Investigating teachers' adoption of signature mobile pedagogies

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ABSTRACT: This study investigated how teachers are using distinctive pedagogical features of mobile learning: collaboration, personalisation and authenticity. The researchers developed and validated a survey instrument based on these three established constructs (Kearney, Schuck, Burden & Aubusson, 2012) and used it to interrogate current mobile learning practices in school and university education. This paper focuses on data from school teachers (n=107). Findings indicated that teachers' perceptions of authenticity were high but aspects of online collaboration, networking and student agency were rated surprisingly lower than expected, given the rhetoric about enhanced connection and flexible learning opportunities afforded by mobile technologies. Device ownership was identified as one factor influencing adoption of these mobile pedagogies. Implications for effective use of handheld devices in teaching are addressed.

Highlights

- We examine teachers' use of distinctive m-learning pedagogies;
- Student agency and networked interactions were ranked low;
- Aspects of authenticity were ranked high;
- Device ownership was a factor influencing use of distinctive m-learning pedagogies;
- We identify areas for further m-learning research.

Keywords: Mobile learning; Pedagogical issues; Secondary education; Elementary education.

1. Introduction

Mobile learning (m-learning) considers the process of learning mediated by handheld devices such as smart phones, tablet computers and game consoles (Schuler, Winters & West, 2012). The ubiquity, flexibility and increasingly diverse capabilities of these devices have created considerable interest from educators in using them to enhance pedagogy. However, despite predictions about transformational teaching practices (Johnson, Adams & Cummins, 2012; Norris & Soloway, 2011), the widespread, effective application of these mobile technologies has not yet been realised (Milrad et al., 2013). Although considerable research has been carried out on the technical affordances of mobile devices, typically informed by instructionist models of learning (Frohberg, Goth & Schwabe, 2009; Murray & Olcese, 2011), there is an ongoing need to examine pedagogies that are suitable for m-learning to inform teacher practice, policy makers, curriculum developers and teacher education (Goodwin, 2012; Pegrum, Oakley & Faulkner, 2013; Traxler, 2008). This study addresses this need by interrogating teachers' use of distinctive pedagogical features of mobile learning environments: authenticity, personalisation and collaboration (Kearney, Schuck, Burden & Aubusson, 2012). It draws on analysis of survey data collected from mainly Australian and European teachers, with a particular focus on these signature mobile pedagogies, to highlight areas for future development.

2. Background

2.1 Theoretical framework

Research studies have examined m-learning through various theoretical perspectives and frameworks such as activity based approaches, authentic learning, action learning and experiential learning (Sharples, Taylor & Vavoula, 2007). Some studies have adopted a socio-cultural perspective, where learning is considered as a situated, social endeavour, facilitated and developed through social interactions and conversations between people (Vygotsky 1978), and mediated through tool use (Wertsch 1991). For example, Koole's (2009) FRAME model takes into consideration both the technical characteristics of mobile devices as well as social and personal learning processes. She refers especially to enhanced collaboration, access to information and

deeper contextualisation of learning. More recently, Kearney et al. (2012) developed a pedagogical framework of mobile learning to extend Koole's model, including understandings of "mobile pedagogy" which draw on socio-cultural understandings. This framework was developed and tested during two mobile learning projects located in teacher education communities (Schuck, Aubusson, Kearney & Burden, 2013). It was validated through inter-researcher validation, using feedback from other mobile learning researchers; and intra-researcher validation, through discussions amongst the designers of the framework. Also, each iteration of the framework was tested in the context of a range of project initiatives (Kearney et al., 2012). The framework privileges three distinctive features of m-learning: personalisation, authenticity and collaboration. How learners ultimately experience these pedagogical characteristics is influenced by the 'time-space' configuration of the learning context (Ling & Donner, 2009): the organisation of the temporal (scheduled/flexible; synchronous/asynchronous) and spatial (e.g. formal/informal, physical/virtual) aspects of the m-learning environment (Traxler, 2009; Tubin, 2006) as depicted in Figure 1. This configuration is often described in the literature through words such as 'anywhere, anytime', 'on the move' and 'multiple contexts' (Mifsud, 2014).
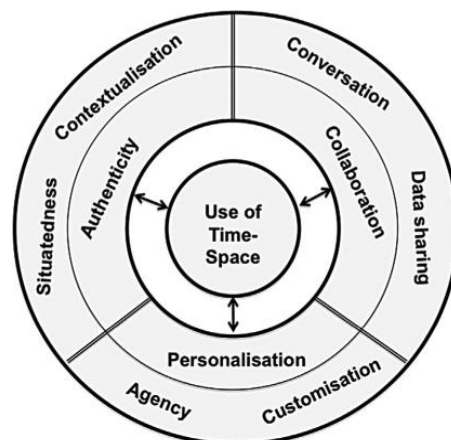

Fig. 1. Framework comprising three distinctive characteristics of mobile learning experiences, with sub-scales. From Kearney et al. (2012, p.8).

The rationale behind these scales is provided through the use of subsidiary themes under each of the central features, which pinpoints the critical features of m-learning from a pedagogical perspective. The personalisation feature has strong implications for ownership, agency and autonomous learning. It consists of the sub-themes of agency and customisation. High levels of personalisation would mean the learner is able to enjoy a high degree of agency in appropriately designed m-learning experiences (Pachler, Bachmair & Cook, 2009) together with the ability to customise and tailor both tools and activities, leading to a strong sense of ownership. The authenticity feature highlights opportunities for contextualised, participatory, situated learning. The sub-themes of contextualisation and situatedness bring to bear the significance of learners' involvement in rich, contextualised tasks (e.g. realistic setting and use of tools), involving participation in real-life, in-situ practices. Learners can generate their own rich contexts (Cochrane, 2014; Pachler, Bachmair & Cook, 2009) with or through their mobile devices. The deeper contextualisation of tasks in these physical or virtual spaces can be supported by geo-location and data capture facilities (Brown, 2010). Thirdly, the collaboration feature captures the oft reported conversational, connected aspects of mobile learning. It consists of conversation and data sharing sub-themes, as learners engage in negotiating meaning, potentially forging rich networked connections with other people and sharing information and resources across time and space.

This framework has recently been used to inform research on m-learning in school education (Burden, Hopkins, Male, Martin & Trala, 2012), teacher education (Kearney & Maher, 2013), and other areas of higher education (Kinash, Brand & Mathew, 2012). For example, Viberg and Grönlund (2013) used the framework to develop a survey instrument in their examination of students' attitudes toward mobile technology use in and for second and foreign language learning in higher education. Their findings showed most respondents (345 Chinese and Swedish university students) held positive attitudes towards m-learning, with personalization being most positive

(83%), followed by collaboration (74%) and authenticity (73%). While Green, Hechter, Tysinger and Chassereau (2014) used the framework to inform the development of their own instrument—the 'Mobile App Selection for Science' (MASS) rubric—to aid teachers' rigorous selection and evaluation of K-12 science applications (or 'apps').

2.2 M-learning pedagogies in school education

Studies of m-learning in school contexts have typically used case studies to interrogate practices, highlighting a range of pedagogical affordances. A major study in Scotland by Burden et al. (2012) involving eight schools and around 365 students found significant benefits for students, teachers and parents, such as more collaboration between teachers and students, increased peer coaching and more effective feedback. Personal 'ownership' of the device was identified as a crucial factor influencing these benefits. They found that the mobile devices raised challenges for teachers, including a need to find a balance between providing complete autonomy and choice for learners, and the need to scaffold learning tasks. Ownership and learner agency were key issues discussed in other studies. Hughes' (2014) case study of four Grade 6 and 7 Canadian classes explored how use of mobile devices mediated a multiliteracies pedagogy to enhance student voice, agency and identity in the context of their learning communities. Jones, Scanlon and Clough (2013) used two case studies to investigate learner control and how mobile learning can support inquiry-learning in informal and semi-formal settings. Participants included 14 and 15 year old Geography students in an after-school Geography club. A resultant framework was proposed for considering the dimensions of learner control, location of learning and supports. While Bjerede and Bondi (2012) reported on a study with 27 Grade 5 students, finding a shift from instructionist teaching practices to a culture where the teacher and the students became co-learners.

Aspects of collaboration have been emphasised in studies, often in the context of 21s Century skills development. Kulkarni, Shook and Thomas (2013) recently conducted case studies in four upper-elementary US schools. They found, amongst other findings, that teachers placed an emphasis on fostering the development of a range of 21st century skills, including creativity, communication, collaboration, critical thinking and media literacy. While findings from Magley's (2011) 6-month case study of 109 Grade 8 students in Millis Public Schools (US) indicated increased student engagement, collaboration, self-direction and personalization. Kucirkova Messer, Sheehy and Fernández-Panadero (2014) conducted an 'iPad intervention' study in a Spanish school. This particular paper looked at the educational value and impact of a story-making app with 41 Spanish 4-5 year old children. Their investigation explored engagement and exploratory talk while using the app. While Bressler and Bodzin (2013) interrogated middle school science students' flow experiences during a mobile augmented reality (AR) science game. The study demonstrated great potential for mobile AR science games enhancing interest and collaboration skills.

Themes relating to authenticity have also been highlighted. White and Martin (2014) conducted a design experiment with 16 middle school students' informal mobile practices in Maths learning. They explored how mobile devices can help bridge the gap between everyday phenomena and the study of mathematics. Ekanayake and Wishart (2013) conducted a similar project in the science domain. Sri Lankan secondary student participants made use of images and video recordings to "bring the outside world into the classroom" (p.229). They reported positive perceptions of authenticity and enhanced formative assessment procedures.

Many studies have focused on the effectiveness of m-learning, particularly in higher education (Wu et al., 2012), usually exploring the affordances and barriers to adoption. Unlike these, our study foregrounds teachers' pedagogies, rather than specific technologies or perceptions of m-learning drivers and constraints, by examining teachers' current m-learning practices. It provides a contemporary snapshot of distinctive m-learning approaches being enacted by primary and secondary school teachers. Although aspects of m-learning identified in the framework (personalisation, authenticity and collaboration) are evident in recent case studies described above, this study is unique in that it specifically targets all three constructs to investigate how teachers are orchestrating and designing these signature pedagogies into their m-learning tasks.

3. The Study

The aim of this research project was to gain an understanding of contemporary mobile learning pedagogies in education, exploring the key research question: *how are educators using distinctive pedagogical features of mobile learning?* A 30-item survey instrument was developed specifically for this purpose, with a focus on the previously discussed distinct pedagogies associated with m-learning (Kearney et al., 2012). Data were collected during semester one, 2013, and analysed according to the three themes of authenticity, collaboration and personalisation. In order to avoid response bias, participants were not explicitly introduced to the m-learning framework that was used to design the survey instrument. This facilitated our endeavour to elicit the participants' own pedagogical understandings about m-learning. For similar reasons, 'm-learning tasks' were broadly defined in the survey as 'specific learning tasks or activities in which mobile technologies were used'. There were 195 school and university educator participants who completed the survey. This paper focuses on the 107 participants from the school sector.

3.1 Development of survey instrument

The online survey was developed over several iterations prior to the commencement of the study. Intra-researcher validation was achieved through regular discussions amongst the authors of this paper and with regular feedback from two other co-designers of the original pedagogical framework (Kearney et al., 2012). These discussions critiqued each version of survey items and how well they aligned with the framework constructs and the underlying socio-cultural theory. Early iterations of the survey were tested by using the items to analyse existing m-learning scenarios. A well developed version of the survey instrument was trialled as part of a pilot study with 20 external academics and school teachers at the beginning of 2013. Evaluative discussions focused on how well items elicited data relevant to the three constructs and also the consistency of these results. Feedback from pilot survey participants, including four specialist m-learning researchers, helped us to make final refinements. For example, feedback indicated that three questions focusing on setting, tool and task authenticity would provide more clarity in the authenticity section of the survey. For similar reasons, a distinction was made between face-to-face and online conversations in the collaboration category. Also, the four questions relating to 'data sharing' (collaboration construct) were divided up into 'generativity' (the extent to which learners shared learner-generated content) and 'networking' (the extent to which they shared data in networked collaborations). The actual items contributing to each of the three constructs are shown in the Appendix.

The final version of the survey required teacher participants to choose a mobile learning task that had been recently used with their own students, as the focus for their responses. Their chosen task did not necessarily need to be perceived as innovative or 'successful'. There were 6 survey sections, consisting of 24 multiple choice questions yielding quantitative data and 6 open-ended questions producing qualitative data. Sections One and Two were designed to ascertain background data on teacher participants (e.g. *teaching sector*, *experience integrating mobile devices into teaching*) and their chosen m-learning task (e.g. *task location*, *device ownership* and *applications used*). Sections Three to Five constituted the core of the survey, containing items relevant to the three constructs in the framework: six items relating to collaboration, five items for personalisation and three items for authenticity (see Appendix A for items. NB. Participants did not see the categorisation of items shown in the right-hand column of this table.). Each question usually contained three response options that corresponded to 'low' or 'none', depending on the context of the item (rank of 1), 'medium' (rank of 2) and 'high' (rank of 3) ratings for a particular construct. Most items offered an 'other' option but these responses were not included in mean rankings calculated for the components of each construct. The final Section Six was optional to complete and gathered further information about participants' chosen tasks (e.g. teacher roles, intended learning outcomes).

3.2 Data analysis

The data set was coded under the three constructs of collaboration, personalisation and authenticity. Data from open-ended survey item responses was condensed, categorised, and connected over time (Huberman & Miles, 1998) according to emerging themes relating to these constructs. An interpretive approach was employed for this analysis, providing insights into

participants' perceptions (Mason, 1996). A statistical analysis of the constructs was performed in two stages. Firstly, an overall analysis of these three domains was performed, using mean ranking scores for each multiple-choice item. Secondly, cross-tabulations were used to examine relationships between individual multiple-choice items on each construct and background teacher and task data (experience using mobile devices, teacher sector, device ownership and task location). Statistical significance was assessed using Pearson's chi-square tests; Fisher's Exact Test was used for tables in which the expected count of any cell was less than 5. Although the data consisted of ordered categories, the more conservative chi-square test and Fisher's Exact Test were preferred to nonparametric tests, due to the limited range of the responses. Where relationships were found to be statistically significant, the ordinal nature of the data was leveraged to identify trends in the relationships.

A reliability analysis of the entire questionnaire (n=195), and separately for each of the three constructs, was carried out using Cronbach's alpha. Although the focus of this paper is on the data collected from teachers in the school sector (n=107), the reliability values were calculated for both, the entire data set (n=195), and for the school teachers (n=107) separately. Internal consistency of the whole questionnaire (with all three scales combined) was excellent for both the entire cohort (α = 0.828) and for the school teachers separately (α = 0.832). When considered separately, the internal consistency was in the acceptable range for each of the three constructs, as shown in Table 1.

Table 1
Internal consistency for each of the three constructs from the theoretical framework.

Construct	#items	Cronbach's alpha (Entire cohort: n=195)	Cronbach's alpha (School teachers: n=107)
Collaboration	6	.715	0.760
Personalisation	5	.711	0.694
Authenticity	3	.775	0.772

3.3 Participants and contexts

There were 107 volunteer school teacher survey participants (the focus of this paper), mainly from Australia (64%) and Europe (20%), where the researchers' institutions were located. Thirty-eight percent of participants taught in primary/elementary school contexts and 62% taught in secondary school contexts. Participation in the survey was voluntary and there was a diverse range of experience levels identified in the participants' background data. Just over half of the survey participants (53%) had been teaching in schools for more than 10 years, while 25% had been teaching for less than 2 years. Similarly, 45% of participants perceived themselves as experienced users of mobile devices in their teaching—defined as more than 2 years' experience—while 24% said this was their first attempt at implementing a mobile learning task. Participants chose a range of task contexts. Eighty-six percent described a formal task that was classroom-based. Only 6% of teachers reported on a task that was situated in an 'extra-mural' context (school playground, excursion site, museum, home) and even fewer tasks (2%) were set in a totally informal location such as a cafe or public transport (6% reported a combination of locations). Discipline areas included Literacy (18%), Maths (17%), Science (17%), Languages (14%) and Creative Arts (11%). Most tasks involved use of an iPad (47%), laptop (15%) or mobile phone (12%), with 15% of tasks integrating a mixture of devices. Fifty-two percent of tasks involved use of school-owned devices (39% restricted to on-campus use only) while only 22% of tasks involved student-owned, 'bring-your-own' devices (BYOD).

4. Findings

The teachers perceived their m-learning tasks as being particularly rich in aspects of authenticity (setting, task, tool), despite few tasks (14%) located outside of a formal school location and few

tasks (19%) demanding genuine student participation in real, community-based activities. Teachers' ratings for the constructs of personalisation and collaboration were lower, with weaker ratings in aspects of student control and autonomy, and less favourable ratings in online conversations and networking, as shown in Table 2. The majority of tasks described by teachers involved high levels of face-to-face collaboration around the mobile device, as well as the generation (but limited sharing) of digital content.

Table 2
Mean rankings for components of the collaboration, authenticity and personalisation constructs (n=107).

Construct	Component	Mean rank
COLLABORATION	Conversation (face-to-face)	2.4
	Conversation (online)	1.4
	Data sharing (generativity)	2.4
	Data sharing (networking)	1.9
AUTHENTICITY	Setting	2.3
	Tool	2.3
	Task	2.4
PERSONALISATION	Agency	1.9
	Customisation	2.0

In the following sub-sections, relevant qualitative data from the teachers' open ended responses, as well as quantitative survey data, is integrated into the presentation of findings. An analysis of individual survey items in each category yielded some statistically significant relationships. Most findings emerged from the entire K-12 school teacher data (n=107); however, there were some specific findings relevant to the primary/elementary (n=41) and secondary school teacher (n=66) subsets.

4.1 Collaboration construct

4.1.1 Conversation
The majority of m-learning tasks chosen by survey participants involved a high level of face-to-face conversation *at* the device (Crooks, 1999) in the classroom. Most teachers prioritised students working in small groups around the iPad, with three-quarters of school teachers ranking their task as 'medium' or 'high' for face-to-face collaboration. For example, one K-6 task involved small groups of students who were studying a poetry unit to write and record their own rap music video, while another K-6 task required students to work in small groups to create an original music composition. Whole-class discussions were frequently mentioned, with teachers using the 'mirroring' feature of the iPad, for example, to display students' work on a large screen. One teacher asked students to use their handheld device to reply to an in-class survey and responses were projected for all to see and discuss.

However, levels of online conversation *through* the device (Crooks, 1999) were generally ranked lower (64%). This was particularly the case for primary school tasks (71%), compared to secondary tasks (59%). In tasks that included online discussion, communications were mainly between class peers (36%) or between students and their teachers (20%). Only 7% of tasks involved 'extra-mural' communications with participants outside their immediate peer/teacher class network. For example, a secondary English teacher participant asked students to create digital narratives, emphasised both peer and external feedback from artists and family members to promote discussion: "Students wrote digital stories using the Storybird app, employing professional artists' work, sharing between peers and families in other countries … including weekly online feedback from 'reading grannies'".

A small number of teachers emphasised a blend of both face-to-face and online discussion *at* and *through* the device. An English teacher mentioned deliberate elicitation of both face-to-face and online discussion of her students' video products that "were played for the class and put on class blog … so comments could be both face to face and online". Another secondary Visual Arts teacher asked students to use QR codes and social media to leverage participation and a blend of face-to-face and online communications during an excursion to a seaside sculpture exhibition:

> Students recorded photographs, audio and video of aspects of the 'Sculpture by the Sea' exhibition, taking on a role of an art critic and tweeting their thoughts as they viewed the exhibition and participated as audience members. They also took part in using augmented reality apps, particularly a QR reader app, which was a part of an artwork. This facilitated discussion, interacting and promoting conversations on Twitter through a class hashtag.

Statistically significant relationships emerged between background data and the conversation components of the collaboration construct, as shown in Tables 3 and 4. There was a statistically significant relationship (p =.028) between *experience using mobile technologies in teaching* and *face-to-face conversation*, as shown in Table 3. Teachers who were more experienced using mobile technologies in teaching were most likely to assign tasks that required face-to-face discussion in pairs or small groups. For example, the proportion of teachers who were using mobile technologies in teaching for the first time who indicated their tasks involved face-to-face discussion in pairs (48%) was far smaller than the teachers with more experience in this area of their teaching (80%).

Table 3
Statistically significant relationship identified between background data and the face-to-face conversation component of the collaboration construct (n=107).

		Face-to-face conversation (at device)		
		None	Pairs/small groups	Medium/large groups
Experience using mobile devices in teaching	First attempt	39%	48%	13%
	Up to 2 years	10%	74%	16%
	> 2 years	13%	80%	7%

Two further links related to *online conversation* through the device (e.g. SMS, Skype etc.), as shown in Table 4. There was a highly significant relationship (p =.005) between *task location* and *online conversation*. Teachers whose students worked in formal school locations were least likely to encourage online discussion in their m-learning scenarios. In comparison, 100% of teachers whose students worked in informal locations (e.g. cafes, public transport) and 57% of teachers whose students worked in extra-mural locations (e.g. playground, excursion sites, museums), encouraged some online discussion in their tasks. This relationship was also highly significant for the secondary teacher data set (p =.002).

Table 4
Statistically significant relationships identified between background data and the online conversation component of the collaboration construct (n=107).

Online conversation (through device)

		None	Small groups: 2-30 people	Large groups: >30 people
Device ownership	Institution: School use only	83%	18%	0%
	Institution: Use anywhere	57%	43%	0%
	Student-owned	55%	36%	9%
	Combination of above	47%	47%	6%
Task Location	Institutional	71%	28%	1%
	Extra-mural	43%	43%	14%
	Informal	0%	50%	50%

There also was a significant relationship (p =.028) between *device ownership* and *online conversation*. Only a small percentage of teachers whose students used institution-owned devices for use in school only, indicated that their assigned task involved some form of online discussion. In contrast, almost half of teachers whose students owned their devices, assigned tasks that involved at least some online discussion. This relationship was also significant for the primary/elementary teacher data set (p =.012).

4.1.2 Data sharing
Generation and (within-class) sharing of digital content were a feature of teachers' chosen tasks but there was a distinct lack of networked interactions. Almost half the tasks (43%) involved learners, often working in teams, generating their own digital content (51% in primary schools and 38% in secondary schools) and most tasks (58%) involved school students 'adding value' to shared content—annotation, mashing, tagging etc. Indeed, 51% of the apps mentioned by survey participants were used in a way that would be classified under Goodwin's (2012) 'constructive' category: leveraging learners' creation of their own digital content. The following apps were most frequently mentioned: eBook creation apps; video production apps such as iMovie, audio production apps such as Garageband, and mind-mapping apps. However, there was a stronger emphasis on the use of teacher-generated and external digital content in secondary school tasks (44%), compared to primary school tasks (22%).

Despite the high level of digital generation of content, only 38% of tasks involved a networked exchange of digital data and information, or *networked interactions* (e.g. via blogosphere, Twitter, multi-layer games etc.). This figure was lower for primary school tasks (31%) compared to secondary school tasks (43%). Most online interactions were asynchronous rather than 'real-time', especially in secondary schools where only 18% of tasks involved 'live' synchronous communications. The main mode of learners' online collaborative exchanges was text-based, with only 18% of all tasks involving multi-modal interactions.

There were no statistical relationships identified between background data and the digital data sharing components of the collaboration construct. However, there was a statistically significant relationship (p =.03) identified for secondary teachers only (n=66) between *experience using mobile technologies in teaching* and tasks that required *networked interactions*. Secondary teachers who were more experienced integrating mobile technologies in their teaching were more likely to have designed a task that involved networked interactions. For example, 57% of secondary teachers who were more experienced in this area of their teaching indicated that they assigned tasks that involved moderate-extensive online interactions. In comparison, only 35% of secondary teachers who were using mobile technologies in teaching for the first time, indicated that they

assigned tasks requiring learners to connect in these networked environments.

4.2 Authenticity construct

Of the three constructs under scrutiny in this survey, authenticity was perceived by teachers in the most positive light (mean rank of 2.3 as shown in Table 2). Although 86% of tasks were implemented in school-based locations, over one-third of teachers (39%) rated this formal context 'highly' as a suitable, realistic setting for the discipline area associated with the task. Tool authenticity—use of the device in a similar way to how it might be used by real-world practitioners—was perceived by survey participants in a similarly positive light, particularly by secondary teachers (43% percent of secondary teachers rated their tasks highly for tool authenticity compared to 29% of primary teachers). For example, a secondary biology teacher who ranked her task highly for tool authenticity, explained her students' discipline-specific use of phone cameras as a multi-modal note-taking device as follows:

> Students used their phone cameras to record various stages in the processes of dissecting kidneys and brains, displaying the appropriate stages of dissection. They identified various specified parts of the kidney and brain and provided evidence of appropriate exploratory investigation of structures, as decided by the students. The photos became an integral part of their notes.

Perceptions of task authenticity – relevance of problems and processes—were the highest ratings in the survey, with 55% of teachers giving a high rating in this category. For example, a primary teacher reported on a music composition task that used realistic musicianship processes: "Students were composing in a small group. Using their mobile devices they were able to record what they had done and use the recordings as part of the review process along the way, making use of the sound recorder app". Multiple options for one of the survey items in this section were used to distinguish perceptions of 'simulated' and 'participatory' task authenticity (Radinsky et al., 1998). Despite the overall high ratings in this construct, only 19% of teachers perceived their task as authentic in a participatory way, in the sense that the task demands student participation in a real, community-based activity. The previously discussed Visual Arts ('Sculpture by the Sea') excursion was one such example of this type of authenticity: "Students are developing their role as an art critics. They are exploring the concept of an artworld as a source of ideas and interactions. Students are actively engaging with the audience of the artworld". However, 36% of teachers thought their task was authentic in a simulated way, in the sense that the task engages students in a simulated form of reality. For example, a music teacher described their use of Garageband for music composition: "Using the Garageband app allowed the students to experiment with instrumental sounds and with mixing these together. This would have been very difficult to resource with 'real' instruments."

In the quantitative analysis, only one statistically significant relationship emerged between background data and components of the authenticity construct (see Table 5). This involved the relationship between *device ownership* and use of the mobile device in a similar way to real-world practitioners in the discipline area (*tool authenticity*). Higher levels of tool authenticity were associated with student ownership of the device (p =.031).

Table 5
Statistically significant relationship identified between background data and the tool authenticity component of the authenticity construct (n=107).

	Use similar to real-world practitioners		
	No	Partially	Fully

		14%	62%		
	Institution: school use only	14%	62%	24%	
Device Ownership	Institution: use anywhere	8%	69%	23%	
	Student-owned	4%	44%	52%	
	Combination of above	0%	37%	63%	

For example, 52% of teachers whose students owned the device indicated the technology was used in a similar way to real-life discipline. In contrast, only 24% of teachers whose students used institution-owned devices for use only in school, indicated that the device was used in a similar way to real-life disciplines.

4.3 Personalisation construct

4.3.1 Agency
The frequently cited 'own time, pace, place' flexible learning affordances of m-learning environments were not evident in survey responses in this category, with only 19% of tasks giving full control to students for task pacing and 21% of tasks allowing students full autonomy where and when the activity was implemented. Approximately one-quarter of teachers perceived their task as lending absolutely no student control over aspects such as the learning context—where and when the activity occurs (28% of teachers), task pacing (24% of teachers), task content and learning goals (25% of teachers).

The only noteworthy statistical relationship observed in this Agency category was for primary/elementary teachers only (n=41). There was a statistically significant relationship identified for primary school participants between *experience using mobile technologies in teaching* and the extent to which the assigned task allows primary students to *control the context* (p =.036)*. In general, more experience teaching with mobile devices was associated with giving students greater control over when and where the task occurred. For example, one elementary teacher who was more experienced integrating mobile devices into teaching, allowed the children to move outside the classroom to a more intimate, quiet setting to record their music composition, reporting student trust as a key aspect in this initiative: "Teachers need to trust the students to move out of the classroom and to stay on task".

4.3.2 Customisation
The low portion of tasks making use of BYO devices (22%) would have contributed to the lack of ownership and device customisation evident in the survey responses. As one Maths teacher mentioned: "Greater effect would be possible if we could afford personal iPads for each student to allow for more file sharing, work distribution and personalisation of the iPad." Indeed, the high number of tasks using formal school-based locations was no doubt related to the distinct lack of user-generated task contexts (virtual or physical). A sample exception was a digital storytelling task where students chose a context to inspire their narrative. Their teacher reported: "The task is completed at students' choice of location (home, park, coffee shop, etc.), providing an increased level of freedom and/or creativity in completing the task. That is, their surroundings may provide inspiration for their narrative".

Two strong statistical relationships emerged from the survey data in this category, both relating to device customisation. There was a very highly significant relationship (p < 0.001) between *device ownership* and the extent to which students are able to *customise their devices* (Table 6). As might be expected, lower levels of customisation were associated with institution-owned devices.

Table 6
Statistically significant relationship identified between background data and the device customisation component of the personalisation construct (n=107).

		Student customisation of device		
		None	Partial	Full
Device ownership	Institution: School use only	68%	29%	2%
	Institution: Use anywhere	14%	71%	14%
	Student-owned	4%	17%	78%
	Combination of above	11%	50%	39%
Educational sector	Primary	62%	28%	10%
	Secondary	23%	39%	39%

There was also a very highly significant relationship (p < 0.001) between *educational sector* and the extent to which students are able to *customise their devices*. In general, lower levels of customisation were associated with primary students as compared to secondary students. For example, 62% of primary teachers indicated that students had no control over device customisation as compared to 23% for secondary teachers. However, an opposite trend was noted in relation to tailoring of activities for students. Although no significant statistical relationship emerged, it was noteworthy that a higher portion of primary school tasks (44%) were rated highly as being personally tailored for learners, compared to secondary school tasks (29%). For example, many of the media production tasks set for K-6 students involved a wider range of topic choice and variety of roles tailored for students.

5. Discussion

We acknowledge that study participants may well have designed and implemented other tasks that have different pedagogical emphases to the one they cited and examined in this survey. Nevertheless, this study has effectively analysed 107 different tasks from teacher participants of varying characteristics across a variety of discipline areas. In this way, it has provided a detailed snapshot of current m-learning practices in the school sector. This final section unpacks findings specific to each of the three constructs before reflecting on the statistical findings. We conclude with a number of questions and issues facing teachers as they design learning episodes to employ the signature pedagogies of mobile learning environments.

5.1 Collaboration construct
The emerging popularity of 1:1 mobile solutions and implementations in schools has led some to question the pedagogical and social value of such an individualistic approach (Traxler, 2009). Indeed, the data from this survey questions some of the assumptions and thinking behind these claims, since most activities described by teachers were highly social and collaborative in nature, albeit within a traditional face-to-face context rather than a remote virtual one. These findings are corroborated in recent studies of children using tablet devices (Berson, Berson & Manfra, 2012; Burden et al., 2012; Falloon & Khoo, 2014). Less than a fifth (17%) of the teachers' scenarios actually involved students working individually on a mobile device, which could indicate 1:1 ownership models are not universal and that teachers are privileging face-to-face collaboration in their m-learning designs.

The high incidence of collaborative content generation, another feature of the collaboration

construct, also questions the individualistic narrative that has attached itself to m-learning in some quarters. The emphasis on the generative use of handheld devices was particularly interesting given the common criticism of over-use of 'drill and practice' apps in education (e.g. Goodwin, 2012; Murray & Olcese, 2011). In contrast, there was a low rate of networked, synchronous interactions in tasks. These low rates of networked data sharing were somewhat contrary to the rhetoric of 'real-time' immediacy and extensive connections (or 'hyperconnectivity') enabled by m-learning environments (Norris & Soloway, 2011; Parry, 2011, Peluso, 2012). These findings were probably related to the high number of tasks using formal school-based locations (86%), where school Internet or Wi-Fi access can be limited, and also related to the low number of tasks making use of BYO devices (22%). They also raise the question of how educators can better leverage 'massive social networking' (UNESCO, 2011) to allow learners to connect with and participate in communities outside the immediate class context (Parry, 2011). The dominant text mode of online communications was also unexpected, given the current emphasis on multimodal literacies in school education (Mills, 2010) and evidence of how young people are increasingly using multimodal devices in their everyday lives (Merchant, 2012; Peluso, 2012).

Taken collectively, these findings suggest teachers are cautiously exploring the potential for collaboration which is mediated through the affordances of m-learning largely in face-to-face contexts, but have not yet fully grasped the opportunities to design learning scenarios which exploit the connectivist, networked characteristics of m-learning.

5.2 Personalisation construct

Neither of the subsidiary themes in the personalisation construct (customisation and agency) was rated highly by teachers and indeed personalisation was ranked as the lowest of all three constructs. Although the low ranking for customisation may be partially explained by the low level of device ownership amongst students in this sample, the lack of opportunities for students to demonstrate their own autonomy and agency is particularly surprising since it runs contrary to a growing body of evidence and commentary highlighting agency and student autonomy as amongst the most important features of m-learning (Burden et al., 2012; Kress & Pachler, 2007; Melhuish & Falloon, 2010; Norris & Soloway, 2011). Data from this survey strongly indicate that teachers do not currently design learning episodes which grant their students high, or even moderate levels of decision-making with regard to the context of their learning (e.g. where or when it occurs). This reluctance may reflect a more general conservatism amongst teachers to cede control over learning to their students and reflects what Kress and Pachler (2007) refer to as a mixed economy of pedagogies whereby "...learning will vary: from those where power is still exercised in traditional ways to those where the learner has power to decide (and the responsibility for the effect of the decision); where framings of the world are determined by others or by oneself..." (p.28). These results support the notion that many of the characteristics of m-learning are in conflict with traditional classroom-based learning (Mifsud, 2014; Traxler, 2008).

The flexible, potentially personalised nature of m-learning, commonly characterised by phrases such as 'anywhere, anytime, any place any pace' or 'just in time, just enough, just for me' (Traxler, 2009), was not evident in many tasks described by the school teachers in this study. This highlights a need for further investigation and professional development between researchers and teachers involved in this field in order to understand better the barriers which limit the amount of agency which students can expect to experience in these m-learning episodes.

5.3 Authenticity construct

In exploring the three constructs that underpin the framework for mobile learning, it is evident, and somewhat unexpected, that teachers in this survey rank the authenticity of their task significantly higher than both collaboration and personalisation. In previous empirical work using this framework, most m-learning scenarios scored very low (by the researchers) against the themes of tool and task authenticity (Kearney et al., 2012), therefore causing some surprise with the high scores accorded to this construct by teachers in this study. The lack of genuinely situated or participatory scenarios, for example, where students used their mobile device in authentic contexts outside of the classroom in real-life activities (e.g. museums or a field trip or community-based projects) had led us to question how far the affordances of mobile devices were actually being leveraged to support learning outside the classroom (e.g. use of Global Positioning System

(GPS) and context sensitive awareness tools). However, this study suggests teachers conceptualise the construct of authenticity through a more nuanced lens which centres around the authenticity of the tool and the task, not only the setting. Whilst it suggests there is still considerable scope for encouraging teachers to further explore the opportunities which mobile technologies provide in non formal spaces beyond the school (Jones et al., 2013), it also invites further investigation of how these technologies can make learning more meaningful and realistic for learners within formal, traditional school learning environments. In this sense the study has revealed an added depth of complexity about who and what are mobile, particularly from the perspective of the learner and their individual habitus which leaves the "…individual constantly mobile – which does not refer, necessarily, to a physical mobility at all but to a constant expectancy, a state of contingency, of incompletion, of moving toward completion, of waiting to be met and made full" (Kress & Pachler, 2007, p.27). In the past, authentic classroom-based tasks might simply have involved the addition of a 'real-world' context such as framing a maths exercise around the construction of a personal budget. Digital, networked technologies, such as the mobile devices described in this survey, seem to have raised the bar in terms of what authenticity may mean for teachers, even within a traditional classroom environment. Today it is more than feasible for students to access real-time, live data such as earthquake reports or traffic data through their mobile device, and this elevates what can be expected in terms of authentic or meaningful learning. The term authentic learning is also highly value laden, associated with pedagogical excellence and quality. It may, therefore, be the case that participants in the survey were inclined to inflate their assessments of this construct given its iconic value to the profession and this will form the basis of further research.

5.4 Statistical relationships
The questionnaire developed and used for this study was found to have high internal consistency, both overall and separately on each of the three domains: collaboration, personalisation and authenticity. A number of statistical relationships were established in the quantitative analysis of survey data. *Device ownership* was identified as a factor associated with certain features of the three mobile pedagogies under consideration in this study, influencing online conversation, tool authenticity and device customisation. Personal ownership of the device by students was positively associated with more extensive online discussions via the mobile device (collaboration construct) and device customisation. It also was a factor contributing to more positive teacher perceptions of the realistic, discipline-specific use of devices in lessons (authenticity construct). Identification of device ownership as a significant factor may encourage schools to develop BYOD policies. Although it could also encourage schools to rethink their policies and approaches to how school-owned devices are used by students, developing less 'locked down' procedures, thereby promoting a greater sense of student ownership.

The level of experience teaching with mobile technologies was interestingly not a factor influencing any distinctive mobile pedagogical approaches, beyond face-to-face discussion around the mobile device (collaboration construct). The lack of any statistical relationships emerging here would suggest that regardless of experience teaching with mobile devices, professional development is needed to help tailor teachers' pedagogical thinking to new mobile learning environments. In this respect, the study points to the growing corpus of research evidence showing how teachers largely use technology in ways which are heavily influenced by their personal pedagogical beliefs and attitudes (Ertmer, Ottenbreit-Leftwich, Olgun, Emine & Polat, 2012; Kim, Kim, Lee, Spector & DeMeester, 2013). Future research should investigate how these predispositions, beliefs and attitudes that teachers hold towards teaching and learning, rather than technology per se, might influence how they integrate or ignore distinctive features of m-learning into their current practices.
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6. Conclusion

As some schools become seduced by the appeal of handheld technologies and the 'promise' of m-learning as the latest panacea for education, we again risk falling into the trap of technology faddism (Lee, 2009) and the 'bandwagon effect' (Peluso, 2012), driven by deterministic views of emerging technologies (Selwyn, 2010). As mobile technologies develop, the challenge for educators is to move beyond the rhetoric to focus on new pedagogical opportunities. This study scrutinised pedagogies privileging authentic, collaborative and personalised learning, drawing on

established socio-cultural tenets. It critically examined teachers' current mobile teaching practices and confronted some commonly held claims of m-learning. The survey instrument developed and validated in this study, enabled us to examine teachers' m-learning practices, allowing perceptions of mobile pedagogies to be scrutinised. Its reliability was excellent, and it can be used in further studies to better diagnose and understand teachers' mobile pedagogical preferences. Practitioners may also benefit from use of this survey instrument as a developmental tool by focusing on the key elements of m-learning from a socio-cultural perspective.

Findings cast light on a hitherto unexplored aspect of m-learning related to how teachers design and implement learning scenarios that utilise signature mobile pedagogies. Teachers in this study believed the pedagogical opportunities offered through using mobile devices, such as the ability to make tasks more realistic or to mimic real life toolsets, are some of the most important reasons for implementing mobile learning scenarios, largely within formal classroom settings. Whilst relatively few teachers are working in contexts where every student has a personal device, the shared use of such technologies still supports relatively high levels of conversation, content creation and sharing, albeit through traditional face-to-face contexts rather than through networked, virtual interactions. Perhaps most concerning for teachers and for those associated with their professional development is the low extent to which learning scenarios incorporated opportunities for learners to control how their learning is framed (e.g. the pace of lessons and how tasks are undertaken). Given the self-evident autonomy and choices which young people exercise with and through their mobile devices in their lives beyond school (Jones et al., 2013), this is an aspect of teachers' practice which deserves urgent attention and understanding.

Appendix: Survey items relating to each of the three constructs

Items	Construct / Component
To what extent does your task encourage student (peer) face-to-face (f2f) discussion *at* the device? e.g. around an iPad screen.	COLLABORATION Conversation (face-to-face)
To what extent does your task encourage online discussion *through* the device? e.g. via email, SMS, Skype, social media such as a Twitter or Facebook 'conversation'.	COLLABORATION Conversation (online)
What is the nature of the digital content (information / data) that is used (accessed, shared or exchanged) by students during the task? [High = Learner-generated]	COLLABORATION Data sharing (generativity)
What additional value is added to digital content (data / information) shared or exchanged by students during the task ? [High = Learner-added value]	COLLABORATION Data sharing (generativity)
With whom do students mainly communicate (online) *through* the device during the task? e.g. via email, SMS, Skype, social media such as a Twitter or Facebook 'conversation'. [High = Extra-mural interactions]	COLLABORATION Data sharing (networking)
To what extent are online interactions (discussions and/or data sharing) *through* the mobile device 'networked'?	COLLABORATION Data sharing (networking)
Do students use the mobile device in a suitably realistic setting for the associated discipline area for this task?	AUTHENTICITY Setting
During this task, do students mainly use the mobile device in a similar way to how it might be used as a tool by real-world practitioners in this discipline area (scientists, artists, authors etc.)?	AUTHENTICITY Tool
Does the task engage students in a genuine problem and processes relevant to real-world practitioners in this discipline (scientists, artists, authors etc.)?	AUTHENTICITY Task
To what extent does the task allow students to control the context (e.g. where and when the activity occurs)?	PERSONALISATION Agency

Who determines the 'pacing' of the task? [High = Learner-controlled]	PERSONALISATION Agency
To what extent does the task allow students to control the content and learning goals of the activity?	PERSONALISATION Agency
To what extent can students customise their device according to personal user preferences?	PERSONALISATION Customisation
To what extent is the task personally tailored for students?	PERSONALISATION Customisation

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