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Assessment of Filipino Higher Education Students' Readiness for e-Learning During a Pandemic: A Rasch Technique Application

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This paper investigated the level of e-learning readiness of Filipino higher education students in the midst of the Coronavirus Disease 2019 (COVID-19) pandemic. Although e-learning is not new in the Philippines, its enforced adoption nationwide as a measure to keep education going must be studied, given the general uncertainty in student readiness. Using Rasch analysis – specifically, the Andrich rating scale model (ARSM) for item response theory – results showed that student readiness for e-learning is a multidimensional metric that is consistent with many claims. Filipino students are ready in terms of computer/internet self-efficacy; however, they are not ready in terms of learner control. The differential item functioning (DIF) analysis showed that gender significantly differentiates e-learning readiness under learner control and self-directed learning. Meanwhile, program classifications have significant differences in responses under computer/internet self-efficacy and online communication self-efficacy. This paper reveals the importance of determining student readiness for e-learning in the midst of a difficult situation – a pandemic.

Keywords: Andrich rating scale model, COVID-19, differential item functioning, item response theory, online learning readiness scale, remote learning

INTRODUCTION

Technological innovations affect the way people think and learn. The transfer of knowledge – which is inevitable in schools, colleges, and universities – has become more convenient and efficient (Raja and Nagasubramani 2018). The integration of technology and education gave way to a positive paradigm shift that led to the increase in interaction and collaboration between teachers and students (Priti 2019). A by-product of this integration between technology and innovation is called e-learning, which is internet-based, *i.e.* learning transpires remotely through digital platforms (LaRose *et al*. 1998; Keller and Cernerud 2002). The United States (US) Commission on Technology and Adult Learning (2001) defined e-learning as instructional content or learning experiences delivered or enabled by electronic technology, which has the potential for high-quality education and training opportunities. This is supported by the US Department of Education (2010), which contextualized e-learning as learning that occurs partially or over the internet. It has become an important tool for enhancing the delivery, interaction, and facilitation of teaching and learning processes (Navani and Ansari 2016). Aside from flexibility, accessibility, and affordability (Sun and Chen 2016), e-learning provides a great opportunity for students to learn regardless of place and time, whether

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full-time or part-time (Worthen and Sanders 1987). Since access to lessons – including communication and collaboration among learners and teachers – happen online, the e-learning system is largely used in higher education (Navani and Ansari 2016; Ngampornchai and Adams 2016; Adams *et al.* 2018).

At the end of 2019, the COVID-19 pandemic created a multifaceted global impact on almost all sectors, including the education system (Osman 2020). Many schools, colleges, and universities were forced to shut down (Alqahtani and Rajkhan 2020), compelling administrators to come up with alternative ways of learning while putting the usual face-to-face learning set-up on hold. In response, educational institutions immediately shifted to distance learning – specifically, the e-learning set-up. The Philippines' Commission on Higher Education encouraged higher education institutions (HEIs) to continue with alternative modes of education (Joaquin *et al*. 2020). As an emergency response to the pandemic, e-learning became the modal solution for various academic institutions.

Although it has already been incorporated into the Philippine education system, as attested through the establishment of the University of the Philippines Open University in 1995 (Arimbuyutan *et al*. 2007), the enforced adoption of e-learning put the country in an entirely different situation. School administrators, teachers, and most especially students were caught unprepared for this new paradigm. The whole situation resulted in a decrease in national student enrollment in 2020 by 3 million from 27.7 million in the previous year in both private and public schools. This is due to the lack of resources and preparedness for the new system (Magsambol 2020).

Alexander and McKenzie (1998) pointed out that this lack of preparation for e-learning could result in learning failure among students as much as the benefits revolve around them (Holmes and Gardner 2006). A wide variety of literature identified student characteristics as a critical success factor (CSF) in e-learning above and beyond the teacher and the institution. In comparing the perspectives of the academic staff and the students on e-learning CSF, student characteristics ranked first for the former, whereas the latter ranked this as the second (Alhabeeb and Rowley 2018). However, this is in contrast to the study of Selim (2007), which found student characteristics the least CSF according to student perception. They instead prioritized infrastructure, instructor, and university support. These reviews support Al-Fraihat *et al.*'s (2020) claim that the factors affecting e-learning success differ depending on the institution's situation. In developing countries such as the Philippines, aside from infrastructure, the role of the instructor and the characteristics of the learners are given priority (Ngampornchai and Adams 2016). On the other hand, developed countries focus on building a strong knowledge economy (Gulati 2008). Furthermore, the primary goal of e-learning in developing countries is to make education available to more poor students (Bhuasiri *et al.* 2011). However, the sudden shift to e-learning systems due to the unexpected public health risk merits consideration, both in developing and developed countries. This should include its possible negative consequences, most especially to learners.

The e-learning system is still in its early stages in the Philippines. Although it was documented that open and distance learning had been in the Philippines since 1952, adoption was slow due to underdeveloped infrastructure, high cost, and the Filipino trait of resisting a new and unfamiliar system (Arimbuyutan *et al.* 2007). This was validated by Medallon's study of 350 new millennium higher education learners in the Philippines' Region IV-A in 2012. They concluded that, given the technological advancements, there has not been much change in how students want to be taught. They adopt technology as a tool but still prefer the teacher's presence in the classroom. Based on the 2013 market research report of Ambient Insight, seven countries in Asia were among the top ten with the highest e-learning growth rates worldwide. These were Myanmar, Thailand, Malaysia, Vietnam, Indonesia, Nepal, and Pakistan (University World News 2014). The Philippines has not yet reached that rank despite the creation of the Information Technology E-commerce Council, which is tasked to prioritize and support the promotion of e-learning as an innovative tool in a knowledge-based society (Dacanay 2010). On the other hand, Garcia (2017) studied college students in the Philippines who use e-learning through a learning management system (LMS). He found that factors affecting adoption are not limited to infrastructures such as internet connectivity, system interactivity, and integrated multimedia instruction; it also includes learner experience, skills, and attitudes. Good planning, which includes assessing the learner's skills and attitudes to eventually measure student readiness, will allow the opportunity for e-learning to be fully and comfortably adopted in the Philippines. This will lead the way for a globally competitive country.

Because of the Filipino trait of being resistant to change at the onset (Bernad 1979; Arimbuyutan *et al.* 2007), students struggle with adjusting to virtual learning environments from face-to-face learning, especially during the pandemic. From the traditional teacher-centered to this student-centered approach (Rasouli *et al.* 2016), questions on the Filipino student's readiness for the new learning environment must be answered. Rohayani and Kurniabudi (2015) mentioned that skills and attitudes are the most significant factors that influence e-learning in HEIs. Students' intention and characteristics, particularly

their e-learning readiness, is indeed an important issue to consider (Hung *et al.* 2010). Thus, the implementation of any e-learning program should be preceded by the measurement of readiness so that the institution is able to design a suitable and appropriate system to fit learning requirements (Navani and Ansari 2016). Imposing an e-learning system without assessing student readiness and needs is indeed an unfortunate move that causes this system to fail in HEIs (Adams *et al.* 2018). According to Rivera (2018), students' lack of readiness for e-learning adds to the academic pressure. In fact, several studies found student readiness as a predictor of successful completion of online coursework (Kuo *et al.* 2014; Demir 2015). As far as e-learning readiness is concerned, there are very few studies done on where the Philippines is currently positioned.

As defined by Maugis *et al.* (2004), e-learning readiness refers to the ability to pursue value creation opportunities through the internet. It is the ability to make use of e-learning resources and multimedia technologies to improve the quality of learning (Kaur and Abas 2004). In this study, Hung *et al.*'s (2010) online learning readiness scale (OLRS) – a multidimensional measure of readiness for online learning – was used. The OLRS has five dimensions: 1) computer/internet self-efficacy, which is the student's ability to demonstrate proper computer and internet skills; 2) self-directed learning, which refers to the student's responsibility for learning contexts to reach learning outcomes; 3) learner control, which refers to the student's control over his/her efforts in directing his/her own learning; 4) motivation for learning, which is the student's learning attitude; and 5) online communication self-efficacy, which is the student's adaptability to ask questions, to respond, to give insights, and to participate in online discussions.

According to Kirmizi (2015) and Rivera (2018), teachers need to identify each student's readiness level. This will enable teachers to develop effective strategies in assisting students in e-learning. Several studies show that student readiness levels differ based on their gender and program classification, among others. A study on e-learning readiness among students of diverse backgrounds in Malaysia showed a significant difference between genders and among educational levels (Adams *et al.* 2018). This study is further supported by Unal *et al.* (2014), which determined gender and grade level differences as influencers of student readiness for e-learning. Varying results have also been published regarding the role of gender in this aspect. In the study by Pingle (2011), it was revealed that there was a significant difference in readiness for e-learning among higher education students between genders. Hung *et al.* (2010), in contrast, found that male and female students demonstrated equal readiness for e-learning. However, in the paper of Mutambik *et al*. (2020), it was highlighted that clear disparity between genders happen but these should be interpreted carefully in consideration of cultural settings. On the other hand, the students' maturity also plays an important role in readiness for e-learning. Hung *et al.* (2010) found that higher student classifications are more ready in terms of self-directed learning, learner control, motivation, and online communication self-efficacy compared to students in lower levels. This is supported by the study of Rasouli *et al.* (2016), which revealed a significant relationship in e-learning readiness across program classifications, *i.e.* among undergraduate, graduate, and post-graduate students. Artino and Stephens (2009) conducted a comparative analysis of students in online learning grouped into undergraduate and graduate students. Though graduate students have relatively less experience with online technologies, they exhibited more adaptive self-regulated learning compared to undergraduate students. Since the findings showed a difference in readiness for e-learning, they recommended different sets of support for the two groups.

Following the discussion on student readiness for e-learning, this research aimed to: 1) determine the readiness for e-learning of Filipino higher education students during a different circumstance such as a pandemic; and 2) verify whether gender and program classification affect student e-learning readiness.

MATERIALS AND METHODS

Participants

The study utilized mixed methods, such that student readiness for e-learning was treated as a variable that can be measured by means of a questionnaire (quantitative), the values and determinants of which can be validated by means of a focus group discussion (FGD; qualitative).

Email addresses of students from the University of the Philippines Los Baños (UPLB) were obtained from the Office of the University Registrar. An affidavit of the undertaking was submitted, ensuring that the students' email addresses will be used only to answer the objectives of the study and that confidentiality of the information obtained will be kept. The respondents gave their consent by proceeding to answer the survey, allowing the researchers to gather personal information subject to the Data Privacy Act of 2012 (Republic Act No. 10173).

A random sample of 290 students was determined using a margin of error of ± 0.04, a confidence level of 0.95, and a design effect of 0.50. The sample of students, which was

stratified by program classification (Rasouli *et al.* 2016) with 80% undergraduate and 20% graduate students, were given a link to an online survey *via* the university's mailing list. When students were difficult to reach through email, the researchers sent the survey invitation *via* Facebook Messenger or through short messaging service.

To have a deeper understanding of and to validate the empirical findings, FGDs were conducted. Included in the online survey was a question on whether the respondent is willing to participate in an FGD. Seventy-four (74) respondents said yes. From these, 48 were shortlisted according to their gender and program classification, such that each cross-classification is equal in number. Invitations to the FGD were sent to these students, but only 13 signified to attend – six undergraduate students and seven graduate students, 62% of which were female. Two separate FGDs were held *via* the Zoom platform, one for each program classification.

Data collection lasted for three weeks from June–July 2020.

Instrument for Assessing Student Readiness for e-Learning

This study adopted the OLRS developed and validated by Hung *et al.* in 2010, which has reported composite reliability of 0.74–0.87 and convergent validity using average variance extracted 0.49–0.69 in all five dimensions. Some studies that applied OLRS were those of Kaymak and Horzum (2013; 85% overall internal consistency), Cigdem and Yildirim (2014; 74–87% internal consistency across dimensions), Kirmizi (2015; 64–88% internal consistency across dimensions), Buzdar *et al.* (2016; internal consistency not reported), Kayaoglu and Akbas (2016; 79–98% internal consistency across dimensions), Elnakeeb and Khalifa (2016; 74–85% internal consistency across dimensions), Engin (2017; 74–86% internal consistency across dimensions), and Cavusoglu (2019; over 70% internal consistency).

The survey questionnaire has three parts: 1) respondent details, 2) access to technology, and 3) e-learning readiness. The latter was measured using five dimensions: 1) computer/internet self-efficacy with three items; 2) self-directed learning with five items; 3) learner control with three items; 4) motivation for learning with four items; and 5) online communication self-efficacy with three items. There were 18 items in total, answerable by a five-point Likert scale, with 1 being "strongly disagree" and 5 as "strongly agree."

To ensure that the survey instrument has encompassed important aspects of e-learning readiness, expert advice was solicited from one professor and two students who have considerable experience in e-learning. They were asked to comment on the wordings and context usage in the OLRS and to suggest improvements if necessary. All three experts agreed to use the OLRS in its original language (English) with no content revisions. The instrument was also pre-tested by five students who were able to answer the items without question or confusion.

The FGD, on the other hand, provided answers to questions that were not asked in the survey instrument. Since the main objective of the discussion was to validate the results of the survey, questions given to the participants were mostly open-ended and closely related to the survey instrument. An in-depth discussion was conducted by the researchers to attempt to draw out the participants' attitudes, perceptions, and experiences regarding their readiness for e-learning, which would otherwise be difficult to obtain with only a survey. Participants were able to share their opinions and experiences equally during the open discussion.

Rasch Analysis

More recent approaches to psychometric measurement have been adopted (Banerji *et al.* 1997; Pallant and Tennant 2007; Mahmud *et al.* 2013; Hagquist and Andrich 2017; Mendoza *et al.* 2019), particularly those associated with the Rasch measurement model (Rasch 1960). The Rasch measurement provides a common metric used to express results regardless of the construct being measured or the instrument being used. It gives the expected response to items based on the assumption that the probability that a person will agree to an item is a logistic function of the difference between a person's level of e-learning readiness (in this study) and the level of readiness expressed by the item in the questionnaire. Data collected from questionnaires were tested against these expectations using a variety of fit statistics (Smith 2000). When data fit the model, a linear transformation of the ordinal raw score is obtained and expressed in logits. These scores can now be used for parametric analyses given that distributional assumptions are met.

Aside from providing linear transformations of the ordinal raw score, Rasch analysis also delivers a neat approach to some key methodological facets of scale development such as construct validation, questionnaire reliability, correct category ordering, and DIF (Boone and Noltemeyer 2017). For these reasons, Rasch analysis was performed on each of the five dimensions of e-learning readiness – specifically, the ARSM (Andrich 1978) was used since data are of polytomous type (*i.e.* Likert-type items). The ARSM is a variation of the traditional Rasch model developed for dichotomous scored items and, as with all Rasch models, item difficulty, person ability, and reliability could also be determined.

Data processing was done using STATA 12.0 and WINSTEPS 4.5. To reflect the sampling design, survey weights were applied to generate estimates of the proportion. To give an impression of the student readiness for e-learning, descriptive statistics were generated. In interpreting these statistics, note that the Rasch model transformed the original responses in the Likert scale into a logit scale so that the higher the logit score, the more ready the student is for e-learning. DIF was then used to show the extent to which items in the questionnaire were measuring different levels of e-learning readiness in students from different subgroups (gender and program classification). The Rasch-Welch *t*-test was particularly used to estimate the Rasch difficulty for the item for each subgroup through an iterative logistic regression model. It was assumed that, since all the respondents were new to e-learning (they have not finished a full-online class) and most (98%) have tried only a few LMSs, the subgroups were nearly homogeneous in terms of readiness. By identifying DIFs, the study recognized the subgroups of students who exhibit different levels of readiness for e-learning. This was done across items in the questionnaire to provide appropriate recommendations.

RESULTS

Survey Respondents' Profile

Table I shows that the UPLB student population is mostly female at 59% (see Appendices section). Based on their classification, most of them belong to the undergraduate program (80.34%).

Although 97% of UPLB students have tablets or smartphones and 89% have desktops or laptops, only 58% have access to a fairly fast and reliable internet connection. About 81% and 77% of students possess cameras and speakers, respectively, but only 41% of them own a printer. These statistics are presented in Appendix Table II.

Student Readiness for e-Learning

The index of raw variance when taking all 18 questionnaire items together was 50%, which was greater than the standard of 40% (Fisher 2007; Adams *et al.* 2018). However, the eigenvalue of the first contrast was above the ideal value of less than 2 (Raîche 2005), which means that there was a non-Rasch explanation for the unexplained variance. Breaking down the instrument into five dimensions, the index of raw variance explained by each dimension ranged from 56–67%. The eigenvalues in the first contrasts suggested that the instrument, through its separate dimensions, gives a good unidimensional scale and can, therefore, effectively measure the e-learning readiness of the students. In terms of OLRS reliability, the interaction between the student and the questionnaire items was described by the Cronbach's alpha coefficient of 0.89, which indicates a very good internal consistency (Ursachi *et al.* 2015).

The degree of students' readiness for e-learning is described in Appendix Table III. Findings showed that students were quite ready in terms of computer/internet self-efficacy and motivation for learning as their mean scores of +2.3 logit [standard deviation (SD) = 2.67] and +2.06 logit (SD = 2.44), respectively, are higher than zero logit. In fact, the students gave the highest ratings on these two dimensions. The sentiment of the students was neutral when it comes to readiness in self-directed learning and online communication self-efficacy. The mean scores on these dimensions were near-zero logit at +0.65 (SD = 1.52) and +0.08 (SD = 2.01), respectively. It is important to note that students rated their readiness in learner control with a mean score of –0.08 logit (SD = 1.53).

Appendix Table IV shows the item difficulties of student readiness for e-learning. Under the computer/internet self-efficacy dimension, students readily agreed that they feel confident in performing the basic functions of Microsoft Office (CS1, –1.11 logit). However, they found it hard to agree that they feel confident in their knowledge and skills in managing online learning platforms (CS2, +1.10 logit). Among the five items under the self-directed learning dimension, students found it easy to seek assistance when faced with learning problems (SL2, –0.75 logit) and have higher expectations for their learning performance (SL5, –0.47 logit). In contrast, they found it hardest to manage their time well (SL3, +1.09 logit). Moreover, under the learner control dimension, the students found that repeating online instructional materials based on their need (LC3, –1.42 logit) was the easiest to agree with, whereas not getting distracted by other online activities while learning online (LC2, +1.72 logit) was the hardest to agree with. For the dimension of motivation for learning, students found it very easy to agree that they are open to new ideas (ML1, –1.13 logit) but found it difficult to agree that they have the motivation to learn (ML2, +1.03 logit). Among the items under the online communication self-efficacy dimension, the students agreed most easily that they are confident in using online tools to effectively communicate with others (OS1, –0.49 logit), whereas having confidence in posting questions in online discussions (OS3, +0.68 logit) was the most difficult to agree with.

Gender and Program Classification Differentiate e-Learning Readiness

Appendix Figure I shows a significant difference in DIF measurements across gender in the learner control dimension (LC3 *p*-value = 0.0261). Male students feel that

they are less likely to repeat online instructional materials based on their needs (LC3) compared to females (see Appendices section).

For the self-directed learning dimension, only the item about seeking assistance when faced with learning problems resulted in a significant difference between males and females (SL2 p-value = 0.0042). Appendix Figure II shows that females are more comfortable than males in seeking assistance when faced with learning difficulties (SL2) (see Appendices section).

Appendix Figure III shows that a significant difference in DIF measurements exists between program classifications (CS2 p-value = 0.0027 and CS3 p-value = 0.0115) under the computer/internet self-efficacy dimension (see Appendices section). Graduate students have more confidence in gathering information online (CS3) compared to undergraduate students. However, since they belong to the "net" generation or those called digital natives, the latter group is more confident in terms of skills in managing e-learning platforms (CS2).

Investigating whether there is DIF at work in the online communication self-efficacy dimension, it was found that there are significant differences in DIF measurements between program classifications (OS2 p-value = 0.0161 and OS3 p-value = 0.0372), as shown in Appendix Figure IV. Undergraduate students are more confident in expressing themselves through text (OS2) compared to graduate students, but the latter group professes more confidence in posting questions during the online discussion (OS3).

Emerging Themes from the FGD

Three themes emerged during the FGD: 1) home is the new classroom; 2) it takes two to tango to achieve a great e-learning experience; and 3) financial aid and access to technology are drivers of e-learning readiness.

Home is the New Classroom

The participants in the FGD have no setbacks in terms of readiness with the computer/internet self-efficacy (CS) dimension. This is consistent with the result shown in Appendix Table III, with CS having the highest mean score of +2.3 logit. Meanwhile, the consensus was that learner control (LC) – followed by motivation for learning (ML) – were the dimensions of e-learning in which students find themselves not ready. Based on the survey result in Appendix Table III, the LC dimension has the lowest mean score of –0.08 logit. As one participant stated, "It is important to emphasize that there are students with responsibility in their own family. How would they be able to balance their responsibility from home and from academics?"

It Takes Two to Tango to Achieve a Great E-learning Experience

During the discussion, one participant who already experienced e-learning before the onset of the COVID-19 pandemic shared the impact of learning resources and assessment on the success of e-learning. An ill-prepared course module and the lack of proper scheduling of learning activities can cause learners to lose attention and motivation throughout the entire course. This is related to the result shown in Appendix Table IV, which emphasized that the students easily agreed on the repetition of online instructional materials (LC3, –1.42 logit).

A strong connection through constant communication between teacher and student is necessary to help learners be motivated and involved in achieving their academic goals, especially during the pandemic. This is very crucial since it is also shown in Appendix Table IV that students found it difficult to agree that they are motivated to learn (ML2, +1.03 logit). However, as one of the participants expressed, "Not only our teachers must do their job, but we as learners must do our part," and this was unanimously accepted by all.

The discussion also highlighted the importance of communication among learners. The importance of communication among students was quantified in Appendix Table IV when students most easily agreed that they were confident in using online tools to effectively communicate with others (OS1, with –0.49 logit). One of the participants stated that student-to-student relationships can prevent possible drop-outs and increase participation in an e-learning environment, especially for synchronous learning.

Financial Support and Access to Technology: Drivers of E-Learning Readiness

One participant stated that, "The transition from physical learning to online learning will still be difficult." This is due to problems caused by the abrupt shift to e-learning in the Philippines due to the COVID-19 pandemic. All the participants admitted that the challenge of unreliable internet connection added to the limited or even the lack of access to useful gadget/technology that can hinder them from learning. This is reflected in Appendix Table II, which shows that around 42% of students do not have a fairly fast or reliable internet connection.

DISCUSSION

Findings showed that student readiness for e-learning is a multidimensional metric consistent with many claims. It also showed that the OLRS developed by Hung *et al.* (2010) has a very good level of reliability. Overall, the

OLRS has shown considerable validity and reliability to measure the e-learning readiness of Filipino higher education students.

Among the five dimensions, the learning environment and controlling learning progress are areas in which the students are not ready. This is similar to the result of the study by Joaquin *et al.* (2020), which showed that there is a connection between the quality of the learning environment at home and the effectiveness of online lectures during a pandemic. The low score in learner control is also attributed to some challenges expressed by the participants in the FGD such as non-academic online activities and family-related problems/duties. Students are also not motivated in e-learning, although they are open to new ideas. One FGD result suggested that the development of course materials matters to a student's motivation for learning. Although students are confident in performing the basic functions of Microsoft Office, they are not in managing e-learning platforms, particularly the LMS.

In addition, DIF findings show that gender and program classification differ in responses for all dimensions, except for motivation for learning (ML). Differences in student e-learning readiness between genders were found under the learner control and self-directed learning dimensions. Meanwhile, program classification differentiates student e-learning readiness under the computer/internet self-efficacy and online communication self-efficacy.

It was emphasized during the FGD that, although participants admitted the lack of readiness under the learner control and motivation for e-learning dimensions, they claimed that these can be easily solved if technological and financial support is provided. In fact, this claim is supported by the survey results showing that around half of the students do not have fast and reliable internet access.

CONCLUSION

This study investigated the level of e-learning readiness among Filipino students in higher education during the pandemic in terms of five dimensions: computer/internet self-efficacy, self-directed learning, learner control, motivation for learning, and online communication self-efficacy. It also confirmed significant differences in their readiness based on gender and program classification.

It was found that, although Filipino students are ready in terms of computer/internet self-efficacy, they are not ready in terms of learner control. Sources of distraction such as social media, house chores, family duties, and work responsibilities pull the learner's focus away from his/her academic tasks, resulting in loss of productivity. Hence, it is necessary for students to maintain a healthy school-life balance even while getting educated through e-learning. This can be achieved if the learners would set boundaries through proper planning and enhancing their time management skills, ensuring that there are no academic goals and household responsibilities overlooked. Other household members should also be aware of these boundaries such that there will be a concerted effort to support each other, promoting mental health in the process, especially during the pandemic. It is further recommended for students to turn off online notifications except those crucial to learning during his/her study period.

Although e-learning is centered on students, teachers play an important role in achieving course learning goals. The study guides should include a detailed schedule of activities for the entire semester so that the students will be able to manage their time well. The course design should uphold the principles of empathy, understanding each learner's situation and differences as shown in the DIF results, and inclusivity by considering the learner's needs. Since students find it hard to sustain their motivation for learning, teachers should find ways to pique the interest of students through various resources such as videos, podcasts, online games, and illustrations, which will suit the students' profile. It is also important to include learning activities that will promote opportunities to work with their peers. According to Hung *et al.* (2010), "to prevent burn-out or loss of interest when studying online, students should take advantage of opportunities to work with other online students." Since some students are hesitant to post questions in the online setting, teachers should allay students' fears and apprehensions by explaining the purpose of online discussions. All lines of communication (*e.g.* email, text, chat, *etc.*) should be open for students to engage with their teachers and peers. Since online communication skill is a prerequisite to lifelong learning, discussion forums are highly encouraged for students to acquire it.

Due to the undergraduate students' lack of readiness to direct their own learning progress, asynchronous meetings might help them practice independence. On the other hand, graduate students who are less familiar with the LMS but are more able to direct their own learning can benefit from attending synchronous meetings. Hence, a blend of asynchronous and synchronous meetings can help students as well as their teachers in tracking their progress. Furthermore, it is recommended for institutions to provide training activities on the use of LMS.

Since it was found that one of the students' problems in e-learning is an unreliable internet connection, an internet subsidy will help. The university can collaborate with other public and private institutions, especially in remote areas, to overcome the limitations brought about by poor

internet connectivity. Overall, in order to successfully shift to e-learning – especially during the pandemic – teachers, students, and higher education institutions should collaborate with each other.

This paper is limited to students who have not experienced a fully online learning environment but have tried the use of LMS. The study only focused on the general online learning mode and did not include different classifications of instruction delivery (*e.g.* purely conducted online, hybrid, or blended format). Moreover, student readiness for e-learning was measured using the OLRS developed by Hung *et al.* (2010). Data collection can be improved by increasing the number of focus groups and the number of participants. Although the study did not undergo research ethics review/approval, consent was given by the respondents under the Data Privacy Act of 2012. Prediction of any future behavior (of technology usage) is not part of the goals of this paper, but future researches may investigate possible associations of academic performance with e-learning readiness. Possible recommended researches may include an assessment of teacher-institution readiness for e-learning, quantifying the change in student readiness for e-learning before and after the experience, and characterizing the least ready students.

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APPENDICES

Table I. Profile of UPLB students.

Characteristic	Percentage (%)
Gender	
Female	58.97
Male	41.03
Program classification	
Undergraduate	80.34
Graduate	19.66

Table II. Access to technology of UPLB students.

Technology	Percentage (%)
Desktop/laptop that runs reliably on Windows or other operating systems	88.66
Tablet/smartphone	96.90
Internet access with fairly fast, reliable connection	57.59
Headphones/speakers and a microphone	76.90
Printer	41.38
Camera	80.69

Table III. Student readiness for e-learning in Rasch scores.

Dimension	Mean	Standard deviation (SD)
Computer/internet self-efficacy	2.30	2.67
Self-directed learning	0.65	1.52
Learner control	–0.08	1.53
Motivation for learning	2.06	2.44
Online communication self-efficacy	0.08	2.01

Table IV. Item difficulties in each dimension.

Dimension	Difficulty	Standard error (SE)
Computer/internet self-efficacy (CS)		
CS1. I feel confident in performing the basic functions of Microsoft Office programs or their counterparts.	–1.11	0.13
CS2. I feel confident in my knowledge and skills of how to manage online learning platforms	1.10	0.10
CS3. I feel confident in using the Internet to find or gather information for online learning.	0.01	0.12
Self-directed learning (SL)		
SL1. I carry out my own study plan.	0.12	0.08
SL2. I seek assistance when facing learning problems.	–0.75	0.09
SL3. I manage time well.	1.09	0.08
SL4. I set up my learning goals.	0.00	0.08
SL5. I have higher expectations for my learning performance.	–0.47	0.09
Learner control (LC)		
LC1. I can direct my own learning progress.	–0.30	0.08
LC2. I am not distracted by other online activities while learning online.	1.72	0.08
LC3. I repeat the online instructional materials on the basis of my needs.	–1.42	0.09
Motivation for learning (ML)		
ML1. I am open to new ideas.	–1.13	0.13
ML2. I have motivation to learn.	1.03	0.10
ML3. I improve from my mistakes.	–0.49	0.12
ML4. I like to share my ideas with others.	0.59	0.10
Online communication self-efficacy (OS)		
OS1. I feel confident in using online tools (*e.g.* email, discussion) to effectively communicate with others.	–0.49	0.09
OS2. I feel confident in expressing myself (*e.g.* emotions and humor) through text.	–0.19	0.09
OS3. I feel confident in posting questions in online discussions.	0.68	0.09

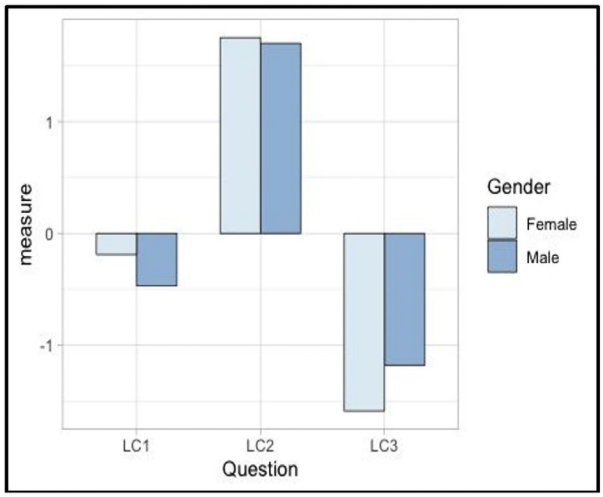

Figure I. Logit scores on items under the learner control by gender.

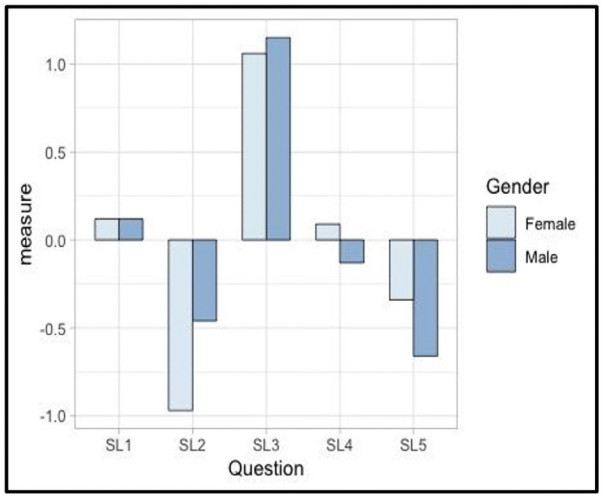

Figure II. Logit scores on items under self-directed learning by gender.

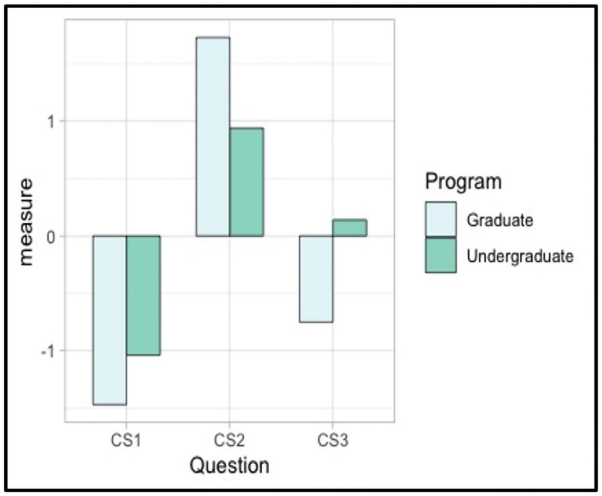

Figure III. Logit scores on items under computer/internet self-efficacy by program classification.

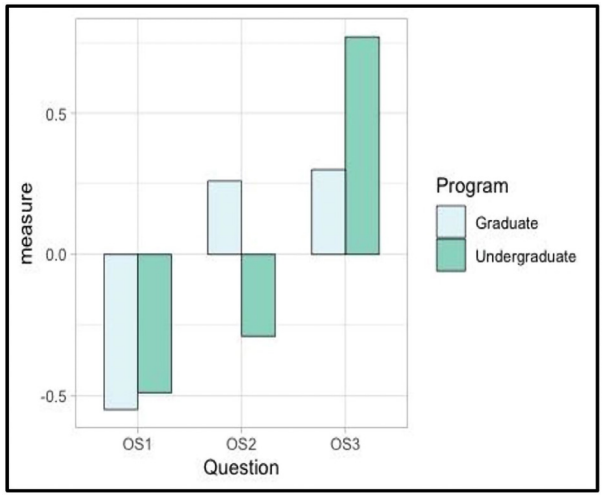

Figure IV. Logit scores on items under online communication self-efficacy by program classification.