Examining the shaping of teachers' pedagogical orientation for the use of technology

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Abstract

Teachers' current uses of technologies still tend to replicate traditional and or administrative practices, with research indicating that the pedagogies required for the effective integration of educational technologies is not yet in evidence amongst the majority of teachers (Author, 2012; Al-Zaidiyeen, Mei & Fook, 2010; Ertmer & Ottenbreit-Leftwich, 2010; 2013; Tsai & Chai, 2012). In order to conceptualise what could be considered effective pedagogies for the use of technology greater understanding of what informs teachers' particular approaches and how teachers come to change their approaches over time is required. Succinctly, what is needed is a deep understanding of a teacher's developmental process for their conceptualisation of the relationship between technology and pedagogy. Through an in-depth, two-year case study methodology, three teachers' journey to use game-based technologies in their classrooms was examined. The results provide valuable insights into the relationship between teachers' pedagogical beliefs and practices about the use of technologies; trigger points in teachers' journeys that influence change in their pedagogical orientation for the use of technology; and rich stories of innovation in teaching. This study has implications for teacher professional development and supporting effective technology integration.

1. Introduction

Teachers' current uses of technologies tend to replicate traditional and or administrative practices, with studies indicating that the pedagogies required for the effective integration of educational technologies is not yet in evidence amongst the majority of teachers (Author, 2012; Al-Zaidiyeen, Mei & Fook, 2010; Ertmer & Ottenbreit-Leftwich, 2010; 2013; Tsai & Chai, 2012). In addition, success with regard to technology integration has been based on how extensive or prominent its use has been in schools rather than on whether the teacher has been able to utilize it for 'new', 'better' or more 'relevant' learning outcomes (Moyle, 2010). Noting that computers have been in schools for over 40 years and the 'digital classroom' currently exists in most developed counties, there are fears that what Ertmer and Ottenbreit-Leftwich (2013) described as the 'status quo' may continue for quite some time. That is, teachers are still using technology for the delivery of content. Students are mainly learning 'from' computers through 'Googling' information and writing assignments. This is confirmed in Hsu (2016) recent study of K-6 year teachers who rely heavily on the websites for representation and information practices. The underlying issues, in the authors' view, is the emphasis teachers place on technology rather than shifting their focus towards pedagogy. This aligns with the long held view of Jonassen (1995) that when thinking about technology integration, computers should be viewed as tools to learn 'with' rather than 'about'. Ertmer and Ottenbreit-Leftwich used the term 'technology-enabled learning' as an emerging conceptualisation of the technology-pedagogy relationship that supports students' meaningful learning with technologies emphasising both the learning process and student-centred pedagogies rather than technology integration as an end goal in itself. For technology–enabled learning to be achieved in classrooms, a greater understanding of the process by which teachers develop this conceptualisation is required, as one would consider it more that just a 'new' approach but rather a 'pedagogical belief' or 'pedagogical orientation'.

According to Bourgonjon et al. (2013) the reason for the slow uptake of technologies in the classroom is the fact that pedagogy largely depends on teachers' acceptance of the given technology, and how they perceive and understand them as learning tools (Miller & Hegelheimer, 2006; Robertson & Howells, 2008). Looi, Sun, Seow and Chia (2014) described the relationship between pedagogy and technology in terms of teachers' appropriation of technology, identifying that teachers' pedagogical orientations, their teaching practices, and the intended curriculum direct their use of technologies in the classroom. Other influencing elements, such as teacher's lack of confidence and pedagogical understanding affect the usefulness of technologies as learning tools (Author, 2012). Evident in the literature is an emphasis on pedagogical understanding and/or pedagogical orientations as directing the integration of technologies. The teacher, per se, is directing how, when, where, and what technology is used in their classrooms. Pedagogical orientations are evidently a significant part of teacher's conceptualisation of the relationship between pedagogy and technology. To date there has been substantial research into the different types of pedagogical beliefs and practices in the use of technology, which will be reviewed in the forthcoming literature. However, there is less currently known about how these pedagogical beliefs and practices are shaped, how these change over time and or how a 'technology–enabled learning' conceptualisation is formed and reformed. Specifically, Levin (2015) has called for further research into specific teacher beliefs by stating "more ways to study the development of teacher beliefs are needed to find out what triggers the development of teacher beliefs and whether developmental shifts or patterns can be predicted or supported in some way" (p. 60).

In responding to this research gap, this paper will examine and provide insight into the shaping of a teachers' pedagogical orientation for the use of technologies. The research question guiding this investigation is: *How do teachers' pedagogical orientations evolve through their continued use of technology?* Specifically to examine, *What are the triggers that promote teachers' uptake of new practices and/or beliefs related to technology?* As pedagogical orientations are founded in beliefs about teaching and learning (Veen, 1993), a review of the literature on teachers' pedagogical beliefs and practices and how these evolve will be conducted.

2. Background Literature

Teacher's pedagogical beliefs and practices for technology use

Pedagogical beliefs are understandings, premises, or propositions believed to be true about education (Tondeur, van Braak & Valcke, 2007), which are formed over many years of experiences beginning with life as a pupil in the classroom (Keys, 2007; Richardson, 2003) and extending to the variety of professional contexts teachers encounter (Author, 2012). These can be conceived of as goals, purposes, and or reasons for the use of technologies in education.

Tondeur et al. (2007) found three types of goals for the use of technology in educational contexts: to learn basic computer skills (technological competency), to serve as an information tool (to research and process information) and to serve as learning tool (to practice knowledge and skills). These goals align with Downes et al. (2001) report on teachers' integration of ICT as: Goal A- Development of skills and Goal B- ICT as a learning tool, which includes both information and learning goals. However, the authors' Goal C- ICT as changing content and pedagogy, identifies beliefs that intend to transform existing curriculum practices.

Ertmer's (1999, 2005, 2012) research has focused on understanding the relationship between beliefs and practices for technology integration. Her three categories identify beliefs about the role of technology: (a) *Supplement* the required curriculum where teachers use technology to motivate, reinforce and practice subject skills such as maths facts; (b) *Enrich*

the existing curriculum where teachers use technology as an educational tool for teaching content, collaboration, higher order thinking; and (c) *Facilitates* an emerging curriculum where teachers' use technology as a transparent tool for 21st century literacies that transform the way students learn. Additionally, Mama and Hennessy's (2013) schema identified a further two categories: Administrative functions and a Subversive role in avoiding its use in classrooms.

Teacher pedagogical practice has been a topic extensively studied from many different approaches (Budge & Cowlishaw, 2012; Kember & Gow, 1994; Meyer & Eley, 2006;). Generally, and in line with pedagogical beliefs, teachers' pedagogical practices can be categorised as having a constructivist orientation and/or a traditionalist/objectivist orientation (Becker & Riel, 1999; Hadley & Sheingold, 1993; Hsu, 2016). Constructivist pedagogical practices can be described as the implementation of more student-centred activities that enable active learning, participation in discussion, collaboration, inquiry and reflection to support the development of reasoned knowledge. In contrast, traditionalist pedagogical practices involve more direct instruction so that students learn through a series of steps that lead to the production of intended and targeted knowledge.

Chan and Elliot (2004) differentiate between a traditional conception, based on teacher-centered approaches, and constructivist conceptions based on student-centered approaches to instruction. In the former approach the activities that a teacher uses to promote learning are emphasized, while in the latter the focus is on student engagement in the activity. Teo et al. (2008) used this model to study the relationship between pedagogical beliefs and uses of technology in the classroom, finding that constructivist teacher beliefs correlated with both constructivist and traditional uses of technology. Whereas, Deng et al. (2014) found no relationship between traditional pedagogical beliefs and the use of technologies but a strong relationship between constructivist beliefs, pedagogical beliefs and the use of technologies. Kim et al. (2013) also analysed this relationship and found a direct correlation between teachers' epistemic beliefs, their pedagogical beliefs, and the appropriation of technologies in teaching. In explaining this relationship further, theses researchers found that if a teacher had a more sophisticated epistemology, their conceptions were closer to the student-centered approaches and their technology integration focused more on supporting learning outcomes rather than on the technology itself. This is further supported by Ertmer et al. (2012) in their study of the relationship between beliefs and technology integration practices. They found that teachers with student-centred beliefs enact student-centred practices to both enrich and transform teaching through the use of technologies. Teachers who were using technologies to implement a project based approach or challenged base learning (new kind of pedagogy) demonstrated constructivist beliefs and practices and enable children to create, peer coach and be more self-directed through technology use. These teachers believed that technology was a leverage to go beyond the curriculum. Whereas, teachers who were using technologies to help students learn skills demonstrated more traditionalist/instructional practices such as the use of tutorial software to develop maths content and to present information to students.

How do these pedagogical beliefs and practices form and reform?

Evidenced in the early 1990's, teacher's beliefs have been repeatedly found to influence their practices or teaching styles in the classroom (Kagan, 1992; Pajares, 1992). Broad consensus also suggests that teachers adopt new technologies based on their existing pedagogical beliefs and practices (Author 2009, 2012; Dwyer, Ringstaff & Sandholtz, 1999; Tondeur, et al., 2008, Veen, 1993). As beliefs direct practice, understanding the evolutionary process of belief formation is critical in understanding the shaping of a teachers' pedagogical orientation for the use of technologies.

Rokeach (1976) talks about the strength or stability of a belief by its position in the belief system. The more central a belief is within what he calls the 'central-peripheral dimension' (p.13), the stronger it is and the less likely it is to change. Strongly held beliefs are

considered primal such as beliefs about the purpose of life or religious beliefs. Whereas the more 'peripheral' a belief within one's system of beliefs the more susceptible it is to change. Beliefs formed through personal experience are called underived beliefs and beliefs formed through other people's experience are called derived beliefs. The latter are the most likely to change as they have fewer connections and therefore fewer consequences for other beliefs. This suggests that beliefs are established during earlier experiences and become stronger over time as they are used to process subsequent experiences (Pajares, 1992). Nepsor (1987) suggested that beliefs gain their strength from their 'unboundedness', meaning that the connection a belief has with another is highly variable, unpredictable, unstable and uncertain, indicating that there is no clear logical rule for the connection. On top of this illogical formation, the linkages are bounded up with emotional and personal experiences. This then suggests that every person has their own idiosyncratic belief system of illogical connections. This premise suggests that teachers' beliefs vary in strength and kind, and the ease with which teachers change their beliefs is related to the strength of the belief under challenge. Additionally, beliefs on the peripheral of a teacher's system are more likely to change, including their underived beliefs. Rokeach (1976) did not specifically identify the formation of pedagogical beliefs or more specifically, beliefs associated with the use of technologies in classrooms. However, his understandings about the strength of beliefs, their formation and the influence of a teacher's personal experiences and other teacher's experiences provide insights into how teachers both form beliefs and appropriate the use of technologies in their classrooms.

It has been established that long-standing beliefs are supported by strong authority and broad consensus (Albion & Ertmer, 2002). Even though beliefs are not easily changed, it does not mean that they cannot be changed. According to Nespor (1987) when beliefs change, it is more likely a conversion or a Gestalt shift, rather than as a result of a marshalling of evidence. In this sense a disruption to the belief and belief system has occurred. Similarly, in order for beliefs to change, Posner, Strike, Hewson, and Gertzog (1982) indicated that an individual must be dissatisfied with their existing beliefs. This suggests that beliefs must be challenged in some way. Levin (2015) stated the need for such challenge to be part of both teacher experiences and in their metacognitive processes. Drawing on professional development literature, the seminal work of Guskey (2002) proposes that teachers' trial something in their classroom, if there is a change in student learning, interaction and or instruction that then affects a change in a teacher's beliefs. Practice precedes change in beliefs, which is congruent with one's experiences in the formation of beliefs. This process aligns with Nespor's (1987) instructional change theory that identifies the gradual change of beliefs over time rather than an abandoning of beliefs altogether. Furthermore, linking Rokeach's (1976) belief structure to Riel's (1999) belief change theory indicates that teachers' practices and beliefs are continually shaped by their ongoing experiences as teachers (underived beliefs) and by the values and opinions expressed by those around them (derived beliefs) suggesting that changing teacher's beliefs through experiences is more difficult and timely but deeper if successful. Lastly, both Kagan (1992) and Levin and Wadmany (2005) highlighted that teachers need to be cognicant of their pre-existing beliefs, be made to challenge these through practice and be open to an evaluation of their beliefs when experiencing new contexts.

In summary, if a teacher's pedagogical beliefs about technologies use is to supplement the curriculum through teacher-centred Instructional practices what triggers a change in their beliefs and/or practices to use the technology to enrich curriculum outcomes through more student-centred constructivist practices? The shaping of a teacher's pedagogical orientation will now be examined.

3. Method

This paper draws upon data collected over a two year period from the project *Serious Play: Digital Games, Learning and Literacy for twenty first century schooling*, funded by the Australian Research Council (Author 2012-2015). The project investigates what happens to

literacy and learning, curriculum, pedagogy, and assessment when digital games are introduced into schools. It explores ways in which young people's out of school experience of games and games-based learning can be used to support literacy, creativity and disciplinary learning through the use of both commercial and 'educational' (serious) games; and how this learning is best assessed. The study involves partners across two Australian states—Queensland and Victoria—and brings together a large research team with teachers in five primary schools and five secondary schools.

Working in conjunction with the research team, teachers undertook school-based research explorations within their curriculum units and attended six professional development days where they had the opportunity to share work in progress, raise questions, hear from others and plan the next iteration of the project under guidance from the research team. The project provided three parallel games-based strands to guide teachers' integration: the *use* of 'serious' and commercial digital games to support learning in the discipline areas; the critical *analysis* of digital games as text; the *making* of digital games to promote creativity. Teachers could choose any strand to focus on. To support the identification, learning and assessment of digital literacies, and to frame curriculum, pedagogy, and assessment, teachers engaged in professional development around a model conceptualising digital games as both text and action (Apperley & Beavis, 2013) and for assessing digital literacies and the use, creation, and sharing of knowledge online (Kimber & Wyatt-Smith, 2010).

In each school, a member of the research team worked closely with the teachers and students. The researcher met with their teachers at their project school sites for individual planning sessions at the beginning of each semester (twice a year). These sessions were recorded and transcribed. To collect data on the project aims, semi-structured interviews were the main data collection tool. Interviews were held at the end of each semester (twice a year). However, an initial interview was held at the beginning of the school year in conjunction with the first planning session to capture teachers' previous personal and professional experiences with digital games as well as knowledge, attitudes and concerns about using digital games in the classroom. Twice yearly interviews canvassed a range of issues that covered project aims plus progress on their digital game curriculum implementation. Specifically, questions addressed such matters as:

Initial interview year 1/term 1	Background; personal and professional experience with digital games; Knowledge, attitudes and concerns about the use of digital games.
Interview schedule year 1/Sem 2	Games as text, games as action, games and content, games and curriculum; Progress on digital game curriculum implementation
Interview schedule year 1/Sem 4	Games and creativity, games and assessment; Progress on digital game curriculum implementation
Interview schedule year 2/Sem 2	Games and pedagogy, games and purpose, games and learning; Progress on digital game curriculum implementation
Interview schedule year 2/Sem 4	Games and differentiation; home-school use of games; Progress on digital game curriculum implementation

Over the course of the two years, classroom observations were completed when the teacher was in active implementation. These were organised to observe teacher instruction for student game play (2 per year). These, at times, coincided with interview schedules. Other data collection tools included teachers' personal blogs where they reflected on their experiences with games in the classroom (submitted at their discretion) and curriculum documentation.

For this paper, teachers from the researcher's two schools are used. School A was an Independent all girl school covering prep to year 12. Three teachers participated. School B was a catholic primary school covering prep to year 6. Five teachers participated. Across the two school sites three teachers were chosen to be presented in this paper as single case studies. These teachers were chosen as they represented unusual cases with maximum variation (Asmussen & Creswell, 1995). Following transcription of interviews and drawing on planning sessions, classroom observations, teacher reflections and curriculum documents (Yin, 2009) a constant-comparison method (Strauss & Corbin, 1998) was employed within-case analysis to look for teacher beliefs, practices and triggers for change in beliefs and practices. The initial approach included an examination of the interview transcripts for evidence of these items, such as 'I believe it motivates…', ' It makes them think..' statements; thick descriptions of pedagogy, such as 'I get the students to research in groups first…'; and instances of change in thinking or practice. From this initial coding, a case record was created for each teacher. Repeated reviews of each interview transcript was completed in conjunction with analysis of planning sessions, classroom observations, blog posts and curriculum documents to support or reshape emerging themes through a constant process of going back and forth with the interview data. Interview quotes, reflection statements, descriptive segments of classroom observations and curriculum excerpts were added to case records. Three case studies considered as interpretive narratives emerged from the data.

The credibility of the data, which is a qualitative analogue of internal validity (Teddlie & Tashakkori, 2009) was gained through a prolonged engagement with the participants over a two-year period as well as the triangulation of data from multiple sources. Member checking was also employed. In the final professional development day, all project results including these case studies were presented to the teacher participants for verification of analysis and to seek further meanings. Also throughout the two-year process, co-researchers discussed, reviewed and validated interpretations and conclusions drawn from the data.

4. Results and discussion

Teacher 1- I do, We do, You do: Using digital games in the early years.

Lucy has taught in the primary classroom for over 20 years. She lacked any personal experiences with games having never played a digital game. When she first became involved in the Serious Play project she thought it was about 'games' like 'boardgames'. Her first approach to using games with a year 1 class (6 year olds) was to implement a reading tutorial to increase each child's reading fluency and to make the process 'fun'. The computer tutorial, 'Reading Quest' has four different worlds in which children advance by completing activities in phonics, word structure, sight words, vocabulary and comprehension. The Reading Quest was implemented using pedagogy Lucy describes as her approach to typical instructional practice:

In my classroom I use 'I-do; we-do; you-do'. So I model; then we do it together; then they have a go. So I think that that, to me, is best practice. I think that allows for all types of learners.

Lucy applied this pedagogy to the implementation of Reading Quest. She described this as:

So I modelled it and went through it on the board. Then we did it together on the smartboard. Then they went off and did it.

This approach evidences *teacher-centred Instructional pedagogy* as Lucy demonstrated the digital game in front of the classroom, the step by step procedure for engagement was important and emphasised, and she was in total control of game play. She chose a reading tutorial where knowledge was represented as right or wrong and sequenced in complexity. Her pedagogical beliefs indicated that she identifies the use of digital games as a tool to

*supplemen*t specific curriculum skills, in this case reading skills, through rote learning exercises. The students primarily are 'doing' or completing a given task issued by the digital game. Practicing reading skills is considered the valuable outcome. Lucy expressed that she is new to using digital games and has little familiarity and competency. As described here, Lucy was implementing digital games by adding them to existing practice (Author, 2009).

Changes to Lucy's beliefs and pedagogy occurred through implementation of this reading tutor. Initially her class were instructed to go through each quest level by level. This approached changed when Lucy saw that some children were getting bored and directed these children to 'start at the top level'. Once children became self-directed learners there was more interest and engagement by the children in the digital game. Lucy stated, "*When they could go where they wanted, they loved it*." This change in her pedagogical approach indicates the beginning of beliefs that digital games can be used in educational ways not necessarily consistent with the intention of the game as well as a disruption in the belief that learning must take place in order of knowledge complexity. The trigger here was disengagement of the children and the need for re-engagement in the learning process. For Lucy, her pedagogical approach changed as a response to learning outcomes. Effective pedagogy to enable positive learning outcomes became more important than the intentional use of the game.

Lucy felt that the use of the reading tutor was not good enough or not what the 'Serious Play' project required. From discussions with the researcher and upon her own reflection, Lucy wanted to try something different with digital games but did not know what that might look like. She stated that: "*This time I'd like to try a game that you suggest is better for them*". She was seeking more from the use of digital games in learning but wanted to be directed or told what to do. In this project the researcher provided critical discussion around the use of digital games but did not tell or prescribe particular digital games and or approaches. Rather discussion involved exploring the three possible approaches that framed the project: using, making, or analysing digital games, as well as the teacher's interests. Lucy was 'using' a digital games but was interested in doing something different.

At this point Lucy could be considered to be more open to or at a critical point for change described by Nespor (1987) as in a 'Gestalt shift' in both her beliefs about the use of digital games and the pedagogy around their use. She experienced a change in her beliefs about the use of the reading tutorial, 'as it wasn't good enough' and acknowledged the change in student experience and learning outcomes. The context of a research project, the opportunity to experiment, and the fact that digital games were new tools for Lucy may have provided her with the trigger to explore the boundaries of her beliefs (Nepsor, 1987).

The following year, Lucy decided to trial Minecraft as she knew it was a game that her year 3 class (8 year olds) enjoyed at home. Minecraft is a sandbox construction game where the player has the ability to move freely around an unlimited virtual world. As Lucy didn't know how to play the game (low competency) she implemented an exploratory period using a couple of children who knew about the game as leaders of groups. She did not use her instructional pedagogy of 'I do, We do, You do' as she said "*it wouldn't work and I had no idea of what I was doing*". Using group rotations, children played in Minecraft freely. To relate it to curriculum outcomes the children wrote recounts of what they were doing in Minecraft. At this stage, Lucy's use of Minecraft could be considered as *enriching* existing curriculum with practices that are primarily *student-centred*. Her pedagogy is more open and experimental but with purpose to subject/content outcomes. The *trigger* here for change in pedagogical beliefs from *supporting* (reading tutor) to *enriching* (Minecraft recounts) curriculum as well as a more student-centred approach to enable integration of the technology could be associated with the type of digital game, that is, an open exploratory sandbox space requiring student to build and create rather than a tutorial game requiring limited responses.

Building on this in the following term, Lucy designed and implemented a multi-disciplinary unit of work that required the children in groups to analyse the history of the local community to build a new community in their Minecraft world. Google Maps was used initially to identify the local area and its attributes such as roads, buildings, resources etc. At the beginning of each week, Lucy conducted a whole class session to cover some local area history. During the week, each group planned and worked on their building tasks, attempting to re-create European settlement in their local Minecraft area. Each group member operated their own computer but they worked together, interacting in their Minecraft world for 40 – 60 mins per week on a rotational basis, while other groups worked on related local area tasks. After each session the children recorded an entry in their personal learning logs. They did some group reflection about building in Minecraft and teamwork, as well as set goals for the next session. Lucy also used the experience for writing stimulus and a variety of maths activities. As a culminating activity, each group had to create a movie demonstrating the features of their Minecraft community persuading others to settle there.

What is interesting here is the difference between Lucy's pedagogical orientation when teaching about the local area content and implementing the digital game. Different rules seem to govern. Lucy was using instructional practices to impart knowledge, step by step about the local area but she changed pedagogical orientation for the use of Minecraft. When the children were using Minecraft, Lucy adopted a *constructivist* approach with *student-centred* pedagogies and viewed knowledge acquisition as more uncertain and generated by self as children were collaboratively creating their own local area through exploration and experimentation in Minecraft. She was *facilitating* new learning pathways but her competency for the digital game itself remained low.

Lucy suggests these changes in her beliefs and pedagogy orientation for the use of the digital game in her classroom were *triggered* by a number of factors as she explains:

I don't like to fail anything and I felt I didn't do it right the first time. So I think it's allowing yourself to know less than the kids, and learn from them because I'm never going be up with all of it anyway. I watch what they do. There'll be more and more games that I won't be interested in either, but as long as I can monitor it and keep an eye on them then I know that it's a good thing, then that's all good. I also think it's finding the right game that lends itself to lots of areas. I wouldn't have used the other game [Reading Quest] as often or as intensely I suppose. It wouldn't have been a huge part of what we did but this one, they just constantly talk about it, it drives me crazy.

The triggers were her students being capable and interested in Minecraft and a greater understanding of her role in technology-enabled learning. Firstly, by stating that it is ok to '*know less than the kids*' indicates a change in her pedagogical beliefs about teaching and learning, that the teacher is not imparting the knowledge in a traditional didactic manner but learning should be self-directed by the students, when involved in game-play. Lucy begins to describe herself as a facilitator, focused on '*monitoring*' the learning, seeking content-free 'sandbox' like digital games, rather than content specific games, where children can explore and discover things for themselves. These sandbox digital games can be used in many areas of the curriculum and become an embedded part of the learning process rather than a separate tool that is used for specific skills, such as in the Reading tutor. This indicates that Lucy is thinking more about the pedagogical use of the digital game rather than thinking about the game /tutorial itself.

Teacher 2- My Big Book game

With no prior experience with digital games, doubts about the value of them as educational tools, and a pattern of restricting her own children's access to technology at home, Judy said she was willing to change her mind coming into the project. Judy had a year 2 class (7 year olds) and wanted to use a digital game in English lessons. Her first goal was to support the

existing curriculum, as she states:

We usually use a storybook a week to practice our grammar skills and as a writing inspiration and springboard. I hope to replace the book with a game.

Judy used the adventure game, Ratchet and Clank, on a Play Station (PS) as an interactive 'big book' for language activities. The class sat around a TV and took turns passing the controls around. There were lots of verbal directions and encouragement (and with much excitement) for the child who had the controls as they played the game. At important points in the game, Judy stopped the play and stimulated the children's thinking about game strategy, character, setting, and narrative elements. Judy describes this *teacher-directed* pedagogical approach:

There were desert settings and sea settings so that was wonderful for vocab. Then of course there is always a problem. As soon as we identified the bomb we would stop the game and go right, so what's the problem in this story, where's it set, who's the character, now let's see how he's going to solve the problem. Then of course as in all narratives the problem isn't solved straight away.

Ratchet and Clank became the class text. On walls around the classroom descriptive words were listed, children's drawings of characters were displayed along with posters of the narrative structure. The children would play the game for 30 minutes and then Judy would teach a 30-minute English lesson. Judy describes the focused *instructional* pedagogy that she used:

We broke down the genre into a definition, habitat description and physical description. We also spoke about pronouns and other subject synonyms. It was great!

When it came to writing Judy states that it was initially a '*resounding moan*', however, to her surprise the children, especially the boys wrote '*really, really good descriptions*'. Judy continues:

The volume for these two boys - like they would be lucky to write half a page and you'd be lucky that it would make sense. Now they write up to two pages - and you can follow it - and that's a big thing for them. Because the picture is in their head, it's clearer - they can follow the story rather than making it up on their own and they follow the story and it gives them that sequence. So it's been good for them.

Judy believes that boys, who are less enthusiastic, were writing volumes of work as they '*have the story running in their minds*', the visual was a leverage for fluid writing. She states that teaching narrative at this age is very hard as children don't have the imagination. The multimodality of the game painted a picture in the boy's heads much better than a book.

Judy integrated the PS game to support curriculum outcomes in English. She used her existing pedagogical practices that were primarily teacher centred where explicit English genre and concepts were taught through instructional practices both during the game and in post English lessons. The game became a text just like any other teaching tool in her classroom. However, Judy's exploration of the PS game with the children opened up her ideas about the PS game being conceptualised as a 'text' and the impact of 'action' and the 'multimodality' of the digital game.

Judy's trigger for change in her beliefs about the role of digital games was associated with the learning outcomes achieved by the boys in her class. It was evident that Judy's pedagogical beliefs about the value of digital games were changing. During implementation, Judy was able to see the level of excitement of the children, the learning outcomes achieved especially for the boys, as well as, the identification of the PS game as a narrative text. All of these experiences contributed to changes in her beliefs associated with game-based learning

as a tool to *enrich* the curriculum. She did not choose a game that developed grammar through a tutorial drill, rather she chose a game that provided a rich multimodal space for application of English curriculum elements. However, her pedagogical practices remained *primarily teacher-centred*, as she had the control of game-play as she and her class played in a step by step fashion, refocusing children's attention to the literacy aspects of the game during play.

The following year Judy had a year 7 class (12 year olds) and wanted to use a digital game in English based on her success in year 2. She expressed her concern in this interview segment:

They're not really doing narrative as such, not in that really simple problem-solution. So I don't think I'd be doing it. I'm concerned that I'm not really fulfilling the curriculum.

Judy's first response to using games with Year 7 was to mirror previous practices. Even though Judy believed that digital games enable additional social outcomes (taking turns, supportive language) she felt a major burden with getting through the Year 7 content. At this point Judy could not see the link between pedagogy, content and technology, like she had with the Year 2 class. Judy decided to implement Temple Run (Ipad App) to support the development of complex sentences. The Year 7 curriculum requires students to use a lot of descriptions, adding extra clauses, embedding clauses and comparing short and complex sentence forms. Judy explains:

I was playing Temple Run and I thought actually this could be a really good thing because it just happens so fast, kids could play and use short sentences like blah, blah, blah, and then longer, you know my heart pounded - add an extra clause as I blah, blah, blah. So I'm thinking Temple Run as an inspiration to see if they can apply using those short sentences for dramatic effect and then also using embedded clauses to write something a bit bigger.

Temple Run was used as a text. Judy implemented it in the same manner as the Ratchet and Clank PS game. She used the interactive whiteboard and played the game with the class leading discussion. Children were then paired and had a series of attempts at playing the game while calling out what was happening for their partner to scribe out the verbal game-play. The move from teacher directed instruction to student-paired work was based on access to technology as Temple Run was available only a class set of Ipads. Her *traditionalist pedagogical practices* directed students to learn through as a series of steps that lead to the production of intended knowledge. This was evident when she was asked if the children would then write a collaborative passage as demonstration of their co-constructed rich descriptions. Judy explained that:

Just because I tend to find with this class if they use stuff - because I do a lot of group work - that it's always one person who does it and the other generally just hang around and don't really achieve anything. I'd like them to all try it on their own [as] you can work together but then ultimately I need to see something that you've produced yourself independently. That's just always been a nit-picky thing of mine. I don't know but no I - as I said, if they did write that thing in pairs, I'd think, oh I wish I knew who came up with that. You asked them and they'd go, oh was it you?

This excerpt illustrates a move towards student-centred practices with the game play however, as Judy still required independent writing outputs, her pedagogical beliefs are still evident in that the technology *enriches* the existing curriculum with primarily traditionalist *teacher-centred practices*. Lastly, as with Judy's use of Ratchet and Clank, she hoped that the students with poorer literacy skills would improve their writing through the stimulus of Temple Run. However, she found the opposite occurred:

My main struggling kids, who have a teacher aide, she worked with them and they struggled. They just didn't know how to put it into words. They really found that hard, just because their

oral language isn't even good enough to look at the game and describe what's happening. Sadly but it's true, if you get to this time - to this part of school, by Grade 7, and you're not a strong writer, I think that's kind of where you are. You will remain - I mean, it sounds bad for a teacher to say that, but there's little more that people can do. It's - like I say to the kids, it's a craft. Being able to write is a craft.

Judy's pedagogical orientations for the use of digital games are focused on *enriching* existing curriculum primarily through *teacher-centred practices*. Her use of both Ratchet and Clank and Temple Run have provided opportunities for her to change her beliefs about the role of games as educational tools and has provided a lens in thinking about student's capabilities in English and how her students learn through technologies. Her pedagogical beliefs were evolving but her pedagogical practices remained the same.

Teacher 3- Solving a Myst Mystery

Kate started out with the objective for this project as wanting to know how to use games effectively as she believed in their value as educational tools. She thought digital games improved learning as she believed that children don't like the '*boring ways of learning as they are used to lights and actions*'. She had used a variety of drill/skill types games (*supplementing* the curriculum). After a lot of investigation into various digital games, Kate chose Myst, an adventure game, with an English curriculum focus on descriptive writing for her Year 7 class (12 year olds). Kate started out exploring the game herself. She had had little experience of these types of games as indicated in this excerpt:

I have never used anything like this before, and when I first came across this I was sceptical as to whether it would actually work, and I actually tried to play it myself and gave up fairly quickly because I wasn't sure what I was doing. So I gave up and thought, well I hope they don't give up as quickly as I did.

Kate wanted to use the Myst Ipad App as she had one Ipad to two students and they hadn't done a lot with those devices as yet. To start off the whole class watched the 'Introduction to Chapter 1'. She stated that '*there was a sea of puzzled faces and they were itching to find out more*'. The children were allowed to explore the digital game in pairs. Kate paired the children who don't usually work together. They had 35 minutes for play and then a whole class discussion for 35 minutes about challenges, achievements, problems solved and goals for next session. They also had to write descriptive passages, placing themselves in character. This indicates a mix of traditionalist and constructivist approach in instructional and exploratory game play.

Interestingly, the children's interactions and the way they played the game became the trigger for change in her pedagogical beliefs and practices for Kate. Initially within the pairs the children were secretive, they wouldn't share with each other when they got through a puzzle/level. In class discussions they wouldn't share how they solved problems or provide suggestions in case others got through levels in the game first. At this point Kate reinforced the idea of the class playing together. She asked groups to take notes during game play and share these in class sessions. This was the turning point in the game play. Kate explains:

They were running around the classroom with the iPads and screeching things and yelling things, and we used the MAC Air-server which throws things up on the screen and they'd go, look at this, look at this. Then they'd all help each other, so it's been an absolutely wonderful experience.

At that point she stated that '*any doubts I may have had that this would be of benefit at all have dissipated*'. Kate said she took on the facilitator role, monitoring children's interaction, stimulating discussion, so much so the children took control of the teaching. She described the collaborative nature of using the game through the tasks the children were doing:

I am pleased to report that they say they are working collaboratively, problem solving, using mathematical types of skills of backtracking and working out puzzles or patterns, making notes, navigating around maps and using their knowledge of music. They are very aware of the benefits they are gleaning from playing what they first thought of as 'a really clunky game with baaad graphics'

Kate moved towards constructivist approaches where she facilitated game play to enable the children to take on the teaching role. She was *facilitating* new learning pathways and like Lucy, her competency for the digital game itself remained low. When challenged on the crowded curriculum and the need to assess student learning, which Judy was constricted by, Kate justifies the inclusion of using Myst through the development of problem solving skills, patience, working collaboratively especially with people the children don't usually work with. She indicates this with importance by stating that *'they've seen strength in others that they don't usually see, and that's really wonderful as those kids don't usually shine'*. Kate also acknowledges that the children know it has helped them to work together and their problem solving, compared to the original curriculum intent of the development of descriptive writing.

Kate's pedagogical orientation changed in that initially she was focused on the use of the technology to enrich specific curriculum, which was descriptive writing in English. As the game was played in her class, her beliefs changed to *facilitate new ways of learning* as she was finding that student learning processes such as collaboration, critical thinking and inquiry were developing, which she believed were just as important. Kate's pedagogical practices were aligned to *constructivist orientations* where student centred learning supports the co-construction of knowledge through collaborative tasks. In the game play Kate required her students to '*go away and think about it and work on the activity/problem with peers*'. Collaboration and experimentation are pivotal to her teaching in the use of digital games. The trigger for Kate was in needing to change students' 'competitive' approach to a 'collaborative' approach. Kate also changed her choice of gaming technology, as she had previously only used skill and drill software. Her choice of Myst, triggered a change in her belief about the educational role of games (from *supplement to facilitating* new ways of learning), as well as using more student-centred practices where her students were leading the teaching-learning. Kate said "*I'd do it again*" but had to withdraw to pilot an Ipad classroom the following year.

5. Conclusion and Implications

This paper has sought to examine and provide insight into the shaping of a teachers' pedagogical orientation for the use of technologies. The research question guiding this study was *How do teachers' pedagogical orientations evolve through their continued use of technology?* Specifically *What are the triggers that promote teachers' uptake of new practices and/or beliefs related to technology?* In all three cases, teachers' pedagogical beliefs about the role of digital games had an impact on their choice of game and during implementation beliefs and or pedagogical practices were triggered to change. For Lucy, her traditionalist teacher-centred practice which focused on content development directed her to choose a Reading Tutor to supplement the curriculum. When this wasn't enabling all students, 'dissatisfaction' occurred within Lucy's belief system as some students were disengaging and she found the tutorial to be pedagogically limited. This dissatisfaction with pedagogical outcomes triggered a change in choice of type of digital game as well as the appropriation of its use. For Judy, she chose a game that replicated other tools she used in her classroom that enriched the curriculum. Her change in beliefs about the role of games was triggered when her boys were more engaged in the process of writing. Judy considered their achievement due to the multimodality of the game. Both her pedagogical understandings of digital games as texts and their value as stimulus for writing were evolving further during game implementation. For Kate, she chose an adventure game as it aligned to her underlying constructivist beliefs which triggered further development of her

student-centred pedagogies as the children took charge, working as a team and thinking critically. In answering the research questions, student learning outcomes associated with curriculum content as well as student engagement, were the major triggers that caused teachers' pedagogical orientations to evolve during game implementation. Identification of these as triggers to disrupt existing beliefs and influence change in both beliefs and practices with technologies presents new insights in belief formation and reformation.

Additionally, there are three major findings associated with the shaping of a teachers' pedagogical orientation for the use of technologies. Firstly, each teacher expressed a change in her beliefs and or practices during the implementation phase. Secondly, each teacher was low in initial technological competency and thirdly, each teacher initially used digital games based on how they usually teach. Each will be discussed with implications.

Firstly, a change in beliefs occurred during the implementation phase as the teachers were using the digital games. This affirms Fullan's (1992) change theory within the context of digital technology appropriation, in that, the implementation of a digital game preceded change in beliefs as action pre-empted reflection during student game play. During digital game implementation tension occurred between content, pedagogy, technology and student experience. Each teacher was focused on student learning outcomes and what the technology was enabling that other educational tools could not. The tension caused 'dissatisfaction' within the teachers' belief system as described by Posner, Strike, Hewson, and Gertzog (1982) that triggered the re-shaping of the belief. This process provides insight into the formation and reformation of a teacher's pedagogical orientation for technology enabled practice. Developing this metacognitive approach to digital game appropriation supported by Kagan (1992) and Levin and Wadmany (2005) provides that space for change to occur. This brings to light implications for teacher professional development, such that, the requirement of a metacognitive approach where teachers come to know and understand their beliefs that inform their practices at the onset and actively explore the 'truth' of these during implementation of their professional learning cycles. Additionally, there is a need for an extended period of professional engagement for reformation of beliefs to occur (see Levin, 2015; Miranda & Daminco, 2015; Author, 2016a). The focus on teacher beliefs within teacher professional development may bridge the gap in the disparity between a shift found in teacher's beliefs in professional learning contexts to evidence in teacher practice in local contexts, which has been a problem found in professional development studies (Ertmer & Ottenbreit-Leftwich, 2010; Miranda & Daminco, 2015; Author, 2016b; Tondeur, et al, inpress).

The second finding of this study opposes other studies' findings in that fact that competency levels are usually considered high when teachers are using innovative practice with technologies (Ertmer et al, 2012; Mama & Hennessy, 2013; Tallvin, 2016). In all the cases presented here the teachers did not perceive their competencies as high and did not consider them as barriers to using digital games in their classroom. Teachers need to acknowledge that their students will be more technologically capable than they are and that the teacher's role is to facilitate learning and utilise their children's competencies. The last finding was that each teacher integrated a digital game using their current pedagogical approach. This is well supported in the literature (Author 2009, 2012; Dwyer, Ringstaff & Sandholtz, 1999; Tondeur, et al., 2008). Change in their practice did not occur until they began experimenting with games in their classroom. Again this provides guidance for professional development designers and facilitators to engender a praxis mode of teaching that enables teachers to interrogate their practice supported by conscious raising and analysis of beliefs, working in tandem during professional learning. In conclusion, this research puts forward the premise that the more freedom a teacher is allowed to experiment, and the time to critically explore new technologies over a substantive period, the more likely the flow of evolving beliefs and practices within a teachers pedagogical orientation for the use of technologies.

6. Limitations and future research

This research has examined changes in teachers' beliefs and practices as they trial digital games in their classrooms. This research presents a number of limitations. Firstly, as a research project a context of inquiry was created for the teachers enabling them to position themselves as co-researchers (Cochran-Smith & Lytle, 2009). In this way, teachers' classrooms became sites for inquiry for making conscious 'knowledge-of-practice'. Through this sense-making approach, the teachers in this project were supported with professional development days, project frameworks plus individual planning sessions. This sense-making process is not provided in the usual context for teachers to integrate a new technology into their classroom. Consequently, these outcomes cannot be transferred to general classroom contexts. Additionally, the teachers chosen for this paper represent only the primary school years (5-12 yr olds). Less flexibility and greater curriculum requirements may limit the appropriation of games in the upper schooling context. These issues were not dealt with in this paper but would provide necessary insights into first-order barriers for technology integration (Ertmer, 2005). Lastly, Levin (2015) called for research over a longitudinal period of time and with a targeted focus on a specific aspect of beliefs. This research did narrow the focus on pedagogical beliefs and the appropriation of digital games over a 2-year period. However, as Levin explained, identifying changes in beliefs and practice takes a long time, and change is more likely to be temporary and situational rather than actual developmental shifts. With this in mind, the changes identified in this research may be temporal, however, the research did identify the re-shaping process with triggers that indicated a change. The transferability of teachers' re-shaped beliefs and practices to new technologies and general teaching approaches needs further research with a longitudinal approach.

Understanding how teachers' beliefs evolve and what triggers change in beliefs and their ensuing practices is foundational for administrators and educators at all level who have a role in supporting teachers' appropriation of technology. New technologies, as one part of the systemic, social and cultural components impacting education, requires constant updating and rethinking for effective integration as part of our move to 21st century classrooms. Professional development, therefore, needs to address the transformative requirements of enabling change in pedagogical practices rather than a re-tooling commitment that responds to only competency 'skill' development (Author, 2016b; Albers, Pace & Brown, 2013; Loveless, 2008). Thus as identified in this paper, transformative professional development must start with teachers' acknowledging their own pre-existing pedagogical beliefs as informing intentions for change in their beliefs that direct effective practice with technologies. Additionally, with respect to teacher professional development, teachers therefore need to experiment with the use of digital games in their classroom, analysing their beliefs about the role of technology.

Acknowledgements

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