



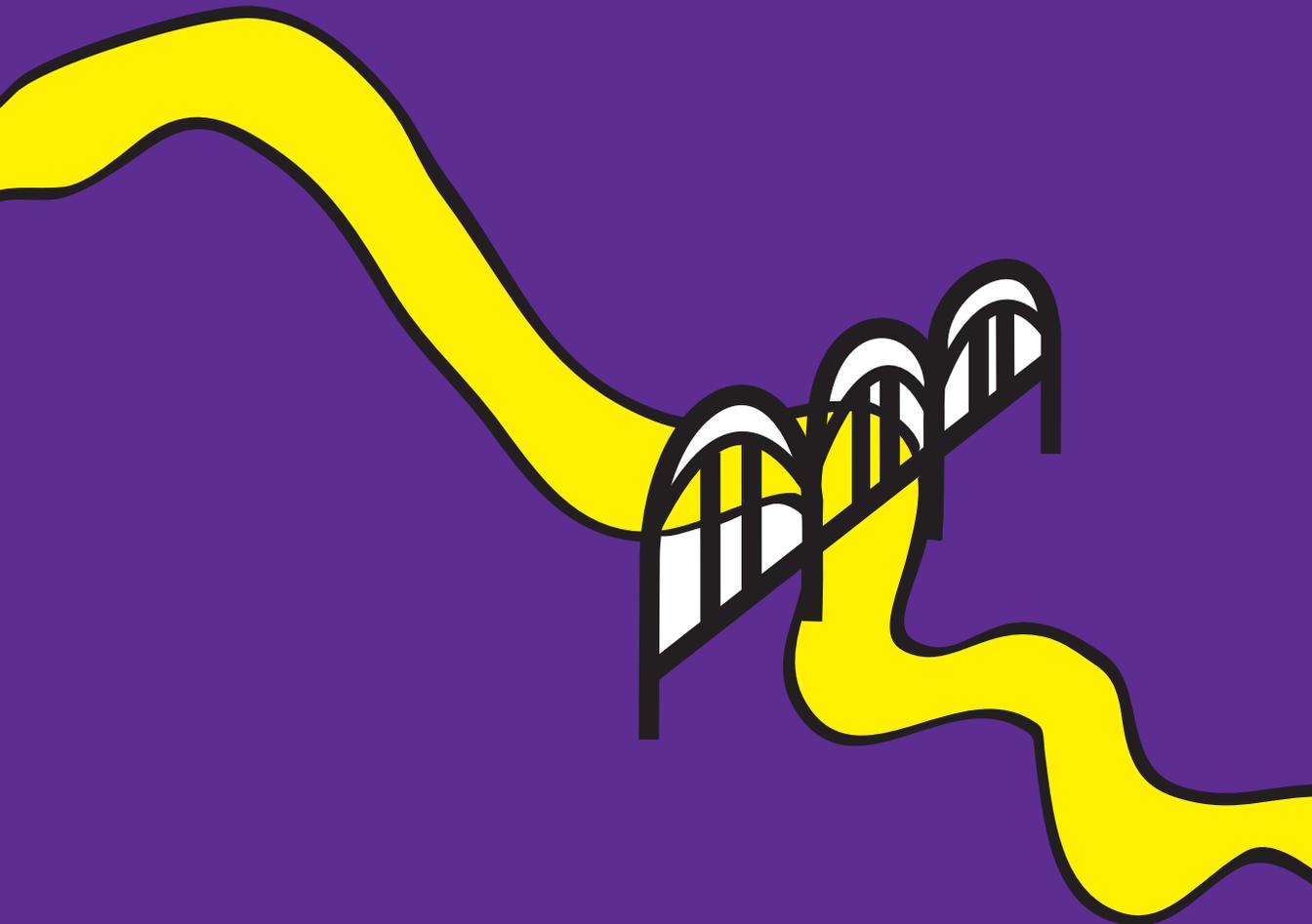
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Changes to teachers' practice when using mobile technology with one-to-one classes

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Abstract

Use of mobile technology in the classroom (m-learning) is a recent educational practice. This study reports on the insights of teachers in New Zealand classrooms about their m-learning practice. It targets the early adopter teachers of school classes where each student has a mobile device. The teachers were asked about the pedagogical changes in their practice, by open questions, in an online survey. A qualitative approach was used to explore the teachers' opinions and recommendations. The teachers' pedagogical approaches to using mobile technology are also considered.

The teachers report that students are using mobile technology to access information and produce content in new ways. They highlight students' engagement and motivation and describe collaborative and informal learning. Teachers advise that pedagogical change and robust infrastructure are essential. They recommend colleagues join Personal Learning Networks and Communities of Practice. These teachers' experience and recommendations may inform others who are about to make this change, and those who will be required to make this change.

Keywords

m-learning; mobile technology; teacher practice; pedagogy; one-to-one

Introduction

Mobile technology is becoming ubiquitous (Traxler, 2013). Research New Zealand (2015) report that almost three-quarters of New Zealanders have a laptop/notebook and/or a smartphone. Some New Zealand school classrooms now require students to bring a mobile device to school (Tasman-Jones, 2012).

In a report by the 21st Century Learning Reference Group, *Future-focused learning in connected communities* (2014) it recommends that "every student from Year 4 will have access to a personal digital device" (p. 12). At the time of this study, the New Zealand House of Representatives Education and Science Committee (2012), had recommended that "the Government consider introducing a policy that every student have access to a digital device for learning" (p. 33). The author pondered that, if this were implemented, then what new learning opportunities would there be in New Zealand classrooms and what changes in teacher practice would be needed? This paper reports on advice from teachers



who are already using mobile technology with a one-to-one ratio of students to devices. It asks these early adopter teachers about the changes they have noticed in their practice and for their advice.

This study has implications for present and prospective educators and for those responsible for teacher education. It supports the strategic priorities identified by the 21st Century Learning Reference Group (2014) to prepare learners with “digital competencies to actively participate in NZ’s rapidly changing 21st century economy and society” (p. 4). It also supports the New Zealand House of Representatives Education and Science Committee (2012) recommendation that trainee teachers understand the “pedagogy of digital learning” (p. 21) in order to prepare for a twenty-first century learning environment.

As mobile technology is increasingly used in school classrooms, m-learning pedagogical choices have escalating significance (Friedel, Bos, Lee, & Smith, 2013). Researchers describe a move towards innovative, one-to-one mobile learning (m-learning) pedagogy becoming part of mainstream education (Bocconi, Kampylis, & Punie, 2013; Price, Davies, & Farr, 2013).

Literature

Overview

The theoretical approaches to m-learning are characterised by the contexts in which mobile technology is used. Pachler, Bachmair, and Cook describe them as the “fundamental societal and cultural transformations currently taking place” (2010, p. 5). Indeed, the development of a theoretical framework has been hindered by how fast the technology is changing (Cochrane, 2013). Common theoretical frameworks include those with a socio-cultural approach, building on the ideas of Vygotsky (1978) of the importance of social interactions for learning and, secondly, on pedagogical frameworks that incorporate a variety of m-learning pedagogical approaches.

Socio-cultural approaches

In *A Theory of Learning for the Mobile Age* (Sharples, Taylor, & Vavoula, 2007) describe learning as a cultural-historical activity system mediated by tools that constrain and support learners as they transform their knowledge and skills. Sharples et al. note that their framework “does not give sufficient importance to what it is that makes a learning activity valuable, to the role of teachers in promoting effective learning” (2007, p. 243). Similarly, Pachler et al. (2010) suggest that the abstraction of this framework limits its value for teachers. Their cultural ecological framework also takes a socio-cultural approach by describing a triangular relationship between socio-cultural structures, agency and cultural practices. Their recommendation to use m-learning to link formal learning and everyday contexts offers a challenge to educators.

Pedagogical approaches

Kearney, Schuck, Burden, and Aubusson (2012) include a range of pedagogical approaches in a pedagogical framework for m-learning. They identify three main characteristics of m-learning experiences, each with two subscales: personalisation (agency and customisation), collaboration (conversation and data sharing) and authenticity (situatedness and contextualisation); all within time and space contexts. They note the importance of the teacher’s role, learning design and epistemological beliefs.

However, Laurillard (2007) specifies m-learning design as an iterative, collaborative process in the conversational framework, where students access theory, offer ideas, practice tasks, share practice outputs, debate ideas, present their ideas and reflect. Mobile technology is used to provide the means to communicate and an experiential environment to support learning.

While Mishra & Koehler (2006) observe that m-learning design requires teachers to combine specialised Technological, Pedagogical and Content Knowledge (TPACK) . Teachers need deep

TPACK understanding so they can creatively apply technologies that have not been designed for educational purposes and contexts (Harris, Mishra, & Koehler, 2009). Factors that may influence the teacher's pedagogical design for m-learning are grouped into categories: (1) associative, (2) individual-constructive, (3) collaborative, (4) situative, and (5) informal, by Lindsay (2015), informed by the work of Mayes and de Freitas (2013) and Naismith, Lonsdale, Vavoula, and Sharples (2004). These pedagogical designs frame the overarching question: what pedagogical opportunities does m-learning offer that would otherwise not be possible?

The importance of the teacher's use of technology

Research illustrates the importance of the teacher's role, reporting significant differences for learner outcomes from *directed* rather than *undirected* learning (Hattie, 2012). As Bolstad et al. note, "the role of new technologies in transforming teaching and learning for the 21st century is heavily dependent on educators' abilities" (2012, p. 59). Findings reported by Norris, Hossain, and Soloway (2013) suggest that the pedagogical use of the technology is a key factor to making a difference in student achievement.

Research indicates mobile technologies offer considerable educational affordances that may either enhance existing practice or alternately they may offer innovative pedagogical opportunities which transform traditional teacher practice. In his SAMR model, Puentedura describes how technology may be used for Substitution, Augmentation, Modification or Redefinition (2006). UNESCO, in *Mobile learning for teachers: Global Themes* recommend that pedagogical models are updated so teachers and students can use the unique opportunities that mobile learning offers (West, 2012). Ongoing pedagogical and technological support is vital for educators to use mobile technology's unique affordances (Cochrane, 2012).

Method

To find out about the pedagogical uses of mobile technology, teachers of classes where each student had a mobile device were asked open questions in an online survey.

This research was exploratory in nature (Neuman, 2003). It investigated the 'what' questions regarding the use of m-learning technology, rather than the more highly developed ideas regarding 'how' and 'why'. An interpretivist approach was taken whereby the research focussed on making meaning from everyday activity (Neuman, 2003).

Purposive sampling (Cohen, Manion, & Morrison, 2004) was undertaken to select principals from 24 New Zealand schools identified as using mobile technology in one-to-one classes. Both primary and secondary schools were included. Schools were identified from their websites and information on education websites such as the Virtual Learning Network (an interactive resource provided by the Ministry of Education for New Zealand educators).

Principals from 10 schools gave consent for their teachers in one-to-one classes to be asked to take part. At some schools only one or two teachers were using mobile technology in these classes. Twenty teachers responded. Participation was anonymous and the research conformed to The University of Auckland Human Participants Ethics Committee procedures.

The open-ended questions were designed to investigate the richness and complexity of the views held by the participants. As open responses are more demanding than closed questions (Denscombe, 2003) the number was limited to two, with the hope that participants would provide detailed responses. The participating teachers were asked: *How might you describe what is different about teaching using m-learning technology?* and *What advice might you give a teacher considering teaching with a 1:1 ratio of m-learning devices to students?*

This study reports the qualitative data obtained from these two open questions. An inductive approach was used for analysis. Open coding (Strauss & Corbin, 1990) enabled thematic analysis of keywords in the participant responses to identify emergent patterns (Boyatzis, 1998; Mutch, 2005). Quotes from

the participants are included to illustrate the themes. The participants were anonymous, so pseudonyms such as Teacher A, B or C, are used.

The pedagogical approaches were grouped using a constant comparative method (Silverman, 2011) to inductively develop them. The pedagogical approaches were informed by the academic research on m-learning pedagogy (Mayes & de Freitas, 2013; Naismith et al., 2004).

Results and Discussion

Demographic data

Most participants (55%) taught upper primary classes (Year 5–8). There were a few secondary teachers (20%) but no junior (Year 0–3) primary teachers in the sample. They used mobile technology to teach core curriculum areas. The school deciles of the participants ranged from 1 to 10, with an average of 5.6, reflective of wider NZ school profiles.

Tablets, specifically iPads, were used by the majority (75%) of the teachers' students in this study. The remaining 25% used a Chromebook, iPod, netbook or other device. The prevalence of iPads is consistent with results from Research New Zealand's recent survey of NZ schools (Johnson, Wood, & Sutton, 2014). Johnson et al. (2013) attribute the popularity of tablets such as iPads to their "portability, flexibility, and natural, intuitive interfaces" (p. 17).

Differences teachers identify

Teachers' responses to the open question about what is different about teaching using m-learning technology, identified a variety of factors. The themes that emerged from these differences are grouped by pedagogical approach in Figure 1.

Figure 1 shows that the pedagogical approaches for the themes that teachers identified were, in descending order, individual-constructive, collaborative, and informal.

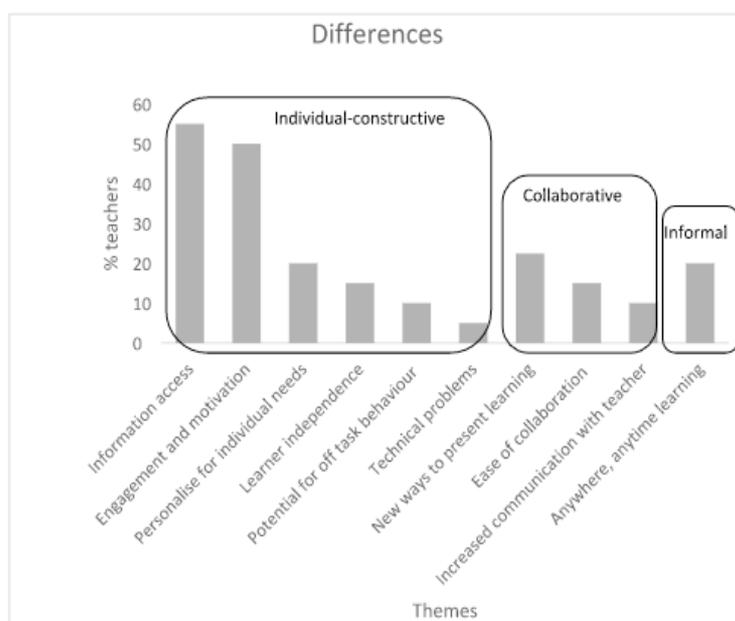


Figure 3. Themes of differences teachers identified, grouped by pedagogical approach

Note. Most teachers identified more than one difference hence the total percentage exceeds 100 percent.

The teachers report their students are using mobile technology to access information and produce content in new ways. The theme 'information access' is identified by more than half the teachers (55%). This is consistent with a United Kingdom study, which reported that accessing the Internet was

the most commonly mentioned student activity when using mobile technology (McFarlane, Triggs, & Yee, 2009). Australian findings report the use of mobile technology to produce content in new ways, giving the example of iMovie use (Goodwin, 2012).

Teachers in this study highlight students' engagement and motivation and the ability to personalise learning. This engagement and motivation accords with research reported by Pegrum, Oakley, and Faulkner (2013), and Ryu and Parsons (2009). Mobile technology affordances support a range of student learning needs, such as assistive technology, to address physiological or cognitive differences (Johnson et al., 2013).

Teachers noted two main concerns: technical problems and the potential for distraction in 'surfing the net'. Naismith et al. (2004) also identify Internet access as providing a means for students to 'escape' the classroom with activities that are outside the teacher's agenda and the curriculum.

Teachers identified collaborative and informal, 'anytime anywhere', learning. This concurs with findings from the United States that mobile devices were used to bridge school and home environments thus making learning more accessible (Chou, Block, & Jesness, 2012). It also aligns with European research that shows informal learning is increasingly being used (Boconni et al., 2013). Parsons (2014) however, observes the need to still take account of *this* time and *this* place (to situate the learning in context).

Advice

The advice that teachers would give other teachers considering teaching with one-to-one ratio of mobile devices to students is grouped into themes and reported in Figure 2.

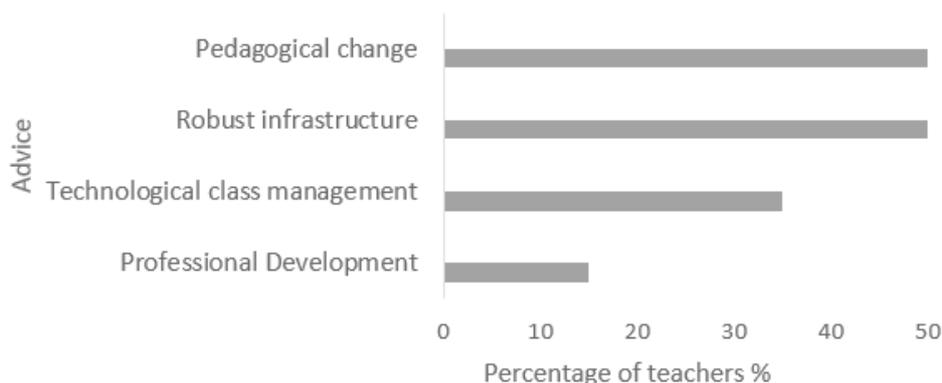


Figure 4. Advice Themes for Teachers Starting One-to-one Mobile Technology

Note. Some teachers gave advice about more than one theme, hence the total exceeds 100 percent.

The major themes that emerge in these responses was the teachers' need for pedagogical change and the importance of robust technological infrastructure. Teachers noted the need for network support, good infrastructure, a reliable Internet connection and, pragmatically, "a fall back option in case the technology fails" (Teacher N). Their suggestions were "research the best tools" (Teacher F), and "choose the correct platform for your needs and students' needs" (Teacher D). Teacher S noted that using technology could be difficult, challenging and, frustrating. Australian research also indicates that the increased demands that one-to-one places on network and bandwidth are not always met (Department of Education and Early Childhood Development, 2011; Goodwin, 2012). The importance of technical support is emphasised by the OECD's statement that "high quality infrastructure and readily available technical support also appear to be important for 1:1 initiatives to succeed" (Valiente, 2010, p. 8).

The need for a change in pedagogy is another major theme. Teacher recommendations included the need to "be prepared to completely redesign your teaching practice" (Teacher H), and to be "open to new ideas" (Teacher M), "be flexible" (Teacher F), "relinquish some control of your students" (Teacher R), "give children the freedom and opportunity to explore and share". Teachers are positive

stating, “do it!” (Teacher P) and “jump in with both feet”. However, they were also cautionary, advising new teachers to “have a vision and small achievable goals to get you there” and to “introduce slowly”. Their advice is consistent with reports that new pedagogical approaches and routines using mobile learning can take up to two terms to establish (Gleeson, 2010).

A related theme, which links to the different teaching requirements, is technological class management. Teachers in this study advise teaching digital citizenship. While some teachers mention the need for “strict guidelines” (Teacher J) and a “BYOD (bring your own device) contract” (Teacher J), others advocate building “a high trust environment” (Teacher S) and “be prepared to relinquish some control of your students' learning to them and build responsibility through trust and consequences (for both appropriate and inappropriate choices” (Teacher R). Other one-to-one educators concur, noting, “teachers have to learn how to work this potential into their planning and classroom management. Students have to learn how to manage the productivity potential of the device as well as the distractibility potential” (Lehmann and Livingstone, 2011, p. 77).

Teachers recommend that their colleagues using one-to-one mobile technology network with each other: “Liaise with teachers from other schools who already have a 1:1 programme running” (Teacher J) and “Use Twitter as a Professional Learning Space” (Teacher J) and “develop your PLN [Professional Learning Network] of like-minded educators” (Teacher K). These practical recommendations highlight the necessity for teachers undertaking one-to-one m-learning to make pedagogical changes.

The Personal Learning Networks that teachers identified which they found to be useful for their practice using mobile technology were: blogs, identified by most (80%) teachers, followed by Twitter (55%) and the Virtual Learning Network (VLN) (55%). This finding is similar to Wright’s (2010) New Zealand mobile case study finding that blogs, Twitter, Slideshare and YouTube provided the most current information. It is notable that, whilst blogs may provide useful information, the reader typically accesses supplied content. By contrast, Twitter, the VLN, or (more recently) POND offer a means for teachers to pose specific questions and get timely, relevant assistance.

Conclusion

This study explores the differences in practice identified by teachers using mobile technology with classes where each student has a mobile device. It shares these teachers’ advice and considers their pedagogical approaches.

Teachers report that mobile technology is used to access information and that it enables personalised, student-directed learning and increases student engagement. Teachers report their students use technology to access digital learning resources both in and outside school and school hours, ‘anywhere, anytime’. This trend towards learning outside school time is in keeping with international reports of the increasing use of mobile technology for informal learning (Boconni et al., 2013).

Teachers in this study highlight the need for digital literacy. This reflects OECD recommendations (Istance & Kools, 2013) and the New Zealand House of Representatives Education and Science Committee (2012) report recommendation that “Digital literacy skills must be fostered and developed as part of compulsory schooling” (Ministry of Education, 2013, p. 5). As Hattie and Yates (2013) note, wide access to online information does not guarantee deep learning.

Teachers report that students are using mobile technology to present their learning in new ways. They mention collaborative pedagogical approaches less than individual ones, despite research which suggests that mobile technologies are suited to collaborative approaches (Kukulka-Hulme, Sharples, Milrad, Arnedillo-Sanchez, & Vavoula, 2009; Looi et al., 2010; Melhuish & Falloon, 2010). It is perhaps notable that collaborative approaches are mentioned as much as they are, given that assessment of students’ progress is nearly always on an individual basis.

Teachers in this study do not identify using mobile technology for situated learning or connecting with experts. This is consistent with reports by Kearney et al. (2012) and Law, Yuen, and Fox (2011). However, other research shows that students *are* sometimes using mobile technology to collaborate, simultaneously both in class time and also outside class time and the classroom (Friedel et al., 2013).

This suggests that there is further opportunity to innovate in the ways that mobile technologies are used for teaching and learning. It also makes support for teachers a necessity. Teachers in this study identify this need, and strongly recommend that their colleagues, who follow them down the path of using one-to-one digital devices, receive substantive m-learning pedagogical and technological support.

Implications of this research

The teachers in this study may be a small, pioneering group, however, as one-to-one m-learning pedagogy is being incorporated into mainstream education (Bocconi et al., 2013; Price et al., 2013), and mobile technology is increasingly used in school classrooms (Friedel et al., 2013), teachers m-learning pedagogical choices are significant. This study, and other research, implies that innovative pedagogical practice using mobile technology, differs from predominant practice.

The present study has implications for school leaders, present and prospective teachers, and for those involved with preservice teacher education. It supports the need identified by the New Zealand House of Representatives Education and Science Committee (2012) who recommend that trainee teachers understand the “pedagogy of digital learning” (p. 21) in order to prepare for a twenty-first century learning environment. In *Towards Digital Fluency* the Ministry of Education recommends making teachers' and students' digital fluency a priority (Ministry of Education, 2015). The recent inclusion of digital technology into the New Zealand curriculum (Parata, 2016) necessitates further teacher professional development in this significant area.

The teachers in this study advise colleagues to join Communities of Practice and Professional Learning Networks. Mobile technology lends itself to such an online, social sharing of information. This ‘snapshot’ of teacher opinions and advice regarding the use of mobile technology one-to-one in New Zealand classrooms offers insights for the further development of m-learning pedagogy.

Limitations

This study is just one snapshot of a select group of early adopters of a new phenomenon, the educational use of mobile technology one-to-one in New Zealand school classrooms. It has a small number of participants ($n=20$) from 10 New Zealand schools, reflecting its recent nature and relative rarity at the time of the study (2013). Ongoing broader research and longitudinal studies will continue to expand this rapidly developing field of pedagogy for mobile technology.

Recommendations

Mobile technology offers new educational opportunities, such as situated and contextualised learning, augmenting reality with an overlay of virtual information, contributing to shared learning resources, using the toolkit of applications and sensors, and personalising learning devices (Parsons, 2014). To realise these learning potentials, substantive research, and relevant teacher professional development is needed. M-learning is a relatively new educational innovation and the use of one-to-one mobile technology in the classroom offers potential for innovative teacher practice to address the future-oriented learning needs of students. This study contributes towards building the necessary body of work on m-learning pedagogy.

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