2014

Learner Perceptions on the Use of Mobile Learning Strategies and Devices for Team e-portfolio Content Creation

Devshikha Bose
Boise State University

Krishna Pakala
Boise State University

Learner Perceptions on the Use of Mobile Learning Strategies and Devices for Team e-portfolio Content Creation

Devshikha Bose
Instructional Design and Educational Assessment (IDEA)
Boise State University
USA
devshikhabose@boisestate.edu
Krishna Pakala
Department of Mechanical and Biomedical Engineering
Boise State University
USA
krishnapakala@boisestate.edu

Abstract: This study intended to determine student perceptions on the efficacy of using mobile learning strategies and devices to create electronic content for inclusion in an engineering team/group e-portfolio. Sixty four students from an undergraduate engineering thermodynamics class, created multimedia videos and produced content demonstrating course content summaries, problem solving techniques, and written work on concept question solutions. Results from a post course completion anonymous survey and focus group meeting indicated that the majority of the students found this to be a very useful exercise in learning, communicating with their instructor, completing homework and assignments as well as to prepare for tests. Some students indicated their preference for use of traditional computers, paper and pen. Recommendations for improved pedagogy using mobile devices are provided. Further research plans include the creation of an engineering industry grounded assessment instrument capable of measuring the soft social skills identified in the ABET Engineering Criteria Outcomes.

Background

Over nearly two decades ago, Chickering and Gamson (1987) identified that fostering interaction between students and faculty, developing mutual exchange and cooperation among students and faculty, encouraging active learning, and providing prompt feedback to students, are elements of what constitute "good practice" in undergraduate education.

The use of mobile devices like tablets and smartphones is a rapidly emerging trend both within and outside the educational setting. Mobile devices enable users to easily connect with each other, communicate, create content, store, and share information. Harnessing the multiple creative and communicative potentials of mobile devices, using appropriate mobile learning strategies, aimed towards bringing about measurable educational benefits can be a worthwhile goal.

However, studies indicating the benefits of using mobile devices for educational purposes have shown mixed results and have not yet been conducted in many disciplines. Moreover, a certain degree of discrimination needs to be applied when it comes to using materials easily accessible through mobile devices in terms of its authenticity and reliability (Little, 2012). In some cases the use of mobile devices may cause added difficulties, especially when the user is not fully trained to use it, as was the case with assessors in a student teaching assessment class (Haughton & Keil, 2009). The limitations of mobile devices - small screens, limited input options, and low computational power (Ting, 2012, p. 119) may deter its use in certain disciplines.

Rationale

Mobile devices can be used in large classrooms to enable individualized and interactive experiences (Day & Kumar, 2010). Moreover, it is possible to support deeper learning and increased engagement by using mobile

devices as audience response systems in large classes (Wang, Shen, Novak, & Pan, 2009; Jain & Farley, 2012; Dunn, Richardson, McDonald, & Oprescu, 2012). Mobile learning (mLearning) technologies can provide a platform for enhancing active learning, collaboration, and innovation in higher education (Fisher & Baird, 2006, p. 3). Use of simple mobile devices like a cellular phone with text messaging services may encourage independent thinking and interaction over course content, while allowing the instructor to provide instant feedback on student questions in a large class (Kinsella, 2009).

The overall levels of engagement, excitement, and motivation of students using mobile devices are often higher than students learning the same content using regular computers (Martin & Ertzberger, 2013). Moreover students receiving content via their mobile device may often learn more than their counterparts who use regular computers (Thornton & Houser, 2005) and other learning aids (Basoglu & Akdemir, 2010).

The 2014 NMC Horizon Report (Johnson, Adams, Becker, Estrada, & Freeman, 2014), which identifies and reports on developing technologies that are most likely to have a substantial impact over the next five years in education, highlights how a key trend in the next three to five years, would be a change in the role of students as consumers, to students as creators of content. In view of this, preparing engineering students to demonstrate their learning through tangible student created content in e-portfolios, appears to be an important step towards preparing students for success in the job market.

Student created videos and photoblogs accessed through smartphones (Benedict & Pence, 2012) have been successfully used in Chemistry and Nursing (Pereira, Echeazarra, Sanz-Santamaria, & Gutierrez, 2014) education as well as student self-reported enhanced learning in Information Technology and Security courses (Tabor & Minch, 2013). However, the impact of student created video content on engineering student learning is worth further investigation.

Goal/Purpose of the study

Mobile learning strategies that make efficient use of mobile device capabilities may have the potential to enhance student learning. The goal of this study was to determine whether benefits derived from the use of mobile learning strategies and devices, enable students to become efficient creators of electronic content for inclusion in team e-portfolios. The purpose of this study was to determine student perceptions on the efficacy of using mobile learning strategies and devices to create electronic content for inclusion in engineering team/group e-portfolios.

Using E-portfolios for teaching and learning may have many benefits attached to it, including increasing student awareness of their learning progress and helping build on learning experiences through reflection (McNair, Paretti, Knott, & Wolfe, 2006). Faculty can teach skills which can be consistent across programs, at the same time as being built to fit individual courses. Moreover, e-portfolios can support assessment by identifying goals and providing a repository for organizing, storing, and sharing records.

Students enrolled in an undergraduate 300-level engineering Thermodynamics class, created multimedia videos and produced content demonstrating course content summaries, problem solving techniques, and written work on concept question solutions. A post course completion anonymous survey and focus group meeting was conducted at the end of the semester, to document student perceptions on the efficacy of using mobile learning strategies and devices to create electronic content for inclusion in the team e-portfolios. Based on the observances made in this study, recommendations were made on how to use mobile learning strategies and devices most effectively for teaching and learning.

Research Hypothesis

It was hypothesized that students will find the use of mobile learning strategies and devices to be efficient means of collaboratively creating electronic content for inclusion in engineering team e-portfolios.

The following **research questions** guided this study:

1. What are the perceptions of the effect of using mobile learning strategies and devices on participants'

creation of team e-portfolios, as reported through a qualitative analysis of a post-course completion survey?

2. What are the perceptions of the effect of using mobile learning strategies and devices on participants' creation of team e-portfolios, as reported through a qualitative analysis of a post-course completion focus group meeting?

Methods of data collection

The phenomenon under study is the effect of using mobile learning strategies and devices on student learning and content creation for team digital e-portfolios, documented through a self-reported survey and focus group meeting.

Students enrolled in a 300-level Mechanical Engineering Thermodynamics course, created multimedia videos and produced content demonstrating course content summaries, problem solving techniques, and written work on concept question solutions. This was a regular part of fulfilling the requirements for completing the course.

At the end of the semester, students participated in an anonymous online survey distributed via an online survey management tool. They also participated in a focus group meeting where the meeting proceedings were audio recorded. Creation of electronic content for the team e-portfolio was a necessary part of completing the requirements of the course, and was therefore a grade bearing activity. However, participation in the survey and the focus group meeting were voluntary and did not affect student grades for the course. Students did not receive any extra credit for participating in the survey or focus group meeting.

Procedures

During the course of the 16 week semester, students enrolled in the course were placed in groups where they collaborated with each other to create multimedia videos - produced content demonstrating course content summaries, problem solving techniques, and written work on concept question solutions.

At the end of the semester, students were invited to participate in a voluntary and anonymous online survey (21 item Likert scale instrument) regarding their perceptions of the efficacy of using mobile learning strategies and devices to create electronic content for inclusion in the engineering team e-portfolios. The survey was delivered via an online survey management platform (Qualtrics.com) and took about 10 minute to complete.

At the end of the semester, students were invited to participate in a voluntary focus group meeting. Five students out of a class of 64, volunteered to participate. The focus group meeting discussion was moderated by one of the researchers (who was not the instructor of the course) and was guided by six pre-determined questions designed to elicit student perceptions on the use of mobile learning strategies and devices.

Sample

Participants who volunteered to take part in this study consisted of registered students in an undergraduate 300-level Mechanical Engineering Thermodynamics course, who took this course as part of completing the requirements for obtaining their undergraduate degree.

Results

Two instruments were used to collect data for this study: 1) A 21-item five point Likert scale survey was electronically administered to identify student perceptions on the utility of using mobile learning strategies and a mobile device (i.e., the iPad) to create content for group e-portfolios. 2) A six item focus group meeting discussion guideline, used to collect verbal responses from participants during a group face-to-face meeting.

Survey Results

A total of 55 (out of a class of 64) students responded to the survey. Of the 21 items in the survey, 11 items were targeted towards determining whether use of the mobile device helped students to actually create the content material included in the group e-portfolio, while 10 items were targeted towards determining whether the mobile device was used strategically to bring about enhanced learning. The following table lists the percentage of students who either "Agreed" or "Strongly Agreed" that the mobile device helped them to complete the following aspects of the e-portfolio content creation process:

Aspects of content creation	**Percentage of students who either "Agreed" or " Strongly Agreed"**
1. Demonstrate appropriate solution format.	76 %
2. Create a clear and appropriately labeled sketch.	71%
3. List pertinent assumptions.	76%
4. State, apply, and document all governing equations and assumptions.	73%
5. Document use of property tables throughout the problem solution process.	55%
6. Document the use of appropriate mathematical notations.	69%
7. Document the use of correct units in each step of the solution process and in the answer.	56%
8. Demonstrate appropriate mathematical calculations.	73%
9. Demonstrate appropriate graphs, label axis and curves.	62%
10. Note significant results.	58%
11. Complete the discussion of the solution.	62%

Table 1. Student opinion on aspects of the e-portfolio content creation process using an iPad

As regards ways in which the mobile device facilitated the use of appropriate strategies for learning, 64% of the students either Agreed or Strongly Agreed that mobile device use helped them to be more organized for class. Eighty percent of the students either Agreed or Strongly Agreed that mobile devices helped them to access multiple information resources during learning, while fifty six percent of the students reported that the mobile device helped them to become a better note-taker through use of various note-taking and annotation applications. Sixty percent of the participants either Agreed or Strongly agreed that use of the mobile device helped them to turn in homework, assignments, and tests more efficiently, while eighty seven percent thought that it enabled them to receive instructor feedback more quickly and efficiently. Sixty seven percent of the participants either Agreed or Strongly Agreed that use of the mobile device, helped them to create content demonstrating learning more efficiently. Sixty percent of the participants either Agreed or Strongly Agreed that using a mobile device to create video content demonstrating learning, enabled them to master the content better than they would be able to do otherwise. Fifty five percent of the participants either Agreed or Strongly Agreed that the mobile device helped them to communicate more easily with the instructor, through use of online office hours. Sixty two percent of the participants either Agreed or Strongly Agreed that use of the mobile device helped them to work collaboratively in groups during problem solving, while sixty nine percent reported that it helped them to prepare better for examinations.

Focus Group Meeting

The data collected through the survey was triangulated through the use of a focus group meeting. All students in the class were invited to participate in the focus group meeting. Out of a class of 64, only 5 students volunteered to participate. One of the researchers met with the participants face-to-face in an on-campus location and audio-recorded their verbal responses. The following paragraphs report on the findings from the focus group meeting under themes, which reflect the questions that guided the discussion during the meeting.

Engagement with course content

Mobile devices (iPads) were used to create chapter summary videos. This process made students review the chapter content and verbalize their understanding of the concepts. Students reported that verbal summaries helped them to condense the materials in the chapter and extract the really important pieces of information. It helped them to think more deeply about each concept and create a comprehensive mental summary before making the actual video. Verbalizing in the video format as opposed to writing a written summary was more useful, since the very process of producing sentences, which would be coherent to others, enabled students to have a clearer comprehension of the content. Also, it was less time consuming than a written summary would have been. Students reported that this process helped them perform better on test problems.

Teamwork via collaboration

Students were placed in groups where they created group e-portfolios. The university provided each group with one iPad for e-portfolio content creation. Students reported that the use of the iPads helped in collaboration in that they did not have to meet in person at the same time, as a group, to produce content. The content creation task was divided between group members, each with assigned duties. Individual members of the group created specific videos and submitted online into the group e-portfolio. The video content was saved at a central cloud storage area, where students reviewed each other's work and provided feedback without actually meeting in person. In a way, this hampered collaboration since the individual group members completed specifically delegated tasks, rather than work together to complete a single product. Students reported that the assignment of a single iPad per group was not helpful toward collaboration since only the student in possession of the device at any one time, could actually create the videos, while the others who did not have a device were forced to remain idle. Only those students who had personally owned iPads, were able to be more productive in terms of video content creation. In future, attempts should be made to provide each member of the group with an iPad, so as to enable them to participate in content creation as well as in anytime, anywhere online communication.

Interaction with classmates and course instructor

Though the use of a single iPad for creating content did not facilitate collaboration within the group, it did help in interacting with the course instructor, through the instructor being available for online office hours. Students who normally would not visit the instructor in person, to make use of face-to-face office hours, were able to use the device to talk to the instructor online, during designated online office hours, often at the student's convenience of time and location. The portability and small size of the device encouraged its use from anywhere with internet connectivity. Interaction with the instructor can be further increased if all students in the group had access to iPads. Students reported that since iPads were quite expensive, it would be beneficial if the university loaned them to students.

A student mentioned that being a habitual PC user, using an Apple device had a steep learning curve for him. This affected his ability to create content using the recommended applications and slowed him down. Moreover, the iPad was not an effective surface for engineering drawings, though it was helpful in scanning and cloud-storing hand-written documents. One student mentioned that access to e-books via the iPad saved him a lot of money as well as the trouble of hauling multiple paper textbooks.

Using mobile devices for content creation: Advantages and Disadvantages

The advantages to using an iPad included the ability to scan documents and store them in the device as well as in the cloud. This meant that students no longer feared losing their class lecture notes. Also, they could access these notes anytime from anywhere. However, some students found note taking and drawing on an iPad to be a cumbersome process, and preferred paper for writing class notes and engineering graph paper for drawing to be more effective.

Use of mobile devices for future learning

Most students mentioned that they would continue to use mobile devices in their future classes, internships, and careers. A student noted having seen his internship supervisor using an iPad all the time to perform various job functions. Another student mentioned that he would like to use a better quality stylus in future, which would allow him to write and draw with more precision. Another student mentioned that he would force himself to be a more frequent user of the iPad though he preferred actual books and paper, keeping in mind the fact that it was practically impossible to avoid the use of technology in this day and age.

Suggested changes for using mobile devices in teaching and learning

Some students suggested that it would be beneficial if the instructor recorded the class notes and lectures and put them up on a youtube channel so that students could review them at a later date. Flipping the classroom, such that lectures could be viewed before arriving in class was suggested as a possible improvement. Some students also suggested that the instructor should use the mobile device to conduct student response-based peer instruction. For example, students can be quizzed in class through multiple-choice questions. Based on student responses, the instructor will be able, to not only gauge student comprehension on the content being taught, but also enable increased understanding, by allowing students to discuss their responses with each other and either maintain or change their responses. Students also requested a mobile device for each person in the class, preferably of the latest generation. Complete elimination of paper while taking quizzes and submitting assignments was also suggested as an improvement.

Discussion

The survey results demonstrated that at least 55% (See Table 1) of the participants Agreed or Strongly Agreed that the use of the iPad as a mobile device enabled them to enhance some aspect of their group e-portfolio content creation. However, during the Focus Group meeting a student mentioned that sometimes the use of the iPad hindered rather than improved his content creation process, primarily due to the user's preference for paper over touch screen, to record notes or illustrate engineering related diagrams. Also, the user's greater familiarity with Microsoft Windows computers over Apple devices was noted as a deterrent towards greater use of the iPad for content creation. Hence it appears that lack of comfort and familiarity with the use of a mobile device may have an impact on its use for facilitating learning. This finding is in keeping with the findings from another study where mobile devices were used to teach French in a language learning program. While most learners quickly adopted the use of the device, there were some learners who required help in recognizing the value of the device in supporting authentic communication (Demouy & Kukulska-Hulme, 2010).

Use of the mobile device helped the instructor and learners implement better teaching and learning strategies. Most students found that mobile devices helped them to be more organized for class, access multiple sources of information anytime and from anywhere, turn in assignments and tests more efficiently, be a better note taker, create content easily, communicate better with the instructor, work collaboratively in groups while problem solving, complete homework and to study for tests. Students reported that their comprehension of the content was improved after they participated in the act of creating video summaries using the mobile device.

During the focus group meeting, participants mentioned that they would certainly use mobile devices in their future engineering careers and suggested some ways in which mobile devices can be used more effectively for teaching and learning. Based on these suggestions, the following recommendations are being made, aimed towards improving the quality of teaching and learning using mobile devices.

Recommendations for teaching and learning practices

Based on the survey results and the Focus Group meeting proceedings, several recommendations can be made which may have an impact on future teaching and learning practices using mobile devices and mobile teaching and learning strategies.

Learners may be more likely to accept mobile learning systems when their learning autonomy is encouraged and they have a chance to experience rich interactive activities (Liaw, Hatala, & Huang, 2010). Some students mentioned that their lack of familiarity or preference for Apple devices hampered their content creation and learning experiences. Hence it is recommended that instructors should consider allowing platform agnostic device use in their classrooms. This practice will allow students with diverse platform preferences to participate more fully.

Students also mentioned that the availability of only a single mobile device per group was a deterrent to collaborative group work since most often, the specific member of the group who had current possession of the mobile device, was able to create content using it. There were few occasions when the entire group got together to create content for the group e-portfolio. This resulted in delegation of duties for completing various assignments rather than true collaboration. Students requested that the university loan a mobile device to each students so that more effective collaboration can take place. Hence it is recommended that for efficient learning, content creation and collaboration to take place, each student should be given access to a mobile device.

Some students found it cumbersome to write and complete engineering drawings on mobile device touchscreens. The styli provided by the university along with the device were of the basic quality and did not depict engineering related drawings with sufficient accuracy. As reported during the Focus Group meeting, this hampered student learning and content creation. Note taking in class is of immense value in learning, since it has been shown that students who elaborate or add more in their notes over what they hear in class from the instructor, perform better on applying what they have learned (Stefanou, Hoffman, & Vielee, 2008). Therefore, to enhance student learning experience, it is recommended that students have access to better quality styli either as a loan or through self-purchase.

During the Focus Group meeting, some students expressed the need to have had better training on the use of the iPad and the applications that they were asked to use in order to create content for the e-portfolios. This is in keeping with an earlier study by Chang et al. (2012) where students expressed the same need. Hence it is recommended that students be provided appropriate training on how to use their mobile devices so that they can experience the benefits of using mobile learning strategies.

When using mobile devices in class for teaching and learning, it is recommended that better methods of designing instruction should be used. For example, assignments should require true collaboration between students for completion, rather than mere delegation of tasks between members of the group. Learners using mobile devise can experience a high degree of collaboration by making fruitful connections with other users of such devices (Kearney, Schuck, Burden, & Aubusson, 2012).

Based on student suggestions, it is recommended that instructional methods like the use of the flipped classroom model and peer instruction be used in combination with other learning strategies conducive to the use of mobile devices. Peer instruction has been reported to increase student understanding of content matter, application of learning in new contexts, and enabling students to take initiative and responsibility for their own learning in traditional classrooms (Crouch & Mazur, 2001; Fagen, Crouch, & Mazur, 2002; Wagner & Gansemer-Topf, 2005; Ghosh & Renna, 2006). Its application in classrooms utilizing mobile devices will be worth investigating.

Further Research

The goal of this study was to determine whether benefits derived from the use of mobile learning strategies and devices, enable students to become efficient creators of electronic content for inclusion in team e-portfolios. In the process of creating content for their team e-portfolios, students may gain the opportunity to experience team-based collaborative learning and problem solving skills.

Future research may be conducted to determine whether and how the process of collaborative learning and content creation using mobile devices can be used to teach engineering students certain social or soft skills. Such soft skills are an inherent component of the Accreditation Board of Engineering and Technology (ABET) accreditation process, wherein engineering students are expected to demonstrate competence in social-communicative (ABET Engineering Criteria Outcome 3 - d, g, f, i, and j) as well as technical skills (Felder & Brent, 2003). Students are expected to be able to work in multi-disciplinary teams, have an understanding of professional

ethics, be able to communicate effectively, and be able to understand how engineering solutions can have a global and societal impact. Moreover, students should have knowledge of contemporary issues as well as engage in life-long learning.

The researchers of this study intend to develop an engineering industry grounded assessment instrument which will be capable of measuring student performance on the above mentioned social skills as identified by ABET Engineering Criteria Outcome 3 - d, g, f, i, and j. A "student-as-content-producers" problem solving model will be used, where students will create digital content using mobile devices. An e-portfolio system will be used to capture and measure student course performance. The assessment instrument targeting measurement of social skills, will be administered independently, to capture student competencies so as to inform students, programs and employers. By developing and implementing a behavior-based assessment system which may capture the ABET Engineering Criteria Outcomes, through the use of rubrics and norms built using appropriate psychometric techniques, both broad use and transferability features can be made available for engineering programs in the US and beyond.

Conclusion

This study aimed to determine student perceptions on the efficacy of using mobile learning strategies and devices to create electronic content for inclusion in an engineering team/group e-portfolio. Results indicated that the majority of the students found creating content using mobile devices to be a very useful exercise in learning, communicating with their instructor, completing homework and assignments as well as in preparing for tests. Some students indicated their preference for platforms other that tablets - computers, paper and pen. Based on the findings from this study, recommendations for improved teaching and learning using mobile devices are provided. Further research plans include the creation of an engineering industry grounded assessment instrument capable of measuring the soft social skills which are identified in the ABET Engineering Criteria Outcome 3 - d, g, f, i, and j.

References

Basoglu, E. B., & Akdemir, O. (2010). A comparison of undergraduate students' English vocabulary learning: Using mobile phones and flash cards. *The Turkish Journal of Educational Technology, 9*(3), 1-7.

Benedict, L., & Pence, H. (2012). Teaching Chemistry using student-created videos and photo blogs accessed with smartphones and two-dimensional barcodes. *Journal of Chemical Education, 89*, 492-496.

Chang, C., Chatterjea, K., Goh, D.H., Theng, Y.L., Lim, E., Sun, A., Razikin, K., Kim, T.N.Q., & Nguyen, Q.M. (2012). Lessons from learner experiences in a field-based inquiry in geography using mobile devices. *International Research in Geographical and Environmental Education, 21* (1), 41-58.

Chickering, A.W., & Gamson, Z.F. (1987). Seven principles for good practice in undergraduate education. *American Association for Higher Education Bulletin, 39* (7), 3-7.

Crouch, C. H., & Mazur, E. (2001). Peer instruction: Ten years of experience and results. *American Journal of Physics, 69* (9), 970-977.

Day, J.M., & Kumar, M. (2010). Using SMS text messaging to create individualized and interactive experiences in large classes: A beer game example. *Decision Sciences Journal of Innovative Education, 8* (1), 129-136.

Demouy, V., & Kukulska-Hulme, A. (2010). On the spot: Using mobile devices for listening and speaking practice on a French language programme. *Open Learning, 25* (3), 217-232.

Dunn, P.K., Richardson, A., McDonald, C., & Oprescu, F. (2012). Instructor perceptions of using mobile-phone-based free classroom response system in first-year statistics undergraduate courses. *International Journal of Mathematical Education in Science and Technology, 43* (8), 1041-1056.

Fagen, A.P., Crouch, C.H. & Mazur, E. (2002). Peer instruction: Results from a range of classrooms. *The Physics Teacher, 40*, 206-209.

Felder, R. M., & Brent, R. (2003). Designing and teaching courses to satisfy the ABET engineering criteria. *Journal of Engineering Education, 92* (1), 7-25.

Fisher, M., & Baird, D. E. (2006). Making mLearning work: Utilizing mobile technology for active exploration, collaboration, assessment, and reflection in higher education. *Journal of Educational Technology Systems, 35*(1), 3-30.

Ghosh, S., & Renna, F. Technology in Support of Good Pedagogy: Electronic Response Systems and Peer Instruction in an Economics Classroom (February 2006). Available at SSRN: http://ssrn.com/abstract=888544 or http://dx.doi.org/10.2139/ssrn.888544

Haughton, N. A., & Keil, V.L (2009). Engaging with faculty to develop, implement, and pilot electronic performance assessments of student teachers using mobile devices. *The Teacher Educator, 44*, 275-284.

Pereira, J., Echeazarra, L., Sanz-Santamaria, S., & Gutierrez, J. (2014). Student-generated online videos to develop cross-curricular and curricular competencies in Nursing studies. *Computers in Human Behavior, 31*, 580-590.

Jain, A., & Farley, A. (2012). Mobile phone-based audience response system and student engagement in large-group teaching. *Economic Papers, 31* (4), 428-439.

Johnson, L., Adams Becker, S., Estrada, V., & Freeman, A (2014). NMC Horizon Report: 2014 Higher Education Edition. Austin, Texas: The New Media Consortium.

Kearney, M., Schuck, S., Burden, K., & Aubusson, P. (2012). Viewing mobile learning from a pedagogical perspective. Research in Learning Technology, 20. DOI: 10.3402/rlt.v20i0/14406.

Kinsella, S. (2009). Many to one: Using the mobile phone to interact with large classes. *British Journal of Educational Technology, 40* (5), 956-958.

Liaw, S., Hatala, M., & Huang, H. (2010). Investigating acceptance toward mobile learning to assist individual knowledge management: Based on activity theory approach. *Computers & Education, 54*, 446-454.

Little, B. (2012). Effective and efficient mobile learning: Issues and tips for developers. *Industrial and Commercial Training, 44* (7), 402-407.

Martin, F., & Ertzberger, J. (2013). Here and now mobile learning: An experimental study on the use of mobile technology. *Computers & Education, 68*, 76-85.

McNair, L., Paretti, M., Knott, M., & Wolfe, M.L. (2006, October 28-31). *Work in progress: Using e-portfolio to define, teach, and assess ABET professional skills*. Paper presented at the 36th ASEE/IEEE Frontiers in Education Conference, San Diego, CA.

Stefanou, C., Hoffman, L., &Vielee, N. (2008). Note-taking in the college classroom as evidence of generative learning. *Learning Environments Research, 11*, 1-17.

Tabor, S. W., & Minch, R. P. (2013). Student adoption & development of digital learning media: Action research and recommended practices. *Journal of Information Technology Educational Research, 12*, 203-223.

Thornton, P. & Houser, C. (2005). Using mobile phones in English education in Japan. *Journal of Computer*

Assisted Learning, 21, 217-228.

Ting, Y. (2012). The pitfalls of mobile devices in learning: A different view and implications for pedagogical design, *Journal of Educational Computing Research, 46*(2), 119-134.

Wagner, M., & Gansemer-Topf, A (2005). Learning by teaching others: A qualitative study exploring the benefits of peer teaching. *Landscape Journal, 24* (2), 198-208.

Wang, M., Shen, R., Novak, D., & Pan, X. (2009). The impact of mobile learning on students' learning behaviors and performance: Report from a large blended classroom. *British Journal of Educational Technology, 40*(4), 673-695.