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in Teacher Education

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Becoming a 21st Century Literacy Teacher: Provocations, Perceptions and Possibilities in Teacher Education

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Abstract: This paper reports on a study that investigated pre-service teachers' digital funds of knowledge and their perceptions of the digital pedagogies and practices in early years literacy classrooms. It also explores pre-service teachers' experiences of "producing" a cumulative multimodal portfolio (in the form of a wiki) and its application for future literacy teaching and learning. Specifically, 123 education students enrolled in their second year of an undergraduate initial-teacher education course at an Australian university completed an anonymous survey. The results show that this group of students were active users of technology-based tools, but had limited experience with using participatory user-led knowledge creation tools (such as Web 2.0 technologies) although many observed the use of these tools in early years literacy classrooms while on professional experience school placements. Further findings show that although the majority of this group of pre-service teachers felt more confident after creating a wiki and reported that they would use them in future literacy teaching and learning, their understandings of the pedagogical and creative potential of these digital tools in supporting literacy learning in young children appeared limited. The findings suggest that there is a need for educators in higher education to understand their students' digital funds of knowledge and to provide rich opportunities to support these students' use and understandings of the affordances of these new technologies as vehicles to explore and enrich 21st century literacy learning in early years digital environments.

Keywords: Literacy, Digital Funds of Knowledge, Higher Education, Pre-service Teachers

Introduction

Digital Literacies in Higher Education

The rhetoric around the digital generation discourse together with the rapid changes in information and communication technology (ICT) and ever-changing social behaviours and values have led policy makers to include practices within higher education that align teaching and learning pedagogies with students' digital knowledge and experiences (Lea and Jones 2011). Education institutions are forced to continually re-evaluate their approaches to pedagogy and often are confronted by the impact of these changes on how they shape future curriculum (Cobcroft, Towers, Smith, and Bruns 2007). As a result, many higher education institutions have attempted to address these changes by offering "online," "blended," "anywhere," "anytime," flexible learning modes to cater to the learning needs of the students.

In addition to this acknowledgment of the technological needs and traits, and the ubiquitous nature of the 21st Century learner, education institutions are further challenged by the need to recognise the impact of this social transformation of technology on the understandings of "literacy" and the need to better equip students for the life and language of their future (Bulfin 2009; Street 2003; Walsh 2010). Kist (2005) states that literacy now incorporates sophisticated uses of technology and multimodal, multi genre composition. Multiplicity of literacy is indicated by "new" terminology with terms such as "multiliteracies" (Cope and Kalantzis 2000) and "multimodality" (Kress and van Leeuwen 2001) identified as "attempts to describe the multiple devices and media texts that are ubiquitous in our world"—the multimodality of contemporary forms of representation (Cope and Kalantzis 2009; Rowsell and Walsh 2011, 34).

Understandings of the changing and complex nature of literacies also involves being literate in what some theorists refer to as “digital literacy/literacies” (Bawden 2008; Lankshear and Knobel 2006; 2013). The term “digital literacy” was first coined in the 1990s to refer to the ability to read, write and comprehend information using the technologies and formats of the time (Bawden 2008). Lankshear and Knobel (2008) argue that digital “literacy” includes broader understandings of digital “literacies” that distinguish between “conceptual” and “standardised operational” definitions. Conceptual definitions present ideals or ideas of what digital literacy involves (e.g., the idea that digital literacy is more than reading and writing but includes understanding information presented in a number of different modes). In contrast, standardised operational definitions of digital literacy involve performance of tasks and skills including careful evaluation of information and in-depth analysis and synthesis of the information presented in various modes (Lankshear and Nobel 2008). Bawden (2008) further argues that the term “digital literacy” appears to represent a very broad concept that links other relevant literacies (e.g., reading, writing, critical, media, information) with ICT skills and competencies, but also includes other higher order thinking skills of evaluation and synthesis, together with a person’s understandings, perspectives and values.

Many higher education institutions have begun to respond to this need to develop digitally literate learners with the emergence of digital literacies skills, knowledge and practices embedded throughout course and program expectations. In the Australian university context, the establishment of the Australian Qualifications Framework (Australian Qualifications Framework Council 2013) across all levels of higher education has led to the development of course and program level outcomes as well as ways that these will be demonstrated (McMahon 2014), including literacy. In many universities, digital literacy is often addressed within one of their many graduate learning outcomes. For example, one Australian university defines digital literacies “as using technologies to find, use and disseminate all kinds of information” and notes that:

All students need to become competent users of technology. But it’s more than that. Digital literacy means, as a student, you can search and navigate, think critically and analyse, as well as create and communicate, and do all of this using a variety of media, and not just media of today but things that are always adapting and changing (<http://www.deakin.edu.au/library/study/digital-literacy>).

Such definitions of digital literacy show an acknowledgement that the acquisition of literacy moves beyond the development of a narrow set of skills to intersecting with other relevant literacies and modalities across all areas of the curriculum. However, while it is recognised in the literature that contemporary learners in higher education commence study with diverse digital skills and knowledge, and that digital literacies are essential for future success, the challenge remains for educators to provide students with opportunities to support literacy learning. Bruns (2007, 5) proposes that students should graduate from university “equipped for successful participation in ‘produsage’ environments,” including a set of literacies, and that universities themselves should “model the processes of ‘produsage’ in their learning and teaching environments (and beyond).” Bruns (2007) further suggests that educators should support learners to develop the capacities that will they will require to not only play the role of “user” but also “producer,” a hybrid term referred to as “producers.” There is a need, therefore, for educators to change their pedagogical approach for the more effective teaching of these literacies, including digital literacies (Walsh 2010). Change must move beyond changed resources to changed pedagogy and transformed practice.

Learners in Higher Education: Digital Funds of Knowledge

The term “funds of knowledge” (Moll, Amanti, Neff, and Gonzalez 1992, 368) is widely used as a term in education circles to refer to “historically accumulated and culturally developed bodies of knowledge and skills essential for household or individual functioning and well-being.” They include the tools, strategies, and individual expertise that families engage in on a daily basis. Central to literacy learning is educators’ recognition of the experiences, skills, and knowledge students bring with them to educational settings that can be drawn upon as vehicles for further literacy learning. In relation to the present study, the term “digital funds of knowledge” is used to refer to the varied technology-based skills, knowledge and experiences education students in higher education engage with in their own lives.

It is well documented in the literature that the generation of young people enrolled in higher education are those who are classified as digital natives, e-generation, generation C, Net generation and Millennials (Kennedy, Judd, Churward, Gray, and Krause 2008; Oblinger 2003; Prensky 2001). These young people are reported to have grown up with computers and digital technology as part of their everyday lives and as a result, are claimed to think and learn differently to previous generations (Prensky 2001). In particular, it is argued that these digital natives (born after 1980) are not only spending a high proportion of their time engaging with a range of digital technology, they are also “confident creators of future content which they want to share with others who can in turn modify and shape to new forms of knowledge” (Towers, Smith, and Bruns 2005, 5).

Education commentators further argue that this new generation of students are active learners, highly skilled in multitasking, dependent on communications technologies for social interaction, and have a preference for group-based activities (Bennett, Maton, and Kervin 2008; Cobcroft, Towers, Smith, and Bruns 2007). Smith (2012, 6) suggests that there are eight dominant claims that originate from the digital native discourse literature. These include recognising that today’s undergraduate students: (1) process new ways of knowing and being, (2) drive a digital revolution transforming society, (3) are innately or inherently tech-savvy, (4) are multi-taskers, team oriented, and collaborative, (5) are native speakers of the language of technologies, (6) embrace gaming, interaction and simulation, (7) demand immediate gratification, and (8) reflect and respond to the knowledge economy. Some researchers also claim that these students have a greater interest and higher level of skill for using technologies than their teachers and previous generations of students, and expect that technology will be an important part of their education (Kennedy, Judd, Dalgarnot, and Waycott 2010). Proponents of the digital native debate argue that education communities must quickly respond to the technology needs and traits of this generation of learners suggesting that students no longer process information in ways which are aligned with conventional ways of learning and study (Lea and Jones 2011).

There are, however, recent research findings that strongly contest this digital native discourse and the assumption that young people enter universities with a uniform and universal digital upbringing (Bennett et al. 2008; Kennedy et al. 2008; Selwyn 2009). Findings from these studies suggest that higher education students’ use of technology shows a stark contrast to the tenets of the digital native discourse and that the picture of the digital natives as a generation grouped by specific characteristics is highly complex. Further contentions relate to the labelling of students in terms of a single generation (Jones, Ramanau, Cross, and Healing 2010) that divide those who fit within this chronological age bracket and those who do not (often referred to as digital immigrants). Such classifications assume that those who do not fit within this generation require professional learning, forcing teachers and institutions to change their practices, with the aim of narrowing the gap between the “natives” and the “immigrants.”

Studies that have investigated the nature of technology-based activities (“digital funds of knowledge”) that university students engage in show a wide variation in practices. Students vary significantly with their experiences, access, and understandings of technology, with findings suggesting that these variances relate to factors such as socioeconomic background, age, and gender, (Jones et al. 2010; Kennedy et al. 2008; Smith 2012). Kennedy et al. (2008) investigated the degree to which first year Australian university students access and use an array of technologies and technology-based tools. They also explored how these students claim to want to use these technologies to support their university studies. Results showed that there was a lack of homogeneity in this group of students with a significant level of technological diversity evident. Many of these students possess a core set of technology-based skills but they do not “necessarily translate into sophisticated skills with other technologies or general information literacy” (117). Similar findings were reported by Jones et al. (2010) in an investigation of 596 first year students across five universities in England in regards to access to, and use of, technology. Results showed that while the majority of students had access to mobile technologies and computing facilities to access course materials and communicating with friends and peers, a complex picture of minorities were evident. For example, there was a large minority who used the Internet to download or upload materials, and a minority who contributed to blogs and wikis or engage with virtual worlds. These findings suggest that most new and emerging technologies, including Web 2.0 are not widely used.

Despite these wide variations in students’ “digital funds of knowledge” and the call from opponents of the digital native debate for further research and critical examination of these claims, advocates of this debate continue to argue that education institutions, both in schooling and higher education, need to respond to students’ constant interaction with this ubiquitous environment and suggest that “today’s teachers have to learn to communicate in the language and style of their students” (Presnky 2001, 4). Bayne and Ross (2007) suggest that educators are required to constantly reflect on and change their practices according to the terms of the native in order to remain relevant and presumably employable. Bruns (2007) further suggests that educators can no longer ignore the emergence of new participatory technologies and should support learners to develop the capacities to be “producers” of content knowledge within a collaborative environment.

Learners in Initial-teacher Education Courses/Preparing Future Teachers of Literacies

Educators who are preparing future teachers of literacies within initial-teacher education courses are required to not only engage in practices that foster the pre-service teachers’ own literacies learning, but need to support these students to meet both the graduate learning outcomes of their course and those outlined by their country’s professional teacher registration bodies. In the Australian context, initial-teacher education courses must meet the graduate standards as set out by the Australian Institute for Teaching and School Leadership (AITSL). The award of this qualification means that students who successfully complete their initial-teacher education have met these Graduate Standards. These AITSL graduate standards include seven broad standards that are elaborated across an additional 37 standards. Specifically, many of these standards relate to literacies and the use of ICT. For example, Standard 2.6 states that graduates must be able to “implement teaching strategies for using ICT to expand curriculum learning opportunities for students” while Standard 3.4 states that graduates must demonstrate knowledge of a range of resources, including ICT, that engage students in their learning (<http://www.aitsl.edu.au/australian-professional-standards-for-teachers/standards/list>). The challenge for educators in higher education initial-teacher courses is finding ways to prepare these future teachers of literacies to be able to continually engage in new, effective and productive practices made possible by new technology (Leu, Zawilinski, Castek, Banerjee, Housand, Liu, and O’Neil 2007). Furthermore, it is important to provide these pre-service

teachers with opportunities to move beyond the users of technology to understand the affordances of these new technologies in supporting literacy learning, and to become creative, critical and collaborative “producers” within digital environments.

Research Design

The authors of this paper are teacher educators working in literacy education with undergraduate and postgraduate education students. We are aware of the demands and challenges for literacy educators posed by the rapid expansion of Web 2 technologies in modern lives, and the need to understand our students’ digital funds of knowledge, and provide them with opportunities to capitalise on the pedagogical and creative potentials of digital technologies in fostering literacy learning.

The aims of the present study are to investigate the digital funds of knowledge in a group of undergraduate initial-teacher education university students and to explore their experiences with developing a cumulative multimodal portfolio (in the form of a wiki) as part of their assessment in their literacy unit. Specifically, this study sought to investigate the following research questions:

1. What are the pre-service teachers’ own digital funds of knowledge?
2. What are the pre-service teachers’ observations of the use of technology-based tools to “produce” content knowledge that supports literacy learning in early years primary school classrooms (Year Prep to Year 6: Children aged 5 to 8 years)?
3. What are the pre-service teachers’ own experiences of “producing” a cumulative multimodal portfolio (in the form of a wiki) as part of their assessment in their second year literacy unit?

Method

Participants

Pre-service teachers enrolled in the first of three compulsory core language and literacy education units, across two of the three campuses at an Australian university in the state of Victoria, were invited to participate in this study. These students (342) were all completing their second year of the Bachelor of Education (Primary) course whereby they undertake core language and literacy education units in second, third and fourth years of the course. At the completion of the unit they were sent an initial e-mail inviting them to complete an anonymous on-line survey. Follow-up e-mails were sent each week over a period of one month. At the end of the month, 123 pre-service teachers (36%) completed all questions on the survey. Twenty-two participants (18%) were male and 101 (82%) were female. The highest numbers of participants were aged between 20 to 29 years (68%), with 13% under the age of 20 years and 14% aged between 30 to 39 years. Only six participants (5%) were aged over 40 years.

The Assignment

As part of the assessment requirements for the first language and literacy compulsory core unit, pre-service teachers were required to develop a cumulative multimodal portfolio (in the form of a wiki) containing reflections and analysis of their engagement with early years literacy learners and early years teachers’ literacy programs. Wiki is defined as a collection of webpages that are usually organised around headers, and enables the users to access, create, develop and modify the content at any time (Wikipedia 2008). All students were given time throughout the tutorials to become familiar with using a wiki. They were also given information in the unit’s Learning

Management site and in the Unit Guide for how to get started with developing a wiki, as well as being provided with the link to the online tutorials available on the wiki site.

Resultant portfolios contained a body of annotated evidence of “engagements” including: analyses of children’s literacy work samples and assessment results; analyses of teaching approaches; and relevant digital literacy resources that would support these young children’s literacy abilities. The students worked in groups of five to six over 10 weeks to create their wikis. Students were required to collaborate with their group members to build, critique, and edit the content knowledge around young children’s literacy and approaches to literacy teaching and learning, and to present this new knowledge creatively using multiple modes of presentation.

The academics responsible for the development of the second year literacy unit decided on using wikis as the platform for the development of the portfolio after reviewing the literature and experimenting with the user-led online environment. Research suggests that there are many benefits of using wikis in higher education classes and as part of student assessment (Bruns 2007; Duffy and Bruns 2006; O’Mara 2006; Ramanau and Geng 2009). These include the potential for encouraging collaborative group work, fostering communication, the ease of use, and the increase in multimodal authoring skills. Furthermore, wikis “provide a space where knowledge becomes networked (situated, contextualised) but remains ephemeral” (Duffy and Bruns 35). Throughout the process of creating their wikis, students moved between different roles as “leaders, participants, and users of content” (Bruns 2007, 101). A further consideration in choosing an appropriate content creation online environment (Bruns 2007) was the cost to students and academics. During the time that this literacy unit was developed and during the data collection phase of this study, students were able to access the free K-12 wiki site.

Data Collection

Pre-service teachers were invited to participate in an anonymous on-line survey on SurveyMonkey consisting of 23 key items. The survey sought to investigate the following three areas:

1. pre-service teachers’ own experience with creating and using multimodal artifacts (digital funds of knowledge),
2. pre-service teachers’ observations of the use of technology-based tools within the literacy teaching and learning environment of an early years primary school classroom during their professional experience school placement, and
3. pre-service teachers’ own experiences of “produsing” a cumulative multimodal portfolio as part of their assessment in the literacy unit.

The survey included nominal, open-ended, and tick-the-box type questions that explored the three key areas. Questions 1 to 6 and 8 sought to gain the background information of the participants regarding their age and gender, as well as their access and use of the Internet, and their own digital funds of knowledge including their level of familiarity with particular technology-based tools and the use of these tools for knowledge creation. Questions 7 and 9 explored participants’ observations of technology-based tools in teaching and learning in the early years of primary school. Questions 13 to 23 invited participants to reflect on their experiences with “produsing” a cumulative multimodal portfolio (in the form of a wiki) prior to, and after, the completion of their assessment in the unit.

Findings

Pre-service Teachers' Digital Funds of Knowledge

The majority of the participants (91%) stated that they had their own computer/laptop/notebook/netbook, while a smaller percentage of pre-service teachers accessed computers at work, university or public libraries, or used web-browsing capabilities on their mobile phones (9%). 89% of pre-service teachers had Internet access at home, while 43% used the university wireless access to the Internet.

Participants were also asked to indicate what they did on the Internet. Results showed that this group of pre-service teachers predominantly use the Internet to send and receive e-mails (98%) or for study and research purposes (97%). They also used the Internet for creating or updating their online profiles such as blogs or Facebook (78%). All other activities for which over half of the pre-service teachers engaged in included browsing online content (63%), listening to music (55%) and chatting online (54%). A smaller percentage of participants (less than 50%) used the Internet to purchase items, browse merchandise, download free materials, read newspapers/magazines, play games or watch TV.

Table 1 shows results from participant responses when asked which of the technology-based tools they were familiar with or have used. Pre-service teachers were asked to select from four categories for each of the 15 technology-based tools listed. Results showed that the most commonly used technology-based tools were e-mail (84%), social networking sites (77%) and online chatting (50%). Eighty-three percent of participants had a wiki account but did not use it much, while 44% had online video accounts but did not use them often. Interestingly, this group of pre-service teachers had heard of many technology-based tools but did not use them. Nine of the 15 technology-based tools listed in the survey were ranked the highest within the category of "I've heard of this but don't use it." These included Blogs (80%), Micro-blogging (85%), multiplayer online games (81%), Internet games (75%), photo sharing sites (65%), online surveys (64%), conferencing (63%), webcasts (70%), and virtual worlds (63%). The highest ranked technology-based tool within the category "I've never heard of this" was the use of social bookmarks (58%).

Table 1: Participants' Familiarity and Use of Technology-based Tools (N=123)

Technology-based tools	I've never heard of this (%)	I've heard of this but don't use it (%)	I have an account but don't use it much (%)	I have an account and use it often (%)
Email	0.8	3	12	84
Blogs	10	80	9	2
Micro-blogging	2	85	9	3
Social networking sites	2	7	14	77
Wiki	0.8	13	83	3
Multiplayer online games	12	81	6	2
Internet games	15	75	9	2
Photo sharing sites	8	65	22	5
Online surveys	24	64	10	2
Online videos	0.8	22	44	33
Online chatting	0.8	17	33	50
Conferencing	2	63	42	11
Webcasts	26	70	3	0.8
Virtual worlds	31	63	6	0
Social bookmarks	58	41	2	0

Participants were also asked which technology-based tools they had used for knowledge creation (“produsage”). This question invited participants to nominate one of the four categories for each of the nine items listed. Results in table 2 show that the knowledge creation tools that were most often used were those involving word processing (93%), presentations (55%), Internet research (86%), and photo taking (63%). The use of spreadsheets (50%), creating digital images (46%), creating movies (45%) and recording audio data (44%) were only used sometimes. Interesting results were gleaned from the participants’ responses regarding their use and knowledge of tools for creating digital images. A small proportion of the participants (12%) had no knowledge of the tools for creating digital stories, with 48% having knowledge but had not used any.

Table 2: Technology-based Tools used by Participants for Knowledge Creation (N=123)

Technology-based tools	I don't know what this (%)	I know what this is but haven't used it (%)	I know what this is and use it sometimes (%)	I know what this is and use it often (%)
Word processing	0	2	6	93
Spreadsheets	0	5	50	46
Presentations	0.8	3	42	55
Creating digital images	2	33	46	20
Creating digital stories	12	48	33	7
Undertaking Internet research	2	4	8	86
Using a digital device to take photos	0	7	30	63
Using a digital device to make videos/movies	2	36	45	18
Using a digital device to record audio	2	29	44	25

Pre-service Teachers’ Observations of the use of Technology-based Tools in Early Years Primary School Classrooms

Participants were invited to indicate the technology-based tools they had seen used in early years primary school classrooms while on their professional experience school placements. Two questions invited participants to select technology-based tools from a list of 15 items and knowledge creation tools from a list of nine items. Both lists were the same as the items used in the previous questions, which investigated pre-service teachers own knowledge and use (see tables 1 and 2 for lists of items). Results showed that all technology-based tools and knowledge creation tools were observed in early years classrooms. However, the highest observed tools in use were email (58%), Internet games (50%), online videos (44%), and wiki (36%). The lowest observed tools included social bookmarks (0.8%), virtual worlds (2%), online chatting (2%), and micro-blogging (4%). A similar number of pre-service teachers observed the use of conferencing and online surveys (6%) and webcasts and photo sharing sites (7%). Twenty six of the 123 participants (21%) had observed the use of blogs, while 11% had observed the use of social networking and 10% had observed multiplayer online games. The knowledge creation tools which were observed in use in early years classrooms most often were those involving word processing (97%), presentations (86%), Internet research (74%), photo-taking (74%), spreadsheets (63%) and creating digital images (53%). Pre-service teachers also observed the creation of digital stories (33%), making movies (37%) and recording audio (23%).

Pre-service Teachers' own Experiences of "Produsing" a Cumulative Multimodal Portfolio (wiki) as Part of their Assessment in their Second Year Literacy Unit

In order to investigate the participants' knowledge and use of wikis for personal use prior to completing their university assignment, and whether they had observed the use of wikis in early years primary school classrooms during their professional experience school placements, the participants were invited to respond to five "Yes/No" questions. Results showed that only 26% of pre-service teachers knew about wikis, with only 6% who had previously engaged with a wiki and only 3% who had previously created a wiki. Twenty-three of the 123 pre-service teachers (19%) knew about the use of wikis in schools with only 7% of pre-service teachers who had actually observed the use of wikis in early years primary school classrooms prior to undertaking their literacy unit assignment.

After the completion of their literacy assignment, participants were also asked to reflect on their experiences of creating a wiki. Results show that the majority of participants (84%) agreed or strongly agreed that they felt a sense of accomplishment after creating their wiki while 16% did not agree. A similar pattern of results was evident regarding the participants' level of confidence in the use of, and learning how to use, multimodal technologies. Results show that after completing their assignment, this group of participants agreed or strongly agreed that they now felt confident in using multimodal technologies (75%). They also reported that they now felt a high level of confidence in trying to learn how to use multimodal technologies (89%).

Pre-service Teachers' Reflections' on "Produsing" Wikis in Future Literacy Teaching and Learning

Participants were also invited to indicate whether they intended to use wikis in their literacy teaching in the future. Eight of the 123 participants (7%) strongly agreed, while 74 participants (60%) agreed that they intended to use wikis in their teaching. However, 33% of participants did not intend to use wikis in their literacy teaching.

The final question from the survey asked participants to explain how they would use wikis in their future literacy teaching and learning. 108 of the 123 participants (88%) wrote responses to this open-ended question. Responses were scrutinised for their thematic content and three broad categories emerged from the data. These included responses which indicated that the participants (1) would [61%], (2) would not [22%], or (3) were unsure if they would [17%], use wikis in their future literacy teaching and learning. Each of these three categories were further scrutinised for emerging themes within each category.

Reflections on Use of Wikis in Future Literacy Teaching

The first broad category that emerged from the data included responses that indicated that the participants would use wikis in their future teaching. While the question asked participants to indicate how they would create a wiki in their future literacy teaching and learning, many of the responses were not related specifically to literacy but showed applications to the wider teaching and learning in classrooms. Over half of the participants (61%) who responded to this question thought they would use a wiki in the future. Six key themes emerged from this data that showed how wikis could be used. These themes, according to order of most frequently occurring, included wikis as a space for: (1) storing and displaying information, (2) fostering communication, (3) collaboration and knowledge creation, (4) assessing children's learning, (5) developing an understanding of students' Funds of Knowledge, and (6) engaging students in their learning.

Responses grouped in the theme of storing and displaying information were the most prominent in this broad category. Typical responses included "use this to display information," "display work undertaken in classes," "used as a means of storing information," "get kids to

present their work,” “creating an online presentation,” and “allowing students a chance to present their work in many other ways.” Other participants viewed the wiki as a space for teachers to “upload and present information” for students to “view at any time.” Other pre-service teachers stated that wikis “could be used by the teacher to put activities up which the children could access and complete” and “I would create my own wikis on topics relevant to students’ learning tasks and provide additional learning material for students to use.”

Typical responses in the theme of fostering communication included using wikis as a communication tool between parents, teachers, and the school community. For example, participants stated that wikis could be used to “keep the school and parent community updated on what types of literacy activities the students are engaged in and what is being produced,” and “updating parents on curriculum topics and creating reading list suggestions for parents to extend students,” while other participants responded with “[wikis] are perhaps a way of students to communicate ideas” and “children can contact the teacher and peers to communicate.”

Responses categorised within the theme of collaboration and knowledge creation typically showed that the participants viewed wikis as a way for teachers and students to lead and participate in the creation of content. For example, some pre-service teachers saw that the wiki provided a space for collaboration between teachers and students, while others saw it as a way for teachers to collaborate with other teachers, and students to collaborate with other students in their class or in other schools. Typical responses contained verbs such as “create,” “develop,” “write,” and “construct.” One participant stated that, “I would get the students to create content...allowing them to go and add to other student’s pages.” Similar responses included “where the students become the writers of the content that is learned within class”; “teachers could start a story...and ask students to add to it”; and “each child would have some personal contribution and be able to learn from peers, experience pride in its creation, explore collaborative work, and gather information from many sources into a usable format.” Other participants saw that wikis could be used to construct content with other teachers. For example, “I could use the wiki [as a] discussion and learning platform with my fellow teachers,” and “research/development with other teachers within the school.” Two participants stated that knowledge creation could be extended to include collaboration “for children to interact with other schools” and “for inter-school projects perhaps on a national or even international level.”

Pre-service teachers also viewed the use of wikis as a way of assessing children’s learning and developing an understanding of students’ Funds of Knowledge. For example, one participant thought that wikis would be useful in “making classroom profiles for each person,” while another participant thought that “students could do a wiki on themselves and update pages with who they are so that I could get to know my students more.” The final theme that emerged from the data included responses that showed that wikis were useful in engaging students in their learning. Typical responses that were grouped in this theme included “to enhance student learning,” “to engage students in learning,” and is a “fun way for children to engage in the material that is being taught.”

Reflections on Non-use and Possible-use of Wikis in Future Literacy Teaching

The second broad category that emerged from the data related to responses that indicated that the participants would not use a wiki in their future literacy teaching and learning. Twenty-four of the 108 participants who gave responses to this question (22%) fitted within this category. Responses in this category were further scrutinised for emerging themes in order of most frequently occurring. Four main themes emerged: (1) time required creating the wiki, (2) participants’ own level of confidence and experience, (3) the design and features of the tool, and (4) relevance of its use in early years’ literacy classrooms. Typical responses in the theme of time required creating a wiki included “when I am teaching full time, I won’t have time to create and update a wiki...they are an evolving concept that takes too long to learn about and then keep up

with as it changes.” Another participant stated that they “found it time consuming...to set up and I don’t think that students would be able to use it.”

Responses grouped under the theme of participants’ own level of confidence and experience included those participants who would not use it again and those who would use it only after they gained more experience. For example, one participant acknowledged that they did not feel confident but would use it after they gained further knowledge and skill in creating a wiki, stating that, “I would need to learn how to use it a bit better but I would use a wiki to communicate with parents and other teachers.” Similarly, another participant stated that “I am not 100% confident in creating wikis...I think it would be useful in the school environment.” In contrast, other participants stated that they found it difficult and would not use it in their teaching. Typical responses included “I don’t appreciate technology as much as I am expected to,” “I don’t feel confident in using a wiki and therefore would not use one in my classroom,” and “I am still not confident to implement this in teaching. I don’t know where I would start.”

Under the theme related to design and features of the tool, typical responses included participants’ own frustration with particular features of the tool. For example, one participant stated that “I do not really like the wiki formatting” while others found that the tool was “difficult to control. Information was being deleted left, right and centre” and “it was a bit too complicated, and I would rather look at a webpage that is already created, rather than create my own.”

The final theme evident in the responses from participants who would not use a wiki in their future literacy teaching related to the relevance of its use in early years’ literacy classrooms. Typical responses included participants who could not see the benefit of using it for literacy or those who felt that the use of a wiki was more appropriate for students in the upper years of primary school. For example, one participant stated that, “I don’t think that I would use it unless it was to...make one for an assignment in higher primary grades,” while another participant articulated that, “I probably wouldn’t use it for literacy. It would be far more effective for other subjects: science and numeracy for instance.” Another participant felt that, based on their own experiences of creating a wiki and working in early years’ classrooms during professional experience placements, that they could not see the benefit of using a wiki, stating that, “perhaps with older children they could have one that they could update with new projects and reflections? Having only done [professional experience school placements] in a prep class I am not really familiar with how to use ICT in schools as I have not seen it done!!” Similarly, one participant did not see the benefit of using wikis in primary school, stating that “they might be more useful in secondary school...and I do not see the need for them between levels year prep to year 6.”

The final broad category of responses from this open-ended question was related to the participants who were not sure if they would use a wiki in their future literacy teaching but acknowledged that they found the experience useful. Eighteen of the 108 participants (17%) who gave responses to this question were unsure. Typical responses included “I am not sure yet, but I am glad that I have it in my ‘teacher toolbox,’” “haven’t decided yet,” “unsure, I found it useful,” and “I’m not really sure if I would use it. I thought it was a great resource but I think it needed further guidance.”

Discussion

This study investigated a group of pre-service teachers’ digital funds of knowledge and examined their experiences with “producing” content knowledge related to young children’s literacy learning in the form of a wiki. This study also explored pre-service teachers’ observations of the use of technology-based tools by early years primary school teachers of literacy. Data was collected through an anonymous online survey from 123 pre-service teachers enrolled in their second year of a four-year initial-teacher Bachelor of Education (Primary) degree at an Australian university in the state of Victoria.

Pre-service Teachers' Digital Funds of Knowledge

The term “digital funds of knowledge” was used in this study to refer to the technology-based skills, knowledge and experiences pre-service teachers engage in within their everyday lives. The findings showed that the majority of this group of 123 pre-service teachers had their own digital device (e.g., computer, laptop), could access the Internet, and mostly used email (88%) and social networking sites (77%). In addition, these pre-service teachers used a variety of technology-based tools but predominantly used word processing (93%), undertook Internet research (86%) and used computer devices to take photos (63%). These findings suggest that while these pre-service teachers are active users of technology, and that the majority fit within the digital native chronology (81% born after 1980), they appear to be users of this technology rather than producers within participatory user-led spaces such as blogs, wikis, and virtual worlds. These findings confirm previous research findings that suggest that there is wide-spread diversity amongst higher education students, with only a minority engaging with Web 2.0 technologies to actively create and collaborate with others to produce content (Jones et al., 2010; Kennedy et al., 2008).

Implications of these findings suggest that assumptions based on a generation grouped by specific characteristics around use and expertise with technology-based tools, as highlighted in the prevailing digital native discourse (Prensky 2001; Oblinger 2008), should be treated with caution. However, these findings do show that these students require opportunities to develop understandings and knowledge of the affordances of, and creative potential inherent in, technology-based tools beyond mere usage. As Leu et al. (2007, 4) propose, the “Internet and other new ICTs require new skills, strategies, and disposition of their effective use.” The user-led environments of the world are continuously changing and technology enables students to learn in ways not previously possible (Labbo and Place 2010). This is a global trend with the Organisation for Economic Co-operation and Development (OECD 2005, 3) stating that ICT has “profound implications for education...ICT can facilitate new forms of learning...ICT is an important element of the best outcomes with new literacies.” It is critical, therefore, that educators in higher education continually reflect on, and change, their digital pedagogies to prepare the next generation of learners. In the case of educators in initial-teacher education courses, it is also important to support pre-service teachers to meet the standards set by universities and teacher registration bodies (e.g., AITSL) so that they are able to develop 21st Century literacies. One way to support this understanding is to provide opportunities for pre-service teachers to observe effective teaching pedagogies that use technology-based tools as a vehicle for literacy learning.

Pre-service Teachers' Observations of the use of Technology-based Tools for Literacy Learning in Early Years Primary School Classrooms

The findings from this study also showed that the use of technology-based tools for literacy learning in the early years of primary schooling, as observed by this group of pre-service teachers, is varied across schools and classrooms. However, when comparing pre-service teachers' own use of technology-based tools with those observed during professional experience school placements there appears to be some similarities and some distinct differences. Similarities include the regular use of word processing (97% observed to 93% used), undertaking Internet research (74% to 86%), use of photos (74% to 63%), and recording audio (23% to 25%). However, the main differences evident in the findings related to the use of technology-based tools for knowledge creation in the area of literacy. Pre-service teachers' observations of early years classroom practice showed greater use of wikis (36% observed to 3% used frequently), Internet games (50% to 2%), blogs (21% to 2%), presentations (86% to 55%), creating digital images (53% to 20%), creating digital stories (33% to 7%) and making movies (33% to 18%) when compared with their own frequent use of these technology-based tools. In contrast, this

group of 123 pre-service teachers reported greater personal use of email (58% observed to 84% used), online chatting (2% to 50%), and social networking (11% to 77%) when compared to their observations in early years classrooms. These findings suggest that while there is a diverse range of experiences with digital technologies, there is a mismatch between pre-service teachers' own digital funds of knowledge and the ways that they observed these technology-based tools used in early years classrooms to support literacy learning in young children. In contrast to their own use of technologies, it appears that this group of pre-service teachers have observed some teachers' use of Web 2.0 technologies to model and encourage young learners to use these tools to "produce" content knowledge that support literacies learning. These results highlight the challenge for educators in higher education to foster the importance of preparing pre-service teachers to consider to what extent digital technologies can be part of the classroom literacy program and the ways for establishing new pedagogy to use with new literacies (Walsh 2010).

Pre-service Teachers' Reflections on their own Experiences of "Producing" a Cumulative Multimodal Portfolio (wiki) as Part of their Assessment in their Second Year Literacy Unit

This study also investigated pre-service teachers' experiences with engaging in "producing" a cumulative multimodal portfolio (in the form of a wiki) as part of their assessment in their second year literacy unit within an initial-teacher education course. Prior to undertaking their literacy assignment, pre-service teachers were asked if they had observed the creation of wikis to support literacy learning in the early years primary school classrooms they had attended during professional experience school placements. Only 7% of pre-service teachers reported any use of wikis. This finding appears to be in contrast to the higher proportion of responses to an earlier item from the on-line survey that asked pre-service teachers whether they had observed wikis in classrooms (36%). Differences in responses may be attributed to the fact that the higher response was a more general question around the use of wikis while the lower response item asked pre-service teachers to state whether they had seen wikis in use prior to commencing their assessment task. Perhaps some students were unaware of what a wiki was or may not have had the opportunity to observe its use in early years classrooms prior to their assessment task.

This study found that the majority of pre-service students felt more confident in using technology-based tools after collaboratively "producing" content knowledge through their wiki (89% agreed or strongly agreed) and would use it in future teaching of literacy (60% agreed or strongly agreed). The findings showed six key reasons for why this group of pre-service teachers would use a wiki. Two of the main reasons were related to pre-service teachers reporting that wikis were useful for storing and displaying information and were a space for communication. A smaller proportion of pre-service responses showed an understanding of the affordances of these content creation online environments, such as a wiki, as a tool for collaborating and knowledge creation. This pattern of responses may be related to the fact these pre-service teachers' own use of technology-based tools is predominantly as users rather than "producers" and perhaps they do not know the pedagogical potential of these tools in supporting young children's literacy learning. Furthermore, the pre-service teachers in this study were only asked to state whether they had observed these technology-based tools in use in early years literacy classrooms. They were not asked to report how these technology-based tools were being used to support literacy learning. It could be possible that they have only observed these collaborative, knowledge creation tools as spaces for storing information and communication. Clearly further research is warranted to investigate teachers' pedagogical practices with digital technology.

Further findings from open-ended responses also showed, however, that 33% of pre-service teachers did not intend to use wikis in their future literacy teaching. Reported reasons for why these pre-service teachers would not use a wiki related to four main themes including: time taken to create the wiki; own level of confidence; the design features of the tool, and its relevance to

early years literacy classrooms. These findings suggest that while the majority of pre-service teachers feel more confident in using this user-led technology-based tool, they could still not see its place in literacy teaching and learning in the early years classroom with some stating that it could only be used in upper primary and secondary classes. These responses may reflect these pre-service teachers' own challenges with using the tools and perhaps the assumption that if these tools were too challenging for them to use then they would be too difficult for young children. Furthermore, it appears that providing positive experiences in using technology-based tools that links to their applications for literacy teaching is critical. Educators in higher education initial-teacher education courses need to provide ongoing, rich opportunities for learning to support pre-service teachers' understandings of the "complex relationships among technology, content, and pedagogy to facilitate teachers' growth in new literacies" (Leu 2013, 1173).

Conclusion

This paper reported on a study that investigated pre-service teachers' digital funds of knowledge and their perceptions of the pedagogical and creative digital practices in early years literacy classrooms. It also highlighted 123 second year pre-service teachers' experiences of creating a cumulative multimodal portfolio (in the form of a wiki) through collaborative "produsing" of content knowledge with their peers, and its' application for future literacy teaching and learning.

The findings from our anonymous survey show that this group of students were active users of technology but predominantly used technology-based tools for sending and receiving emails, for study purposes, social media and browsing online content. There was a wide variation in practices in relation to the use of knowledge creation technology-based tools (Web 2.0) amongst the group. Many pre-service teachers reported hearing of some of these tools but did not use them in their everyday lives. These findings confirmed previous research that has reported on the widespread diversity amongst students in higher education and the need to be cautious about making assumptions about the digital characteristics of the generations of students entering university. Our findings highlight the need, as teacher educators, to understand our students' digital funds of knowledge and to explore effective ways to build on these skills, knowledge and experiences in order to support them with their own digital literacy learning. We are also continually challenged to reflect on, change, and model our own literacy practices to cater for the individual digital literacy needs of our students and to prepare them as 21st Century teachers of literacy.

Further findings from our survey suggest that there is a need for teacher educators to support pre-service teachers' understandings of the affordances of these technology-based tools as vehicles to explore and enrich 21st Century literacy learning in agentive ways. While many of the pre-service teachers' observed a variety of knowledge creation tools in use in early years classrooms, it was also apparent from their responses that there was some lack of understanding in how these technologies could be infused into future literacy teaching and learning. Even though this group of students felt more confident in creating a wiki after their university assessment, the majority understood its use as a space for storing and displaying information and for communication with parents, while 33% of these pre-service teachers showed resistance for future use. These findings may reflect the pre-service teachers' own lack of confidence and expertise, with the notion that if "I can't use knowledge creation tools then children in the early years of schooling won't be able to use them" or they may show evidence of what the uses observed in classrooms while completing professional experience school placements. We suggest that there is a need for teacher educators to guide pre-service teachers' classroom observations highlighting their varied implementation and provide them with rich experiences that demonstrate effective literacy teaching and learning practices in digital environments. The findings also suggest that our role as teacher educators is to foster evidence-based understandings of what young children in early years of schooling can do with technology, how technologies can

support new forms of literacy learning, and how new generations of teachers of literacy can capitalise on the creative, innovative and pedagogical potentials of technologies within early years literacy environments.

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