12-12-2020

Mobile Learning and Student Engagement in Higher Education: A Review

Fatma Elbabour

Milena Head

Mobile Learning and Student Engagement in Higher Education: A Review

Completed Research

Fatma Elbabour
McMaster University
elbabouf@mcmaster.ca

Milena Head
McMaster University
headm@mcmaster.ca

ABSTRACT

Researchers and practitioners agree on the value of student engagement for positive learning outcomes. With the advancement and proliferation of mobile electronic devices there is potential for such devices to further enhance engagement through the mobility of learners and their learning experiences. The purpose of this review is to synthesize mobile learning research and practices in higher education with a focus on its effects on student engagement. Utilizing a three-mobility level framework, extant literature is organized and analyzed with a goal to identify research trends, gaps and opportunities. Although there is a growing interest to study behavioural, emotional, and cognitive engagement, fewer studies considered cognitive engagement of post-secondary students in mobile learning environments.

Keywords

Mobile learning, student engagement, higher education, literature review.

INTRODUCTION

Student engagement is an important aspect of the learning experience in higher education. It is associated with positive learning outcomes (Trowler and Trowler, 2010), such as academic achievement and student persistence (Kuh, Cruce, Shoup, Kinzie and Gonyea, 2008). Kahu (2013) views student engagement as a "psycho-social process, influenced by institutional and personal factors, and embedded within a wider social context…" that consists of emotions, cognitions, and behaviours. Yet, researchers are not conclusive about how to measure this multi-dimensional construct (Kahu, 2013). This may be further complicated by e-learning, in which learning is facilitated by the use of information and communication technologies (Kirkwood and Price, 2014). For example, Henrie, Halverson, and Graham (2015) found that most e-learning related studies used behavioural indicators to measure student engagement, while fewer studies measured emotional and cognitive indicators.

E-learning is a broad category that captures a wide range of technology-mediated learning tools, methods and environments (Duval, Sharples and Sutherland, 2017), including mobile learning. Mobile Learning (m-learning) is known to facilitate 'anytime, anywhere' learning using mobile devices, which are widely used by post-secondary age users (18–29 years old) (Crompton and Burke, 2018).

The literature suggests that there is a lack of reviews on the use of m-learning in higher education (Pimmer, Mateescu and Grohbiel, 2016). Only few researchers conducted reviews to synthesize the characteristics of m-learning research (e.g. Crompton and Burke, 2018; Krull and Duart, 2017; Kaliisa and Picard, 2017). Others focused on the critical success factors of m-learning (Alrasheedi, Capretz and Raza, 2015), and the pedagogical effects of m-learning (Pimmer et al. 2016). Overall, student engagement was not the focus of these reviews.

Thus, we describe trends in m-learning research in higher education with focus on the effect of m-learning on student engagement, using the '3 Mobilities Framework' (Pegrum, 2019). This framework classifies m-learning into three levels according to the mobility of the technology, the learner, and the learning experience. According to Pegrum (2019), in a m-learning environment the device can be mobile only (Level 1), the device and the learner can both be mobile (Level 2), or the device, the learner, and the learning experience can be mobile (Level 3).

Figure 1 shows three aspects of interest to this research: the learner, the m-learning environment, and engagement. The *learner* refers to post-secondary students, the *m-learning environment* is classified by the three mobility levels (Pegrum, 2019), and *engagement* refers to the three dimensions of student engagement (i.e. behaviour, emotion, and cognition). Hence, in the context of higher education, our review is guided by the following research questions (RQs):

RQ1: What are the research trends of studying student engagement in m-learning literature?

RQ2: To what extent are the three levels of mobility implemented in the literature to study student engagement?

RQ3: How does the implemented level of mobility influence student engagement?

RQ4: What are the potential research gaps in the mobile learning and student engagement literature?

Our framework (Figure 1) aids in organizing the extant literature to understand the extent to which the three levels of mobility have been studied, and affected student engagement. However, identifying learners' characteristics and their interaction with m-learning levels was not within the scope of this review.

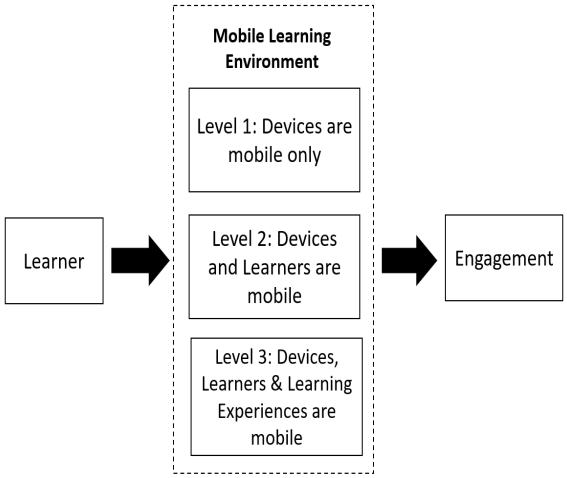

Figure 1. Theoretical Framework.

(adapted from Pegrum, 2019)

WHAT IS MOBILE LEARNING?

The conceptualization of m-learning evolved from a narrow view, that is technology focused, to a broader view, that highlights contextual, pedagogy and social aspects of m-learning. For example, Traxler (2005) included the dimension of technology: "any educational provision where the sole or dominant technologies are handheld or palm-top devices" (p. 262). Recently, Traxler extended his definition to include crucial dimensions such as knowledge and mobility while removing reference to technology: "acquiring the knowledge, attitudes, skills and processes appropriate to or aligned to societies characterized, perhaps defined, by the individual and collective connectedness and mobility" (Traxler, 2020: p. 257).

Nevertheless, because it is important to understand how technological features influence the psychological process of learning (Alavi and Leidner, 2001), we believe that the reference to technology should not be removed when defining m-learning. In line with this, Crompton (2013) proposed that m-learning is "learning across multiple contexts, through social and content interactions, using personal electronic devices" (p. 4). This definition highlights two important distinctive features of m-learning: (1) it is not associated with one learning context, and (2) this is achieved using personal electronic devices.

However, desktop computers are not m-learning devices, but they can be personal too. When connected to the Internet, they can achieve a certain level of contextual mobility (e.g. interacting with different learning content). Thus, in addition to the personalization of the technology, we believe that the mobility of the device is critical to understand the m-learning experience. In this review, building on the 3 Mobilities Framework (Pegrum, 2019), we define m-learning as a subset of e-learning in which learners use mobile devices to facilitate the personalization and contextualization of the learning experience.

METHODOLOGY

Search Strategy

We searched for peer-reviewed journal articles published in English between January 2005 and August 2020 in four multi-disciplinary databases, (Web of Science, Scopus, ProQuest, and Google Scholar) in addition to ERIC. Year 2005 was selected as a cut-off starting point because this was the approximate time of the development of m-learning research field (Crompton, 2013). The following search statement was used in titles, abstracts, and keywords (Google Scholar: titles only): engagement AND ("mobile learning" OR "m-learning" OR "m-learning").

Study Selection

The initial search yielded 117 records from ERIC, 190 records from Web of Science, 178 records from Scopus, 147 records from ProQuest Databases, and 47 records from Google Scholar. These numbers were augmented by 14 articles found by other search methods (e.g. cited in previous literature reviews), making a total of 693 articles. Using a reference management software, we identified and excluded any non-journal articles (e.g. books, dissertations, and conference papers) as well as duplicates. The resulting sample (355 articles) was further assessed using titles and abstracts (and full texts when needed). We selected full empirical m-learning and learner-focused studies in which student engagement was measured in higher education settings, where post-secondary students used mobile devices (including laptops and wearable technologies) for learning purposes. Accordingly, only 48 articles were included in this study.

Coding: Student Engagement

Kahu's conceptual framework of student engagement in higher education (see Kahu, 2013; Kahu and Nelson, 2018) was used to distinguish between actual indicators of student engagement (see Table 1) and its antecedents (e.g. motivation) and consequences (e.g. satisfaction). In Table 1, we included possible variations adopted from the literature (e.g. Henrie et al. 2015), and those that could not be categorized under the seven indicators were classified under 'others'.

Table 1. Student engagement dimensions and its indicators

Dimension	Indicators	Variations
Emotion	Interest	Expressed desire to use m-learning again.
	Enthusiasm	Enjoyment; Fun; Excitement; Passion
	Others	Happiness; Visible and verbal expressions of pleasure.
Cognition	Deep learning	Higher mental functions of Bloom's Taxonomy (create, evaluate, analyze, and apply).
	Self-regulation	Self-regulated strategies
	Others	Focus; Attention*; Concentration
Behaviour	Participation	On-task behaviour; Attendance; Task completion
	Time & Effort	Time spent on task; effort
	Interaction	Student-student interaction; Student-instructor interaction; Student-content interaction
* Unlike Henrie et al. (2015), we consider 'attention' as a cognitive process (see Knudsen, 2007).		

LITERATURE ANALYSIS

Research Trends

There is an increased interest in studying student engagement in m-learning environments in higher education (see Figure 2). A limited number of articles were published between 2005 and 2012. Since 2013, the number of publications increased steadily, with a sharp growth between 2018 and 2019 (11 and 10 articles, respectively). This is possibly linked to the overall development of m-learning as a research field; in addition to the increased interest in studying student engagement in higher education (Henrie et al. 2015; Kahu, 2013).

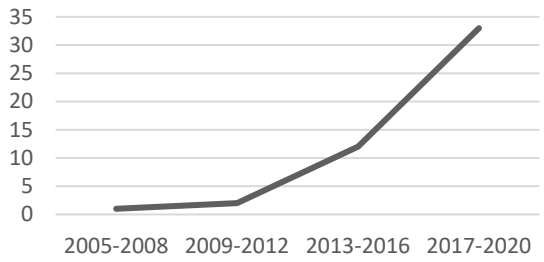

Figure 2. Number of articles by year.

Figure 3 shows the distribution of articles published by discipline: education, educational technology, human-computer interaction (HCI), applied linguistics, science (i.e. plants and cartography) and technology. Most articles were published in educational journals (80%). Unexpectedly, only two articles were published within HCI; however, both are recent studies published in 2019.

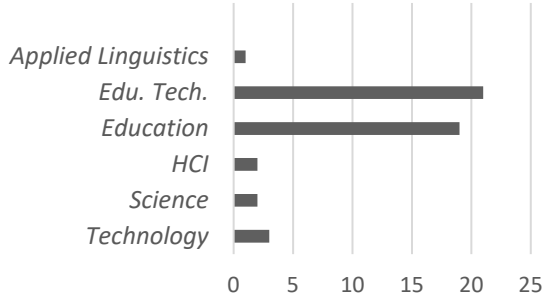

Figure 3. Number of articles by research discipline.

Quantitative (25%), qualitative (29%), and mixed (46%) research methods were all employed in the reviewed articles. These findings do not confirm previous reviews (e.g. Bond et al. 2020) that reported a higher frequency of research using quantitative methods, followed by mixed methods and then qualitative methods. However, in their review Bond et al. (2020) included articles published between 2007 and 2016, and we found that 73% of the mixed methods articles were published between 2017 and 2020. Figure 4 suggests a growing interest in employing mixed research methods since 2016.

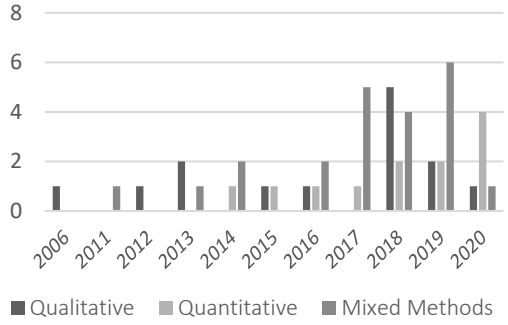

Figure 4. Number of articles by methodology, per year.

Further, similar to the findings of Henrie et al. (2015), we found that self-reported questionnaires were the dominant data collection method, employed by 67% of the articles (of which 66% were pure quantitative surveys). Followed by interviews (25%), content analysis (19%), focus groups (17%), and case studies and observations (13% each).

In line with Bond et al. (2020), we found that most of the reviewed articles involved undergraduate students only (71%). STEM subjects were the most subjects in which m-learning and student engagement was studied (33%), followed by languages courses (25%), healthcare-related subjects (17%), then business-related courses (8%). Other subjects, such as history and sports, were represented in single studies.

M-learning Levels and Student Engagement

The three levels of mobility (see Figure 1) were all present in the reviewed articles, with Level 3 having the smallest representation at 25%. When examining the effects of the m-learning level on student engagement, while 45 studies reported positive outcomes (e.g. high enjoyment levels, increased attention, and increased task completion rates), such positive outcomes were highly present in the three levels of m-learning (see Figure 5).

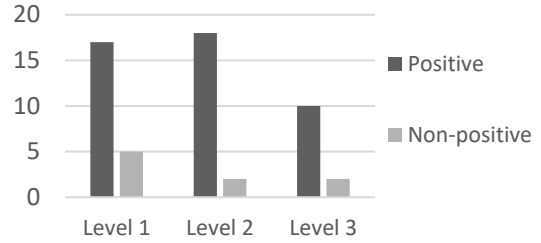

Figure 5. Number of articles by student engagement outcome, per m-learning level.

In line with Bond et al. (2020) and Henrie et al. (2015), we found behavioural indicators (about 46% of the studies) to be the most evident measures. Followed by emotions (36%) and cognitive indicators (18%). A similar pattern was seen in m-learning Levels 1 and 2 (see Figure 6). In Levels 2 and 3, we found that researchers showed greater interest to measure emotions, in addition to behaviours. This is perhaps due to the collaborative learning nature of these two levels, in which greater emotions may present.

Schindler, Burkholder, Morad, and Marsh (2017) found mixed results on the effect of specific technologies (e.g. video-conferencing tools, wikis, and digital game) on behavioural and cognitive engagement. In our review, we noticed that emotional engagement was associated with non-positive effects in the three levels of m-learning, while similar effects were present in Levels 1 and 2 only, for behavioural engagement, and in Level 2 only, for cognitive engagement. Nevertheless, the number of studies that reported *only* non-positive effects on student engagement (e.g. low attendance rates and decreased task interest) was relatively low (3 studies).

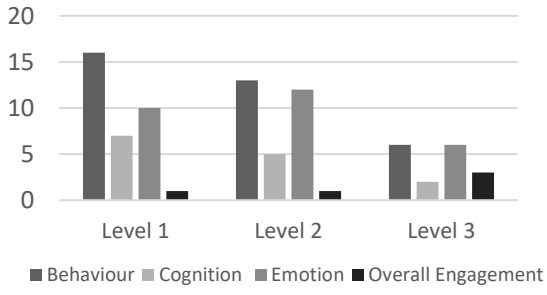

Figure 6. Number of articles by student engagement dimensions, per m-learning level.

However, Schindler et al. (2017) used a different conceptual framework to classify the indicators of student engagement. While they used similar behavioural indicators, their emotional and cognitive indicators were slightly different. For example, they identified 'motivation' as an indicator of cognitive engagement, while in our review it was considered as an antecedent of student engagement (see Kahu, 2013; Kahu and Nelson, 2018). Table 3 shows the frequency of student engagement indicators found in the reviewed articles.

Table 2. Frequent Student Engagement Indicators

Dimension	Indicators (frequency)
Emotion	Expressed desire to use it* again (11); Enjoyment (11); Interest (9); Fun (8); Happiness/Pleasence (2); Visible and verbal expressions of emotions (3); Anxiety** (3); Boredom** (2); Frustration** (1); Excitement (1); Enthusiasm (1).
Cognition	Attention (7); Higher mental functions on Bloom's Taxonomy (create, evaluate, analyze, and apply) (4); Deep learning (2); Focus (2); Self-regulation (1); Concentration (1).
Behaviour	Participation (13); Student-student interaction (9); On-Task behaviour (7); Frequency of use (7); Attendance (6); Time on task (6); Effort (5); Task completion (5); Student-instructor interaction (5); Student-content interaction (2).

* m-learning tool, material/content or m-learning activity.
** (+) and (-) emotions were measured in four studies.

Although there is an increased interest in measuring the three dimensions of student engagement, we found that only 15% of the studies measured the three dimensions together, 35% of the studies measured two dimensions, and 50% of the studies measured one dimension only.

Research Gaps and Opportunities

There is a lack of m-learning research on the influence of individual differences on student engagement. Out of the forty-eight reviewed articles, only three studied the effect of individual differences (i.e. gender and educational levels). Thus, more research is required to better understand how individual differences (including gender, learning styles, educational levels, and culture) may influence post-secondary student engagement in m-learning environments.

There is a need to further investigate the cognitive component of student engagement in m-learning environments within higher education contexts. Measuring cognitive engagement, in addition to behavioural and emotional engagement, is important to our understanding

and conceptualization of post-secondary student engagement in m-learning environments.

None of the reviewed studies used physiological measures to study student engagement in m-learning environments. Although this review shows an increased interest in employing triangulation and mixed methods, physiological data, such as heart rate, skin conductance, and eye tracking, were not collected. Such measures, combined with self-reported and behavioural data, may bring greater insights about emotional and cognitive engagement.

CONCLUSION

Using a three-mobility level framework, this review has examined a sample of 48 m-learning related articles with focus on student engagement in higher education in order to identify research trends, gaps and opportunities. Overall, there is potential for m-learning, in its three levels, to enhance student engagement in higher education. Researchers paid attention to behavioural indicators of student engagement, followed by emotional indicators and cognitive indicators, respectively. Different research methods were employed to study this phenomenon with a growing interest toward using mixed methods.

REFERENCES

1. Alavi, M. and Leidner, D. E. (2001) Research commentary: Technology-mediated learning—A call for greater depth and breadth of research. Information systems research, 12(1), 1-10.
2. Alrasheedi, M., Capretz, L. F. and Raza, A. (2015) A systematic review of the critical factors for success of mobile learning in higher education (university students' perspective). Journal of Educational Computing Research, 52(2), 257–276
3. Bond, M., Buntins, K., Bedenlier, S., Zawacki-Richter, O., & Kerres, M. (2020). Mapping research in student engagement and educational technology in higher education: A systematic evidence map. International Journal of Educational Technology in Higher Education, 17(1), 2.
4. Crompton, H. (2013) A historical overview of mobile learning: Toward learner-centered education. Handbook of mobile learning, 3-14.
5. Crompton, H. and Burke, D. (2018) The use of mobile learning in higher education: A systematic review. Computers & Education, 123, 53-64.
6. Duval, E., Sharples, M., and Sutherland, R (2017). Research Themes in Technology Enhanced Learning. In Duval, E., Sharples, M., and Sutherland, R. (Eds.). *Technology enhanced learning: Research themes*. (pp. 1-11). Springer.
7. Henrie, C. R., Halverson, L. R., and Graham, C. R. (2015) Measuring student engagement in technology-mediated learning: A review. Computers & Education, 90, 36-53.
8. Kahu, E. R. (2013) Framing student engagement in higher education. Studies in higher education, 38(5), 758-773.
9. Kahu, E. R. and Nelson, K. (2018) Student engagement in the educational interface: understanding the mechanisms of student success. Higher Education Research & Development, 37(1), 58-71.
10. Kaliisa, R. and Picard, M. (2017) A systematic review on mobile learning in higher education: The African perspective. TOJET: The Turkish Online Journal of Educational Technology, 16(1).
11. Knudsen, E. I. (2007) Fundamental components of attention. Annual. Review of Neuroscience, 30, 57-78.
12. Kuh, G. D., Cruce, T. M., Shoup, R., Kinzie, J., and Gonyea, R. M. (2008) Unmasking the effects of student engagement on first-year college grades and persistence. The Journal of Higher Education, 79(5), 540-563.
13. Krull, G. and Duart, J. M. (2017) Research trends in mobile learning in higher education: A systematic review of articles (2011–2015). International Review of Research in Open and Distributed Learning, 18(7).
14. Pegrum, M. (2019) Mobile Lenses on Learning. Springer: Singapore.
15. Pimmer, C., Mateescu, M., and Grohbiel, U. (2016) Mobile and ubiquitous learning in higher education settings: A systematic review of empirical studies. Computers in Human Behavior, 63, 490–501
16. Schindler, L. A., Burkholder, G. J., Morad, O. A. and Marsh, C. (2017) Computer-based technology and student engagement: a critical review of the literature. International Journal of Educational Technology in Higher Education, 14(1), 1-28.
17. Sharples, M., Taylor, J. and Vavoula, G. (2007) A Theory of Learning for the Mobile Age. In R. Andrews and C. Haythornthwaite (eds.) The Sage Handbook of Elearning Research. London: Sage, pp. 221-47
18. Traxler, J. (2005) Defining mobile learning. In IADIS International Conference Mobile Learning (pp. 261-266).
19. Traxler, J. (2020) Learning with Mobiles or “Mobile Learning”. In Ling, R., Fortunati, L., Goggin, G., Lim, S. S., & Li, Y. (Eds.). The Oxford Handbook of Mobile Communication and Society, 257-275
20. Trowler, V. and Trowler, P. (2010) Student engagement evidence summary. York, UK: Higher Education Academy.