

Supporting young children as digital citizens: The importance of shared understandings of technology to support integration in play-based learning

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Abstract

The ubiquity of technology in contemporary society positions it as a significant cultural tool in children's lives. Definitions, conceptualisations and understandings of the relevance of technology are diverse which can hinder integration of technology in early learning settings. This paper presents findings from a doctoral research project that investigated Australian educator beliefs and practices in relation to technology integration within play-based curriculums for children aged three to five years. The key findings presented relate to creating connections and shared conceptualisations of technology between educators, families and directors of early learning services. Shared understandings of the sociocultural relevance of diverse technological tools were found to facilitate technology integration in the curriculum. Rogoff's (1995) three planes of analysis were utilised to identify and understand the interplay between the personal, interpersonal and community levels of sociocultural activity. A significant implication is identification of the need for professional discussion, professional learning and critical reflection opportunities to extend educator understandings of technology as socially, culturally, and pedagogically relevant for young children. Sharing this knowledge in collaborative partnerships between educators, families and management can support children's development as digital citizens.

Introduction

Children have access to a broad range of technologies and observe others using technology as an everyday resource (Nikolopoulou & Gialamas, 2015). As such technology becomes a cultural tool that carries significance in their understanding of the world (Rogoff, 1995). While research acknowledges the rapidly changing field of technology Gibbons (2015) suggests that responses to the idea of "newness" of technology in relation to early childhood need to be tempered with recognition that fast-paced change within short timeframes is not a new phenomenon. Reflecting on these studies suggests that discussions with early childhood educators should focus on de-constructing broader beliefs, conceptualisations and understandings of how technologies influence practice and the approaches needed to support children in their daily experiences with

Practitioner notes

What is already known about this topic?

- Children are living in an increasingly digital world, however, this is often not reflected in the play-based experiences and resources they encounter within their early learning settings.
- Many different factors influence educator resistance to integrate technology, such as personal confidence and competence with technology, or lack of resources.
- There is a paucity of effective professional learning that is responsive to educator beliefs and practices with technology and early learning.

What this paper adds

- This paper provides an understanding of the complex and interwoven nature of factors that influence educator beliefs and practices in integrating technology.
- The relationships between key stakeholders (educators, families and service management) is identified and explored in terms of how this influences technology inclusion in the setting, and what sources inform stakeholder thinking.
- Rogoff's three planes of analysis of sociocultural activity are utilised to explain and understand these influences and connections.
- The importance of connection in knowledge and understanding between stakeholders is identified with the overarching focus on supporting children as digital citizens.

Implications for practice and/ or policy

- Further information, support and professional learning is needed to enable educators and early learning service managers to broaden conceptualisations and understandings of how children experience technology, and how technology can be integrated as a resource within their curriculums.
- Professional learning for educators needs to provide opportunities for and access to research, reading, investigation and critical reflection on their own beliefs and practices.
- Educators who are confident and competent in integrating technology in socially and culturally appropriate ways can advocate and share their knowledge with other stakeholders to create connections in understandings.

technology. Educators should also consider how their curriculums foster children's emerging development as digital citizens, which involves supporting children to develop respectful, responsible and ethical behaviours and to use technology appropriately (NAEYC & Fred Rogers Center, 2012).

Drawing on the Bordieusian ideas of cultural capital and habitus, Aldhafeeri, Palaiologou and Folorunsho (2016) note that negative responses to new technologies are often a reaction by older generations with different, acquired understandings and experiences with technology. These beliefs impact upon their views of technology as relevant in young children's lives and appropriate for inclusion in early learning settings. The disconnect between understandings that are inherited and those that are acquired (Aldhafeeri & Palaiologou, 2016) creates a habitus that must be understood and challenged. This is an important process for supporting children as digital citizens. Knowledge and proficiency with technology forms a contemporary and continually developing form of cultural capital, which will essentially empower those who are more technologically competent (Paino & Renzulli, 2012). Early guidance on using technological tools

responsibly and safely will help to equip children for the increasing contact and reliance they will have on these resources throughout their lives. Palaiologou (2014) suggests that research should now focus on the extent to which early childhood educators are “ready to accept the ‘digital child’ of the twenty-first century” (p. 19). Supporting children’s digital citizenship is a diverse and complex issue requiring connections between home and learning contexts (Palaiologou, 2014) or through recognising that there is a “digital difference” between these two contexts which can influence educators’ pedagogical decisions (Edwards, Henderson *et al.*, 2016). This creates the need to further understand educator beliefs and practices in relation to technology integration and consideration of strategies to support children’s development in an increasingly digital world.

Contemporary thinking in relation to early learning in Australia suggests that children learn best in play-based situations that reflect their home cultures and experiences (Ebbeck & Waniganayake, 2016). This approach also underpins Australia’s *Early Years Learning Framework (EYLF)* (DEEWR, 2009), the framework which guides the practice of early childhood educators. This document defines play-based learning as “[...] a context for learning through which children organise and make sense of their social worlds, as they engage actively with people, objects and representations” (p. 6). Respecting and incorporating children’s views and voices in this way aligns with sociocultural theory, highlighting the importance of scaffolding and the social interactions to support children’s learning and development (DEEWR, 2009; Rogoff, 1995).

However, technology is often not always seen as a priority or of pedagogical value for early learning. Early Childhood Australia, the peak national early childhood advocacy organisation, recently released a discussion paper on young children and digital technology in Australia (Edwards, Straker and Oakey, 2018). Drawing on contemporary research, the paper acknowledges that digital technologies have a legitimate place within early learning settings. It also identifies that while non-digital technologies (such as pencils and blocks) are accepted as everyday resources, understandings about digital technologies in play-based curriculums are still emerging. Additionally, more than half of the respondents stated that early learning curriculums should not include provisions for developing children’s skills with digital technologies. The report authors note that while early childhood educators traditionally know that social and play-based learning is optimal “Little is currently known about how to make digital citizenship education play-based for young children” (p. 7). There is a reliance on traditional theories to provide context for how technology should feature in the curriculum, rather than a shift in thinking that acknowledges digital technologies as new types of play (Edwards *et al.*, 2018). Further insights are needed into the factors that shape educator beliefs and practices. This knowledge will help to identify strategies to facilitate change and shifts in thinking in relation to appropriateness and need for technology in play-based curriculums for young children.

Purpose and research questions

This research investigated how educators used technology in their early learning services and the factors that influenced their practices. It was acknowledged that definitions and conceptualisations of technology were diverse between educators and service directors. To create consistency within this study technology was conceptualised to include digital toys or other devices such as personal computers, cameras and tablets (Palaiologou, 2016) as well as less concrete technological resources such as the Internet (Knight & Hunter, 2013); imaginary technologies and props used in dramatic play such as non-functioning keyboards and phones (Edwards, 2015); and non-digital technologies that require an external power source such as light tables and overhead projectors.

This research was positioned within a sociocultural theoretical framework and included these key research questions:

1. What are the beliefs of early childhood educators about integrating technologies in early childhood services?
2. How was technology integrated in early childhood educators' practices and what factors affected this integration?

Method

A qualitative, collective case study approach was utilised, and enabled extensive, authentic consideration of individual contexts. This study employed a design-based research approach which allowed data collection methods and the professional learning strategies to be tailored to the specificities of each service (Anderson & Shattuck, 2012). This was an important consideration in this study as each collected data set informed the next stage of the project. The iterative nature helped to ensure that the professional learning was contextually relevant.

Context and participants

Purposive sampling was used to select three early learning services in New South Wales, Australia. The study required participating services to be long day care (LDC) to increase opportunity for engagement, and for the services to be within a close proximity (two hours of travel time) to enable parity. An additional requirement was for educators to work only with children over three years of age during the study. This was due to the limited research available regarding the appropriateness of technology use for children under the age of three when the study commenced. At that time the highly regarded recommendation from the American Academic of Pediatrics was that children under the age of two should not engage with any screen media, a position they moderately revised in 2015 (Brown, Shifrin & Hill, 2015).

Three services were recruited to take part, and each service had between two and four educators involved across the two phases of the project. Each service had one director involved in the study who was responsible for overarching service operations and management. Service details are outlined in Table 1.

The selection criteria did not specify qualification levels or years of experience. This study adopted the EYLF (DEEWR, 2009) perspective of recognising all people working with young children as educators. However, qualification levels were considered in data analysis in terms of responsibility, authority and engagement with professional learning materials. Participant details are outlined in Table 2.

Theoretical framework

A sociocultural framework underpinned the study and Rogoff's (1995) three planes of analysis were utilised to understand how educators' pre-existing experiences, skills and beliefs impacted

Table 1: Details of service type, age ranges of children and number of educators involved across the study

	Type of service	Age of children in participating room	Number of educators in room
Service 1	University based LDC	3–4 years	4 (Phase 1) 2 (Phase 2)
Service 2	Privately operated LDC	3–4 years	2 (Phase 1) 2 (Phase 2)
Service 3	Privately operated LDC	4–5 years	2 (consistent Phase 1 and 2)

Table 2: Participant details

Service 1 participants	1	2	3	4	5
Position	Room leader/teacher	Educator	Educator	Support worker/ Educator	Educator
Involved in project	Phase 1 and 2	Phase 1	Phase 1	Phase 1	Phase 2
Years of experience	8 years	6 years	6 years	1 year	6 years
Qualification	Bachelor of Education (birth to five)	Diploma in Children's Services	Diploma in Children's Services	No qualifications	Certificate III in Children's Services
Service 2 Participants	1	2	3		
Position	Room leader/educator	Educator	Educator		
Involved in project	Phase 1 and 2	Phase 1	Phase 2		
Years of experience	10 years	7 years	1.5 years		
Qualification	Cert III Children's Services	Bachelor of Education	Certificate III Children's Services.		
Service 3 Participants	1	2			
Position	Room leader/teacher	Educator			
Involved in project	Phase 1 and 2	Phase 1 and 2			
Years of experience	8 years	5 years			
Qualification	Bachelor of Teaching	Certificate III			

upon technology integration within the curriculum, as well as how interactions and the early learning service context impacted on practice. Verenikina (2010) identifies that historical views of technology include computers as a tool to increase people's achievement or activity. However, as types of technology evolve and shift, so too are the ways in which technology features as an everyday tool or resource. Technology integration in early childhood education calls for innovative theoretical considerations to support educators to see technology justly positioned within play-based pedagogies (Edwards *et al.*, 2018). This study identified a synergy between the sociocultural theories of Vygotsky (1978) and Rogoff (1990) in terms of interactions and social contexts and the problem of perceived newness as identified by Gibbons (2015). This required understandings of social interaction of key early learning stakeholders (children, educators, families and management) in terms of beliefs, attitudes and practices towards technology in tandem with understandings of technology as a tool to be integrated in seamless, socioculturally relevant ways. Both Vygotsky (as cited in Davydov, 1995) and Rogoff (1990) draw on three distinct factors to demonstrate the complex and interrelated ways that people learn and develop and these provided a valuable foundation for considering the integration of technology. Vygotsky presents that even individual cognitive functions are social in nature, relying on cultural tools that have evolved and are organised in social contexts (Davydov, 1995). Rogoff (1990) consolidated and extended on these, conceptualising three planes as outlined in Table 3. Relationships and interactions are central to these planes and core aspects of sociocultural theory. Therefore, a sociocultural framework links the learner with social and cultural contexts.

Rogoff's planes (1995) enabled the investigation of the sociocultural activity on personal, interpersonal and community planes contemporaneously. These were an effective underpinning framework for the study, enabling a concurrent focus on multiple sociocultural activities (personal, interpersonal and community) and the associated developmental processes (participatory appropriation, guided participation and apprenticeship). Participatory appropriation relates to the way in which children develop as a result of their engagement in certain experiences within their contexts and how these then shape the way they participate in later experiences. Guided participation encompasses interpersonal processes, include the interactions that support and promote learning such as the benefit from collaboration with peers. While still acknowledging collaborative learning, apprenticeship focuses on cognitive and mental development within a community and the enhanced learning that can occur when working with a more capable peer (Rogoff, 1995).

Table 3: Vygotsky and Rogoff's sociocultural theories as foundations of Rogoff's planes of analysis

	Vygotsky	Rogoff
Plane 1	Student/Individual	• Subjective • Personal
Plane 2	Teacher/Intersubjectivity	• Participatory appropriation • Interpersonal • Guided • Guided participation
Plane 3	Milieu/Classroom	• Community • Institution • Apprenticeship

Note: Adapted from Vygotsky (Davydov, 1995) and Rogoff (1990; 1995).

Research indicates that diverse factors influence educator decisions to integrate technology in the curriculum (Blackwell *et al.*, 2013). Therefore, Rogoff's planes provided a lens that enabled participants to be understood within the unique complexities of their context. This approach is important as it enabled investigation of stakeholder knowledge of technology as a tool or resource in play-based learning (cultural capital) alongside and understanding of their attitudes and beliefs (habitus) (Aldhafeeri *et al.*, 2016).

Data collection

The study comprised of two phases, with findings from the first phase informing the practitioner inquiry projects in Phase 2. Initially, in Phase 1 educators at each of the three services took part in individual qualitative interviews. The interviews included nine questions, designed to gain insights into educator beliefs and perceived practices in relation to technology in early learning services, and their perceived personal confidence and competence with technology. Development of the interview questions was informed by key themes identified in a meta-analysis of research relating to technology in early learning services (including Blackwell *et al.*, 2013; Nikolopoulou & Gialamas, 2015; Palaiologou, 2014; 2016; Plowman, Stephen, & McPake, 2010).

Two observations sessions of two hours duration were also undertaken at each service during Phase 1. Observations focused on technology integration within the curriculum and provided data that was compared with educator interview responses. Recording observation data were guided by a qualitative checklist. This was designed by the researcher and included a wide range of possible considerations based on the meta-analysis of research (as noted in the previous paragraph).

Artefacts such as planning and assessment records and other documentation of children's learning and experience as recorded by the educators were collected by the researcher across both phases of the study. Data collection across Phase 2 involved four concurrent processes within the practitioner inquiry projects at each service. These included initial focus group discussions with educators at each service, involving four questions adapted from Gibbons' (2010) investigations of reflective practice and professional learning for early childhood educators and integration of technology. Observation sessions, meetings, journaling and the collection of artefacts were also integrated into the practitioner inquiry projects.

Practitioner inquiry projects

Educators engaged in reflective thinking and discussion in relation to technology after the Phase 1 case study, which informed educator projects in Phase 2 of the research. Involvement in practitioner inquiry spanned a four-month period and provided a context-specific, guided professional learning opportunity. Key professional learning components included reading and discussing contemporary research, critical reflection through journaling and group discussion and trialling new ideas and changes within their early learning programs. Meetings were held weekly and the researcher took the role of "critical friend" (Groundwater-Smith *et al.*, 2013) in guiding professional learning by encouraging engagement with professional readings, application of ideas to practice and critical reflection on the outcomes.

Data analysis

Data analysis utilised Saldaña's (2009) coding to theory approach. Data were disassembled and reassembled first into categories and then, as the project progressed, into codes and sub-codes. Additionally, analysis occurred through the coding filter or analytic lens (Saldaña, 2009) of Rogoff's planes of analysis (1995) to provide objectivity, as well as alignment with the theoretical

framework of the research project. Three categories were predetermined, relating specifically to the research questions (see Figure 1). The codes and sub-code categories were determined based on patterns of frequency, as well as similarity and difference (Saldaña (2009). Analysis of this research adopted the position that the individual is inseparable from their context, and this intersubjectivity (Rogoff, 1995) significantly impacts educator beliefs and practices, as well as how they respond to professional learning opportunities. Rogoff (1995) three planes of observing sociocultural activity (personal, interpersonal and community) were used in correspondence with related developmental processes (participatory appropriation, guided participation and apprenticeship). It was acknowledged within this framework for analysis that while one plane may be at the forefront, the other planes are interrelated and feature as background influences and must be considered when analysing data. Rogoff (1995) posits that the three planes cannot be considered independently. Therefore, throughout the coding process the interplay of participatory appropriation, guided participation and apprenticeship were consistently identified and utilised as lenses for understanding the data.

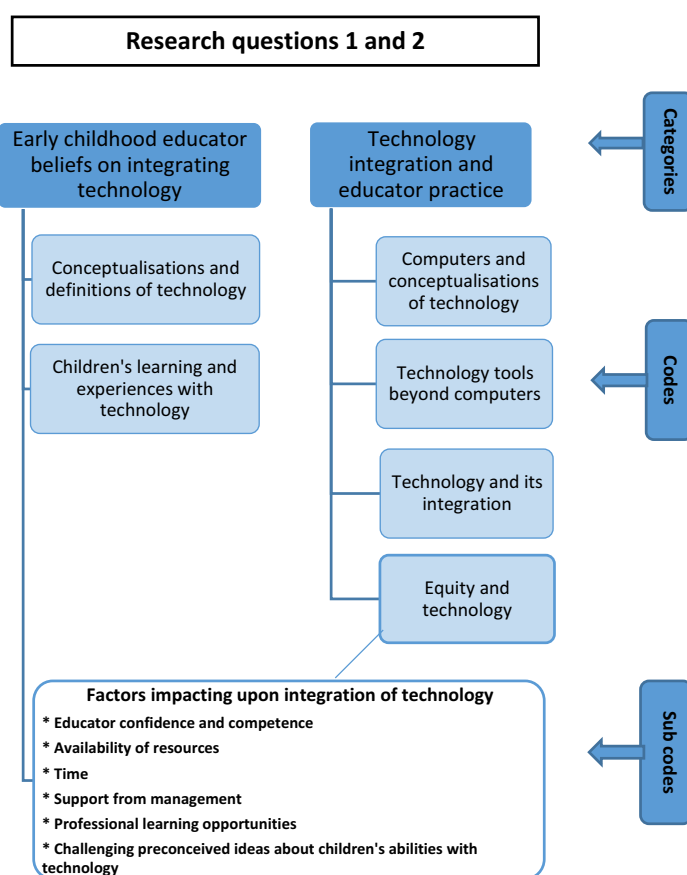


Figure 1: Categories, codes and sub-codes based on Saldaña's (2009) Coding-to-theory approach [Colour figure can be viewed at wileyonlinelibrary.com]

Findings and discussion

A number of factors were identified as influencing educator beliefs and practices relating to technology integration. These were associated with two key themes: (1) conceptualisations and definitions of technology and (2) educator understanding of children's learning and experiences with technology. These two factors were often found to be interrelated, with educator beliefs about the pedagogical appropriateness of technology influencing their perceptions of children's experiences or capabilities with technology.

Conceptualisations and definitions of technology

Differences in beliefs were apparent between all educators in this study and these related to understandings of technological resources as well in relation to the ways in which they believed technology was relevant and contributory to pedagogy. For instance, two educators at Service 2 perceived technology primarily in terms of screen media such as iPads, computers and smart phones. This contrasted with Service 3 where educators believed that technology should be conceptualised beyond physical resources. Similarly, one educator at Service 1 discussed the integrated nature of technology in children's learning stating:

You can't separate learning from technology, it has to be together otherwise it's hard these days [...] I'm not talking about Internet or—there are other things [technological resources] that offer opportunities for children to learn.

The director at Service 2 identified technologies that were essential for the service such as telephones and cameras, but expressed a disinclination to use touchscreen devices. The director from Service 3 indicated a broader conceptualisation of technology, stating:

To me technology is anything that progressed things forward [...] Like the progress of clocks through time, and telephone [...] Typewriter to computer [...] Technology is about constant change. It's about whatever is progressing life forward really.

Conceptualisations and understandings expressed by educators in terms of what constitutes technology and its relevance in the curriculum were often inconsistent. During Phase 1 interviews six of the eight participants initially identified computers (for either educators or children) when asked about technology use. However, observations of their practice over both phases of the study revealed more diverse and integrated technology use (see Table 4). This highlights the need for further discussion, reflection and professional learning opportunities to support broader understandings of children's experiences with technology in an increasingly digital world.

As evident in Table 4, educators at Service 3 included a diverse range of technological resources and experiences, however, educators did not always recognise the breadth of technology integration in their curriculum. In contrast, Service 2 educators believed they included diverse technologies yet mainly only included computers.

However, technology and learning were found to be inseparable in the context of play-based learning. For example, educators at two of the three early learning services held the view that technology was useful as a resource to follow up on children's interests in meaningful ways. Educators at these services used technological resources contemporaneously with other resources, such as the Internet alongside books to access information. This aligns with Edwards (2015), who acknowledges the difficulty in separating technology in children's play from more traditional resources due to interrelations and inter-reliance between them. Findings from this study provide examples

Table 4: Technological Resources within the Services across Data Sets

	S1	S2	S3
Computers for educators	Phase 1 Interviews Phase 1 observation Phase 2 observation Phase 2 meeting	Phase 1 interview Phase 1 observation Phase 2 observation Phase 2 meeting	Phase 1 interview Phase 1 observation Phase 2 observation Phase 2 meeting
Computers for children	Phase 1 interview Phase 1 observation Phase 2 observation Phase 2 meeting		
Internet access in room	Phase 1 observation Phase 1 artefacts Phase 2 observation Phase 2 meeting	Phase 1 observation Phase 2 observation Phase 2 meeting	
Internet access in office	Phase 1 observation Phase 2 observation Phase 2 meeting		Phase 1 observation Phase 2 observation Phase 2 meeting
Tablet device for children			Phase 1 observation Phase 2 observation Phase 2 meeting Phase 2 focus group
Digital camera for educators	Phase 1 interview P1 observation Phase 2 observation Phase 2 meeting	Phase 1 interview P1 observation Phase 2 observation Phase 2 meeting Phase 1 interview	Phase 1 interview Phase 1 observation Phase 2 observation Phase 2 meeting Phase 1 interview
Digital camera for children		Phase 1 observation Phase 2 observation Phase 2 meeting	Phase 1 artefacts Phase 2 observation Phase 2 meeting
Light table			Phase 1 observation Phase 1 artefacts Phase 2 observation Phase 2 meeting
Overhead projector			Phase 1 observation Phase 1 artefacts Phase 2 meeting
Microscope	Phase 1 interview Phase 1 observation Phase 1 artefacts		
Photocopier	Phase 1 artefacts		
Imaginary play/dramatic play props	Phase 1 interview	Phase 1 interview	
DVD/YouTube		Phase 1 observation Phase 2 observation Phase 1 interview Phase 2 focus groups Phase 2 meeting	Phase 1 interview Phase 1 observation Phase 2 observation Phase 2 meeting Phase 2 focus group

of educators also using technologies—both tangible (such as touch screen devices) and intangible (such as Internet searches) alongside traditional resources (such as reference books)—in an integrated and complementary way within a play-based curriculum.

Educator understandings of children's learning and experience with technology

In the initial interviews, one educator from each service acknowledged that technology had potential as a resource to support children's exploration and discovery. The room leader at Service 2 suggested that technology was a valuable tool for providing children with additional information, and that access to information was potentially immediate. Interview responses from educators at Services 1 and 3 reinforced this line of thinking:

[...] With things like iPads and the new apps there are different ways that children start knowing different things and it makes it easier for them [...] they will become more close to technology and it will be easier for them to learn [...] that helps them to research, to do something quickly.

[Using Google searches] is a discussion point that comes up all the time from here. So it's sort of fed in that there are other ways to find information fairly quickly [...] it's almost immediate, to follow up on their interests. Straight away, they don't have to wait.

Three educators across Services 1 and 3 acknowledged the importance of supporting children's inquiry, thinking and theorising when using technology. This acknowledgement was exemplified in a comment from an educator at Service 2:

Because if we give them all the answers straightaway they—it's not like something that they've worked on to get the answer [...] I see it's important to work on. So technology offers this opportunity for them to work on, to find answers, to explore things, to investigate things [...] It's not like we read a book, so okay, this is the answer in the book, so okay.

Data collected at Service 3 also identified technology as a complementary resource to support children's thinking and knowledge on a topic of interest. The director noted that they focused on "asking the questions, rather than giving the answers" in terms of using resources such as the Internet to facilitate inquiry and learning. At both Service 1 and Service 3, educators integrated technological resources alongside other tools such as books to support the development of critical thinking skills. Across these examples it was apparent that educators saw technology as an integrated tool, much like any other resource they included in the curriculum.

Beliefs of digital technology between stakeholders

A key issue identified was that the beliefs of other stakeholder such as service directors, families or even external regulatory bodies influenced how educators integrated technology in their curriculums. In line with the often-cautious reaction to newness identified in the introduction (Gibbons, 2010) much of the dichotomised thinking hinged on views of technology as either active or passive. As an example, there was a clear contrast between the beliefs and practices of educators at Services 2 and 3 in relation to active and passive use of technology. The director at Service 2 stated that families would not approve of screen-based technologies at the setting and service policies were adapted accordingly. Educators at this service also expressed concern the frequent use of technology distracted children and encouraged passivity at the expense of interaction and conversation. Their concern was that children were missing opportunities to

interact with their families and failing to process information in the world around them as they may have done if not provided with technological resources such as smartphones or iPads. One educator stated:

It's almost like [the parents] use it as a behaviour management tool to keep [the children] quiet.

The director at Service 3 held an alternative view of how technology could be child-led and interactive, rather than passive and isolated. This translated to service policy and philosophy, and saw educators at Service 3 empowered children by adopting a co-learner approach, inviting children to explain what they knew about digital resources and by asking open-ended questions, such as "how do we ...?" Educators always positioned digital resources as collaborative experience where the technology was a resource to support investigation rather than passive entertainment.

These examples demonstrate that the role of the director was pivotal in influencing how educators integrated diverse technologies in the curriculum. At Service 2, the director's position against technology created a situation where educators were disinclined to include it. Alternatively, the director at Service 3 supported educators to include diverse resources. Lack of support within the service context is acknowledged as a key factor impacting upon educator proclivity to integrate technology, including resistance from other educators (Nikolopoulou & Gialamas, 2015).

The influence of external stakeholders

During Phase 2, the director at Service 2 identified the influence of an external stakeholder on technology integration. The director explained that their position of avoiding digital technology was influenced by advice received from an assessor during a National Quality Standard assessment (a compulsory quality assessment process for early learning services in Australia):

The real push I got in this last visit [from the assessor] was to let them play [...] [but that] playing is not on computers, playing is not technology [...] playing is about getting dirty, climbing trees, planting things.

This example further highlights the subjectivity that exists not only in defining technology, and also the prevailing idea that technology is somehow counterproductive to other forms of play-based learning experiences for children. This advice from a regulatory body representative negatively impacted the director's attitude towards technology integration within the service. Lack of support for educators is identified as a prohibitive factor in the integration of technology and can also overlap with other barriers such as lack of resources or access to professional learning (Nikolopoulou & Gialamas, 2015).

These findings indicate that discussion on technology and early learning need to include both educators and other stakeholders who influence curriculum content, including families, service directors and also those in management or advisory positions. The influence of stakeholders was identified as one of the many complex and diverse set of factors shaping educator beliefs and practise. The interrelate nature of these factors aligned with each of Rogoff's (1995) three planes of analysis and extended beyond the individual to include interpersonal experiences and also the impact of contexts and are detailed in Table 5.

The dynamic interplay in the beliefs and experiences of the key stakeholders ultimately influences how digital technology was included within the early learning services as a resource for children.

Table 5: Factors that impacted upon integration of technology and the associated connections to Rogoff’s planes of analysis

<i>Factors that impacted upon technology integration</i>	<i>Rogoff’s planes of analysis</i>
Educator beliefs and knowledge of technology (including confidence and competence with technology, beliefs and conceptualisations of technology, educator knowledge of technological resources	Participatory appropriation
Context of service (support of management, staff team cohesion, availability of resources)	Apprenticeship
Professional learning resources (access to courses and training, readings, time to engage with professional learning and critical reflection with others in their team	Guided participation

The diverse, interactive possibilities with technology need to be discussed and redefined to present and facilitate more diverse views and conceptualisations of how technology can feature in the curriculum. Engaging in discussion and sharing knowledge with children aligns with the socio-cultural perspective of learning through communication and collaboration, which highlights the possibilities of empowering children to understand and manage their use of technology. It is important that children develop an awareness of the technologies available in contemporary societies to support digital citizenship. Discussions with stakeholders should include the types of technology children engage with and the need for active guidance and social learning with technology.

Conclusions

Contemporary research indicates that debates should move beyond the whether technology is suitable in early learning (Johnston & Highfield, 2017). However, disconnect is apparent between what is presented in contemporary research and the beliefs and practices of key stakeholder such as educators, management and families. Each educator’s willingness or interest in integrating technology varied depending on complex, interdependent and interrelated factors and the interplay of personal, interpersonal and community aspects (Rogoff, 1995), including the beliefs of family members and service directors. These factors included conceptualisations and definitions of technology, preconceptions about children’s abilities and learning with technology. Conceptualisations of technology within early learning services need to be re-examined and reimaged by educators, service directors and management, and also by families involved with the service. This reimagining needs to reflect children’s experiences, interests and knowledge of technology as a holistic and integrated resource that underpins many aspects of their everyday lives.

Within this study involvement in practitioner inquiry enabled educators to develop important foundational knowledge as to *why* technology is important in children’s lives rather than just demonstrating *how* to integrate it. Rogoff’s (1995) planes of analysis serve as a valuable lens for future studies investigating the interplay of factors that influence technology integration in early learning curriculums, and how to create connections and shared understandings between key stakeholders who influence curriculum decision making.

The ongoing nature of the practitioner inquiry projects enabled deep reflection on ideas and practices from each educator and director, within their everyday context. The resulting shifts in thinking could potentially challenge long-held beliefs or ideologies that serve as barriers to technology integration, as suggested by Palaiologou (2016). These findings therefore highlight the need for a critical

reflection in discourse amongst educators on how technology can feature in play as well as challenging assumptions of what technology is, and the value it presents to play-based learning (Palaiologou, 2016). However, educators are not solely responsible for curriculum decisions and further research is needed to investigate how other stakeholders such as families and service directors can be included in discourse, discussion and debate to create shared connections in understanding.

Acknowledgements

The authors would like to acknowledge the educators and service directors that took part in this study.

Statement on open data, ethics and conflict of interests

This study had ethical approval from Macquarie University and written consent from all participants. Six core principles were adopted (Van Den Hoonard & Van Den Hoonard, 2013) to ensure ethical principles were adhered to at all times including integrity and quality of the research, full disclosure about the project to participants and assurance to participants of confidentiality, anonymity and the voluntary nature of being involved in the study. Findings discussed in this paper are drawn from a larger doctoral study that is accessible from the Macquarie University ResearchOnline open access digital collection. There are no conflicts of interest to report for this research project.

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