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The mobile learning training needs of educators in technology-enabled environments

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Mobile learning (mlearning) is an emerging trend in schools, utilizing mobile technologies that offer the greatest amount of flexibility in teaching and learning. Researchers have found that one of the main barriers to effective mlearning in schools is the lack of teacher professional development. Results from a needs-assessment survey and a post-workshop evaluation survey describe the professional development needs of teachers, technology coaches and administrators implementing an mlearning initiative in K–12 schools across 21 US states. Generally, needs shifted from a focus on technology integration and pedagogical coaching to a focus on the needs for ongoing support and time, reflecting a growing confidence in teachers to develop and implement mlearning lessons. Additionally, results from the needs assessment indicated that teachers and staff feel less confident about external areas such as support policies and community involvement – these areas may also offer areas for future growth in mlearning professional development.

Keywords: mobile learning; professional development; Essential Conditions

Introduction

Digital technologies are becoming ubiquitous in today's society. The affordances of mobile technologies are becoming apparent to district leaders, administrators and teachers who choose to harness those capabilities to provide curricula that are contextualized, personalized and unrestricted by spatial and temporal constraints. Mobile learning (mlearning) is an emerging trend in schools, utilizing mobile technologies that offer the greatest amount of flexibility in teaching and learning.

Mobile digital technologies may have these capabilities; however, this does not mean that they will be used effectively. Even teachers who use mobile technologies for social networking and entertainment may not have a frame of reference for using them for educational purposes. Researchers have found that one of the main barriers to effective mlearning in schools is the lack of teacher training (namely, Crow *et al.* 2010, Cheon *et al.* 2012). When teachers use advanced technologies to carry out instructional practices that students perceive as boring or 'old-fashioned,' the students may emerge with negative perceptions of mlearning (Bjerede and Dede 2011,

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Crompton and Keane 2012). Some researchers attribute this disconnect between technology and pedagogy to lack of professional development (Crompton 2011, Hughes 2013). This disconnect is the focus of the research discussed here.

The purpose of this research is twofold. The first goal is to determine the professional development needs of teachers, technology coaches and administrators implementing an mlearning initiative in K–12 schools across North America, and how intensive, on-site training changes participant perceptions about these needs. Secondly, this paper goes beyond professional development only to analyze how teachers, technology coaches and administrators perceive broad needs pertaining to school systems and policies, thus expanding the scope of desired influence as part of mlearning professional training.

To examine these questions, the authors of this study used data collected as part of a national teacher technology professional development program, the Verizon Innovative Learning Schools (VILS) initiative. The goals of the VILS program are to help school leaders and technology coaches increase both teachers' and students' effective use of mobile technology, and increase student engagement in science, technology, engineering, and mathematics (STEM) subjects. Beginning in 2012, the program's professional development is managed by the International Society for Technology in Education (ISTE), and the program is sponsored by the Verizon Foundation. The schools in this sample had competed to participate in the mlearning initiative. Selection criteria included meeting Essential Conditions for successful mobile implementation, including a robust technology capacity and visionary leadership. Additionally, VILS grants were awarded to schools serving a significant population of economically disadvantaged students, having at least a 1:3 student/mobile device ratio working with STEM-focused mlearning initiatives. All schools identified a lack of staff professional development as a weakness.

In addition to the professional development provided, ISTE also manages evaluation of the program. One goal of that evaluation was to determine the professional development needs of teachers, technology coaches and administrators so that the training could be customized to fit the needs of participants at each school. ISTE conducted the evaluation utilizing a multi-method approach, including data collection from surveys, interviews and observations that assessed technology integration, professional development needs and other related factors. The data used for the research presented in this paper are from surveys related to the project's evaluation effort. Two of this paper's authors managed the evaluation of the VILS program. The principal author was an instructional consultant for the program, providing professional development to the schools.

Theoretical framework

Mobile learning

Technology-enhanced learning (TEL) has been expanding with new devices on the market offering new pedagogical affordances. One relatively new area of TEL growth is the subcategory of mlearning, defined as 'Learning across multiple contexts, through social and content interactions, using personal electronic devices' (Crompton 2013, p. 4). This definition provides the underpinning constructs of mlearning, which are pedagogies, context, social interactions and technological

devices. Pedagogies can be extended. Learning can take place across multiple environmental contexts and subject area contexts. Social interactions are important and opportunities to work collaboratively are highly desirable as schools are preparing the future workforce for a connected world, and technological devices are the tools used to provide these new ways of teaching.

Learning using mobile devices can follow traditional methods of teaching, with students using their devices sitting at their desks completing familiar activities while using a mobile device. Nonetheless, mobile devices can also be used to change these traditional pedagogical approaches to connect with learning taking place in the real world, connecting abstract concepts to the students in a meaningful way. With mlearning, there is a pedagogical trend towards empowering the learner (Pachler *et al.* 2010) to provide them with choices of when they want to learn, where they want to learn and how they want to learn. Students are provided with a private space on his/her device to connect with subject content and peers in private or public spaces (Lui and Kao 2007).

As lesson delivery changes, this mobile-connected generation of students presents its own set of challenges to educators. From the educator's viewpoint, with these new forms of learning, students can expect learning to be 'Just in time, just enough, and just for me' (Peters 2007). Many students who have personal mobile devices have become familiar with the 24/7 access to information and resources that these devices can provide. Instruction can take place in the confines of the classroom where teachers are familiar with the resources and support at their fingertips, but it can also take place outside the traditional setting of the school (Peters and Lloyd 2003). These feelings can cause educators to feel apprehensive towards using technology (Amado and Carreira 2006, Amado 2008). To ensure that mobile technologies are used to extend and enhance teaching and learning, there are those (namely, Honey *et al.* 2000, Norris *et al.* 2000, Zhao *et al.* 2002, Shuldman 2004, ISTE 2009, United Nations Educational, Scientific and Cultural Organization [UNESCO] 2012) who advocate for particular conditions to be in place within the educational establishment. These conditions are referred to as the Essential Conditions for technology integration.

Essential Conditions

The effective use of TEL necessarily engages contextual features of schools and districts, for education does not happen in a social vacuum. Personnel, resources and policies all influence the likelihood of success in classrooms, and at the school level regarding buy-in and implementation. Norris *et al.* (2000) conducted a review of the literature to examine and list conditions that facilitated effective technology integration in schools. The findings in this study indicate that technology was most effective when educators had access to technology, time, teacher technology training, effective curriculum and supportive administrators. In a concomitant literature analysis, Honey *et al.* (2000) found six conditions needed for effective technology integration: time; professional development; technology resources; strong educational objectives; technology evaluation; and leadership.

In June 2012, UNESCO published a comprehensive report to highlight ways in which mobile technologies can be used to support learning in North America. The UNESCO authors list five Essential Conditions for mlearning: visionary leadership

and commitment; robust technology capacity; professional development; scalability; and policies that promote and support the initiative (UNESCO 2012).

ISTE has a similar list of Essential Conditions (ISTE 2009) for effectively leveraging technology for learning. ISTE's list of 14 Essential Conditions includes UNESCO components, but breaks them down into smaller, more definable targets. The ISTE Essential Conditions are: shared vision; empowered leaders; implementation planning; consistent and adequate funding; equitable access; skilled personnel; ongoing professional learning; technical support; curriculum framework; student-centered learning; assessment and evaluation; engaged communities; support policies; and supportive external context. For the VILS program, ISTE's Essential Conditions were used primarily as a frame to distinguish the particular areas where professional development was required. Specifically, evaluators analyzed the data and presented results to school teams to show participants what they reported about their schools, and instructional consultants used these results to customize their support to schools throughout the year.

Training in mobile learning

Although there exist useful studies about professional learning needs and the efficacy of training in TEL generally (for example, Martin *et al.* 2010), guidance about mlearning specifically is rarer; and as mlearning is a relatively new field of study, this novelty contributes to a paucity of literature available on mlearning training. Licensure boards and school policies typically require professional development annually and educators and school leaders look for effective solutions, although Garet *et al.* (2001) lament that the majority of training offered is often a one-shot effort at disseminating information and skills with little or no follow-up. Training is often provided by disconnected administrators or outside consultants who arrive with their own agendas and demonstrate a lack of interest in understanding the professional growth needs of the participants (Summey 2013).

Providing effective mlearning training requires careful planning and implementation. A critical factor in successful professional development is in meeting the needs of the target audience. By using tools such as surveys, skill assessments/inventories and feedback from prior training, a good understanding of the professional development needs of the participants will be obtained and can be used for professional development planning (Summey 2013). Planning the training on the diverse learning needs and preferences of the educators can facilitate changes in the instructional approaches and improved student learning (Wlodkowski 2003, Mackenzie 2007, Kesson and Henderson 2010).

Regular, continued professional development is more effective than one-shot training for enabling educators to learn new skills (Cifuentes *et al.* 2011). School districts are now implementing coaches as a way to provide continual professional development (Wei *et al.* 2009). The coach would provide ongoing, on-site support of the mlearning training by creating a shared vision, a supportive environment (Gallucci *et al.* 2010) and encouragement and motivation (Vanderburg and Stephens 2010). In addition, the ongoing support allows time for the educators to process the new information and practice the skills before gaining feedback and further information to extend that knowledge into classroom practice (Summey 2013).

Methods

Study context and participants

All sites were recipients of a VILS grant. To be awarded the grant, a staff member at the school had to write a proposal explaining how they had invested in the hardware and the infrastructure for an mlearning initiative (as the grant would not provide financial support for hardware or infrastructure), but required further staff professional development to support effective implementation. Data for this study come from two cohorts of grantees: a first cohort (C1) that began in fall 2012; and a second cohort (C2) that began in fall 2013. Participants from both cohorts completed items assessing their school and district (Essential Conditions items), but only C2 participants provided qualitative data about their needs on the needs assessment and post-workshop evaluation (these components were added to the evaluation during the second year, and are thus not available for the first cohort). All data used for this study were collected for program evaluation purposes, but re-purposed for this study.

Grantees were provided with three days of face-to-face professional development on resources available for the technologies deployed at the site, with virtual follow-up support during the year as well as on-site support from a school or district technology coach. Each site had a unique combination of technologies and curriculum. Elementary, middle and high schools were represented, and technologies included Apple iPads, Google Chromebooks, Samsung Galaxies as well as various laptops and smartphones. Following the face-to-face workshop, the sites received ongoing support at a distance through an ISTE instructional consultant who worked with the site's local technology coach to identify appropriate resources and successful lessons. The approach was intended to blend elements of hands-on professional development with coaching and virtual learning.

Prior to the onsite professional development, participating teachers, technology coaches and administrators were contacted by email and asked to complete an online survey. Evaluators worked with technology coaches to ensure a representative local sample of responses. The main goal of the survey was to provide the professional development provider (ISTE) with information to customize on-site professional development for each site based on the needs and resource access of teachers. The original solicitation for survey response was emailed in mid-June, with a follow-up correspondence sent approximately two weeks later. The average response rate (defined as number of people who completed the survey divided by expected participants × 100) was 73%, with a relative standard deviation of 0.21, reflecting substantial variance in response rates among schools.

A total of 213 administrators (n = 22), teachers (n = 176) and technology coaches (n = 15) took part in this study from 24 schools in 21 North American states. Table 1 presents response patterns for schools in both cohorts of the program by role and cohort. In both cohorts, about 80% of the respondents were teachers. Between 3 and 11 administrators, technology coaches and teachers from each school completed surveys (described below), with a mean of 8.92 respondents per school.

Data collection and analysis

Three sets of survey data were analyzed for this study. The pre-training needs-assessment survey provided both participant perceptions on the alignment of the

Table 1. Response patterns by cohort.

Role	C1 (summer 2012)	C2 (summer 2013)	Total
Administrator	14	8	22
%	10.94	9.41	10.33
Teacher	103	73	176
%	80.47	85.88	82.63
Technology coach	11	4	15
%	8.59	4.71	7.04
Total	128	85	213
%	100	100	100

Note: Cells contain frequency counts and respective percentages, by role and cohort.

school to ISTE's Essential Conditions and also participant comments about their needs regarding mlearning. The third set of data, qualitative comments about mlearning needs moving forward, is from the post-training workshop evaluation survey. A mixed-methods approach was used, with a quantitative analysis of the Essential Conditions information, and a qualitative analysis of the comments about needs and goals from pre-training and post-training surveys.

Essential Conditions and the pre-training needs-assessment survey

The initial survey had two main components of interest for the current work: an ordinal rating scale for each of the Essential Conditions; and a needs assessment containing open-ended items about needs and goals related to mlearning.

For the Essential Conditions, respondents rated their school using a rubric assessing various components such as 'visionary leadership' and 'adequate funding' with an ordinal scale from 'very weak' to 'very strong.' Essential Conditions data were used to help school leaders and instructional consultants who support teachers and technology coaches at the schools, to identify areas for growth and to enable longitudinal evaluation of school change.

C2 participants also responded to several open-ended items designed to target their goals and needs regarding the upcoming on-site training provided. These needs-assessment items asked VILS participants to respond to three questions:

- Please describe what it is you hope to get out of your participation in the VILS program. What do you hope to learn? What are your goals?
- What do you need to help you get the most out of your experience with the program?
- Do you have any concerns about the program (and your role in it) at this time? If so, describe them here.

Quantitative descriptive results of Essential Conditions data are used to examine response patterns by role, including comparisons of teachers, administrators and technology coaches. Qualitative needs-assessment data are coded using a grounded theory design with a constant comparative method (Strauss and Corbin 1998). In the first step, the participant responses were open coded to identify important words or groups of words in the data and they were labeled. *In vivo* codes were also selected as the participants' verbatim terms provided appropriate descriptive coding terms

(King 2008). The study of the response data was an iterative and inductive process. The initial codes led to intermediate coding and the constant comparison of data of responses with responses, of responses with codes and of codes with codes. The codes were deemed to be theoretically saturated once all of the responses fit into one of the existing categories.

Post-training needs survey

Immediately following completion of the on-site workshop, C2 participants completed a short survey containing items about satisfaction with the training, expected future use of various resources and open-ended prompts, including the following questions:

- What was a highlight of the training for you? What was exceptionally helpful or informative?
- To implement what you learned in this training effectively during the upcoming school year, what do you need? Tell us about a key support you would like in order to put what you learned here into practice in the classroom.

Responses to these questions were coded in the same manner as the pre-training needs-assessment items. The goal of that analysis is to determine how the professional development and integration needs of teachers, administrators and technology coaches changed in response to a three-day, on-site training in technology integration, as such analysis informs how to best plan mlearning professional development.

Results

Essential Conditions

Results of Essential Conditions ratings are disaggregated by both role and cohort in order to examine differences in response patterns among groups. There are justifiable reasons for this. For example, administrators may be more likely to inflate ratings about their schools because, generally speaking, they are accountable for positive school culture, and their job security may, in part, depend on overall perceptions about the school. Teachers may offer more negatively skewed thoughts about the school if they are unsatisfied with aspects of the system, but do not understand administrative efforts to alleviate challenges with, for instance, providing adequate technical support or consistent funding for technology. It should also be noted that it is conceivable that C2 schools provide stronger ratings than C1 schools because the application process for C2 schools was more explicit and demanding about the need for a school/district commitment to adequate funding and infrastructure. Thus, such disaggregation is merited. Essential Conditions ratings are numerically coded as follows:

- 0 = very weak.
- 1 = weak.
- 2 = emergent.
- 3 = strong.
- 4 = very strong.

In general, respondents felt that their school was either 'emergent' (median of two) or 'strong' (median of three) along the conditions. Table 2 presents results for all schools and respondents combined. The table shows that, at the outset (i.e. before the training), teachers, administrators and technology coaches felt stronger about pedagogical orientation (student-centered learning), a shared vision for TEL, empowered leaders who can accomplish change and adequate technology funding, but weakest about curriculum framework and development, policies that support technology use and external factors such as engaged communities and supportive external context including local decision-making bodies and teacher preparation institutions that support the integration of technology.

Table 3 presents these results by role. Generally, technology coaches felt most optimistic about their schools and the amount of technology-related support, with administrators the least optimistic. While tests of difference (analysis of variance and multi-level regression, accounting for clustering by school) did not suggest that mean differences were statistically significant, these results do indicate a gap between administrators and other stakeholders regarding views about school readiness and support around technology integration, with technology coaches and (then) teachers being the most optimistic about their schools.

Table 4 presents Essential Conditions ratings ranked by role. The goal here is to compare, by role, which conditions different respondents rate more strongly *vis-à-vis* others. In general, rankings of the different conditions were quite similar across groups. The main differences that stand out are that: technology coaches rated technical support and shared vision highly; teachers felt very positive about their emphasis on student-centered instruction (pedagogy); and administrators felt very positive about having strong leaders. In essence, each group tended to rate their own area of control as being strong.

Table 5 compares Essential Conditions ratings by cohort. Although there was no statistically significant difference in mean rating across conditions (by cohort), there were some noteworthy differences. Table 6 highlights these differences by ranking

Table 2. Essential Conditions ratings from all schools and respondents.

Essential Conditions	All (n = 213)	SD	Med	Min	Max
Shared vision	2.67	0.92	3	0	4
Empowered leaders	2.65	0.98	3	0	4
Implementation planning	2.38	0.93	2	0	4
Consistent and adequate funding	2.47	1.04	3	0	4
Equitable access	2.53	1.03	3	0	4
Skilled personnel	2.39	0.81	2	1	4
Ongoing professional learning	2.31	0.94	2	0	4
Technical support	2.40	0.93	2	0	4
Curriculum framework	2.16	0.92	2	0	4
Student-centered learning	2.74	0.97	3	0	4
Assessment and evaluation	2.23	0.94	2	0	4
Engaged communities	2.03	0.97	2	0	4
Support policies	2.15	0.91	2	0	4
Supportive external context	1.99	0.87	2	0	4
Mean	2.36				

Note: Sample size noted in parentheses, with SD = standard deviation, Med = median, and Min and Max = minimum and maximum observed values.

Table 3. Essential Conditions ratings including all schools and all roles.

Essential Conditions	Administrator (n = 22)	SD	Md	Teachers (n = 176)	SD	Md	Technology coach (n = 15)	SD	Md
Vision	2.32	0.65	2	2.68	0.94	3	3.07	0.96	3
Leaders	2.82	0.73	3	2.62	0.98	3	2.80	1.26	3
Implementation	2.18	0.59	2	2.40	0.96	2	2.53	0.99	2
Funding	2.23	1.31	2.5	2.51	1.02	3	2.40	0.83	2
Access	2.68	0.95	3	2.49	1.04	2.5	2.73	0.96	3
Personnel	2.23	0.69	2	2.43	0.82	2	2.27	0.88	2
Professional learning	2.18	0.85	2	2.32	0.96	2	2.47	0.83	3
Technical support	2.23	0.75	2	2.38	0.95	2	2.87	0.83	3
Curriculum	1.95	0.72	2	2.17	0.93	2	2.33	1.11	2
Pedagogy	2.36	0.79	2	2.80	0.98	3	2.60	1.06	3
Assessment	1.68	0.65	2	2.29	0.94	2	2.40	1.12	3
Communities	1.64	0.66	2	2.09	0.98	2	1.93	1.16	2
Policies	1.95	0.72	2	2.18	0.91	2	2.20	1.08	2
Context	1.59	0.73	2	2.02	0.87	2	2.13	0.83	2
Mean	2.15			2.38			2.48		

Note: Sample size noted in parentheses, with SD = standard deviation and Md = median.

Table 4. Ranking of Essential Conditions by roles.

Administrators (n = 22)	Mean	Teachers (n = 176)	Mean	Technology coaches (n = 15)	Mean
Context	1.59	Context	2.02	Communities	1.93
Communities	1.64	Communities	2.09	Context	2.13
Assessment	1.68	Curriculum	2.17	Policies	2.20
Curriculum	1.95	Policies	2.18	Personnel	2.27
Policies	1.95	Assessment	2.29	Curriculum	2.33
Implementation	2.18	Professional learning	2.32	Funding	2.40
Professional learning	2.18	Technical support	2.38	Assessment	2.40
Funding	2.23	Implementation	2.40	Professional learning	2.47
Personnel	2.23	Personnel	2.43	Implementation	2.53
Technical support	2.23	Access	2.49	Pedagogy	2.60
Vision	2.32	Funding	2.51	Access	2.73
Pedagogy	2.36	Leaders	2.62	Leaders	2.80
Access	2.68	Vision	2.68	Technical support	2.87
Leaders	2.82	Pedagogy	2.80	Vision	3.07

Note: Sample size noted in parentheses.

Table 5. Essential Conditions ratings by cohort.

Essential Conditions	C1 (2012)	SD	Md	C2 (2013)	SD	Md
Shared vision	2.80	0.93	3	2.47	0.88	2
Empowered leaders	2.78	1.00	3	2.46	0.92	2
Implementation planning	2.48	0.92	2	2.24	0.92	2
Consistent and adequate funding	2.34	1.08	2	2.27	0.94	3
Equitable access	2.41	0.99	2	2.71	1.06	3
Skilled personnel	2.44	0.82	2	2.33	0.79	2
Ongoing professional learning	2.29	0.97	2	2.35	0.90	2
Technical support	2.50	0.89	2	2.25	0.99	2
Curriculum framework	2.20	0.91	2	2.09	0.95	2
Student-centered learning	2.86	0.89	3	2.55	1.05	3
Assessment and evaluation	2.34	0.90	2	2.08	0.99	2
Engaged communities	2.07	0.97	2	1.96	0.98	2
Support policies	2.20	0.91	2	2.09	0.91	2
Supportive external context	2.01	0.88	2	1.95	0.84	2
Mean	2.41			2.30		

Note: SD = standard deviation, and Md = median.

the conditions for each school. Although the patterns for most factors were fairly similar across the cohorts, three stood out. C1 schools were more positive about implementation planning at their school, suggesting that these stakeholders may have been more systematic about mlearning integration. But the most important difference was in C2's strong rating for 'consistent and adequate funding' and 'equitable access.' This difference is probably symptomatic of the C2 Request for Proposals that strongly emphasized the need for schools to have adequate hardware and infrastructure in place in order to be competitively considered for the program.

Tables 7 and 8 present Essential Conditions ratings by role for each cohort separately. What are noteworthy about these results are the drastic differences in perceptions of technology coaches, with coaches from C2 schools being less optimistic about their school's readiness than those from C1.

Table 6. Essential Conditions (ranked) by cohort.

All rank	All (n = 213)	C1 rank	All (n = 128)	C2 rank	All (n = 85)
Context	1.99	Context	2.01	Context	1.95
Communities	2.03	Communities	2.07	Communities	1.96
Policies	2.15	Curriculum	2.20	Assessment	2.08
Curriculum	2.16	Policies	2.20	Curriculum	2.09
Assessment	2.23	Professional learning	2.29	Policies	2.09
Professional learning	2.31	Funding	2.34	Implementation	2.24
Implementation	2.38	Assessment	2.34	Tech support	2.25
Personnel	2.39	Access	2.41	Personnel	2.33
Technical support	2.40	Personnel	2.44	Professional learning	2.35
Funding	2.47	Implementation	2.48	Leaders	2.46
Access	2.53	Technical support	2.50	Vision	2.47
Leaders	2.65	Leaders	2.78	Pedagogy	2.55
Vision	2.67	Vision	2.80	Funding	2.68
Pedagogy	2.74	Pedagogy	2.86	Access	2.71

Note: Sample size noted in parentheses.

Reflections on Essential Conditions results

In general, respondents felt as though their schools were either 'emergent' or 'strong' along most of the Essential Conditions, with student-centered learning, visionary leadership and empowered leaders being the strongest rated qualities of schools. C2 schools were also very strong regarding providing adequate funding for technology and equitable access to devices – this is unsurprising given the strong emphasis in the C2 application process that emphasized the need for adequate hardware and infrastructure for the schools. Many of the participating schools had purchased equipment, which generally requires funding, strong leadership and progressive vision that emphasize the importance of digital technologies – in this case, mobile devices specifically. Devices at these schools were often purchased with funds received from Title 1 status, or through programs such as Enhancing Education through Technology or the American Recovery and Reinvestment Act.

In contrast to these strong areas, stakeholders across cohorts felt as though external contexts, communities, appropriate curriculum focus and school-related policies were among the least supported areas. This leaves factors such as assessment and professional learning in the middle, as areas for growth for teachers and other staff. This suggests that these schools are a good fit for the program, which focuses on classroom strategies for technology integration, including assessment and evaluation, and ongoing professional learning. Many of the features of the program were designed to build professional interaction through work with an instructional consultant, and collaboration among teachers, technology staff (including coaches and directors) and administrators, and thus possibly support these lowest-ranked conditions. The professional development provider has found this pattern common – that schools purchase equipment and have a progressive vision, yet have great need for support in building policies and providing adequate teacher professional development for effective implementation.

Table 7. Essential Conditions ratings from C1 by role.

Essential Conditions	Administrators (n = 14)	SD	Md	Teachers (n = 103)	SD	Md	Technology coaches (n = 11)	SD	Md
Vision	2.36	0.63	2	2.82	0.96	3	3.27	0.79	3
Leaders	3.00	0.68	3	2.71	1.03	3	3.18	0.87	3
Implementation	2.14	0.66	2	2.49	0.95	2	2.91	0.83	3
Funding	2.14	1.46	2	2.38	1.06	2	2.18	0.75	2
Access	2.64	0.93	2.5	2.36	1.01	2	2.55	0.93	2
Personnel	2.29	0.83	2	2.48	0.81	2	2.36	0.92	2
Professional learning	2.14	0.95	2	2.28	0.97	2	2.55	0.93	3
Technical support	2.36	0.97	2	2.47	0.89	2	3.00	0.89	3
Curriculum	1.93	0.93	2	2.19	0.90	2	2.64	1.12	3
Pedagogy	2.21	0.80	2	2.94	0.88	3	2.91	0.83	3
Assessment	1.71	0.73	2	2.39	0.89	2	2.64	0.92	3
Communities	1.43	0.95	1.5	2.15	0.94	2	2.18	1.25	2
Policies	1.93	0.83	2	2.21	0.89	2	2.36	1.03	2
Context	1.50	0.85	2	2.05	0.88	2	2.27	0.79	2
Mean	2.13			2.42			2.64		

Note: Sample size noted in parentheses, with SD = standard deviation, and Md = median.

Table 8. Essential Conditions ratings from C2 by role.

Essential Conditions	Administrators (n = 8)	SD	Md	Teachers (n = 73)	SD	Md	Technology coaches (n = 4)	SD	Md
Vision	2.25	0.71	2	2.49	0.88	2	2.50	1.29	2.5
Leaders	2.50	0.76	2	2.49	0.88	3	1.75	1.71	1.5
Implementation	2.25	0.46	2	2.27	0.96	2	1.50	0.58	1.5
Funding	2.38	1.06	3	2.70	0.94	3	3.00	0.82	3
Access	2.75	1.04	3	2.67	1.07	3	3.25	0.96	3.5
Personnel	2.13	0.35	2	2.37	0.83	2	2.00	0.82	2
Professional learning	2.25	0.71	2	2.37	0.94	2	2.25	0.95	2
Technical support	2.00	0.76	2	2.26	1.03	2	2.50	0.58	2.5
Curriculum	2.00	0.76	2	2.14	0.98	2	1.50	0.58	1.5
Pedagogy	2.63	0.74	2.5	2.59	1.07	3	1.75	1.26	2
Assessment	1.63	0.52	2	2.15	1.00	2	1.75	1.50	2
Communities	2.00	0.53	2	2.00	1.03	2	1.25	0.50	1
Policies	2.00	0.53	2	2.12	0.93	2	1.75	1.26	2
Context	1.75	0.46	2	1.99	0.87	2	1.75	0.96	1.5
Mean	2.18			2.33			2.04		

Note: Sample size noted in parentheses, with SD = standard deviation, and Md = median.

In general, administrators felt less optimistic about their schools than did teachers. Possibly, this is due to the wide array of problems and challenges principals must face, as well as their knowledge of and experience with resilient school decision-making systems. One puzzling discrepancy between cohorts is that for technology coaches – while C1 technology coaches were very positive about their schools, C2 coaches were the opposite, or the least positive group. The cause of this is not known, although it does clearly point towards the need for coach support, especially in C2 schools, and for a deeper understanding about mlearning needs of coaches and other stakeholders.

mLearning professional development

The Essential Conditions surveys address general qualities of schools' readiness for technology integration; the needs assessments address specific characteristics that participants seek in professional growth. The VILS needs assessments, pre and post, reflect the general priorities identified in the Essential Conditions survey, but with an emphasis on the details of professional development. The needs assessments also revealed how needs change following exposure to professional learning experiences.

Initial training needs assessment

Four overarching themes emerged from the coding of respondents' desires for mlearning professional development: technology integration; pedagogical approach; student goals; and specific technology training. Table 9 presents these four themes ordered in size, with 'technology integration' being the most frequently mentioned theme.

Technology integration was the most desirable professional learning component. Integration referred to teachers' desire to know how to effectively incorporate technology into their existing curriculum. Examples of this include Internet-based resources for instruction and student collaboration, applications for mobile devices and formative assessment software. Next was the theme pedagogical approaches, which referred to teachers wanting to use technology to implement specific teaching techniques. For example, project-based learning was mentioned specifically seven times, and flipped and blended classrooms were each mentioned five times. The other two themes of specific student goals and technologies were each mentioned at least three times. The only connection made to a technology application was the mention of a desire to learn about Learning Management Systems. The prominent emphasis of technology integration and pedagogical approaches from participating VILS teachers and administrators affirms the focus of the professional development – increasing the use of mobile devices in the classroom to support more effective instruction, including additional digital-age learning opportunities made possible with the power of technologies.

Post-training needs survey

Four codes emerged from the post-training needs survey as the participants described their future mlearning training needs: support; time; resources; and unsure. Table 10 presents these four themes ordered in size, with 'support' being the most frequently mentioned theme.

Table 9. Themes from the initial needs assessment.

Theme	Description	Example responses
Technology integration	How to integrate technology into the curriculum	'[I want] more use of technology in my classes and have technology be a part of my classes, not just an addition or an afterthought.'
Pedagogical approaches	Flipped, blended, self-directed learning, learner centered, real world and authentic	'I hope to learn better strategies to engage my students in exploring real-world issues and solving authentic problems using digital tools and resources.' 'I hope to learn how to make blended learning for our campus more than turning a worksheet into a digital format.'
Student goals	Engage students, connect students, global citizens	'Students will acquire skills to allow them to become citizens of our global society.' 'I want to increase student engagement through the use of technology.'
Specific technology training	Learning Management Systems	'I would like to know how to effectively use a Learning Management System in my classroom.'

The first two themes, support and time, could be found in many of the responses. To be exact, from the 94 responses, 40 participants specifically stated that they needed support and 30 said that they wanted more time. Thus, these two themes made up the majority of the responses. From the other two themes, eight requested resources and five said that they were unsure what they needed. The eight participants who described a desire to have additional resources were referring to resources that they had been exposed to during the training. Fourteen participants responded to the other questions but left this question unanswered.

Table 10. Themes from the post-training needs survey.

Theme	Description	Example responses
Support	Needs further help or general professional development	'Consistent support and guidance.' 'I would like my own 24/7 personal consultant.'
Time	Time to plan or work with the new tools	'TIME, I would like time over the summer to develop lessons for my five classes for the first half of the year (5hrs a piece) total of 25hrs this summer, followed by more time possible over Christmas break or winter break for time to develop lessons for the 2nd half the year. Also would like time once every week or once every two weeks in the morning to meet as a group at, say, like 7–8 in the morning.'
Resources	Additional programs/ applications	'If you can provide us some software and online space so that our student can post their own websites and stuff like this.'
Unsure	Specifically states that they do not know what they need	'Not sure yet, I will let you know.'

Change in needs over time

There is a great difference in the needs that were reflected in the initial responses and those from the post-training responses. The participants initially had definitive components that they believed would fill the gap in what they need to perhaps be more confident and skilled in mlearning implementation; specifically, help with technology integration and pedagogical approaches. The content of the training the participants then received was based on these needs described in the initial survey. Results suggest that the participants felt that these needs were met during the on-site training component, as these same topics did not appear in any of the 94 responses from the post-training survey. But after the training, participants did not indicate that they were ready to begin effectively implementing mlearning in their classroom or school. Instead they appeared to be saying that they had further needs – on-demand support and time – to effectively implement mlearning in their classrooms.

Descriptions of support were again not specific, but referred to a person or people who would be there to provide advice and assistance when necessary. These included comments like: 'Support from the coaches,' '24 hour tip line!,' 'Consistent communications and updates – reminders on what we covered would also be helpful' and 'We need support and follow-up!' One participant stated that she needed 'ongoing professional development,' which again did not include details about what that professional development should include, but that they would need continued coaching.

Time was the second theme that emerged from the coding, and particular emphasis was put on the word 'time' with capitalization and repetition used by the 30 participants who mentioned it. The majority (16 of the 30 respondents) did not include an indication of what they needed time for: for example, 'TIME!' and 'Time! I would like time.' The other participants described time for planning (eight participants), implementation (four participants) and coordination (two participants). These descriptors are also still vague in what specifically they need time for, but the message is clear that they do know that they want time in order to effectively change their teaching practice.

Despite providing the training people requested, the participants still felt they needed more help to effectively implement mlearning. From this study, it would appear that there is no set model of what should be provided in mlearning training, but instead that ongoing support and coaching is the single greatest need of teachers implementing mlearning practices. The participants in this study were given training on mlearning which included what they had asked for, but following the training the majority of the 94 educators who responded to the post-training survey stated that they needed ongoing support, coaching and time to effectively implement mlearning initiatives.

These results suggest that some participants might have thought that the one-shot training approach would provide them with the skills and knowledge they would need to be prepared for the upcoming transition. However, Cifuentes *et al.* (2011) described this approach as not as effective as regular, continued professional development. Instead, many of the participants described the need for support, encouragement and motivation described by Gallucci *et al.* (2010) and Vanderburg and Stephens (2010), and a time for processing and practicing information and skills with continued follow-up (Summey 2013). While comparison of post-training needs by role could yield valuable insight into how role and position affect needs, such

comparison was not possible because post-training workshop evaluation surveys were anonymous in order to maximize the formative value of responses for the professional developers.

These findings complement those emphasizing the interest in 'hands-on' training, and teachers' aversion to passive 'learning.' The term hands-on was used 11 times in pre-training needs-assessment items. For example, one respondent wrote 'Hands-on learning is important … not *sit and get* training.' Time to explore and learn – in a hands-on fashion – was an issue addressed by nine participants. For example, one participant stated:

> I don't like to be introduced to something new and then feel like I am left hanging to figure it out from there. In most cases, I don't take the time to figure it out, because I don't have the time to figure it out. So the training needs to be designed to allow me to work with the technologies and get the guidance to get me to a comfortable point. Don't just say 'on your own time,' because I probably won't get around to it then.

Five participants also expressed the desire for continued mentorship for future guidance and support to be available after the professional development sessions.

Summary and conclusions

Data from the needs assessment for the VILS initiative found that fundamentals of effective professional development apply in the realm of new technologies (Lemke and Fadel 2006, Penuel 2006, Martin *et al.* 2010). Educators want their professional learning to be job situated, ongoing and closely related to their job assignments. At the same time, teachers in VILS schools cited specific needs that are related to new pedagogies which stem from the new technological affordances provided by these devices. The 'new' pedagogies include incorporation of concepts such as blended learning, which exist only in a technological context.

The findings of this study identified support and time as the two components needed by administrators, technology coaches and teachers to successfully implement an mlearning initiative. However, it is never possible to provide enough time to help teachers master a new set of technology skills in one on-site training. Even when training is developed to meet all of the specified needs, and the training is primarily 'hands-on,' continued time and coaching are needed to help teachers build their competencies *in situ*. Thus, these results suggest that 'additional time' and 'ongoing support for staff involved in a mlearning initiative' are crucial needs – needs that cannot be adequately addressed in an on-site training, but require follow-up coaching support. Onsite training by external consultants is expensive and, even when robust virtual mentorship processes and structures are in place, the support such a person can offer will never equal that of an on-site coach familiar with the particular community, school and students. The recommendation from these findings is clear then: that ongoing, school-based coaching is an essential component of effective mlearning professional development training in order to meet teachers' needs around technology integration and curriculum development and implementation in a school transitioning towards an mlearning environment. Further, professional development (especially for administrators) may also include a focus on external contingencies such as support policies and local communities (such as parents, media and even business), because these aspects were consistently rated as less supportive than other factors more under teacher and staff locus of control, such as

pedagogy, school leadership and vision about technology integration. In cases where a school has identified gaps in Essential Conditions that constrain specific interventions (e.g. policies that preclude professional development during school hours or teacher ability to grant student network access), training providers need to proactively identify these limitations, along with possible workarounds that allow teachers to continue their professional growth.

One challenge for professional curriculum development and application designers is to walk the line between the fundamental and futuristic. Technology introduced without appropriate support will probably not be integrated. Discussing integration without hands-on modeling of specific appropriate technologies may be considered irrelevant. Both on-site hands-on professional development as well as virtual follow-up activities that support continued development are necessary, especially to keep pace with teachers' changing abilities for classroom integration and curriculum innovation (Martin *et al.* 2010). Focusing on digital-age learning standards (such as the ISTE Standards) can also drive pedagogical change, and should accompany basic technology fluency training so that teachers understand that technology affords new possibilities beyond simply replacing old methods (such as lecturing) with technological alternatives (such as using *PowerPoint*).

This study is particularly timely as schools are quickly moving towards the incorporation of mlearning. Many school districts across North America are purchasing mobile devices or incorporating a Bring Your Own Device policy and there are a plethora of studies (namely, Crow *et al.* 2010, Bjerede and Dede 2011, Cheon *et al.* 2012, Crompton and Keane 2012) where researchers have reported needs for teacher professional development for the effective incorporation of these devices. Knowledge about these needs is essential for the design and implementation of effective professional development, and with the rapid pace of technology change it is essential that researchers stay abreast of how new technologies encourage changes in professional development and, also, what features of effective training remain consistent. Exploring the intersection between technology and pedagogy is not a new topic, although future studies in this area could use the Technological Pedagogical Content Knowledge Framework and ISTE's Standards for Teachers as lenses to determine whether teachers use the technology effectively, and what continued professional development needs exist – longitudinal tracking of teacher development would be particularly effective at answering this type of question. Given the rate of technology advances, we recommend ongoing studies to understand the mlearning professional development needs of educators involved in mlearning initiatives.

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