocabulary of **Minecraft** for the various types of rocks that were used for building.

The teacher observed that multiple learning goals were addressed by one game app. For example, one student built a house, planning where he wanted the door. This helped him develop spatial reasoning skills had seen advertisements about it. **Minecraft** though they knew of it. Some could build things fairly quickly and for others building structures was too difficult and they needed teacher support to create things.

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The teacher observed that multiple learning goals were addressed by one game app. For example, one student built a house, planning where he wanted the door. This helped him develop spatial reasoning skills needed for geometry and spatial sense in grade one. Even the conversations had about how many blocks were stacked or how large they wanted their structures to be helped students to develop mathematical vocabulary such as “rectangle” or “square” in an authentic way. As the students created the house, it started to rain in the **Minecraft** world. This brought up the conversation around creating a roof and why people need a roof for shelter.

**Minecraft** also encouraged discussion because students were eager to show each other what they had done, and they also needed each other’s help. Here is one story as related by the teacher,

**Fostering a community of learners is far more powerful than guiding everything as a teacher.** This became obvious when an older child came into the classroom and I asked her to sit with the students at the iPad table and help them with **Minecraft**. She is what I would call a “**Minecraft Expert**” and takes considerable time to study the different features of **Minecraft**. She sat at the table for about an hour with some students who I envisioned having a lot of difficulty navigating **Minecraft** independently because they had a lot of difficulty doing most tasks independently.

Afterwards, I asked her about her experience. I was particularly interested in her experience with one child that I thought might have difficulty with the program. She told me he did really well and she taught him how to make a snowman by stacking two blocks of snow and a pumpkin on top and that if done correctly the snowman would come to life. She also told me that she taught him how to make a mooshroom cow, which is a cow that grows mushrooms out of it.

Several things struck me about this experience. The first was that I had no idea that would happen if you added those blocks together, nor would I have experimented to do that. This made me realize how little I know about **Minecraft** and how kids who spend hours collaborating and experimenting have developed far more expertise than I ever will. The second thing I realized is how my idea of success playing **Minecraft** was so different than it was for kids. In the rare times that I play **Minecraft**, I build houses. And then I make sure to furnish them with a bed and a stove, etc. I make sure that I have nice big windows and an ocean view. Hence when I sat down with children, I showed them how to build houses, which was far too complicated for some of them.

When kids play **Minecraft** they have completely different goals. And for that student who could not yet make a house, making a snowman come to life was a great achievement which he was very proud of. He was learning to follow three step instructions, which is monumental learning for that child. Later when I sat with another student who had also been a part of this group, I asked him if he knew how to make the snowman come to life. He said he did and went about showing me how but was puzzled when his snowman did not come to life. We went back and looked at the blocks he used and realized that he had chosen the wrong white block. This allowed me to discuss with the student the importance of reading the labels on each material before using it. I realized that me not being at that centre and being replaced by a more experienced child was probably the best thing I could have done to support my students’ learning. And that sometimes it’s best if we as teachers get out of the way and let the kids lead the learning, especially as it relates to technology.

### 5.1. Summary of Findings

The teachers’ findings indicate that iPads can help students meet goals from the Kindergarten curriculum through a play-based approach. They found that, when they gave their students the space to make their own decisions about how and when to use the technology, they could demonstrate their ability to learn in all of the four areas of holistic growth. Ipads were a useful tool to scaffold learning to cater to many different abilities as well as to document student learning to inform instruction and as evidence
of learning for report cards. Though there were some time-consuming aspects of using iPads in the learning environment, the teachers also found that iPads saved time and made processes more efficient in other areas such as parent communication. Through this process of teacher action-research, the teachers used the inquiry model to identify their own learning goals, reflect upon how to meet those goals, and put actions in place to do so. As a result, the teachers were able to observe and gain many insights into how students learn using iPads and how teachers can best support them as they learn.

6. Discussion

The teachers experienced first- and second- order barriers similar to those experienced in other classrooms [25]. Connectivity and device management issues were significant. One of the most important factors in overcoming these barriers was time. Since the teachers were given release time for this research, they were able to persevere past the challenges. The school administrator was very supportive of technology use which also may have increased the likelihood of its use by the teachers. They also benefitted from membership in a team of Early Years educators who were very willing to learn about technology and were leaders in technology use amongst their peers. This finding needs to be considered alongside the findings of Wartella et al. [24] that technology is often under-used in early childhood education settings. The two findings offer diverse perspectives.

Time and teacher attitudes towards iPads were two of the greatest second-order barriers. Although the teachers wanted to develop greater understanding of how to use iPads effectively in their classrooms, they expressed that there was insufficient time to explore with the technology and they were frustrated by the amount of time required to work through issues. This resonates with other research that indicates that teachers spend hours of their own time preparing learning lessons on iPads [25], [34]. Because the teachers were given time to do this action research, they articulated that they could focus more deeply on building teacher knowledge and creating learning opportunities for their students on the iPads.

6.1. Teacher attitudes towards technology and play

Initially the teachers were unsure that students would learn on the iPads within a play-based model. They also had concerns about children spending too much time on iPads and neglecting other play areas in the classroom and on choosing apps that were not “educational.” The teachers placed priority on reading and writing skills over other areas of the curriculum, which resonates with other research [34].

Initially, the teachers thought that technology instruction was important as shown by their desire to participate in this research but they were unsure of how literacy instruction should occur using iPads. As the study progressed, the links between literacy and iPads became more and more apparent. This suggests that although teachers feel technology instruction is important, they are not sure how to proceed forward. Again, this resonates with previous research [34]. Teachers are experiencing multiple tensions to shift teacher pedagogies as new programs are introduced. The teachers in this study demonstrated that, through action research, they were able to explore this new program and new pedagogy. As a result, many of their concerns about technology use with young children decreased, which is consistent with other findings also [34].

6.2. Educators’ views of children

The teachers found that, when their students were playing with the technology, they could create learning opportunities for themselves. It wasn’t always what the teachers had set out as the learning goal, but when the teachers adjusted their perspective they realized that the children were more capable of complex thinking. They also realized that students found their own learning opportunities regardless of their developmental levels. One of the findings of this study was that, when the teachers systematically documented learning in all four areas of child development, they began to see pedagogical shifts.

Initially the teachers felt that they had to be involved in children’s activities for learning to take place. They did not realize that they had deep-seated beliefs about the need to be involved in the learning. As the teacher-researcher began documenting student learning using the iPad, she took on the role of the observer. The size and design of the iPad allowed the teacher-researcher to follow the students as they played - snapping pictures, writing down quotes and anecdotal notes. Through this documentation practice, both teachers found that students were meeting goals in all four growth areas as they engaged in play. This also included play with the iPads. This confirmed the teacher-researcher’s belief that children do learn best through play.

With respect to the action research process, when the teachers reflected on their students’ interactions with iPads and identified areas where they needed greater understanding as educators, they were then
able to better support their students. They began to see the positive impact of technology in kindergarten education and use the iPads more. This was an extremely important shift because if teachers do not have positive attitudes about technology’s role in student learning, they will not use it in schools [22], [23].

The findings also suggest that if teachers are given time to do their own action research, their professional knowledge will increase, as will their ability to incorporate technology into their classrooms. According to Blackwell et al., when teachers have professional development opportunities focused on technology use with students, they are more likely to use technology in their classrooms [23]. As the teachers engaged in action research, they could solve problems and gain more understanding specific to their situation. This is consistent with Brydon-Miller et al. (2003)’s definition of action research which places the power to do research in the hands of the community affected [31].

6.3. Digital Play

Initially the teachers felt very unsure about how the relationship between technology and play which highlights that there is an absence of this topic in the new Early Years curriculum policy. Teachers need adequate guidance so that they can keep up with the levels of technology use reflected in society. This highlights a policy lag or a policy gap in the curriculum. In addition, there is little direction provided to kindergarten teachers about teaching digital literacy skills. Although today’s children are learning to read and write in dramatically different ways (using text predictors, collage creators and simple video software), teachers of Early Years students in Ontario have not received policy direction on teaching these skills to students. As the teachers in this study observed children during iPad play, they found that there were many instructional opportunities to teach literacy skills. Also, if provided with more guidance, teachers would be able to provide more specific interventions for students using sustained, shared thinking, which is the technique described earlier where the Early Years educators intervene purposefully and sensitively during play to assist the children with gaining new understandings and moving forward in their learning. When combined with systematic observation and teachers’ insights, this could be a powerful combination for the development of the whole child. The teachers observed that these opportunities for children to learn through digital play developed skills across all frames of the curriculum. Similar to Rowsell and Harwood [35], this study finds that iPads expand the number of texts and types of texts to which students are exposed. This also provides opportunities for new learning for students.

6.4. Educator involvement in play

Prior to this study, the Early Years teachers had very little involvement with the technology in the classroom, similar to earlier findings that teachers of young children were taking a hands-off approach to technology and providing students with minimal direction [26]. This study confirmed that multiple first- and second-order barriers contribute to this. Once technology was placed into the forefront as a learning tool in the classroom through this study and the teachers began to explore how students could use iPads to learn, teacher involvement with the iPads increased. Though in some cases the teachers felt that controlling what the students did on the iPads seemed to get in the way of their learning, it also provided opportunities for the type of guided interaction discussed earlier is a different level of teacher involvement with technology [26]. Possibly most teachers do not have these types of interactions with students because they lack the technological skills to do so. Because the teachers in this study had time to explore the iPads and apps, they could facilitate guided interaction with their students.

Throughout the study, the teachers’ approach to iPad instruction was a hybrid approach: a mix between reacting to the students and supervising their work with technology and more thoughtful, guided interactions with students. The teachers expressed that, because they had the time to explore the use of iPads in their classrooms and their own practices, they could gain the knowledge needed to overcome second-order barriers such as lack of time or knowledge. This study resonates then with earlier findings that indicate that, although educators feel that students would benefit from this type of approach, they are not sure how to implement it in kindergarten [26].

A key finding of the present study is that, for iPads to be used effectively in the classroom, effective teaching strategies need to be used such as sustained shared thinking and a hybrid approach to technology instruction. A hybrid approach would be one that is characterized by sufficient educator support to enable the students to work independently without directing the technology engagement. Multiple studies in the literature review support similar findings [7],[8],[19],[36],[37]. This is also consistent with the position statements by the National Association for Early Years Children and the Fred Rogers Centre that technology can be an effective learning tool for young children when
6.5. Playful Teaching

Through the process of teacher reflection that was part of the action research framework, the teachers began to shift their perspective to one that more closely honours the whole child and places equal importance on development in each of the four areas of growth. Most studies about the effectiveness of iPads as a learning tool for young children focus on literacy and mathematics apps [5]; this narrow focus may be an obstacle to implementation for many stakeholders including teachers, school boards, parents, app developers, and researchers. Though the curriculum has changed, the change in educators’ instructional strategies may take longer and educators will need opportunities for professional development to explore ideas about play-based learning with technology. This study supports the finding that, even though the curriculum may have changed, deep-rooted beliefs that educators may not even be aware of can stand in their way of truly creating a play-based learning environment for students [39]. According to Pui-Wah and Stimpson, “Development of persistent inquiry and of metacognitive ability is a step to promote teachers’ competence to face the challenges of the changing context” [39], p.351.

The teachers observed that, when children are given the opportunity to choose their learning activities, they demonstrate intrinsic motivation to learn. The new Ontario kindergarten curriculum policy supports this, advocating that children will naturally endeavor to develop new understandings in each of the four areas of holistic child development. Play supports this natural development of skills. Children define play as **self-directed activities they have chosen to participate in** and this type of discovery play results in the greatest learning for students [40]. Again, the findings of this study from the teacher observations are consistent with earlier studies on play and the new curriculum policy which has a focus of meeting multiple learning goals through authentic learning experiences [13].

The teacher educators came to realize that sometimes they just need to let kids have fun without intervening in their learning to steer them towards educational goals. This is supported by Hyvonen’s findings that one of the features of playful teaching is fun and enjoyment [41] and Bergen’s finding that the most important criteria of play is that it is fun [42].

7. Conclusion

This study finds that, when teachers are engaged in action research, they are able to engage in learning that can result in positive pedagogical shifts. This is particularly important in the rapidly changing landscape of technology instruction where children are learning in dramatically different ways than generations before. This study indicates that iPads can be used in Kindergarten classrooms to meet broader curriculum goals in all four areas of child development identified in the curriculum. Further, the technology was employed optimally in an environment where students are given the freedom to play with the technology and make their own choices about how they will use the technology to learn. Within this play-based model, teachers can support student learning by using a hybrid interaction model to provide a mix of guided and reactive instruction [26].

This study highlights the need for more guidance for kindergarten teachers about how to use technology effectively in a play-based setting. This study also provides important considerations for policymakers and school boards as more funding is funneled into additional technology in schools to provide teachers with the time and resources to think and act reflectively.

In addition, this study finds that there are gaps in the present Early Years curriculum in Ontario with respect to linkages between children’s play and technology. If we want children to play with technology, then this needs to be addressed.

8. References


