

Early Childhood Teachers' integration of ICTs: Intrinsic and Extrinsic Barriers

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The aim of this paper is to report on barriers to ICT integration in teaching practices from the perspective of early childhood teachers. Six early childhood teachers from a combined private school in Queensland participated in this study. Individual interviews explored the ICT tools used in early childhood programs and the barriers to integration in teaching programs. Results indicate that a range of extrinsic barriers which included lack of certain digital tools, time, access (technical and tools) and professional development opportunities were perceived as the major barriers. Intrinsic barriers were also identified but less frequently. Strongly held philosophies about early childhood teaching practices influenced some teachers' decisions about incorporating ICT into their programs.

Introduction

The digital age has heralded a vast array of new opportunities provided by technology. In tandem with these opportunities is increased demand for our citizens to be numerate. Hence, nationwide there are calls for schools to embed technology into their educational programs to support numeracy development. Early childhood teachers and young children are the vanguard of this educational and digital revolution. Although the Early Years Learning Framework (Department of Education, Employment and Workplace Relations (DEEWR, 2009) acknowledges the importance of technology and mathematics, it provides scant guidance for early years teachers challenged with preparing young students in these areas (Fox & Diezmann, in press). This research study seeks to provide insight into the barriers that early childhood teachers might face when confronted with integrating technology into the curriculum to support numeracy learning. The research question that has guided this study is:

What are the barriers to early childhood teachers' use of educational technology to support numeracy development?

Literature Overview

Technological tools for communication, collaboration, social networking, and user-generated content have transformed how children learn (National Association for the Education of Young Children, 2012). Children are eager to engage with information communication technology (ICT) tools such as the internet, hand held mobile devices and social media (Jacob & Issac, 2008). Research has concluded that teachers held positive attitudes toward ICT for teaching and learning, and consequently are enthusiastic about integrating ICT into teaching (Ihmeideh 2009; Bingimlas 2009). Despite this optimism, the incorporation of ICTs into classrooms has proven a challenge. Notwithstanding the

dramatic growth in the digital technology accessibility in schools, research evidence concludes that teachers do not integrate technology as anticipated (Aldunate & Nussbaum, 2013), especially in early childhood education (Wartella, Blackwell, Lauricella & Robb, 2013).

This lack of integration of technology has resulted in many studies being conducted to investigate barriers to the integration of ICT into classrooms (e.g. Kopcha, 2012). Ertmer (1999) described two types of barriers that influence the effective use of ICT in classrooms, what he terms first-order extrinsic and second-order intrinsic barriers (p.48). First-order extrinsic barriers stop teachers from using technology due to lack of training and professional development; limited time to learn, practice and use technology as well as limited access to technology. Other researchers have identified similar inhibitors. For example, Bradshaw (2002) and Hinson, LaPrairie and Heroman (2006) recognised that when training was not connected to pedagogical practice or was too technically focused rather than pedagogically focused, the professional development hindered integration of ICT. Al-Senaidi, Lin and Poirot (2009) discussed findings that indicate that the time it takes teachers to plan for and use ICT is extensive and therefore can create a barrier for its assimilation into the classroom. Clark (2006) and others highlight issues that teachers face trying to access technology. Teachers may have digital tools but they do not work adequately, for example the internet may drop out, the passwords may not provide access, the tools that teachers have might not cater to the class size or they might not be appropriate for the specific teaching that is the focus of a particular lesson.

Second-order intrinsic barriers acknowledge that teachers' use of technology are influenced by their teaching beliefs and philosophies, personal confidence with a specific technology, and perceived values of that technology to promote a deeper learning experience than would otherwise be provided by that teacher. In extreme cases, teachers have revealed that they consider ICT is not useful, not appropriate and even harmful to children, and therefore, may choose not to include any digital tools in their teaching (Inan & Lowther, 2010; Parette, Quesenberry, & Blum, 2010). Research indicates many early childhood classrooms are still lacking ICT integration often due to concerns about technology's role in the early childhood curriculum (National Association for the Education of Young Children 2012; Plowman, McPake & Stephen, 2010). Hence, it is widely accepted that there are a variety of barriers that early childhood teachers might encounter when integrating ICT into their classrooms when trying to promote numeracy development.

Method

This paper draws on data from a larger research study investigating how early childhood teachers use educational technology to redefine learning experiences and support numeracy development. This paper addresses the sub-question, *What are the barriers to early childhood teachers' use of educational technology to support numeracy development?* The study used participatory action research because it empowers participants to engage in cyclic iterations of planning, action and observation, and reflection to improve professional practice (Carr & Kemmis, 1986). The data presented in this paper is from the commencement of the first iterative cycle. The key participants in this study are from a pre-preparatory to year 12 independent school in Brisbane. This study presents the results from six early childhood teachers. There were two preparatory teachers,

one teacher that taught across years 1 – 3, one year 2 teacher and two year 3 teachers. These teachers had completed degrees in early childhood education and had taught from a range of 2 – 21 years.

Results reported in this paper are from data collected through individual semi-structured interviews. The interviews focused on early childhood teachers' perceptions of the ICTs they integrated into their teaching and the supports and inhibitors they encountered when integrating digital resources into their teaching of numeracy. The interview sought information about the digital tools and software they used in their classrooms, whether they enjoyed using technology to teach, and what would help them to integrate technology more effectively in their classrooms. Example questions were, *What would help you to integrate technology into your classroom more?* and *“Do you enjoy using technology in your teaching (examples)?* The interviews were approximately 45 minutes long. They were audio recorded and later transcribed.

Data analysis explored barriers to early childhood teachers' use of educational technology to support numeracy development by drawing on Ertmer's (1999) first-order intrinsic and second-order extrinsic barriers. Within these two groups of barriers, the data was then thematically chunked (Miles & Huberman, 1994). These findings are reported below.

Results and Discussion

The interview data analysis revealed that all six teachers identified a range of first-order barriers that influenced their integration of ICT into teaching practices. However, only two teachers discussed second-order barriers.

First-order Extrinsic Barriers

Specific extrinsic barriers identified by the early childhood teachers were related to access issues (tools and technical), time constraints and lack of professional development. In relation to access issues, all six teachers cited issues with limited ICT resources and technical support.

Limited ICT Resources: The teachers indicated that young children needed individual hands on access to tools and thus the student to device ratio proved to be a significant obstacle to interaction. In some classes, students had no access to technology. Statements typical of these perceptions include:

Prep teacher B: We don't have devices, or systems, that can work for early years.

Year 1-3 teacher: Even though they're portable machines, we're not meant to be moving them around the school because of the insurance

Year 3 teacher B: They need a laptop in front of them to actually do it themselves.

The need for an adequate number of digital devices to create a one-to-one ratio was of concern to these teachers in early years' classrooms:

Year 1 – 3 teacher: It's a real life hindrance throughout the school of being able to seamlessly just pick it [e.g., laptop, iPad] up just as you would a pencil or a pair of scissors or whatever else you want or need that's right for the task.

The classrooms in this school did not have a policy in the early years of having one device for each student. The teachers indicated that for technology engagement to be effective each child needed access to a device in order to have a ‘hands on’ experience. The lack of resources created challenges for teachers to integrate ICT authentically. It also proved to be a deterrent for teachers to plan learning with digital tools as it was not considered pedagogically appropriate.

Internet and Printing Access: All early childhood teachers discussed issues with technical support and access as a major barrier in their use of ICT. Teachers reported a range of technical issues that reduced the reliability of the tools including internet drop out, devices that don’t work, and waiting time for technical support. One teacher explained the difficulty of young students accessing the internet:

Year 2 teacher A: The only issue with the iPad is they're WiFi enabled, but the school has made it that they have to connect to the guest WiFi and that requires two sets of logins each and every time with upper case, lower case and multiple letters.

Some teachers were frustrated with the functionality of the tools. Two teachers in particular were exasperated by the lack of management of technical support. This theme was the most discussed throughout the transcripts and caused the greatest frustration for the teachers. Whilst there were devices available to them, they were not necessarily in working order or they were waiting for technicians to repair the equipment:

Year 2 teacher A: I say, Hey, I need an Apple TV, because that would be better rather than me plug in every single iPad and try and get it onto my computer or just upload them and the kids can peer at it and that'll be beautiful". School goes and buys an Apple TV for me. And six months later, it's still not installed 'cause it's sitting in an IT queue.

Year 3 teacher B: It is so bizarre because when I first started in grade three there's a printer outside the classroom and it has not worked for four years. Initially I used to email, email, email. I was always told it was getting fixed and now we have to print down to the staff room. So even ourselves as teachers we're running up and down the stairs to gather work and run back upstairs. Unfortunately, because it's a community printer other people come along, grab a pile of printing and run off with it, [so] you get down there and your printing is gone. Run back up print it again, run back down. It's almost like a deterrent to even get the laptops out.

These comments demonstrate the pragmatic everyday issues teachers experience with the integration of technology. National Association for the Education of Young Children and the Fred Rogers Center for Early Learning and Children’s Media (2012) issued one joint position statement, recommending that early childhood teachers needed to use modern technologies and interactive media “intentionally” and “appropriately”.

Time constraints: Three of the six early childhood teachers discussed time constraints that impeded integration of ICTs in their classroom. These issues related to the time it took for their students and also the time it took to develop their own technology skills. Transcript excerpts give examples of the time barriers:

Prep teacher B: It's too time-consuming. It's not assistive to any learning. It's just slow...it's actually making it a slower experience, or it's a hindering thing. And I think, you're a teacher yourself, we're so time poor. You can't afford it. If you can teach it without it, and it's going to be simpler for you, then that's what we're doing

Prep teacher A: Clearing the time that it takes to address that properly rather than doing lots of things superficially, and nothing in depth, or not enough time to do anything.

Prep teacher B also indicated that because the children were young and did not have the fine motor skills or experience to use the digital tools this also created a time constraint that was specific to the younger years in schooling:

Prep teacher B: That would definitely be a barrier, that the kids can't operate them on their own, because they're not autonomous with operating them on their own. It's not set up so that they can do that. I just find it too time consuming within a lesson.

Appropriate Professional Development: Four teachers reported that the lack of training or the need for the appropriate type of training was also a barrier to technology integration. They identified, inappropriate training that lacked the connection to actual classroom practice, appropriate pedagogical knowledge and/or focused solely on technical skills. Typical comments follow:

Prep teacher A: I'd really like some sort of PD, so that I can work out with the apps that I have, the full gamut, like what I can do with them. I need time to explore them, but I need someone to help me troubleshoot.

Prep teacher B: There needs to be interactive whiteboards. There needs to be PD on technology, on software, sorry. Yeah, and it's just not there.

Year 3 teacher B: We get new devices and things and someone comes along and gives us a little lesson on how to use your new device, but there's still not a lot being offered to us in as... Like going off somewhere and spending a day with somebody doing Maths and showing you how you can actually use Maths.

Teachers indicated that the training support they received was limited, in-house and technical as opposed to pedagogically-based. However, they indicated a willingness to learn. For example one teacher reported:

Year 1 – 3 teacher: I think the school's strength, one of its main strengths, is the professionalism of its staff. If there is some way g that we can gain access to the stuff, most of them will jump on board very, very quickly.

The first-order barriers, external to teachers, identified were: lack of access to hardware and software, lack of time, lack of support, and lack of teacher training. Hence, the teachers in this study are experiencing significant first-order extrinsic barriers that reduce the way they authentically and purposefully integrate ICT into their programs. These barriers were responsible for significant frustration experienced by the teachers. This frustration has the potential to reduce the teachers' use of ICT in early years' classrooms. One year 3 teacher expressed her frustration stating you could:

Year 3 teacher B: Pull your hair out with a lot of it yes I just don't want to do this anymore 'cause at least when I get my handwriting book out I can just sit and all that works", sort of thing. So it's a very frustrating process.

Significant importance has been placed on the integration of ICTs into classrooms nationally and globally. The Organisation for Economic Co-operation and Development (2012) suggests that digital technologies have the potential to change education and teaching in schools. The role of ICTs in learning also aligns with the conception of the National Partnership Agreement on the Digital Education Revolution (DER) designed to

"contribute sustainable and meaningful change to teaching and learning in Australian schools to prepare students for further education, training and to live and work in a digital world" (DEEWR, nd, para. 1). Hence, a key goal of the *Digital Education Revolution* is to ensure that innovative uses of technologies underpin all students' learning, and that these approaches gain a strong foundation in all Australian schools (DEEWR, 2008). When ICT is not reliable, teachers will choose not to incorporate it into their programs and children will not have access to these valuable learning opportunities. Barriers experienced by these teachers are impacting on the inclusion of ICT in young children's learning experiences.

Second-order Intrinsic Barriers

The six teachers expressed interest in using ICT and high levels of comfort in using a range of applications. However, the two prep teachers also questioned the purpose of ICTs in an early childhood program. Philosophically, they expressed concern about the type and amount of ICT appropriate to their programs and its educational benefit:

Prep teacher B: So, considering my classroom isn't set up well with an interactive board, and the kids aren't using technology to learn anything, then it's not in my classroom. It's sort of either gotta [sic] be 100% learning, or we don't touch a screen, and that's me being very early years conscious, about their little brains, and eyes, and...

Prep teacher A: There needs to be a balance. I'm really wary of early childhood development and possibly not having certain skill development if there's not opportunity for that and then how that's gonna [sic] impact on them further on.

These Prep teachers were making conscious decisions not to use some forms of ICT in the classroom as Prep teacher B indicates, "[t]o be honest I haven't intentionally integrated the iPads into my lessons." These teachers need support to review the intrinsic barriers to integrating ICT into teaching to promote children's learning and development. Research has shown that quality educational media can enhance young children's learning (e.g., Jennings, Hooker, & Linebarger, 2009) and policy advocates its importance (e.g., NAEYC & Fred Rogers Center for Early Learning, 2012). United Nations Educational Scientific and Cultural Organisation (UNESCO) also views technology as a way of addressing "access, inclusion and quality" (UNESCO, 2011, para1). Thus, if teachers are to support all individuals to be successful learners from their earliest years, a concerted effort is needed to embed digital learning opportunities in classroom activities.

Conclusion

Even though the digital age provides many new opportunities for teaching and learning, the introduction and integration of ICT in early childhood teaching has long been debated by researchers (e.g., Blackwell, Lauricella & Wartella, 2014). The findings in this first phase of this study suggest that the early childhood teachers experience first-order extrinsic barriers more often than second-order intrinsic barriers. Overwhelmingly teachers identified barriers associated with access and technical support as the most detrimental to their ICT integration. They also reported a lack the time and training to use classroom technology for instructional purposes. These barriers create significant obstacles to the effective and authentic integration of ICT. Significant frustration was discussed in school practices that averted teachers' successful assimilation of ICT. The lack of access and

technical support reduces teachers confident to include ICT in their programs. The year 3B teacher commented:

We're covering ourselves with a patched sheet and that sort of thing because yes we've got the sheet, but it's just not great, but we're all making the best of what we can. And still pushing forward and still doing what we can.

Given that most teachers have an interest in engaging with technology, it is recommended that the school leadership and management review their support structures to provide seamless provision of ICT resources and services and adequate time and training to enable teachers to capitalise on opportunities to integrate ICT use to support numeracy development. Thus contemporary research is needed to provide an evidence base for school leaders and managers in adequately supporting their teachers. Further, such research can contribute to the ongoing debate about barriers that influence early childhood teachers' integration of ICT (e.g. Alliance for Childhood, 2000; Blackwell et al. 2014).

The next iterative phase of our research will investigate teachers' use of technology to support the teaching of numeracy across the curriculum. Observations of classroom practice and analysis of planning documents will provide insight into pedagogical practices and lead reflective focus groups. These practices will be situated against the four levels of the SAMR model (Puentedura, 2011) being 1) substitution, 2) augmentation 3) modification and 4) redefinition, as a way to determine if the technology being used promotes deep learning of numeracy across the curriculum.

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