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Understanding the concepts of digital learning approaches: An empirical analysis of schools in developing countries

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Abstract

The rising popularity of learning via e-learning platforms, coupled with the accelerated pace in mobile devices' uptake during the post-COVID-19 environment, presents tremendous learning demands on mobile and wireless networking infrastructure. Some fundamental principles and components are essential to maximizing user experience and online program success. This paper will explore the gaps between traditional learning and mobile learning by presenting a comprehensive survey of the two areas' cusps. We trace the practices in mainstream schools with potential online program development and delivery strategies to meet the school's ratification. We identify the critical learning and performance support. We then discuss several techniques and platforms that facilitate the efficient deployment of learning onto mobile systems. Finally, we discuss how to tailor learning to mobile environments, propose a set of activities that would augment online presence for students, and open directions for future research.

Introduction

The relentless growth of ICT (information and communications technology) and AI (artificial intelligence) has triggered a radical challenge to the notion and practice of traditional learning space. Mobile technology opens new opportunities for integrating classroom learning with online learning methods. This blended learning approach that amalgamates varied modes of learning and incorporates various ways to access content using mobile technology is not new. However, blended learning gives learners the impression of learner-centricity by providing more significant opportunities for learners to engage with learning materials. It does not augur well with industrial attachment or internship training where a crucial experiential component is lacking. In part, many educators have begun to consciously mix different elements of e-learning and face-to-face learning into a blended learning model (Mestan, 2019). It is not surprising that several writers posit a tendency to use blended learning scenarios by coalescing different approaches of learning and assimilating a variety of ways to access content, for instance, web-based, desktop, and mobile (Cigdam & Ozturk, 2016; Thomas et al., 2017; McCarthy, 2017). Interestingly, the universality of blended learning research in technology journals over extant higher education literature highlights that blended learning needs clarity as findings that blended learning will become the "new" normal in higher education course delivery are inconsistent (Norberg et al., 2011; Brown, 2016).

ICT and tools such as mobile communication devices have become necessary since they offer a new paradigm in connectivity, communication, and collaboration in our daily lives (Harfoushi, 2017). In the post-COVID-19 epoch, many schools worldwide are closed due to social distancing measures and other health concerns. Students across all levels, from primary school to universities, have shifted to home-based learning. This has caused personal, psychological, and sociological consequences for learners (Toquero, 2020; Cao et al., 2020; Cesco et al., 2021). Unless learners can quickly learn to adapt themselves in their personal and professional affairs and society at large, they are destined for disappointments in the digital learning space. The mundane cycle of change relating to ICT within the academic community has now become the 'new' normal. As the result of the continuous onset of new innovative ICT applications, devices, practices, and structures, members of the learning community are presented with numerous opportunities to improve classroom delivery, including the necessity for embracing technology for continual improvement. From a learner's perspective, mobile technology gives impetus for a relevant and fresh learning experience (McQuiggan et al., 2015). ICT development has created new devices like smartphones, electronic gadgets, cloud computing, and wireless networking, which have become the dominating factor in mobile learning (Vlădoiu, 2012).

The usage of mobile technology such as smartphones and tablets is profoundly entrenched in Generation Z learners (born between 1995 and 2010). It is not surprising that the overall enrolment in distance learning sees an increase in higher education across all sectors (Straumshein, 2017). Generation Z people have the innate ability to use

technology for their socializing and learning, as they barely have known life without the internet, smartphones, and computers (Hope, 2018). They seamlessly mix their online and offline worlds and perform more on their smartphones, laptops, and tablets than they do on personal computers (Piercy, 2017; Smith, 2015). Furthermore, mobile technology allows learners prospects to integrate spontaneous learning in a formal learning context.

Challenges in the developing countries' education system

Students from both Cambodian and Indian education systems have similar challenges especially relating to pedagogies with technologies, designing interactive activities, enhancing formal learning, gaining students' support, and dealing with problems using technology (Son, 2018). Moreover, obstacles in fully online learning are stress and anxiety caused by many different sources of challenges such as having too many online tasks, lack of motivation, and guiding students on how to manage and deal with new normal. Many other related psychological issues can trigger a student's new everyday life due to some family's lack of awareness of the nature of online education (Al-Kumaim et al., 2021).

Further, the teachers find difficulties in engaging low motivated and passive students in the online learning setting. It is indicated by few students who get involved in discussion. Some students do not focus and even go to sleep when they participate in the teleconference. Due to the students' laziness, unstable internet connection, and low English language proficiency, it demotivates them to participate in discussion and question and answer sessions using English. The student's English language proficiency becomes another problem in this online learning. It is because the students do not use English in daily communication both inside and outside the classroom.

Good pedagogy will not make sense if there are problems in technology access (Cakrawati, 2017). The financial situation of the students also creates difficulty, that is, the inability to afford sufficient internet data for online learning. They can only afford limited internet data that are insufficient to participate in online learning well. Many students have low digital literacy. They find problems in operating the applications and platforms used for online learning. This is mainly due to the unfamiliarity of learning online and interacting with those applications and platforms. It becomes a new challenge to teach students with low cognition and various learning styles in the online learning environment.

Relevant literature

Early writers like Jenkins, Browne & Armitage (2001) suggested that the main reason for the extensive investment in web-based technology is their potential to enhance teaching and learning, and to enhance the development of student-centered, independent learning (Pahl, 2003), fostering a deep approach to learning (Collis, 1997). The notion of technology-based learning is synonymous with e-learning,

which is learning content using electronic technology, not limited only to the Internet, intranets, but also chat rooms, e-bulletin boards, webcasts, computer-based instruction. This e-learning delivery method is typically used in distance education that allows both synchronous and asynchronous exchange of resources over a communication network (Iqbal et al., 2019). Indeed, e-learning holds promise for modern learners; it promotes communication and collaboration among students and instructors (Khan, 2000) and augments accessibility to learning by offering anytime and anywhere delivery. This collaboration also provides a means of exchanging personal information, such as attributes of participating members in an online group endeavor.

On the other hand, the ubiquity of modern mobile devices and the popularity of educational applications for mobile devices has enabled learning to become mobile vis-à-vis to learn from anywhere and at any time without the need to attend physical classes. It also characterizes a range of methods and approaches that bring about benefits and future growth of mobile technologies. The term mobile learning is a part of learning techniques. It refers to the escalation of mobile device usage in the learning community to deliver content and rudiments. Learning can be positioned in a broader range of contexts than traditionally (Uther, 2019; Li & Cao, 2020; Fakomogbon & Bolaji, 2020).

According to Park, Nam, & Cha (2012), mobile learning's acceptance varies depending on several reasons such as ease of use, perceptions of usefulness, and attitudes toward mobile learning generally. These, in turn, are based on self-efficacy, the relevance of the teaching, system accessibility, and social norms. This mobile learning approach should not be confused with personalized learning. It is a preferred mode of instruction in which the pace of knowledge and the instructional process are optimized for individual learning requirements. Consequently, the learning objectives and activities are driven by personal interests and often self-initiated; for instance, the instructional approaches, content, and arrangement may vary based on learner needs (Office of Educational Technology, 2015). Moreover, Barron (2006) asserted that it is indispensable that learning must be viewed with a broader learning ecology lens to appreciate how diverse groups of students adapt technology skills in both formal and informal settings.

Issues surrounding online learning platforms

Nowadays, technology-enhanced learning, namely an online learning environment with adaptive technologies, has gained popularity in teaching and learning. From a teaching standpoint, mobile learning is prompted by characteristics associated with the technologies and devices used, the massive size of data generated throughout a learning session, and the interactions among the learners outside the classroom. Owing to ICT and AI's digitalization, opportunities arise that lead to innovative teaching and learning approaches within institutions and universities. This has led to the implementation of big data analytics to efficiently process big learning data to add value to the mobile learning environments. With the proliferation rate of smart devices, their use is becoming widely accepted in

mobile learning, which provides instructors' capability to manage the learning content with the intention not only to facilitate the content delivery. It also augments the learning process by adapting content to learners' requirements, which is crucial.

From the extant literature, the authors conclude that mobile learning permits wider opportunities for students to learn on-demand vis-à-vis anytime and anywhere at their convenience. However, this type of knowledge can also present the chances of learning in or outside the classroom environment. The fundamental requisite for mobile learning is accessibility to mobile technologies with multimedia facilities, stable internet, and instructional content quality. As the education sector move quickly into the AI (artificial intelligence) arena, to harness the benefits of deep learning and artificial neural network pervasive in everyday learning. Deep learning refers to algorithms that can forecast possible outcomes based on user data, which lets a computer show behaviors learned from experiences rather than human interactions. It aids automation using algorithms in learning from data and consequently generate predictions (Ahmadi-Karvigha et al., 2019). Some developmental theorists went further to embed consideration of AI's benefits and risks in education as technology tools into the development, marketing, and deployment of these tools (Berendt et al., 2020). More importantly, AI impacts data protection and privacy, and fundamental rights in general; secondly, who (which body or organization) should be responsible for regulating AI in education (Berendt et al., 2020)?

The success of any learning platform is conditional upon the pedagogy adopted by the instructor using it. One aspect of this study is to investigate practical ways of implementing the learning platforms. We intend to speak generally about the challenges and opportunities afforded by these approaches inclusively as we explore their practical uses in the K10-12 education context. Online platforms that are in use in both formal and informal situations, particularly in education (like Blackboard or Moodle) or for social use (like Facebook or Twitter), are those pedagogies that are frequently linked to the implementation of these platforms.

Research objectives (ROs) and research questions (RQs)

The key objectives of this study are:

- (i) To identify the association between a school's adoption of new technologies and embracing a set of ICTs, specifically mobile learning and the school's performance.
- (ii) To cultivate students' ease of learning using technologies and improve their overall learning experience. And meet the requirements of national, social, and personal developments, which leads them to greater use of ICTs and permit users to navigate, learn, and communicate spontaneously to fulfill self-gratification.

Accordingly, this study applied the mobile learning technology and blended flipped classroom into K10-12 teaching to explore the characteristics of this teaching mode and then take its advantages to create effective learning and teaching (L&T) strategies in schools that promote deep learning.

To achieve the above-mentioned research objectives, this study was guided by three exploratory research questions that asked:

- (i) How do the affordances of mobile technology support widespread acceptance of learning in the COVID-19 environment?
- (ii) What are the contributing factors that facilitated schools and parents in embracing mobile learning?
- (iii) What critical challenges do schools and parents face in adopting mobile learning?

Methodological approach and data collection

The research design underpins the analytical identification of the learning environment and relevant variables. The design rests on the selection and application of data collection techniques, namely interviews, focus group discussions, non-participant observations, document, and social media account reviews, including thematic analysis methods (Meyer, 2001). With the compendium of the dataset, this study is interpretative, mainly intended to appreciate the realities of the research context from modern learners and the learning community who experience these realities (Creswell, 2003; Walsham & Sahay, 2006). To achieve the study objectives, a questionnaire was designed and distributed over a sample of 330 respondents.

Primary data

A survey questionnaire was developed to gather field study data in southwest India and Cambodia's capital and most populous city. The questionnaire incorporates general information data related to the respondents to gain an overview of the landscape of the L&T (Learning and Teaching) in schools, particularly the different media of L&T, their comfort zone, learning models, the services provided, and how they communicate. This was necessary because not much is known or documented about the different learning models and their media in developing countries and their e-inclusion approaches, including how they learn individually and for social development. The data collection methods included interviews (face-to-face and telephonic), focus group discussions, and non-participant observations.

Secondary data

This study applied a descriptive methodology using a literature review related to learning technology in mobile learning. Besides, this study also utilized a survey

methodology supporting the conclusion through the sample's responses, hypotheses testing, and providing a set of recommendations.

Research sample

A random sample was selected from the study population comprising staff members of the school, students, and parents. A total of 330 questionnaires were distributed, and 231 (or 70%) were collected. Table 1 shows the study sample distribution according to study variables.

Table 1: Sample distribution according to study variables (n=231)

Variable	Variable levels	Frequency	Percentage (%)
Gender	Male	80	34.6
	Female	151	65.4
Age	Less than 40 years	130	56.3
	41 – 50 years	71	30.7
	Over 50 years	30	13
Usage of ICT experience	Less than 3 years	39	16.9
	3 – 5 years	159	68.8
	Over 5 years	32	13.9
Nationality	Cambodian	172	74.5
	Indian	59	25.5

Study instrument

A questionnaire was developed after reviewing the literature from various references that deal with the research topic and related to the study objectives. The questionnaire comprised 25 questions. A Likert scale offered five options: Strongly agree = 5, agree = 4, neutral = 3, disagree = 2 and strongly disagree = 1. The study instrument consisted of the three following parts:

Section One deals with respondent's information such as gender, education, age, and experience. Section Two covers familiarity of ICT. Section Three measures the mobile learning adoption.

Analysis

Advantages of mobile devices in distance learning

In referring to RQ1: While the authors of the study contend that enriching student mobile engagement is the central feature of effective learning, the findings indicated that students could enhance their engagement through peer-led discussions and group work. This study also supports Gregen (2015), who asserted that conversations between the teachers and students, students and students within the classroom, draw attention to the quality of teaching and learning in an environment where collaboration occurs. In the same vein, Jay et al. (2019) argued that near-peer moderation programs working in partnership with faculty might increase student engagement.

The result of the study's findings is teachers' experience in teaching the subject demonstrates a corresponding methodology of blending theoretical and practical

exercises, which is vital for effective learning (Callaghan et al., 2002). Accordingly, students retain knowledge, especially when they can internalize the concepts taught, putting into practice what they are learning. In contrast, the rapid development of mobile technologies via smartphones, tablets, and laptops and online applications and tools has challenged educators to be radically transformed through the use of such technologies in their teaching and learning strategies (Alwraikat, 2017).

Online teaching and learning have become an everyday reality. The article provides an assessment of fully online course(s) delivered from teachers via Zoom, Google Meet, Google Hangouts or BigBlueButton in an online learning environment. Benefits and challenges of applied tools for online teaching and learning are delineated, leading to recommendations for future developments.

Two important affordances, viz. flexibility and portability, offer substantial benefits to students using mobile devices to access their LMS (Learning Management System) app. Students are no longer bound to a laptop or desktop computer, but with a fully functioning mobile LMS app, students can access their course on-demand (Lee, 2015; Ekúndayò & Tului, 2010). Through mobile devices and mobile LMS, students can better manage learning and their activities.

Adoption of new technologies in learning experiences

In referring to RQ2: Technology-based learning is changing the way learning takes place because of its numerous advantages; for example, it fosters more significant access to knowledge by offering to learn on-demand. It provides scalability to a small as well as large group of learners. Furthermore, the content and curriculum can be developed and updated whenever the need arises, and more interestingly, it can be done remotely. For these reasons, technology-based learning has seen tremendous development in the training marketplace in government, industry, and education.

The significance of technology to education has also been recognized by educational institutions in developing countries and, in particular, the suburban areas that are embracing ICT for teaching delivery in the post-pandemic epoch. However, the technology-based learning programs come in different delivery modes and forms. For example, Phnom Penh schools can deploy online tools, such as discussion boards and e-mail, and real-time events, through videoconferencing and web conferencing. They can be self-paced and have a varying focus of instruction. With the appropriate combination of delivery modes and methodologies, technology-based learning offers more than a repository of learning resources online or a new way of reaching learners at a distance. When executed well, it presents a way to complement any learning process, and in most cases, it can bring learning to places where it has not traditionally been accessible.

Discussion

According to the survey results and consistent with the extant literature, one of the critical reasons for developing technology-based learning is their potential to enhance teaching and learning (Tanu et al., 2020). Also, it encourages the development of student-centered, independent learning and fosters a deeper approach to learning. While the popularity of the e-learning environment promotes more flexible and independent learning due to its scalability, it can still present an obstacle to institutions that cannot afford the initial investment. So, finding ways to augment existing e-learning resources can alleviate the expense of content development. From an educator's perspective, it is necessary for students to be participative in the class and collaborate rather than merely listening and memorizing. The students must be driven to apply concepts to real-world situations or to critique an assertion or claim. Hence, meticulous organization of materials in the e-learning platform is crucial. To improve existing e-learning applications, learning environments should offer personal services to help students use, manage, and interact with the learning system (see Table 2).

Table 2: Conventional versus technology-based learning

	CONVENTIONAL	TECHNOLOGY-BASED
Goal	Deductive: Faculty determine the scope of learning and establish right and wrong answers.	Inductive: Students use their experiences to create indicators of successful outcomes.
Aim	the course or subject to be learned	based on student's learning behavior
Learning objectives	based on faculty's judgments	stimulate self-confidence through the knowledge and application of knowledge
Nature of learning	The content is established by a curriculum, and all students study the same topics at the same time.	systemic, non-linear, with multiple feedback
Learning approach	Students have access to limited information, selected by the faculty.	usually highly visual and highly kinesthetic
Design for	Knowledge intensive: Teaching students who learn best by listening.	Students work on activities and projects connected to long-term goals aimed at building deep conceptual understanding and proficient strategy use.
Assessment	Students sit for the exams in a controlled environment. Students need to memorize large extent of the material even though only part of it will be tested.	Students are aware in advanced the assessment format. Have input into the criteria by which they will be assessed, receive feedback from the faculty throughout a course.

Key learning and performance support

A well-structured portion of instructional content on a mobile platform, presented through a mix of audio, video, simulation, and animations, can easily explain complex concepts more clearly. The media mix in a mobile learning instructional content may profoundly engage the student's intellectual capacity through effective participation in a collaborative learning ambience. Furthermore, the availability and accessibility of social network applications also encourage individual contribution to a group task in a mobile learning endeavor, hence, unleashing lasting relationships in discipline and particular interest among participants in a collaborative environment. In a similar vein, the effectiveness of collaboration in mobile learning could be alleviated through faculty's attitude, quality of instructional content, and the suitable connections of multimedia tools of related activity and task.

Teaching effect analysis

After one semester, teaching effects were analyzed using students' questionnaires, reflection reports, students' interview contents, and test scores of the initial week and 16th week. The contrast of two tests scores indicates the students' grasp and retention of knowledge improved significantly after a semester of blended flipped teaching. The average score increased from 76.43 to 88.12, an increase of 15.3%.

This study also coordinated a course evaluation questionnaire to all 84 students using four teaching modes: teaching content, interactive response, and learning impact. The questionnaires applied a five-point Likert scale, five points referring to very satisfied, four points satisfied, three points generally satisfied, two points dissatisfied, one point very dissatisfied. The results are shown in Table 3.

This study also examined students' learning experience according to the students' bi-weekly reflection reports and interviews. Mainly students were satisfied with the learning experience on various online learning platforms such as Zoom, Google Meet, Google Hangouts, and BigBlueButton. Some said in learning and exploring off-class, virtual platforms created three-dimensional scenes and presented the lesson's main emphasis during the classroom situation. The personal space and sense of virtual scenes facilitated students in eliminating interferences and get fully engaged in the learning experience. Several students declared in their interviews that they prefer learning online as they would be less shy.

Table 3: Questionnaire results of learning through mobile learning

Problem Dimension	Problem Statement	Average Value	Standard Deviation
Teaching Mode	This model is conducive to acquiring and expanding learning resources.	4.15	4.15
	This model is conducive to personalized learning.	4.24	0.76
	This model is conducive to effective use of time.	4.09	0.82
	This model is conducive to the cultivation of knowledge.	4.21	0.47
Teaching Content	The difficulty of teaching content is appropriate.	4.22	0.66
	The teaching content features high applicability.	4.36	0.51
	The teaching content is new and exciting.	4.45	0.48
	The teaching content is contemplative and learner-centric.	4.21	0.71
Interactive Response	Teaching activities vary in form.	4.16	0.59
	Teacher's feedback is in time; there are opportunities for interactions between teachers and students.	4.01	0.77
Learning Impact	Opportunities for interaction with peers	4.13	0.65
	Subject knowledge has increased.	4.16	0.54
	Knowledge/skill has enhanced.	4.27	0.45
	Independent learning has improved.	4.25	0.79
	Critical thinking and analytical ability have improved.	3.87	0.83

Challenges faced by schools in developing countries

With reference to RQ3: The introduction of technology-based learning in schools is not without challenges. They include:

- Bridging the digital divide triggered by low computer literacy rates as well as the dearth of accessibility to technology amongst specific learner populations;

- social loafing occurs when students are indifferent towards technology-based learning programs and/or are frustrated in their attempts to make use of technology because of the program's lack of face-to-face interactions.

From the result, it is observed that the inequalities in most countries within schools are far smaller than those found outside of schools, viz. within communities and homes. Moreover, in most industrialized countries, many classrooms in all schools have a Wi-Fi environment. This goes some way to eliminate inequalities between schools in low-income areas and those in high-income ones. Nonetheless, students in more impoverished urban neighborhoods have access problems, not only in the school itself, but in the community and at home.

Technology-based learning can potentially lead to social loafing during which students reduce their level of effort when they perceive that doing so will not have adverse social effects. The main reason for this phenomenon is that without the face-to-face contact of instructors and peers, it is easy for students to perceive that they are not being monitored. In particular, larger class sizes can contribute to social loafing unless students are held answerable for their actions, requiring students to post contributions on group discussion boards, or require periodic deadlines for deliverables. Students who are frustrated by the technology or better able to absorb information through face-to-face contact with an instructor may also reduce their effort in technology-based learning, which may be perceived as social loafing.

India, as opposed to Cambodia, does not have a single nationwide education system. Students can choose several educational pathways, e.g., state board examination, national board examinations, or even an international board examination. It has been 34 years since India did a significant restructuring of its national educational policy. Unfortunately, the Ministry of Human Resource Development, Government of India (2020) announced the National Educational Policy just before the Covid-19 outbreak. The new policy emphasizes the need for further consolidation, standardization, and investments in the education system. Lack of access to quality education is a persistent problem in India, especially among low-income groups in remote and rural areas. This pandemic uncovered the real gap in accessibility to learning in India. Government schools in India could put together some form of e-learning experience in a haphazard manner, while the private school systems were well-thought-out and systemized. Top private schools offer students greater access to relevant information, reduced cognitive load, and increased digital access, such as smartphones, tablets, personal digital assistants (PDAs), laptop computers, and MP3 players.

Development of students' ICT competence the mobile learning adoption

The result of RQ3 is the contemporary notion that the instructor's ability to integrate ICT into the curriculum is vital to students' successful take-up of ICT. Consequently, the next step needed to make courseware practical and valuable for all students, is for publishers to focus on providing resources for teachers to integrate with their lessons rather than fully online courses that attempt to duplicate what instructors do.

Student capacity for self-learning is crucial for ICT skill acquisition. This is due to the nature of computing as an individual activity, particularly for lower and upper secondary students, and the elevated pressure for problem-solving triggered by the current state of the technologies. Students who can monitor their learning, acknowledge when they are unable to grasp a concept, seek help, and communicate their knowledge needs to instructors are more likely to learn best from a self-paced system than those who are weak in these abilities. The development of student's ICT competence is illustrated in Figure 1.

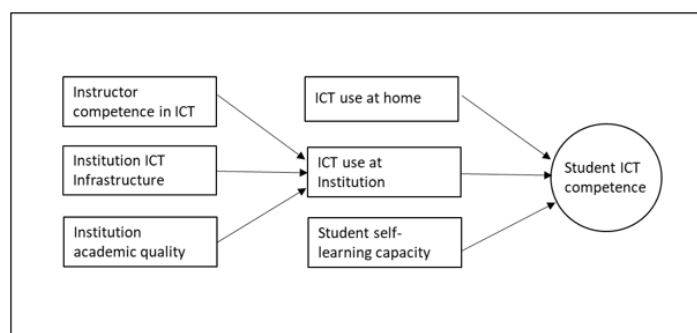


Figure 1: The development of student's ICT competence

Future research on technologies integration

A critical research area for instruction and curriculum lies in enabling faculty to make changes and bolster mobile devices like tablets, smartphones in their teaching delivery and finding effective ways to support them in this effort. The deployment of mobile technology in education provides new possibilities to integrate face-to-face learning and online learning. Many of our experienced and qualified faculty today are digital immigrants; hence, they have to keep up with their secondary school students (typically in Gen Z or iGen, or centennials) who are digital natives. The central question is that how should managers and educators construct the teaching tasks and assessments so that tablets and smartphones are essential parts of the learning toolbox for both faculty and students?

In this study, we concentrate on the instructional system design of mobile blended learning that can be used by faculty who are interested in delivering their lesson through mobile blended learning. The practical delivery of mobile learning and blended learning can be augmented via efficient instructional design and the inclination to use composite learning developments by combining various learning approaches and integrating a variety of ways to gain access to content by using mobile technology. Longitudinal

studies on mobile devices and pedagogy are needed by content areas (e.g., science, technology, engineering, and mathematics). Expanding non-traditional assessments to gauge student success and faculty effectiveness in the use of mobile devices should be meaningful endeavors.

To improve the implementation of mobile blended learning design, managers and educators can examine the essential steps of need analysis, design development activities, learning resources, determination of the learning evaluation, and validation by the experts. As the educational landscape continues to evolve and is being shaped by technological advancements, classroom teaching needs to change. Additionally, the issue of community investment in bridging the digital divide and in bringing e-learning to the poor and disadvantaged areas will continue to dominate discussions about technology-based learning in education and government.

Concluding remarks

Undeniably, web-based and mobile technology is increasingly ubiquitous and makes students ever more dependent on being connected to the internet regularly. Consequently, educators should consider to ingeniously inspire students to learn via mobile learning instead of conventional classroom instruction. One prevalent approach is the notion of blended learning (examined in detail by Halverson et al., 2017), where an online learning environment and activities support face-to-face classroom instruction.

As learning institutions accelerate the pace in mobile devices' uptake during the post-COVID-19 environment, they invariably depend on digital platforms to structure students' learning experiences. Schools must contemplate pedagogical practices and quickly adapt to exploit these changes. While this study shows that such pedagogies are still in their infancy, the authors believe that the instructional system design outlined above can guide making judgments about the efficacy of a learning platform and how best to use it in developing countries' education setting.

From the analysis of the development of students' ICT competence in mobile learning, the study found that mobile learning platforms should be encouraged for instructional delivery in the classroom to enhance students' performance. It should be recognized that mobile learning necessitates student mobility support and not simply support for mobile devices. The usage of mobile devices should be considered in support of other initiatives, for example, mobile calendar notifications for learning events.

Given the discussion on critical learning and performance support, a collaborative learning style should be employed more frequently for better performance during the mobile learning experience. It should be considered more often for students during group work and class assignments in the mobile learning environment.

Finally, students should be encouraged as much as possible to adopt the collaborative problem-solving learning style in writing their assignments. Simultaneously, it is advantageous

to provide access to ebooks to support online courses. However, there is a need to provide access to more than just ebooks, as learners require access to videos, podcasts, learning objects, and other performance support resources.

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