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How can a mobile device be effectively utilised for studying in an e-learning context?

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【Abstract】

71 students of diverse nationalities studying in Malaysia and Japan completed a survey on their e-learning preferences. The survey covered the kinds of devices they used, their choices of applications and browsers, and their feelings toward the Personal Learning Environment (PLE). A large proportion of these business, marketing and management students professed to a lack of confidence in their technological prowess. It appeared that study programmes would have to incorporate explicit teaching/training of the various modules that go into forming the PLE to meet success in e-learning, and design activities to take advantage of mobile device functionality.

【Keywords】

mobile device, e-learning, Personal Learning Environment (PLE), learner preferences

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Introduction

This paper investigates learner preferences in the use of mobile devices and applications in e-learning contexts or environments. There is still much for educators to glean regarding effective and ineffective patterns of use. Students are making use of mobile devices in multiple facets of their lives, both in directed learning at school and in unsupervised social situations outside school. Self-directed behaviour occupies a vast area, and it would be only scratching the surface to consider gaming, movies, music, social networking, texting, self-study apps, and video chat as part of that PLE world. Changing the connected world outside the school and classroom is less likely to succeed than inviting the virtual world into education. Tasks are increasingly designed to maximise the potential of e-learning, particularly with advances in broadband and mobile which enable voice, video and a graphical interface, where before the keyboard and text were central to activities. Hence, one of the key questions was whether educators should customise or adapt their e-learning materials, with a view to making them user-friendlier for learners with mobile devices, especially smartphones and tablet computers. It was hypothesised that learner preferences for interacting with mobile devices would be likely to have an effect on both usage and study success. A 20-question survey was administered to business and marketing students in universities in Malaysia and Japan, with a particular emphasis on learner attitudes toward PLEs. One outcome of the survey was that tablet use, and the way learners access mobile devices and select the most effective applications, was not as apparent as anticipated. The relevance of this realisation to the PLE is that greater support is needed for learners to make effective use of their e-learning contexts. Educators themselves will need to be more conversant with the affordances of the digital tools and materials at hand in order to encourage the students to make better use of them.

Background

While mobile apps or software are interesting to investigate in their own right, it is the characteristics of the mobile device or hardware, and the e-learning context, which form the focus of the current paper. One study investigating the specific functionality of the mobile phone (Kress, 2010) discovered that convergent mobile devices, those that sprang up with the advent of Web 2.0 technology, have come to change the way humans represent the world around them, creating new forms of composition suited to multimodal discourse and relying less on written texts. At the same time, the habitus (Bourdieu, 1977) in which humans exist has been undergoing a transformation, in that the socially learnt ways of behaviour that people take in as their own in their formative years have been influenced by the possibilities of the digital age.

This is especially important for business and management students examining consumer behaviour, reflected in purchasing patterns based on Maslow's Hierarchy of Needs (Maslow, 1970). Psychologist Abraham Maslow's hierarchical structure theorised that the order of development is fixed, implying that humans must attain a certain level before activating a need for the next level up (Maslow, 1970). Maslow listed the following needs in order of influence, with their levels ranging from the lowest to the highest: physiological, safety, social, esteem and self-actualisation (Saunders et al, 1998). Hence, a marketer's application of this hierarchy in a simplistic form could be working adult students with a thirst for education having it delivered in a PLE at a university:

- Physiological – I want to study in a Personal Learning Environment for my degree in a university
- Safety – I feel safe studying in a PLE as it is less formal and has a lower level of supervision/monitoring than a conventional learning environment
- Social – I am very happy to share my working experiences, skills and knowledge with my lecturers, students and friends alike anytime and anywhere I want (convenience)
- Esteem – There is a sense of belonging to and being part of the team through a discussion forum
- Self-actualisation – Studying in a PLE at a university gives me a sense of power, as I have become even more tech savvy than my General Manager who is five years my junior.

In the case of a technological device such as a tablet computer, the functions of what were disparate devices are now combined into one, satisfying multiple needs, and the individual makes meaning and forges an identity through the processes that the device encourages or opposes (Adami & Kress, 2010). Hence it is the affordances of a device, those things that are possible to express in a straightforward way when using it and those that are not, that impact on the learner and the e-learning context. Unlike a desktop computer, the screen of a tablet computer fills the surface area and the device dispenses with the keyboard. It does not have buttons like an older mobile phone, and indeed the phone function is hidden away entirely. By design, it 'foregrounds' (Kress, 2010) other features and functions, and these tend towards convergence and the visual but away from the written.

A number of key findings regarding the multifaceted convergence characteristics of the hardware came out of research into reflective practice by Palmer & Nur Iswanti (2013) undertaken using one kind of tablet computer, namely, the iPad. In particular, they highlighted

five main findings: first, that an instructor could benefit from the affordances of a mobile device at both the planning stage (e.g. taking pictures of household or office items to demonstrate in class) as well as during instruction (e.g. passing the tablet around groups and having students touch and select items); second, that there was a real time aspect to tablet use, which brought the dynamism of the outside world into the class, allowing educational activities to be recorded as still or moving images (e.g. live streaming on YouTube at the time they occurred for those who were not physically present); third, that activities could be captured and edited or reframed for later reflection and alternative uses (e.g. uploaded after class on to a blog); fourth, that they could reflect on the activities and teaching and learning processes (e.g. for professional development or programme accreditation); and fifth, that they could collaborate with other instructors and researchers (e.g. via voice chat or video conference), contributing to meaning making and knowledge construction (Palmer & Nur Iswanti, 2013). Business students can relate to the tactile nature of the tablet, drawing parallels between the appearance and touch of a device and the taste, texture, or smell of an item and the impact it has on customer experience and evaluation of the products and services. Students as consumers may prize the "PLE as a product and also a service" (Solomon, 2015) that carries them to faraway places, and depending on the course content allows them to experience the diversity of other cultures, even if it is only viewing how other students have behaved elsewhere.

Other attempts have been made to make sense of e-learning contexts themselves. Some have looked at the nature of the PLE, either conceiving it as a system (Van Harmelen, 2008) in which learners are helped to take the reins of their own learning and manage it, or alternatively by characterising it as learning through and in a community (Downes, 2010), one which embraces the online and physical world. Graphics of the PLE typically include apps which encompass search engines, digital scrapbooks, communication and sharing such as wikis and blogs, storage and management, as well as multimodal literacy tools, to cover video, sound, image manipulation and other essential aspects of a toolkit. Business, management and marketing students might prefer to view the PLE with themselves at the centre, surrounded by their groups or communities, their tags or news sources, their products or marketplaces, their blogs, their assets or social media services, and their profile or friends and contacts. The classroom instructor needs to take into account the interface of the available technology and the various interactions of teacher and students, students and students, and each of those individuals with their PLE and the PLEs of others. One effort to make sense of the choices (Harris and Harrigan, 2011) listed the technology employed to enable more learner autonomy, the kind of study

undertaken at an institution, the ability of a university to support learning through advanced technology, and adapting to working in new environments. Though that research focused mainly on study programmes, the emphasis here is on hard decisions that educators may have to make on adapting materials and activities to the mobile technology preferences and needs of today's learners. Business instructors, for instance, might examine how McDonald's decided to go global while acting local when they penetrated into foreign markets by localizing their food menu (Vignali, 2001), analogous to the course content structure fitting into the PLE. McDonald's has a standardised menu that tastes the same regardless of whether it is in India, Japan, Malaysia, or Spain. However, adaptation is necessary due to customs/laws and consumer tastes/preferences (Vignali, 2001). McDonald's chains in Malaysia and Singapore have to undergo rigorous inspections by Muslim clerics in order to obtain a "halal" certificate, indicating the fast food chain outlets in Malaysia and Singapore have a total absence of pork products (Vignali, 2001). Likewise, course content for mobile eLearning in the PLE reflects the global reach of the Internet, conditioned by local concerns, both cultural and course specific.

The Survey

The Survey Instrument

In order to gather and share data effectively, the survey was created using Google Forms. Forms in Google Drive are free to use and have no restriction on the number of people who can respond. Students take part in the survey via any web browser, which makes it flexible enough to reach out to a wide population of learners, including those who are not in class or on campus and is especially beneficial for those, such as the Malaysian students in the present sample, enrolled in open university online distance learning programmes. When reaching out to respondents for a survey on mobile learning, the PLE, and e-learning contexts, Google Forms helps by being set up for access anywhere from a mobile device. Results are aggregated in a spreadsheet, which makes analysis of data sets more manageable.

Reasons for the Survey

The main factor that served as the motivation to perform the survey was the need to find out about student use of mobile devices and apps. General surveys reveal little about the actual student population of the learners in the academic institutions and contexts where both of the current researchers are working. Additionally, the analytics software built into Google Forms makes it relatively simple to view the data and make apparent the relevance of the survey.

The purpose of the study was to ascertain how a mobile device could be utilised effectively for studying in an e-learning context, by asking respondents about their thoughts, feelings, and attitudes towards the advanced technological learning environment around them. An associated goal was to reveal and make sense of various aspects of the personal learning and institutional study relationship, by focusing on the PLE, an e-learning context of immense importance in the lives of learners raised in the digital age. The survey succeeded in magnifying the importance of convergent mobile devices and apps; however, it pointed to a troubling disconnect between student desire to use more technology in learning and an inability amongst many respondents to use current know-how in an appropriate way that aids the learning process.

Data Collection Process

The survey method involved university learners in Japan and Malaysia using the browsers on their mobile device to access the online survey via a link or QR code. 71 respondents studying business, management, and marketing completed the survey. The only criterion for inclusion in the survey was that the students were enrolled (and currently taking classes) at either of the universities where the researchers were working. Results were stored in a secure Google Drive, accessible only to the authors. Questions were divided into three main categories, in an effort to elicit information on the subjects of About you, About your PLE preferences, and About your learning. Question formation adhered to four types: multiple-choice; choosing from a list; checkbox; and sliding scale. Each type lends itself to particular responses, and the spread of questions was intended to aid research reliability (i.e. obtaining consistent answers in comparable situations) and research validity (i.e. corresponding to what those questions actually intended to measure). Asking respondents to select the closest or most accurate answer from a list, such as how often they do something, is a feature of multiple-choice questions, and compared to some other types they are less prone to problems of interpreting the meaning of questions. With many of the students taking the survey in a foreign language, multiple-choice questions helped to ensure reliability. Choosing from a list questions in drop down boxes limit the answers to one only, and while limited in scope, provide unambiguous answers to demands for personal information, such as age. Check boxes allow for multiple responses, and are used to find out as much as possible about individual preferences where there are likely to be wide variations between respondents, such as favourite apps or using tablets more than desktops. Sliding scales help to clarify to what extent an individual agrees or disagrees with a particular hypothesis. The help with questions concerning learning environments, confidence, and

affective needs.

Results and Analysis

~ About you ~

1 How old are you? (Multiple Choice)

2 What is your gender? (Choosing from a List)

3 What is your nationality? (Choosing from a List)

This section includes a brief overview of the background of the respondents. Question 1 asked respondents their age, with the majority of learners (54 out of 71) between 18 and 23, fitting the mould of the traditional university population. Concerning gender in Question 2, slightly more than half of the students (40 out of 71) were female. As for nationality in Question 3, 47 were Malays, 17 Japanese, and the rest were Indians (4) and Chinese (3).

~ About your PLE preferences ~

4 What devices do you use every week? (Checkbox)

smartphone	80%	laptop	63%
tablet	24%	netbook	0
desktop	24%	Chromebook	1%

In the second section, respondents were asked about their PLE preferences. Question 4 revealed that while one kind of convergent mobile device, the smartphone, was used by four-fifths of learners in the survey, more (63%) still used the laptop regularly than used the tablet (24%). The tablet is now used as much as the desktop (24%), despite universities favouring fixed desktops for learning over mobile by insisting that students complete class work in a CALL lab. Thus while the decision to purchase a smartphone is down to the individual, the choice of device to use for learning is frequently less than free. Institutional policies bring influence to bear on the choice of hardware, and it is still the case that certain instructors and programmes apply pressure on students to buy laptops with a keyboard (e.g. for practising standard computerised tests which demand keyboard use). Depending on the instructor, a smartphone may be banned in class while a laptop is permitted, something that may be confusing to students. Some institutions, even for technology-based instruction, prohibit the use of Facebook and other social networks on school hardware, which encourages learners to use their personal devices (such as smartphones) to sidestep what to them appear excessively rigid rules. Note that a possible bias

was detected in the question in that some respondents considered a tablet to mean a Windows-based tablet, hence even though they had an iPad they failed to check the box.

5 Which OS do you use every week? (Checkbox)

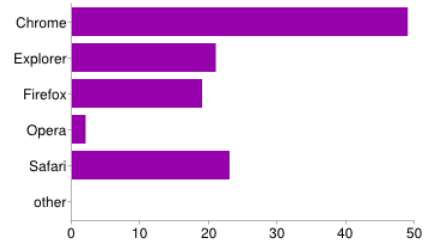
Android	55%	Mac OS	13%
iOS (iPhone/iPad)	42%	Linux	0
Windows	59%	other	0

It appears that student use of Android is overtaking Windows as the default OS, with Mac's OS and iOS combined equaling Android. That being said, Windows still represents the largest unique share. It would have been useful to find out which respondents use only one device and one OS, and which use multiple devices and are familiar with and proficient in using more than one OS. Increasingly, learners have access to a laptop and possibly a tablet as well in addition to a smartphone.

6 Which browsers do you use every week? (Checkbox)

Chrome	69%	Opera	3%
Explorer	30%	Safari	32%
Firefox	27%	other	0

Though the numbers adopting the Chromebook were low, Chrome is becoming the browser of choice across devices, with 69% of respondents using it every week. A visual representation makes its dominance in the survey clearer:



It could be that while Explorer (30%) is common amongst Windows users and Safari (32%) amongst Mac users, Chrome is seen as being multi-platform, enjoying popularity across devices. Whether this is a long-term development or short-term trend is hard to say, but it does fit the narrative of a generation of learners focusing more on convergent devices in constant communication over a cloud and less on software that might function well on one device but not at all on another.

7 Which of these productivity apps do you use? (Checkbox)

Any.Do	6%	Mailbox	52%
Buffer	6%	Microsoft Office Mobile	31%
CARROT-to-do	0	OneNote	4%
CloudMagic	1%	Pages, Numbers, Keynote	3%
Contacts+	14%	Pocket	0
Evernote	11%	QuickOffice	21%
Fantastical 2	0	Quip	0
GoogleKeep	10%	Sunrise	0
IFTTT	0	SwiftKey	3%

These apps were chosen based on their vast user base as reported by a number of websites covering the field of technology. Mail, word processing and spreadsheets remained the overwhelmingly common functions. It was notable that only 6% of respondents used Any.Do, a well-known task management app. Likewise, only 6% used Buffer, a social media management app. Nobody at all was using CARROT, a to-do list app, and hardly anyone (1%) used CloudMagic, an email client app. There was no respondent using either Fantastical or Sunrise, the calendar apps, or the recipes in IFTTT to create connections via simple statements, or Pocket as a save-for-later service. Respondents also ignored the productivity suite, Quip. There was no sense of a switch away from traditional desktop functions towards productivity apps to take advantage of the mobile PLE. It was hard to know whether this was because students learnt in school environments to perform traditional tasks favouring desktop and keyboard use and this carried over into home use, or whether students of their own accord still preferred to work in the old ways.

8 Which sites do you upload videos to? Check them. (Checkbox)

Break	1%	Vevo	3%
DailyMotion	11%	Vimeo	3%
Flickr	7%	YouTube	77%
Metacafe	0	other	23%
Veoh	3%		

YouTube is the overwhelming leader in this category (77%), though increasingly students appear to be posting content on their own sites (other), such as on their Google Drive. Some

respondents may have been confused by this question, which referred to video uploading in its widest sense. It would have been helpful to distinguish between video for one's own purposes, such as storing; video for viewing by invitation, such as an educational activity when it is peer reviewed by one's classmates; and video for general dissemination, such as a movie. It also leaves out the question of whether the video was self-generated or sourced from elsewhere, and whether it was for entertainment or assessment or self-promotion. When talking about the PLE and e-learning contexts, the social purpose behind uploading the video and the projected audience for the video content takes on enormous importance.

9 Which messaging apps do you use? (Checkbox)

hike	0	MessageMe	6%
KakaoTalk	8%	Tango	0
Kik	0	Viber	15%
LINE	51%	WeChat	55%
Nimbuzz	0	WhatsApp?	70%

The market appears to be dominated by LINE (55%) in Japan, and by WhatsApp? (70%) and WeChat (55%) more generally. Messaging proved to be one of the core functions, and its allure has remained while some other functionality (such as email) has declined in popularity.

10 Which social networks do you use? (Checkbox)

Facebook	92%	Mixi	0
Google Plus+	25%	Pinterest	4%
Gree	0	Tumblr	4%
Instagram	41%	Twitter	34%
LinkedIn	8%		

Facebook, sometimes derided in the media as the social tool of parents or the middle-aged, is still remarkably dominant (92%). What is not clear, however, is how active users are. The same respondent might have a Facebook and Twitter account that they rarely use, while spending most of their online time on Instagram (41%) or similar. It would be useful to know how much time students spend using each in a typical day or week. User profiles are free, and some accounts may be effectively dormant.

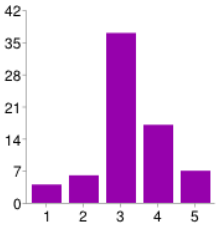
~ About your learning ~

11 What classes are you taking this semester? (Checkbox)

lecture	48%	English	32%
tutorial	45%	marketing	17%
project	25%		

In the third section, respondents were encouraged to talk about their own learning. The business, marketing, and management students involved in the survey cope with a wide range of classes, reflected in the data above. There was a possible area of confusion for the word lecture in English can mean different things to different people, and as noted already many of the students who took part in the survey were native speakers of English. Since this was a checkbox answer, there were several areas of overlap and the respondents may have checked marketing as well as tutorial or lecture to indicate the same class. What has to be borne in mind here, is that what is referred to as an English class, for instance, will have relatively few students compared to a lecture; and thus the learning context and environment will be correspondingly different.

12 How motivating for you are your classes at school/college/university? (Scale)



Being a scale question, the data are displayed graphically with a score of 1 denoting ‘not motivating at all’ and a score of 5 indicating ‘highly motivating’. There is a strong connection between questions 11 and 12. A motivating lecture and a motivating project may mean different things to different people. Taken as a whole, the data suggest that the emphasis on e-learning in both of the institutions involved in this survey has a positive correlation. The respondents indicate that in broad terms they do find their university classes motivating and they do indicate a willingness to make use of technology in their lives both inside and outside the classroom. While it would be a stretch to argue for causality between the high level of motivation and the use of mobile devices and apps, it appears to be an area deserving of more research.

13 How often do you meet in person with teachers or professors in school? (Multiple Choice)

almost every day	28%	monthly	17%
weekly or more often	32%	every few months	10%

less than twice per year	13%

Finding sufficient face-to-face time with academic faculty can be a major challenge for adult learners. It is very unlikely to be a case of either e-learning or meeting an instructor in person. Rather, learners need to be able to contact or speak with an academic adviser whenever they feel the need for support. While this question purposefully concentrates on the frequency of meetings, it would be instructive to know exactly how often respondents wish to meet their instructors, and to what extent it has a bearing on their educational success.

14 What do you use your mobile device for in class? (Checkbox)

taking photos or capturing images	46%	taking notes	39%
voice recording or video recording	18%	writing essays	14%
chatting	39%	reading articles	31%
watching videos	13%	bookmarking	6%
blogging	3%	gaming	15%
searching	77%	sharing or collaborating	20%

The respondents evidently use their mobile devices in class in a wide variety of ways. It would be informative to know which tasks require note taking, for example, and which apps and devices lend themselves to writing notes, storing notes, and using them in other study. Given that the most common function is searching (77%), it helps the instructor to focus on ways to search, and narrow the searches down into other sub-categories. Likewise, if bookmarking is used so infrequently (6%), then it suggests that the instructor might need to spend time on creative uses of bookmarking and how it fits into the PLE.

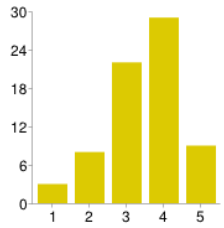
15 Do you prefer to use social media such as Facebook or WhatsApp for course discussions or do you prefer meeting your teacher? (Multiple Choice)

I prefer using social media	45%
I prefer meeting my teacher	55%

The difficulty of making sense of e-learning contexts is apparent in this question. Do students who prefer using social media dislike meeting teachers face-to-face; and are students who prefer face-to face resistant to social media? Course discussions is a term which may be interpreted as talking to some students and a formal discussion to others. Students may have in mind that they

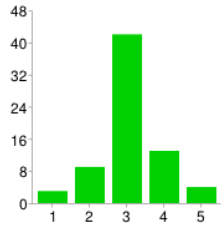
are conversing one-to-one with the instructor, or alternatively that it is a group discussion. Moreover, discussion can mean the spoken or the written word. Whenever a question asks for preferences, there is going to be ambiguity since it is a tendency towards one kind of behaviour and away from another. The general trend in evidence here is that there is not as much of a clearcut preference for face-to-face discussions as might have been anticipated.

16 How well do the teachers at your school/college/university create a school environment that matches the way you like to learn? (Scale)



It seems that students broadly approve of the school environment. What is still to be determined is what they understand by school, such as facilities (staffing levels to ensure cleanliness), or computer-equipped classrooms (investment levels to ensure excellence), or general ambience (friendliness). The way students like to learn can depend on learning style, but is also likely to be influenced by the kind of instruction they are accustomed to. Hence a system that drills and discourages students from asking questions may be in tune with the way they like to learn, and if a teacher follows a more innovative approach it may not resonate well with students.

17 How confident are you that you understand school content better through using the PLE than through traditional teaching methods? (Scale)



This question has inconclusive results. Though not leaning strongly one way or the other, it does not argue convincingly against the PLE as a learning tool; for it can be read in a number of ways, including the notion that learners in the survey are not yet adept enough at using the PLE to know its benefits. It lends credence to the idea that the PLE is still a murky construct for many, and that without clearer instruction on building a learning environment to best suit the individual learner, self-directed e-learning may frustrate students.

18 What do you use your mobile device for outside class? (Checkbox)

taking photos or capturing images	75%	taking notes	23%
voice recording or video recording	34%	writing essays	8%
chatting	79%	reading articles	46%
watching videos	69%	bookmarking	11%
blogging	14%	sharing or collaborating	34%
searching	73%	gaming	44%

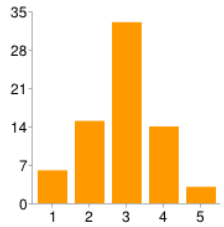
Best viewed in parallel with the responses to Question 14, respondents say they use their mobile devices outside class principally for chatting (79%), capturing still images (75%), searching (73%) and watching videos (69%). They rarely use a mobile device for essay writing (8%), bookmarking (11%), or blogging (14%). Given that the PLE is at the heart of individual efforts at organisation and community, the lack of bookmarking and blogging as core activities is striking.

19 How often do you try to learn something outside your home using the PLE? (Multiple Choice)

almost every day	27%	every few months	6%
at least once a week	41%	less than twice per year	15%
monthly	11%		

Efforts to learn via the PLE are as broad as massive open online courses (MOOCs), and as narrow as time alone on a game or using flashcards. Through the PLE, there are communities to collaborate with, news sources to read about, links to save and follow up on, marketplaces to find data on, products to rate, blogs to explain how to do things, social media services to connect with the right people to accomplish tasks, and the wider networks to simply ask for help or advice. The most common responses were learning virtually every day (27%) or on a weekly basis (41%).

20 How confident are you in your ability to support your own learning at home through the PLE? (Scale)



Responses to Question 20 are toward the negative side of the scale. As with Question 17, which was nevertheless slightly more positive, many respondents still lack confidence in their ability to use the PLE, and hence in this case are uncertain about e-learning contexts and how to use them. It underlines the fact that much more has to be done to convince students of the efficacy of predominantly e-learning environments. A follow-up survey could usefully focus on which areas in particular learners wish to be helped with.

Conclusion and Recommendations

The outcomes obtained paint a varied picture. As hypothesised, learner preferences for interacting with mobile devices do show an effect on usage, though success in study needs to be investigated more fully. Learners appearing proficient in the use of mobile devices notwithstanding, taken as a whole they were not sufficiently confident in their ability to use the PLE effectively (as evidenced in Questions 17 and 20). What is more, much as the respondents professed to be adept at using a wide range of applications, their choice and uses of apps did not display compelling evidence that they were competent in skills required for digital literacy (see Question 7). Effective and imaginative selection of apps was not as common as anticipated in a digitally literate generation. Some biases in the questions, as discussed in the previous section, may certainly have had an influence on the data. Similarly, the English level of the students (such as the students studying in their second language in Japan) may have negatively impacted their ability to answer the questions. Nevertheless, important reservations are raised concerning the ability of learners to do well in e-learning and personal environments, which in the age of cloud computing are linked and community-based.

A significant shift appears to be taking place in education concerning the personalising of the learning environment by learners to suit contexts familiar to them and their immediate needs. Responses indicate that educators and institutions have been making an effort to adapt to technological changes while at the same time customising e-learning materials to entice and enlighten students, including those who are working adults. The e-learning market is growing

domestically and internationally. Over and above rapid growth in the e-learning industry, educational institutions are in dire need of upgrading skills of all parties (students and educators) in the usage of mobile devices, the Internet, and the web, for educational improvement. The huge demand in this industry involves satisfying customer and learner needs. The main recommendation is for scaffolded programmes that are easy to implement and offer the most help to students in their e-learning contexts. Such study programmes will need to incorporate explicit teaching of the various components that go into forming the PLE to meet success in e-learning, and they will need to include activities that take advantage of mobile device functionality.

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