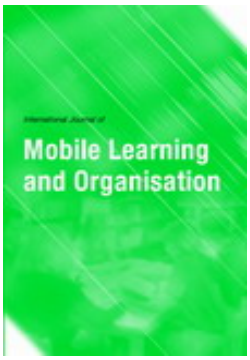

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A profile of college students' mobile learning readiness: an integrative literature review of studies from 2007 to 2021

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Abstract: An integrative literature review of 29 studies from the past 15 years (2007–2021) was conducted to understand and frame college students' mobile learning readiness (MLR) comprehensively. A resultant conceptual profile with theoretical and practical implications is proposed that includes 13 factors grouped into three categories: learner traits (past mobile learning experience, self-efficacy, innovativeness, optimism, intention, self-regulated learning), technology expectations (expectations of mobile learning effort, performance and relative advantages), and external influences (facilitating conditions, subjective influence, infrastructure readiness and cost). The results from the analysis originally locate college students' personality and psychological prerequisites for engaging in mobile learning; identify three relative advantages of mobile learning – flexibility, interactions, and enjoyment; and pinpoint the external determinants for examining college students' MLR including costs, public infrastructure resources associated with mobile learning, and student-peers and instructors subjective influences. Recommendations for fostering MLR are discussed as well.

Keywords: conceptual profile; mobile learning readiness; college students; integrative literature review.

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1 Introduction

Currently, mobile learning can be interpreted as learners smartly adopting mobile devices to engage in learning activities and for acquiring equitable and personalised learning experiences. Many higher education institutions (HEIs) have realised the benefits of mobile learning and implemented it (Almaiah et al., 2019; Alhassan, 2016). The analysis from National Centre for Education Statistics in the USA showed that 84% of students in higher education experienced online/mobile learning in the USA in 2020 and the trend is inevitably increasing due to the pandemic (Cameron et al., 2021).

Nevertheless, a wide adoption of mobile learning also faces challenges from three aspects in general. The first aspect is caused by the technological limitations of mobile devices, including small screens and keyboards of mobile phones, limited battery life, and inadequate memory capacity of mobile devices (Eschenbrenner and Nah, 2019; Tabor, 2016). Socially, mobile phones ownership and use for learning activities bring security concern for students and faculties (Al-Adwan et al., 2018a; Almaiah et al., 2019; Hamidi and Chavoshi, 2018). The second aspect originates from the issues around the availability or the development of the digital infrastructure. Network connectivity (Ajayi et al., 2019; Akkaya et al., 2021), unstable electric power supplies (Ajayi et al., 2019), and the cost of internet and mobile devices (Ajayi et al., 2019; Akkaya et al., 2021) are obstacles to adopt mobile learning widely for students and faculties in the HEIs, especially in the less-economic developed areas (Ajayi et al., 2019; Akkaya et al., 2021; Zayim and Ozel, 2015). The third is the assumption that students at HEIs already have an adequate readiness for mobile learning. College students are generally considered ideal candidates for mobile learning (Bere and Rambe, 2016; Sulaiman and Dashti, 2018). For one, they are generally more acclimatised to mobile technology use in daily life and work far more intensely than their predecessors (Hussin et al., 2012; Kenny et al., 2012). For another, they seem to have enough general knowledge of mobile technologies to help them engage in learning activities (Ajayi et al., 2019; Alhassan, 2016).

However, college students are often not adequately ready to engage in mobile learning. First, their technology skills are often not as high as expected (Al-Adwan et al., 2018b). Second, they may not have adequate advanced cognitive learning skills (e.g., comprehending, synthesising, and evaluating online information) for mobile learning (Livingstone, 2008). Third, some college students are not aware of the advantages of mobile learning and are not enthusiastic about utilising it (Messuti et al., 2014; Wu and Perng, 2016).

To understand the MLR of college students, prior studies have identified multiple factors:

1 the perceived usefulness of technology and the perceived ease of use of technology (Al-Adwan et al., 2018a; Aljuaid et al., 2014; Azam et al., 2020; Cheon et al., 2012)

2 perceived trust and security (Al-Adwan et al., 2018; Almaiah et al., 2019)

3 computer self-efficacy (Lin et al., 2016; Özkütük et al., 2021; Tagoe and Abakah, 2014)

4 self-directed learning (SDL) skills (Al-Adwan et al., 2018b; Lin, et al., 2016).

We agree that the above factors are meaningful for determining college students' mobile learning readiness. However, these factors were identified generally from a disintegrative perspective, which cannot comprehensively capture college students' mobile learning readiness. As HEIs (especially under pressure from COVID-19) move increasingly toward the use of mobile learning, it becomes essential to comprehensively understand, foster, and support MLR in its student populations. Therefore, a comprehensive profile is needed. Accordingly, this study aims to frame a comprehensive conceptual profile by conducting an integrative literature review, driven by the following two questions:

1 What factors for college students' MLR were identified in previous studies?

2 Can these factors be integrated into a comprehensive profile to indicate college students' mobile learning?

2 Background

2.1 Mobile learning

The understanding of mobile learning roughly evolved through three stages from 2000 to 2021 (when the study was written): 2000–2007, 2008–2015 and 2016–2021.

During the first stage (2000–2007), mobile learning comprised virtually any form of learning via mobile devices. Mobile learning was reckoned as any combination of mobile devices including wireless, digital, or handheld devices with learning activities in classrooms (Perry, 2003; Traxler, 2007).

During the second stage (2008–2015), the fit between learning activities and the mobility of mobile devices (the unique characteristic of mobile technologies) was emphasised. Mobility characteristics include the mobility of technology, the mobility of learners, and the mobility of learning. Mobility of technology highlights device portability and connectivity (El-Hussein and Cronje, 2010). Mobility of learners emphasises that the learners enjoy flexibility which refers to that learners can decide when and where to engage in learning by themselves in contrast to traditional classroom learning (Tagoe and Abakah, 2014). Mobility of learning refers to learning ubiquity (James, 2011). Ubiquitous learning means learning could be delivered anywhere in the context of mobile learning, even to previously unreachable areas. Learners in these areas can adopt mobile devices to access and use previously unavailable education resources (whether due to socioeconomic, language, educational, or other barriers or even geographic remoteness). In summary, mobile learning in this stage was defined by the mobility of mobile devices that enabled ubiquity, flexibility, and connectivity of education (Cheon et al., 2012; Tagoe and Abakah, 2014).

The third stage (2016–2021) integrated factors for understanding mobile learning comprehensively as student satisfaction around using mobile devices to engage in learning (Chao, 2019; Lam et al., 2019; Sulaiman and Dashti, 2018), the content quality of mobile learning (Almaiah and Mulhem, 2019; Almasri, 2018), and personalisation available during mobile learning (Lai and Zheng, 2017; Hwang et al., 2021;

Komalawardhana et al., 2021). Scholars focused on the experience of mobile learning for promoting formal learning, for motivating learners' agencies, and for improving equity within education generally. In this current stage, mobile learning is interpreted as learners smartly adopting mobile devices for engaging in learning activities and for acquiring equitable and idiosyncratic and personalised learning experiences (as already noted above).

This evolution of mobile learning (more urgently under COVID-19) prompts HEIs to implement it. In that context, the disadvantages of mobile learning occur in two layers. First, infrastructure limitations that impede wider adoption of mobile learning include but not limited to poor network connectivity (Ajayi et al., 2019; Akkaya et al., 2021), costs of internet access (Ajayi et al., 2019; Akkaya et al., 2021; Kenny et al., 2012) and mobile devices (Hussin et al., 2012), and unstable power supplies (Ajayi et al., 2019).

Second, the technical limitations of mobile devices can impact learners' experience of mobile learning. Specifically, learners frequently mentioned the inconveniences caused by the small-sized screens and keyboards on smartphones (Eschenbrenner and Nah, 2019), limited memory capacity (Tabor, 2016), and short battery life. Students and faculties in HEIs also stated that the interactions through mobile learning are not natural enough compared to onsite learning (Alhassan, 2016).

2.2 Mobile learning readiness

Parasuraman (2000) first proposed the concept of technology readiness (TR) as that state of mind determining a person's predisposition to accept new technologies. The concept of TRnavigates later studies to define mobile learning readiness. Lin et al. (2016) proposed that MLR was how prepared a person is for the acceptance of mobile learning. Here, MLR is both a prerequisite to people engaging in mobile learning and a determinant of the effectiveness of mobile learning (Lin et al., 2016). Almasri (2018) similarly notes that MLR is a person's propensity to embrace and use mobile devices toward completing learning objectives.

Much earlier, Ajzen's (1991) theory of planned behaviour (TPB) had already described a persons' intention to perform a given behaviour as determined by their attitude toward the behaviour and as contextualised by subjective norms and any perceived behavioural control. Under this view, MLR is not only the learners' intention to accept mobile learning but also a movement across a six-stage cyclical process during which the learners are contextualised by social influence (Azam, 2020).

Overall, MLR is a construct around people's state of preparedness for using mobile learning which cannot be directly observed or evaluated.

2.3 Theories to investigate mobile learning readiness

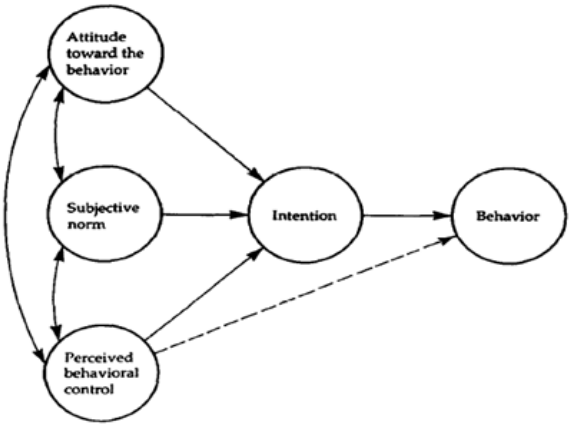
Three main theories afford a groundwork for extant studies of mobile learning readiness: Ajzen's (1985) TPB, Parasuraman's (2000) TR, and SDL. The following overviews these the frameworks of the fundamental theories and major models formulated from them.

2.3.1 Theory of planned behaviour and mobile learning readiness

Ajzen's (1985) TPB sought to explain the mechanisms underlying individual behaviour. Specifically, TPB proposed that intention mediated the individual's given behaviour and

a positive attitude toward the behaviour, prevailing subjective norms (e.g., others' influences), and any perceived behavioural control (e.g., a person's environment, self-efficacy), which is presented in Figure 1. The attitude toward the behaviour refers to "the degree to which a person has a favourable or unfavourable evaluation or appraisal of the behaviour in question" [Ajzen, (1991), p.188]. Subjective norm means "perceived social pressure to perform or not to perform the behaviour" [Ajzen, (1991), p.188]. Perceived behavioural control refers to "the perceived ease or difficulty of performing the behaviour" [Ajzen, (1991), p.188]. The perceived behavioural control includes the impact of past experience, the impediments expectancy, a person's sense of self-efficacy toward a given behaviour, and the external resources and opportunities the person could obtain (Ajzen, 1991). Self-efficacy refers to one's confidence around executing an action (Ajzen, 1991).

Figure 1 The model of theory of planned behaviour



Source: From Ajzen (1991, p.182)

Two commonly models to examine MLR building on TPB include the technology acceptance model (TAM), unified theory of acceptance and use technology (UTAUT).

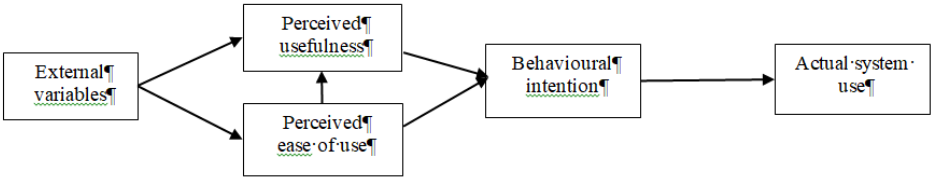
2.3.1.1 TAM and mobile learning readiness

Developed by Davis (1989), TAM aimed to address why users accept or reject an information technology and how the actual system use is influenced by certain factors (Davis, 1989, 1993).

The key contribution of TAM is that it identified two constructs of beliefs among computer-user behaviours based on the attitude paradigm proposed by Fishbein and Ajzen. Ajzen's attitude paradigm proposes that a person's beliefs toward a given behaviour involve the "subjective likelihood that performing the behaviour will lead to a specified outcome" [cited in Davis, (1993), p.477]. By situating TPB in the context of computer user behaviour, Davis epitomised two beliefs to predict new technology acceptance: perceived ease of use and perceived usefulness. Perceived usefulness is defined as "the degree to which an individual believes that using a particular system would enhance his or her job performance" [Davis, (1993), p.477]. Perceived ease of use is identified as "the degree to which an individual believes that using a particular system

would be free of physical and mental effort" Davis, (1993), p.477. Davis validated that perceived ease of use and perceived usefulness significantly predicted behavioural intention of technology acceptance. He further proposed that some external variables (e.g., system characteristics, training, user involvement in design) impacted perceived ease of use or perceived usefulness [Venkatesh and Davis, (1996), p.453]. The entire TAM is presented in Figure 2.

Figure 2 Technology acceptance model (TAM)



Source: Adapted from Davis (1993, p.476)

2.3.1.2 UTAUT and mobile learning readiness

Unified theory of acceptance and use of technology (UTAUT), proposed by Venkatesh et al. (2003), aimed to systematically explain how and why individuals adopted new technology. UTAUT re-evaluated the factor of perceived usefulness identified in TAM and found users who adopted new technology were influenced by users' perception of the relative advantages of new technology or system other than their perceived performance of the technology or system. Relative advantage refers to 'the degree to which an innovation is perceived as being better than its precursor' [Moore and Benbasat, (1991), p.195]. In UTAUT, perceived usefulness is renamed performance expectancy. Similarly, the factor of perceived ease of use was also re-evaluated and renamed effort expectancy.

UTAUT also identified two other factors: social influence and facilitating conditions. The two factors originated from subjective norms and perceived behavioural control in TPB. UTAUT incorporated the factors of facilitating conditions (individual's environment to support new technology/system use) and social factors (individual's internalisation of the reference group) into perceived behavioural control and subjective norms, respectively.

2.3.2 Technology readiness

TR theory, developed by Parasuraman (2000, p.308), contends that TR is a construct for the "overall state of mind resulting from a gestalt of mental enablers and inhibitors that collectively determine a person's predisposition to use new technologies." TR proposes four dimensions: optimism, innovativeness, discomfort, and insecurity. Among the four dimensions, "optimism and innovativeness are drivers of technology readiness, whereas discomfort and insecurity are inhibitors" [Parasuraman, (2000), p.311]. Table 1 defines each dimension.

Table 1 Four dimensions of technology readiness

Dimension	*Description*
Optimism	A positive view of technology and a belief that it offers people increased control, flexibility, and efficiency in their lives
Innovativeness	A tendency to be a technology pioneer and thought leader
Discomfort	A perceived lack of control over technology and a feeling of being overwhelmed by it
Insecurity	Distrust of technology and scepticism about its ability to work properly

2.3.3 Self-directed learning and mobile learning readiness

SDL broadly refers to as "self-learning in which learners have the primary responsibility for carrying out and evaluating their own learning experiences" [as cited in Ellinger, (2004), p.159]. Investigations of SDL especially highlight the three goals of SDL and its measurements. One goal, including studies grounded in humanistic philosophy, concerns the "development of the learner's capacity to be self-directed" [Merriam, (2001), p.9]. The second goal is fostering learners' transformational learning abilities, which generally amounts to a critical reflection capacity (Mezirow, 1985). Finally, SDL aims to promote emancipatory learning and social action (Collins, 1996).

Multiple measurements have been developed to evaluate SDL. Garrison (1997) proposed a three-dimension model, which involved "self-management (task control), self-monitoring (cognitive responsibility), and motivation (entering and task)" [Garrison, (1997), p.21]. Williamson (2007) developed an instrument to assess SDL skills using five dimensions: awareness, learning strategies, learning activities, evaluation, and interpersonal skills. Cheng et al. (2014) included four dimensions for measuring students' SDL abilities: learning motivation, planning and implementing, self-monitoring, and interpersonal communication.

3 Method

Utilising integrative literature review (Torraco, 2016), we identified and qualified articles that met pre-determined criteria for addressing research questions of this study: what factors for college student MLR could be identified and can these factors be integrated into a comprehensive profile.

3.1 Article inclusion

3.1.1 Databases

We consulted Scopus, EBSCO, and ProQuest (accessed through the library of a large public university located in the Midwest region of the USA) to identify relevant articles. We did not use Google scholar as a search platform since it did not allow delimitation of search results against our pre-determined criteria (e.g., keywords).

3.1.2 Criteria for article inclusion

We used the keywords in the sequences below to identify articles and to limit searches to peer-reviewed articles published from 2007 to 2021. The keywords and corresponding numbers of initially returned articles (132 total) are as follows:

- 'mobile learning readiness' in title: 79 articles
- 'mobile learning readiness' plus 'college students' in the title: 3 article
- 'mobile learning readiness' in the title and 'determinants' in the abstract: 12 articles
- 'mobile learning readiness' in the title and 'factors' in the abstract: 16 articles
- 'mobile learning readiness' in the title and 'technology readiness' in the abstract: 16 articles
- 'mobile learning readiness' in the title and 'UTAUT' in the abstract: 2 articles
- 'mobile learning readiness' in the title and 'TAM' in the abstract: 1 articles
- 'mobile learning readiness' in the title and the 'SDL' in the abstract: 3 articles.

After removing duplicate search results, we screened the remaining articles' abstracts to meet three criteria:

1 articles using college student samples

2 empirical studies that included factors for college students' mobile learning readiness

3 peer-reviewed journal publications.

This yielded 29 qualified articles.

3.2 Data analysis process

3.2.1 Identifying factors

We identified all factors for college student MLR as referred to or named the 29 articles. Following Potter and Levine-Donnerstein's (1999), researchers conducted factors twice to ensure reliability. Conferencing was done to resolve any factor identification between researchers until none remained.

3.2.2 Integrating factors

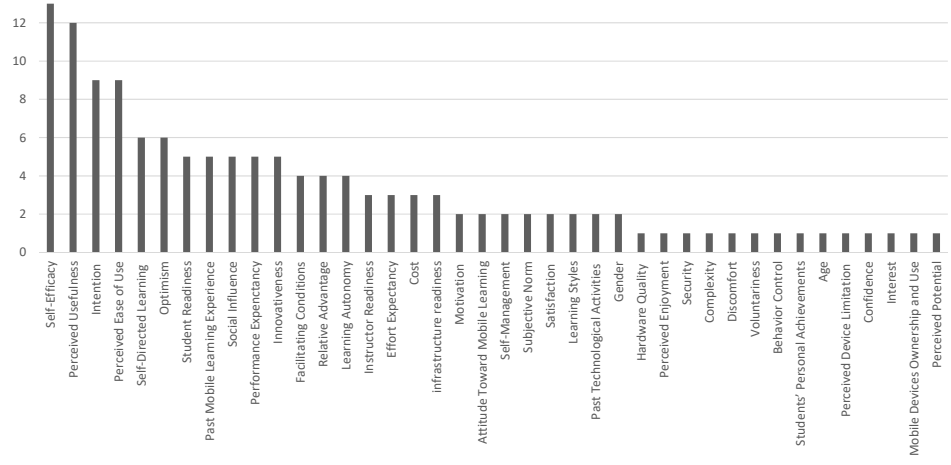
First, for greater generalisability, factors that occurred less than twice across the 29 studies were eliminated. This does not mean that such factors have no relevance or meaning for explaining MLR but might be relevant only in limited or specific contexts. In general, researchers determine the elimination criteria (Carley, 1993), and our goals for the more generalisability of an integrative profile motivated this decision. Then, we merged and coded factors through further analysis. When we found factors that indicated the same dimension of college students' MLR (despite different theoretical backgrounds), we merged and coded them. Last, the remaining factors (after merging) were grouped into categories. The integrative profile of college student MLR emerged from these categories and the integrating factors.

4 Results

4.1 Factors identified in the included articles

We identified 40 factors in all 29 articles as is presented in Figure 3, while 22 factors that occurred less than twice were eliminated. The specific factors identified from each article are presented in Appendix.

Figure 3 All factors identified and frequency



We further found that nine factors of four pairs can be merged. First, perceived ease of use and effort expectancy were merged and coded as mobile learning effort expectation. Studies building on TAM and UTAUT used perceived ease of use and effort expectancy respectively to measure college students' expectations around the degree of ease of using mobile learning systems or technology. Both factors positively predict college students' mobile learning readiness. Students are much more ready to engage in mobile learning when they have high expectations about the ease of effort in manipulating mobile learning systems and technologies (Cheon et al., 2012; Chaka and Govender, 2017; Iqbal and Bhatti, 2015; Issaramanoros et al., 2018; Tezer and Beyoglu, 2018). Hence, they were merged and coded as effort expectation.

Second, perceived usefulness (identified in the studies building on TAM) and performance expectancy (identified in studies using UTAUT) were merged and coded as *mobile learning performance expectation*. Both factors measure the same dimension: college students' expectation around increased study gains using mobile learning over traditional ways of learning. When college students have this high expectation, they are much more ready to engage in mobile learning (Cheon et al., 2012; Chaka and Govender, 2017; Iqbal and Bhatti, 2015; Issaramanoros et al., 2018; Tezer and Beyoglu, 2018). Therefore, they were merged.

Third, social influence, student readiness, and instructor readiness were merged and coded as *subjective influence*. The three factors investigate the same dimension of college students' mobile learning readiness: college students' internalisation of the reference groups or other important people's subjective impact on the use of mobile learning. College students are more likely to engage in mobile learning when they are positively

influenced by peers and instructors (Chaka and Govender, 2017; Cheon et al., 2012). Studies building on UTAUT named the dimension social influence; studies referring to TPB name the same dimension (involving students and instructors primarily in higher education) student readiness and instructor readiness. They, thus, were merged.

Fourth, SDL and learning autonomy were merged and coded as *self-regulated learning*. The two factors indicate the same learning behaviour: students are responsible for their learning processes during mobile learning. Studies that refer to TR identify the factor of SDL to indicate college students' self-regulated learning capacity. Studies building on TPB identify the factor of learning autonomy to examine college students' self-regulated learning capacity. Both factors positively influence college students' MLR (Al-Adwan et al., 2018; Ata and Cevik, 2019; Baş and Sarıgöz, 2018; Tagoe and Abakah, 2014). Therefore, they were merged.

The remaining 13 factors were grouped into three categories. The three categories (learner traits, technology expectations, and external influences) and their integrated 13 factors comprise an integrative conceptual profile of college student mobile learning readiness: learner traits (six factors), technology expectations (three factors), and external influences (four factors). Table 2 summarises these findings.

Table 2 The profile of college students' mobile learning readiness

Category	*Factor*	*Definition*	
Learner traits	Past experience	College students' past experience of using mobile learning	
	Self-efficacy	College students' perceived proficiency of manipulation on mobile devices	
	Innovativeness	College students' tendency to become the pioneer of mobile learning	
	Optimism	College students' positive attitude to mobile learning which can improve their learning performance	
	Intention	College students' actual intention of using mobile learning	
	Self-regulated learning	College students have the primary responsibility for carrying out and evaluating their own learning experiences	
Technology expectations	Effort expectation	College students' expectation of the degree of ease of using a mobile learning system	
	Performance expectation	College students' expectation of using mobile learning to attain gains in learning performance	
	Relative advantage	College students perceive that mobile learning on mobile devices is better than traditional ways of learning	Flexibility Interaction Enjoyment
External influences	Facilitating conditions	College students' mobile learning environment that makes mobile learning easy to do (e.g., technology supports)	
	Subjective influence	College students' internalisation of the reference group or important people's impact to use mobile learning	
	Infrastructure readiness	College students can access necessities to implement mobile learning (network, electricity supply)	
	Cost	College students' willingness to bear the expenses caused by mobile learning (e.g., data plan, devices purchase)	

4.2 Profile of college students' mobile learning readiness

4.2.1 Learner traits

Learner traits incorporate factors of *mobile learning past experience, self-efficacy, innovativeness, optimism, intention, and self-regulated learning*.

First, five studies identified that direct *mobile learning experience* by college students, even moderate past experience, played a role in their readiness to engage in mobile learning. Such past experience influences college students' confidence around using mobile learning (Shorfuzzaman and Alhussein, 2016), optimism toward mobile learning (Mumthaz, 2021), the intention to use mobile learning (Ajayi et al., 2019; Alhassan, 2016), and effort expectancy about mobile learning (Ajayi et al., 2019). If college students have little experience in using mobile learning, their past experiences in using mobile technologies are beneficial to them when they intend to engage in mobile learning (Alhassan, 2016; Mumthaz, 2021). Therefore, past mobile learning experience directly indicates college students' MLR.

Second, *self-efficacy* and *innovativeness* are identified as direct factors for predicting college student MLR in 13 and 5 studies, respectively. Affording strong self-efficacy for using mobile learning to college students would improve their confidence in manipulating mobile learning systems and devices and would further lead to an increased likelihood of their engagement in mobile learning (Cheon et al., 2012; Kenny et al., 2012). This relation is validated across genders (Baş and Sarıgöz, 2018; Bicen et al., 2021), ages (Baş and Sarıgöz, 2018; Bicen et al., 2021), majors (Cheon et al., 2012), and countries with different economic development (Sungur-Gul and Ates, 2021). For instance, Sungur-Gul and Ates (2021) validated the positive relation between college students' self-efficacy and MLR in the context of Turkish higher education and the same relation was also validated earlier by Cheon et al. (2012) in US higher education contexts. Likewise, college students with high innovativeness are more likely to attempt to engage in mobile learning (Issaramanoros et al., 2018; Mahat et al., 2012; Shuib et al., 2018; Zayim and Ozel, 2015).

Third, factors of *optimism* and *intention* are also significant for college students' MLR in six and nine studies respectively. When college students generate a positive belief in mobile learning and an intention to use mobile learning, they advance their psychological state of readiness toward engaging in mobile learning (Aljuaid et al., 2014; Baş and Sarıgöz, 2018; Bicen et al., 2021; Cheon et al., 2012; Lin et al., 2016; Shuib et al., 2018; Tezer and Beyoglu, 2018).

Fourth, *self-regulated learning* behaviour control is also found to be a significant factor in college students' MLR (Al-Adwan et al., 2018; Ata and Cevik, 2019; Baş and Sarıgöz, 2018; Bicen et al., 2021; Cheon et al., 2012; Özkütük et al., 2021; Tagoe and Abakah, 2014; Zayim and Ozel, 2015). Twelve studies employed some variant terms of self-regulated learning (e.g., SDL, learning autonomy and self-management) to indicate this factor. Still, all agreed that self-regulated learning capacity positively determined college students' mobile learning readiness. High self-regulated learning ability helps individuals control their learning behaviour and take responsibility for their learning process (Ata and Cevik, 2019; Bicen et al., 2021; Lin et al., 2016; Özkütük et al., 2021).

4.2.2 Technology expectations

Technology expectations encompass factors of *performance expectation, effort expectation*, and relative advantage.

First, 17 studies found that college students expect to use mobile learning to enhance their academic performance. Students with high expectations toward mobile learning performance tend to be prepared to participate in mobile learning (Almutairy et al., 2015; Azam et al., 2020; Issaramanoros et al., 2018; Sungui-Gul and Ates, 2021; Tagoe and Abakah, 2014; Zayim and Ozel, 2015). Therefore, performance expectation is vital in determining college students' MLR.

Second, 12 studies recognised that college students expect mobile learning systems to require less effort since complicated mobile learning systems can demotivate college students to engage in mobile learning (Azam et al., 2020; Issaramanoros et al., 2018; Sungui-Gul and Ates, 2021). When mobile learning systems and devices cater to this expectation, college students tend to be more likely to participate in mobile learning.

Third, college students also expect mobile learning systems to afford them relative advantages over traditional ways of learning. College students with high expectations about the relative advantages of mobile learning tend to be prepared to participate in mobile learning. Specifically, we found that three mobile learning system technology comparative advantages are commonly investigated in the context of mobile learning readiness: flexibility (Mumthaz, 2021), interactions (Al-Adwan et al., 2018; Alhassan, 2016; Hussin et al., 2012), and enjoyment (Al-Adwan et al., 2018a; Al-Husain and Hammo, 2015). College students prefer that mobile learning systems that are not constrained by location or time (Mumthaz, 2021), that can realise immediate and multiple interactions between students and students (Al-Adwan et al., 2018b) or students and teachers (Alhassan, 2016), and that are more interesting or entertaining than traditional ways of learning (Al-Adwan et al., 2018; Al-Husain and Hammo, 2015).

4.2.3 External influences

External influences include factors of *facilitating conditions*, *subjective influence*, *cost*, and *infrastructure readiness*.

The *mobile learning facilitating conditions* include training courses (Al-Adwan et al., 2018a), technical support (Al-Adwan et al., 2018b; Issaramanoros et al., 2018), the availability of applications designed for mobile learning (Abu-Al-Aish et al., 2012; Chaka and Govender, 2017), and the mobile learning opportunities and resources associated with HEIs (Issaramanoros et al., 2018). Facilitating conditions are identified in four studies to predict college students' MLR directly. If students attain sufficient facilitating supports, their feelings of pressure on accessing or manipulating mobile learning systems will be mitigated and, in turn, their MLR will be improved (Abu-Al-Aish et al., 2012; Al-Adwan et al., 2018a; Chaka and Govender, 2017; Issaramanoros et al., 2018).

Subjective influence is identified to impact college students' MLR directly. We further pinpoint that student-peer and instructor influences are crucial in determining college students' mobile learning readiness. The proximity of peer students and instructors to college students (either face-to-face offline or virtually in online settings) helps increase their influence (Azam et al., 2020; Cheon et al., 2012; Sungui-Gul and Ates, 2021; Tagoe and Abakah, 2014).

Costs associated with mobile learning include connectivity to a network (Ajayi et al., 2019), data plans (Kenny et al., 2012), and the mobile device itself (Hussin et al., 2012; Zayim and Ozel, 2015). These costs can thwart college students both in developed and developing nations from engaging in mobile learning. Kenny et al. (2012) found that a widely cited barrier for nursing college students in Canada was the cost of mobile devices and wireless connectivity. Similarly, Zayim and Ozel (2015) found that the cost of mobile devices restricts nursing college students to engage in mobile learning in Turkey. College students' hesitation of engaging in mobile learning can result from its prohibitive expense or costs that cannot be factored into the budget of a student's lifestyle. Hence, costs cannot be overlooked to explain college students' MLR.

Infrastructure readiness indicates prerequisite resources for mobile learning that students can access. These resources include the availability and stability of internet or digital access (Asghar et al., 2021), the sufficient supply of electrical power (Ajayi et al., 2019), the availability of mobile devices (Zayim and Ozel, 2015), and compatibility between mobile devices, apps and mobile learning (e.g., video function, storage capacities) (Asghar et al., 2021; Hussin et al., 2012). We found that infrastructure readiness is more widely emphasised among college students in developing and underdeveloped countries. College students in developing and less-developed countries more often express that poor infrastructure conditions place obstacles to engaging in mobile learning (Ajayi et al., 2019; Asghar et al., 2021; Zayim and Ozel, 2015). Thus, infrastructure readiness influences college students' MLR.

5 Discussion

Combining the above categories and associated factors affords a comprehensively integrative conceptual profile for college students' mobile learning readiness.

5.1 Leaner traits

The six factors in the learner traits category indicate that college students embrace some learners' prerequisites if they intend to engage in mobile learning. These prerequisites can be examined from three perspectives: college students' personality attributes, psychological traits, and a direct experience influence.

The personality traits of self-efficacy, innovativeness, and self-regulated learning show that college students can actively attempt new technologies and implement their learning plans before engaging in mobile learning. The emphasis on these factors across the included studies can be explained as follows. For one, from students' perspective, students with higher self-efficacy, innovativeness, and self-regulated capacity are more likely to attempt and utilise the advantages of mobile learning (e.g., flexibility) without differences across genders and majors (Baş and Sarıgöz, 2018; Bicen et al., 2021; Lin et al., 2016; Özkütük et al., 2021; Tagoe and Abakah, 2014; Zayim and Ozel, 2015). For another, from the mobile learning perspective, it occurs primarily beyond the classroom and formal class settings. This situation raises more requirements on students and requires them to be self-motivated and self-responsible for their learning behaviours (Lin et al., 2016), to be willing to try new mobile learning systems or devices (Mahat et al., 2012; Shuib et al., 2018), and to be confident in manipulating those systems and devices without formal class supports (Ata and Cevik, 2019; Cheon et al., 2012). Accordingly,

students with higher self-efficacy, innovativeness, and self-regulated capacity meet these requirements better. Noticeably, the fact that the current generation of college students have average or even under average self-regulated learning capacity (Baş and Sarıgöz, 2018; Bicen et al., 2021; Tagoe and Abakah, 2014) may suggest that HEIs should pay more attention to improve students' self-regulated capacity when they intend to implement mobile learning programs.

Optimism and intention reflect psychological traits toward engaging in mobile learning that involve an evaluation of mobile learning. The development of optimism and intention of engaging in mobile learning evolves from college students' appreciation of the advantages of mobile learning system (Baş and Sarıgöz, 2018; Bicen et al., 2021; Lin et al., 2016; Shuib et al., 2018) and their evaluations of mobile learning performance (Cheon et al., 2012; Aljuaid et al., 2014; Shorfuzzaman and Alhussein, 2016; Tezer and Beyoglu, 2018).

In this study, we identified five studies that agreed that college students' past mobile learning experiences directly influenced their mobile learning readiness. However, that experience was considered only a moderator in the UTAUT model. This distinction may suggest urgent attention should be given to providing more mobile learning opportunities to students given that college students' mobile learning experiences can be less pronounced than expected in both developing and underdeveloped countries (Ajayi et al., 2019; Alhassan, 2016; Hussin et al., 2012). Due to the COVID-19 pandemic, many college students in poorer parts of the world (both domestically and internationally) have been faced with access to mobile learning whether they were willing to or not. Granting more opportunities to access mobile learning or mobile technologies will increase their readiness to engage in mobile learning comprehensively.

5.2 Technology expectations

TAM and UTAUT contribute to nine articles in this study toward identifying direct factors for students' expectancy of mobile learning (e.g., perceived usefulness, effort expectancy), which we integrated into three factors under the technology expectation category and further identified the relation that the MLR among college students improved when they perceived mobile learning as beneficial for academic performance and required less or little effort to comprehend its manipulations (Azam et al., 2020; Issaramanoros et al., 2018; Sungui-Gul and Ates, 2021; Tagoe and Abakah, 2014; Zayim and Ozel, 2015).

Three relative advantages of mobile learning were highlighted: *flexibility, interaction*, and *enjoyment*. From the literature review, flexibility, a key advantage of mobile learning, is consistently emphasised during the evolution of mobile learning (2000–2021). College students prefer mobile learning over traditional ways of learning because:

1 it is not constrained by time and location (Huang et al., 2007; Mumthaz, 2021; Shorfuzzaman and Alhussein, 2016; Zayim and Ozel, 2015)

2 it provides learning opportunities to more students (Alhassan, 2016; Issaramanoros, 2018)

3 it can be tailored to individual learning needs (Shuib et al., 2018).

Recently, an emphasis on interaction and enjoyment has emerged in studies examining student expectations around the mobile learning process. Students expect mobile learning to provide multiple interactions during the learning process, including synchronous and asynchronous interactions (Al-Adwan et al., 2018) and interactions with different user groups domestically and even internationally (Ajayi et al., 2019; Azam, 2020; Mumthaz, 2021). They anticipate that mobile technologies can realise more interesting educational possibilities during mobile learning processes (Al-Adwan et al., 2018; Issaramanoros, 2018). These expectations may recommend mobile learning developers to advance mobile learning to meet students' needs during the learning process.

5.3 External influences

In the category of external influences, four factors reflect MLR as socially and culturally dependent on external determinants.

First, *facilitating conditions* reflect how external supports impact MLR (e.g., tech facilitating) (Abu-Al-Aish et al., 2012; Al-Adwan et al., 2018; Chaka and Govender, 2017). *Subjective influence* explains that mobile learning is situated in the social and cultural contexts (Al-Adwan et al., 2018; Chaka and Govender, 2017; Issaramanoros et al., 2018; Shorfuzzaman and Alhussein, 2016). For instance, the students in Asian regions can accept mobile learning more easily when instructors recommend it because respecting teachers through accepting their suggestions is a widely accepted norm (Chaka and Govender, 2017).

Second, *costs* inhibit college students' MLR and can be in general offset or worsened by external factors (e.g., national affluence, the socioeconomic status (SES) of a student's family). In this study, 26 out of 29 articles had college student samples in developing countries (e.g., Thailand, Turkey) where the overall national affluent level and individual family SES may influence college students' financial status.

Last, *infrastructure readiness* is integrated into the profile since MLR is heavily dependent on available public resources for mobile learning including networks, electrical power supply, Apps, and mobile devices designed for mobile learning (Abu-Al-Aish et al., 2012; Ajayi et al., 2019; Asghar et al., 2021; Zayim and Ozel, 2015). The lack of these public resources is especially evident in developing and underdeveloped countries, which further impedes college students to engage in mobile learning. For example, Ajayi et al. (2019) found Nigerian college students much concerned about inadequate network availability and coverage, which presented a big challenge for them to engage in mobile learning. Infrastructure readiness is certainly a factor in college students' MLR profile, but it involves often national-scale issues well beyond the ability of individual students to influence or mitigate. The identified specific infrastructure readiness for mobile learning in this study may provide the precise directions to develop infrastructure for mobile learning in developing and underdeveloped countries since mobile learning can bridge the education gap between developed and developing or underdeveloped countries (Issaramanoros et al., 2018).

6 Limitations and future research

This study is limited by:

1 only accessing to selected databases

2 26 articles out of 29 qualified articles for analysing in this study originating in developing or underdeveloped nations

3 methodologically leveraging qualified factors in the final profile for generalisability.

The qualified articles search from Scopus, EBSCO, and ProQuest databases may cause exclusion of qualified studies and the fact that the majority of selected articles for analysing in this study rooted in developing or underdeveloped countries may limit the generalisability of the findings in this study for developed countries. Moreover, the goal for generalisability may rightly limit our analysis only on those factors that occurred more than twice and therefore potentially excluded some 'outlier' factors with low frequency. These factors become 'outliers' not because they are barely inherently related to MLR itself but because MLR research already draws from a pool of common theoretical backgrounds or frameworks, such that certain terms (e.g., self-efficacy) occur more often than those 'outlier' factors.

Equally, the limitations in this study also suggest an agenda for future research. First, future research could further refine the profile of college students' MLR in this study in light of other literature and databases. Second, we find that a majority of studies examining college students' MLR are rooted in developing or underdeveloped nations, which also points to a need for studies using developed nation participants. Third, those 'outlier' factors (frequency below twice in this study) could still befit future research and add more granularity to the understanding of influences on college students' MLR. Meanwhile, further research can validate the conceptual framework of college students' MLR proposed in this study based on empirical evidence and observations in the higher education context.

7 Conclusions and implication

This study proposes a conceptual profile integrating 13 factors into three categories to comprehensively describe college students' MLR. In terms of learners' traits, the profile emphasised students' personality traits (self-efficacy, innovativeness, and self-regulated learning) and psychological attributes (optimism and intention) to determine their MLR as rooted in students' past mobile learning experience. Moreover, in terms of technological expectancy, the profile further highlights the learner-perceived three advantages of mobile learning – flexibility, interactions, and enjoyment – other than college students' mobile learning performance and effort expectations. Last, the profile stressed external influences including costs (e.g., affordable mobile devices, data plan), public resources (e.g., electric power supply, network availability, and coverage), and student-peers and instructors' subjective influence as supporting or hindering college students' MLR.

The conceptual profile provides the following implications. First, the study contributes to theoretically framing college students' MLR rooted in extant studies. Second, this study provides insights into the factors that HEIs can draw on to foster, support, and enhance students' MLR. For instance, the better HEIs understand the direct impacts of facilitating conditions on students' mobile learning readiness, the better they can accommodate the corresponding supports (e.g., more techs on campus, solar charging

stations for isolated rural communities, WIFI connectivity). College students can also adopt the profile to assess whether they are ready to use mobile learning or identify gaps. Lastly, mobile learning system developers can use the profile to incorporate college student mobile learning expectations to tailor mobile learning designs.

References

Abu-Al-Aish, A., Love, S., and Hunaiti, Z. (2012). 'Mathematics students' readiness for mobile learning', *International Journal of Mobile and Blended Learning*, Vol. 4, No. 4, pp.1–20.

Ajayi, A., Ayo, C.K. and Olamide, O. (2019) 'Mobile learning and accounting students' readiness in tertiary and professional institutions in Nigeria', *Cogent Arts and Humanities*, Vol. 6, No. 1, pp.1–25.

Ajzen, I. (1991) 'The theory of planned behaviour', *Organizational Behavior and Human Decision Proces*, Vol. 1991, No. 50, pp.179–211, American Press Inc.

Akkaya, S., Ciğerci, M.F. and Kapıdere, M. (2021) 'Investigation of the relationship between prospective teachers' attitudes towards mobile learning and their readiness for mobile learning', *International Online Journal of Education and Teaching* (IOJET), Vol. 8, No. 4, pp.2949–2965.

Al-Adwan, A. S., Al-Adwan, A. and Berger, H. (2018) 'Solving the mystery of mobile learning adoption in higher education', *Int. J. Mobile Communication*s, Vol. 16, No. 1, pp.24–49.

Al-Adwan, A.S., Al-Madadha, A. and Zvirzdinaite, Z. (2018) 'Modeling students' readiness to adopt mobile learning in higher education: an empirical study', *International Review of Research in Open and Distributed Learning*, Vol. 19, No. 1, pp.221–241.

Alhassan, R. (2016). 'Mobile learning as a method of ubiquitous learning: Students' attitudes, readiness, and possible barriers to implementation in higher education', *Journal of Education and Learning*, Vol. 5, No. 1, pp.176–189.

Al-Husain, D. and Hammo, B.H. (2015) 'Investigating the readiness of college students for ICT and mobile learning: a case study from King Saud University', *International Arab Journal of e-Technology*, Vol. 4, No. 1, pp.48–55.

Aljuaid, N.M.F., Alzahrani, M.A.R. and Islam, A.Y.M.A. (2014) 'Assessing mobile learning readiness in Saudi Arabia higher education: an empirical study', *The Malaysian Online Journal of Educational Technology*, Vol. 2, No. 2, pp.1–14.

Almaiah, M.A. and Mulhem, A.A. (2019) 'Analysis of the essential factors affecting of intention to use of mobile learning applications: A comparison between universities adopters and non-adopters', *Education and Information Technologies*, Vol. 24, No. 2, pp.1433–1468.

Almaiah, M.A., Alamri, M.M. and Al-Rahmi, A.W. (2019) 'Applying the UTAUT model to explain the students' acceptance of mobile system in higher education', *IEEE Access*, Vol. 7, pp.174673–174686.

Almasri, A.K.M. (2018). 'New mobile learning process model for higher education students in Jordanian universities', *International Journal of Information, Business and Management*, Vol. 10, No. 1, pp.201–213.

Almutairy, S., Davies, T. and Dimitriadi, Y. (2015) 'Students' perceptions of their m-learning readiness', *International Journal of Electronics and Communication Engineering*, Vol. 9, No. 5, pp.1464–1467.

Asghar, M.Z., Barberà, E. and Younas, I. (2021) 'Mobile learning technology readiness and acceptance among pre-service teachers in Pakistan during the COVID-19 pandemic', *Knowledge Management and ELearning*, Vol. 13, No. 1, pp.83–101.

Ata, R. and Cevik, M. (2019) 'Exploring relationships between Kolb's learning styles and mobile learning readiness of pre-service teachers: a mixed study', *Education and Information Technologies*, Vol. 2019, No. 24, pp.1351–1377.

Azam, M., Naeem, S.B. and Bhatti, R. (2020) 'University students' readiness towards mobile learning: the stages of change model', *Pakistan Journal of Information Management & Libraries* (PJIM&L), Vol. 22, pp.37–59.

Baş, M. and Sarıgöz, O. (2018) 'Determining the readiness levels of pre-service teachers towards mobile learning in classroom management', *Educational Research and Reviews*, Vol. 13, No. 10, pp.382–390.

Bere, A. and Rambe, P. (2016) 'An empirical analysis of the determinants of mobile instant messaging appropriation in university learning', *J. Comput. High. Educ.*, Vol. 28, No. 2, pp.172–198.

Bicen, H., Demir, B. and Serttas, Z. (2021) 'Pre-service teachers' readiness levels for mobile learning', *Brain. Broad Research in Artificial Intelligence and Neuroscience*, Vol. 12, No. 2, pp.53–66.

Cameron, M., Lacy, T.A., Siegel, P., Wu, J., Wilson, A., Johnson, R., Burns, R., and Wine, J. (2021) *2019–20 National Postsecondary Student Aid Study (NPSAS:20): First Look at the Impact of the Coronavirus (COVID-19) Pandemic on Undergraduate Student Enrollment, Housing, and Finances (Preliminary Data)* (NCES 2021-456), National Center for Education, US Department of Education, Washington, DC, Statistics [online] https://nces.ed.gov/pubs2021/2021456.pdf (accessed March 10, 2022).

Carley, K. (1993) 'Coding choices for textual analysis: A comparison of content analysis and map analysis', *Sociological Methodology*, Vol. 1993, No. 23, pp.75–126.

Chaka, J.G. and Govender, I. (2017) 'Students' perceptions and readiness towards mobile learning in colleges of education: a Nigerian perspective', *South African Journal of Education*, Vol. 37, No. 1, pp.1–12.

Chao, C. (2019). 'Factors determining the behavioral intention to use mobile learning: an application and extension of the UTAUT model', *Frontiers in Psychology*, Vol. 2019, No. 10, pp.1–14.

Cheng, S.F., Lee-Hsieh, J., Turton, M.A., and Lin, K.C. (2014) 'Validation of self-directed learning instrument and establishment of normative data for nursing students in Taiwan: using polytomous item response theory', *J. Nurs. Res*, Vol. 22, No. 2, pp.90–100.

Cheon, J., Lee, S., Crooks, S.M. and Song, J. (2012) 'An investigation of mobile learning readiness in higher education on the theory of planned behavior', *Computers and Education*, Vol. 59, pp.1054–1064.

Collins, M. (1996) 'On contemporary practice and research: self-directed learning to critical theory', in Hanson, E.R. and Raggart, P. (Eds.): *Boundaries of Adult Learning*, pp.109–127, Routledge, New York.

Davis, F.D. (1989) 'Perceived usefulness, perceived ease of use, and use acceptance of information technology', *MIS Quarterly*, Vol. 13, No. 3, pp.319–339.

Davis, F.D. (1993) 'User acceptance of information technology: system characteristics, user perceptions and behavioral impacts', *Int. J. Man-Machine Studies*, Vol. 38, No. 3, pp.475–487, Academic Press Limited.

El-Hussein, M.O.M. and Cronje, J.C. (2010) 'Defining mobile learning in the higher education landscape', *Journal of Educational Technology and Society*, Vol. 13, No. 3, pp.12–21.

Ellinger, A.D. (2004) 'The concept of self-directed learning and its implications for human resource development', *Advances in Developing Human Resources*, Vol. 6, No. 2, pp. 158–177.

Eschenbrenner, B. and Nah, F.F.H. (2019) 'Learning through mobile devices: leveraging affordances as facilitators of engagement', *Int. J. Mobile Learning and Organisation*, Vol. 13, No. 2, pp.152–170.

Garrison, D.G. (1997) 'Self-directed learning: toward a comprehensive model', *Adult Education Quarterly*, Vol. 48, No. 1, pp.18–33.

Hamidi, H. and Chavoshi, A. (2018) 'Analysis of the essential factors for the adoption of mobile learning in higher education: a case study of students of the University of technology', *Telematics and Informatics*, Vol. 35, No. 4, pp.1053–1070.

Hussin, S., Radzi Manap, M., Amir, Z. and Krish, P. (2012) 'Mobile learning readiness among malaysian students at higher learning institutes', *Asian Social Science*, Vol. 8, No. 12, pp.276–283.

Hwang, G.J., Tu, Y.F. and Lin, C.J. (2021) 'Advancements and hot research topics of artificial intelligence in mobile learning: a review of journal publications from 1995 to 2019', *Int. J. Mobile Learning and Organisation*, Vol. 15, No. 4, pp.427–447.

Iqbal, S. and Bhatti, Z.A. (2015) 'An investigation of university student readiness towards m-learning using technology acceptance model', *International Review of Research in Open and Distributed Learning*, Vol. 16, No. 4, pp.83–103.

Issaramanoros, E., Khlaisang, J. and Pugsee, P. (2018) 'Auto mechanic students' perceptions and readiness toward mobile learning in Thailand', *International Journal of Interactive Mobile Technologies* (IJIM), Vol. 12, No. 5, pp.28–42.

James, P. (2011) 'Mobile-learning – Thai HE student perceptions and potential technology impacts', *International Education Studies*, Vol. 4, No. 2, pp.182–194.

Kenny, R.F., van Neste-Kenny, J.M., Burton, P.A., Park, C.L. and Qayyum, A. (2012) 'Using self-efficacy to assess the readiness of nursing educators and students for mobile learning', *The International Review of Research in Open and Distributed Learning*, Vol. 13, No. 3, pp.277–296.

Komalawardhana, N., Panjaburee, P. and Srisawasdi, N. (2021) 'A mobile game-based learning system with personalised conceptual level and mastery learning approach to promoting students' learning perceptions and achievements', *Int. J. Mobile Learning and Organisation*, Vol. 15, No. 1, pp.29–49.

Lai, C. and Zheng, D. (2017) 'Self-directed use of mobile devices for language learning beyond the classroom', *ReCALL*, Vol. 30, No. 3, pp.299–318.

Lam, C.T., Ke, W., Im, S.K., Gomes, A., Mendes, A.J. and Marcelino, M.J. (2019) 'Students' characteristics in programming learning and the design of a mobile learning platform', *Int. J. Mobile Learning and Organisation*, Vol. 13, No. 4, pp.352–391.

Lin, H.H., Lin, S., Yeh, C.H., and Wang, Y.S. (2016) 'Measuring mobile learning readiness: scale development and validation', *Internet Research*, Vol. 26, No. 1, pp.265–287.

Livingstone, S. (2008) 'Taking risky opportunities in youthful content creation: teenagers' use of social networking sites for intimacy, privacy and self-expression', *New Media and Society*, Vol. 10, No. 3, pp.393–411.

Mahat, J., Ayub, A.F.M., Luan, S. and Wong, S.L. (2012) 'An Assessment of students' mobile self-efficacy, readiness and personal innovativeness towards mobile learning in higher education in Malaysia', *Procedia – Social and Behavioral Sciences*, Vol. 2012, No. 64, pp.284–290.

Merriam, S.B. (2001) 'Andragogy and self-directed learning: pillars of adult learning theory', *New Directions for Adult and Continuing Education*, Spring, Vol. 2001, No. 89, pp.3–13.

Messuti, A., Wambeke, T., Kalz, M. and Bruschi, B. (2014) 'M-workplace learning @ ITC-ILO', in Kalz, M., Bayyurt, Y. and Specht, M. (Eds.): *Mobile as a Mainstream – Towards Future Challenges in Mobile Learning*, *Communications in Computer and Information Science*, pp.272–286, Springer, New York.

Mezirow, J. (1985) 'A critical theory of self-directed learning', *New Directions for Adult and Continuing Education*, Vol. 1985, No. 25, pp.17–30.

Moore, G.C. and Benbasat, I. (1991) 'Development of an instrument to measure the perceptions of adopting an information technology innovation', *Information Systems Research*, Vol. 2, No. 3, pp.192–222.

Mumthaz, F. (2021) 'Psychological readiness for mobile learning among Maldivian students at higher education institutions', *GATR Global J. Bus. Soc. Sci. Review*, Vol. 9, No. 3, pp.224–232.

ÖZkütük, N., Orgun, F. and Baysan, A. (2021) 'The readiness of nursing students for mobile learning: a cross-sectional study', *Contemporary Nurse*, Vol. 57, Nos. 3–4, pp.1–11.

Parasuraman, A. (2000) 'Technology readiness index (TRI): a multiple-item scale to measure readiness to embrace new technology', *Journal of Service Research*, Vol. 2, No. 4, pp.307–320.

Perry, D. (2003) 'Handheld computers PDAs in schools', *Becta ICT Research*, March [online] https://dera.ioe.ac.uk/1644/7/becta_2003_handhelds_report_Redacted.pdf (accessed 15 May 2021).

Potter, W.J. and Levine-Donnerstein, D. (1999) 'Rethinking validity and reliability in content analysis', *Journal of Applied Communication Research*, Vol. 27, No. 3, pp.258–284.

Shorfuzzaman, M. and Alhussein, M. (2016) 'Modeling learners' readiness to adopt mobile learning: a perspective from a GCC higher education institution', *Mobile Information Systems*, special issue, Vol. 2016, pp.1–10.

Shuib, M., Azizan S.N. and Ganapathy, M. (2018) 'Mobile learning readiness among English language learners in a public university in Malaysia', *Pertanika J. Soc. Sci. and Hum*., Vol. 26, No. 3, pp.1491–1504.

Sulaiman, A. and Dashti, A. (2018) 'Students' satisfaction and factors in using mobile learning among college students in Kuwait', *EURASIA Journal of Mathematics, Science and Technology Education*, Vol. 14, No. 7, pp.3181–3189.

Sungur-Gul, K. and Ates, H. (2021) 'Turkish adaptation of mobile learning readiness scale in the framework of theory of planned behavior', *International Online Journal of Education and Teaching* (IOJET), Vol. 8, No. 2, pp.814–831.

Tabor, S. (2016) 'Making mobile learning work: Student perceptions and implementation factors', *Journal of Information Technology Education: Innovations in Practice*, Vol. 15, No. 1, pp.75–98.

Tagoe, M. and Abakah, E. (2014) 'Determining distance education students' readiness for mobile learning at university of Ghana using the theory of planned behavior', *International Journal of Education and Development Using Information and Communication Technology* (IJEDICT), Vol. 10, No. 1, pp.91–106.

Tezer, M. and Beyoğlu, D. (2018) 'How do preservice teachers' readiness and attitudes toward mobile learning affect their acceptance of mobile learning system?', *TEM Journal*, Vol. 7, No. 4, pp.875–885.

Torraco, R.J. (2016) 'Writing integrative literature reviews: Using the past and present to explore the future', *Human Resource Development Review*, Vol. 15, No. 4, pp.404–428.

Traxler, J. (2007) 'Defining, discussing, and evaluating mobile learning: the moving finger writes and have writ……', *International Review of Research in Open and Distance Learning*, Vol. 8, No. 2, pp.1–12.

Venkatesh, V. and Davis, F.D. (1996) 'A model of the antecedents of perceived ease of use: development and test', *Decision Sciences*, Vol. 27, No. 3, pp.451–481.

Venkatesh,V., Morris, M.G., Davis, G.B. and Davis, F.D. (2003) 'User acceptance of information technology: toward a unified view', *MIS Quarterly*, Vol. 27, No. 3, pp.425–478.

Williamson, S.N. (2007). 'Development of a self-rating scale of self-directed learning', *Nurse Res*., Vol. 14, No. 2, pp.66–83.

Wu, W. and Perng, Y. (2016) 'Research on the correlations among mobile learning perception, study habits, and continuous learning', *Eurasia Journal of Mathematics, Science and Technology Education*, Vol. 12, No. 6, pp.1665–1673.

Zayim, N. and Ozel, D. (2015) 'Factors affecting nursing students' readiness and perceptions toward the use of mobile technologies for learning', *CIN: Computers, Informatics, Nursing*, Vol. 33, No. 10, pp.456–464.

Appendix

Table A1 Factors identified in the each article

Author (year)	*Country*	*Theory/model utilised*	*Factor identified*
Abu-Al-Aish et al. (2012)	UK	Mobile learning readiness	Past mobile learning experience
			Technology self-efficacy
			Facilitating conditions
			Relative advantage
Ajayi et al. (2019)	Nigeria	Exploring the obstacles and challenges of mobile learning	Mobile devices availability
			Cost of internet access
			Instability of network
			Past experience
			Student and instructor readiness
Akkaya et al. (2021)	Turkey	Exploring relationship between prospective classroom teachers' attitudes towards mobile learning and their mobile learning readiness levels	Attitude
			Satisfaction
			Effect on learning
			Motivation
			Usability
			Self-efficacy
			Optimism
			Self-learning
Al-Adwan et al. (2018a)	Jordan	TAM and UTAUT	Self-management (self-directed learning)
			Mobile learning social influence
			Complexity
			Relative advantage
			Facilitating conditions
			Perceived enjoyment
			Behavioural intention of use m-learning
Alhassan (2016)	Riyadh	Exploring the obstacles and challenges of mobile learning	Relative advantage
			Past experience of technology activities
			Past mobile learning experience
			M-learning adoption
Al-Husain and Hammo (2015)	Saudi Arabia	Roger technology adoption model	Academic benefits of technology (ease of access to a lot of resources; connectivity; productivity; enjoyment)
			The value of applications

Table A1 Factors identified in the each article (continued)

Author (year)	*Country*	*Theory/model utilised*	*Factor identified*
Aljuaid et al. (2014)	Saudi Arabia	TAM	Perceived ease of use
			Perceived usefulness
			Intention to use
Almutairy et al. (2015)	Saudi Arabia	Technology readiness	Confidence
			Interest
			Performance expectancy
Asghar et al. (2021)	Pakistan	UTAUT	Performance expectancy
			Social influence
			Quality of services (infrastructure and mobile learning facilities)
			Innovativeness
			Intention
Ata and Cevik (2019)	Turkey	Kolb's learning style inventory	Self-directed learning
			Mobile learning self-efficacy
			Converge learning type (learning style)
			Accommodator learning type (learning style)
Azam et al. (2020)	Pakistan	The stage of change model	Perceived ease of use
			Perceived usefulness
			Subjective norm
			Behaviour control
			Student readiness
Baş and Sarıgöz (2018)	Turkey	Mobile learning readiness scale	Optimism
			Self-directed learning
			Mobile learning self-efficacy
Bicen et al. (2021)	Turkey	Mobile learning readiness scale	Optimism
			Self-directed learning
			Mobile learning self-efficacy
Chaka and Govender (2017)	Nigeria	UTAUT	Effort expectancy
			Performance expectancy
			Social influence
			Facilitating conditions
			Readiness towards m-learning

Table A1 Factors identified in the each article (continued)

Author (year)	*Country*	*Theory/model utilised*	*Factor identified*
Cheon et al. (2012)	USA	Theory of planned behaviour (TPB)	Perceived ease of use
			Perceived usefulness
			Instructor readiness
			Student readiness
			Perceived self-efficacy
			Learning autonomy
			Intention
Hussin et al. (2012)	Malaysia	Behaviourism/ constructivism/ informal or situated learning/collaborative learning	Facility readiness
			Skills and experiences
			Perceived mobile learning readiness (perceived mobile learning usefulness)
			Budget readiness
Iqbal and Bhatti (2015)	Pakistan	TAM	Students' personal satisfaction
			Students' personal achievements
			Students' learning style
			Mobile learning self-efficacy
			Perceived usefulness
			Perceived ease of use
			Behavioural intention
Issaramanoros et al. (2018)	Thailand	UTAUT	Performance expectancy
			Effort expectancy
			Social influence
			Facilitating conditions
			Hedonic motivation
			Personal innovativeness
			Behavioural intention
Kenny et al. (2012)	Canada	Bandura's self-efficacy judgement	Mobile ownership and use
			Perceived potentials (benefits and barriers)
			Self-efficacy
			Motivation
Lin et al. (2016)	China	technology readiness	M-learning self-efficacy
			Optimism
			Self-directed learning
Mahat et al. (2012)	Malaysia	Roger's innovativeness theory	Mobile self-efficacy
			Students' readiness (perceived usefulness)
			Students' personal innovativeness

Table A1 Factors identified in the each article (continued)

Author (year)	*Country*	*Theory/model utilised*	*Factor identified*
Mumthaz (2021)	Republic of Maldives	Social cognitive development theory	Relative advantage: flexibility
			Experience of practices in daily activities on mobile phone applications
Özkütük et al. (2021)	Turkey	Mobile learning readiness scale	Optimism
			Self-efficacy
			Self-directed learning
Shorfuzzaman and Alhussein (2017)	Saudi Arabia	UTAUT	Performance expectancy
			Effort expectancy
			Social influence
			Behavioural intention
			Voluntariness
			Gender
			Age
			Experience
Shuib et al. (2018)	Malaysia	Technology readiness	Optimism
			Innovativeness
			Discomfort toward mobile technology
			Insecurity toward mobile technology
Sungui-Gul and Ates (2021)	Turkey	Theory of planned behaviour (TPB)	Perceived ease of use
			Perceived usefulness
			Instructor readiness
			Student readiness
			Perceived self-efficacy
			Learning autonomy
			Intention
Tagoe and Abakah (2014)	Ghana	Theory of planned behaviour	Subjective norms
			Student readiness
			Perceived usefulness
			Perceived ease of use
			Learner autonomy (self-directed learning)
			Self-efficacy
			Intention

Table A1 Factors identified in the each article (continued)

Author (year)	*Country*	*Theory/model utilised*	*Factor identified*
Tezer and Beyoglu (2018)	Turkey	TAM	Perceived usefulness
			Perceived ease of use
			Gender
			Mobile learning attitude
			Mobile learning intention
Zayim and Ozel (2015)	Turkey	TAM	Hardware quality
			Financial constraint
			Perceived ease of use
			Perceived usefulness
			Personal innovativeness
			Self-management of learning
			Perceived device limitation
			Device availability