Overcoming challenges to make e-learning a panacea for present and future crises

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Abstract

Purpose – This study identified salient challenges related to future preference for e-learning of undergraduates during closure of institutions of higher learning due to the Coronavirus disease 2019 (COVID-19) and put forth suggestions to overcome challenges of e-learning for present and future crises.

Design/methodology/approach – Undergraduates were drawn from two universities in Malaysia who normally attend conventional classroom learning. Underpinned by the literature, the challenges and future preference for e-learning were operationalised into statements. Data were collected via a self-administered questionnaire hosted on Google Forms and were analysed with Statistical Package for the Social Sciences and STATA statistical software.

Findings – The hierarchical multiple linear regression results showed that the salient challenges related to undergraduates' future preference for e-learning, in descending order, were learning outcomes, followed by disadvantages (negatively) and discipline. Moreover, there were nuanced gender differences on the relative importance of salient challenges related to future preference for e-learning.

Research limitations/implications – Because the literature on e-learning during the closure of institutions of learning due to the COVID-19 pandemic is evolving, some salient challenges may not be captured in this study. Next, this survey was carried out in July 2020 when all courses were conducted using one hundred per cent e-learning for the first time. Hence, future replication studies may produce different results. Lastly, findings are not generalisable to other contexts as the salient challenges may be unique to the Malaysian context.

Practical implications – Concerted efforts by all stakeholders to address these salient challenges will shift e-learning in higher education closer to a panacea during present and future crises.

Originality/value – The sudden and involuntary switch from face-to-face learning to e-learning during the closure of institutions of higher learning due to the COVID-19 pandemic provided opportunity to research the salient challenges encountered by undergraduates and to overcome these salient challenges.

Keywords E-learning, E-learning challenges, E-learning future preference, Hybrid learning, E-learning readiness

Paper type Research paper

Introduction

The COVID-19 pandemic has ravaged the world for more than two years. To control the spread of the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), many public places were closed. Hence, institutions of higher learning (IHL) were not allowed to conduct face-to-face teaching and learning. To date, the scale and duration of closure of IHL are unprecedented in history (UNESCO, 2020c) and has severely disrupted the routine learning schedule (Zayapragassarazan, 2020). The closure of IHL carries high social and economic costs (UNESCO, 2020a). Interrupted learning deprives learners of opportunities for learning, growth and development (Almaiah *et al.*, 2020). Moreover, extended interruption of study causes suspension of learning time, loss of knowledge and skills gained (Reimers and Schleicher, 2020) due to forgetting and lack of practices.

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Almost overnight, e-learning was adopted as a strategic response to this sudden interruption of educational processes as a result of the COVID-19 pandemic (Crawford *et al.*, 2020; UNESCO, 2020c; Zhou *et al.*, 2020). By switching to e-learning, there is continuity of teaching-learning activities to protect educational opportunities of learners (Reimers and Schleicher, 2020). In other words, "School's Out, But Class's On" (Zhou *et al.*, 2020). Notwithstanding, e-learning can create adverse consequences, especially for vulnerable and marginalised learners (UNESCO, 2020a).

Under normal circumstances, e-learning can be an effective way to complement, supplement and reinforce learning experiences within the broader education context (Zhou *et al.*, 2020). Therefore, IHL should exploit digital innovation to enhance their teaching and learning process in a well-planned and progressive manner. However, the sudden and involuntary switch from face-to-face learning to one hundred per cent e-learning without any prior experience with one hundred per cent e-learning, proper training or mental preparation posed many challenges for learners (Looi *et al.*, 2022). After this sudden disruptive change in the mode of delivery for higher education, what is the future outlook for e-learning from the perspectives of learners? Will learners abandon e-learning once their IHL are re-open or do they prefer a combination of conventional learning and e-learning (i.e. hybrid learning)? A better understanding of learners' contextual challenges and their future preference is essential to urgently mitigate negative impacts of challenges and increase the effectiveness of e-learning during crises. Presently, there is scarcity of theorising on the contextual challenges and future preference for e-learning during the closure of institutions of learning.

The tug-of-war to eradicate the COVID-19 pandemic is characterised by new waves (new surges) and new variants of the SARS-CoV-2. This war is not expected to end soon. Besides, new and more deadly viruses may emerge in the near future (Parkhill, 2020). Additionally, natural disasters and other crises are expected to happen more frequently in the future, seriously disrupting the delivery of higher education. Taken together, e-learning is likely to continue for some time. Consequently, a future crisis response plan for the education system facing major emergencies should be in place right now. Therefore, the purpose of this study is twofold. First, to identify salient challenges of e-learning related to future preference for e-learning of undergraduates. Second, to put forth suggestions to overcome salient challenges of e-learning for present and future crises.

Literature review

E-learning exploits digital innovation to enhance teaching and learning (Looi, 2021) but it is not a recent phenomenon (see, for example [Song *et al.*, 2004]). There were many studies on e-learning using well-known models such as Technology Acceptance Model (Davis, 1986), Unified Theory of Acceptance and Use of Technology (Venkatesh *et al.*, 2003), Theory of Planned Behaviour (Ajzen, 1991, 2014; Looi and Klobas, 2020) and Community of Inquiry (Garrison *et al.*, 2010; Lee *et al.*, 2020). A key underlying assumption of these models is volition. In other words, learners choose to adopt e-learning contingent on factors such as perceived ease of use (effort expectancy), perceived usefulness (performance expectancy), attitude (desirability), subjective norm (desirability), perceived behavioural control (feasibility), intention, et cetera. However, adoption of e-learning during the closure of institutions of learning is involuntary as it is the only option available for continuity of education. Therefore, the aforementioned factors are unlikely to be relevant during the current crisis.

Prior to the COVID-19 pandemic, face-to-face was the dominant mode of learning, albeit many IHL practised partial e-learning (i.e. combining face-to-face learning with e-learning), such as using learning management systems, email and social media to deliver learning contents and communicate with learners. E-learning offers a number of opportunities and challenges (Gordon, 2014). Thus, effective e-learning should be well-planned and implemented in a progressive manner, similar to other information technology projects.

However, the unprecedented scale and sudden shift from face-to-face learning to e-learning during the closure of institutions of learning due to the COVID-19 pandemic posed enormous human and technical challenges (Crawford *et al.*, 2020; Reimers and Schleicher, 2020; UNESCO, 2020a, c). A review of the recent literature suggests the following challenges for learners using e-learning during closure of institutions of learning.

Information and communication technology equipment and Internet connection for e-learning

During closure of IHL, teaching and learning are carried out completely online. As such, the availability of Information and Communication Technology (ICT) equipment (hardware such as desk top computer, laptop, tablet or smart phone plus software) and reliable Internet connection (in terms of coverage and speed) are paramount pre-requisites (Almaiah *et al.*, 2020).

Training, support and resources for e-learning

After ICT equipment and Internet connection are in place, ideally learners should receive technical training on e-learning tools and techniques as well as guidance for e-learning (Reimers and Schleicher, 2020). Furthermore, e-learning can be based on a variety of software. Thus, raising serious technical challenges (Wang *et al.*, 2020). Although learners may be known as the digital generation, they may lack digital skills related to e-learning (UNESCO, 2020c) and suffer technophobia of e-learning (Embi, 2011).

E-learning can fail as a result of lack of technical support – the unavailability of technical staff to support installation, operations, maintenance, network administration and security (Almaiah *et al.*, 2020). Another critical challenge in switching to e-learning is resistance to change as learners prefer face-to-face learning method (Almaiah *et al.*, 2020). Training programmes and technical support can alleviate resistance to change. Furthermore, sufficient e-learning resources must be available (Zhou *et al.*, 2020).

Discipline for e-learning

There are vast differences among learners in terms of resilience, motivation and skills to learn online independently (Reimers and Schleicher, 2020; UNESCO, 2020c). Successful e-learning tends to require learners to be motivated (UNESCO, 2020b), to foster good study habits (Zayapragassarazan, 2020) and good study skills (UNESCO, 2020c) and possess self-direction, self-discipline and self-organisation (UNESCO, 2020c). Motivation and self-discipline were found to predict experienced learners' performance in e-learning (Stark *et al.*, 2013).

Actual or perceived advantages of e-learning

E-learning can be carried out anywhere and anytime (24/7) as long as there is access to ICT equipment and Internet. Thus, breaking the limitation of study space and time (Zhou *et al.*, 2020) and offers learners flexibility (Abbasi *et al.*, 2020; Zayapragassarazan, 2020) and better control over their learning environment (Abbasi *et al.*, 2020).

E-learning is a "learner-centric" education model (Zayapragassarazan, 2020; Zhou *et al.*, 2020) with emphasis on learners' autonomous learning ability (Reimers and Schleicher, 2020; UNESCO, 2020c; Zhou *et al.*, 2020). This "learner-centric" education model offers rich learning choices and opportunities for learners to take more responsibility for their own learning (Zayapragassarazan, 2020), leading to greater learning effectiveness and efficiency (Almaiah *et al.*, 2020) and enhancing higher-order thinking skills, such as questioning, creativity and problem solving (UNESCO, 2020b).

Actual or perceived disadvantages of e-learning

The sudden and involuntary adoption of e-learning may induce learners to feel overloaded and confused (UNESCO, 2020b). Besides that, the disruptions resulting from the COVID-19 pandemic impose mental and financial distress on learners (UNESCO, 2020a). Learners with deficiencies in motivation and self-discipline will most likely experience stress and depression, and without strong social support, will be susceptible to burnout and eventually, give up e-learning or drop out from their study (UNESCO, 2020a).

Closure of IHL, notwithstanding e-learning, reduces learner–lecturer interaction (Abbasi *et al.*, 2020), while creating a physical and psychological separation and distance (UNESCO, 2020c), a sense of disengagement (UNESCO, 2020c) and social isolation (Abbasi *et al.*, 2020; UNESCO, 2020a).

Learning outcomes

The education priorities in response to the COVID-19 pandemic are to ensure the continuity of academic learning for learners and to support learners lacking independent (i.e. online) study skills (Reimers and Schleicher, 2020). Notwithstanding, e-learning during closure of IHL does not negate the importance of assessing learning outcomes (UNESCO, 2020c). In other words, learning outcomes must be achieved irrespective of mode of learning, albeit not at the same level as face-to-face learning, resulting from challenges of sudden and involuntary adoption of e-learning. A recent study found that achieving learning outcomes enhances learners' future preference for e-learning (Looi *et al.*, 2022). Given the context of this study, which is e-learning in Malaysian IHL, it is natural to adopt the five clusters of learning outcomes developed by the Malaysian Qualifications Agency (MQF, 2017), namely, knowledge and understanding, cognitive skills, functional work skills (practical, interpersonal, communication, digital, numeracy, leadership, autonomy and responsibility), personal and entrepreneurial skills, ethics and professionalism.

Geographic factor, demographic factor and e-learning

The extant literature suggests that learners from poor families and those living in remote or rural areas (vulnerable and marginalised learners) are likely to suffer loss in educational opportunities (Wang *et al.*, 2020; World Health Organization, 2020; Zhou *et al.*, 2020) due to inequitable access to ICT equipment and Internet for e-learning (Almaiah *et al.*, 2020; UNESCO, 2020a; Crawford *et al.*, 2020). A recent study found that household income level affects learners' e-learning effectiveness (Mok *et al.*, 2021).

Malaysia is an upper-middle income country, with roughly 40% of the population categorised as bottom 40 (B40), 40% categorised as middle 40 (M40) and the remaining 20% categorised as top 20 (T20) (Department of Statistics Malaysia, 2020). In 2020, Malaysian households' access to Internet is at 91.7% and access to computer is at 77.6% (Department of Statistics Malaysia, 2021). Due to an uneven economic and infrastructure development, there are disparities in accessing Internet and computers across Malaysia. As such, this study hypothesises that vulnerable and marginalised learners may face barriers to adopt e-learning (i.e. digital divide) during the closure of IHL.

Additionally, there exists gender differences towards e-learning preference (Ong and Lai, 2006; Yoo *et al.*, 2015). Thus, future research should take cognisance of gender when developing and testing e-learning theories (Ong and Lai, 2006).

Materials and methods

Participants

This study was approved by the Research Ethics Committee of Xiamen University Malaysia, Malaysia (REC-2005.02). Undergraduates were drawn from one private and one public university in Malaysia who normally attend face-to-face learning prior to the closure of IHL.

Measurement

Control variables. To control for confounding variables, the level of study, major/specialisation and prior experience of e-learning were made uncorrelated to the dependent variable by holding them constant across samples (Atinc *et al.*, 2012; Becker, 2005; Bernerth and Aguinis, 2016). That is, undergraduates, majoring in economics or business using one hundred per cent e-learning for the first time were selected. For this purpose, the questionnaire contained three screening questions (i.e. level of study, major/specialisation and prior experience of e-learning).

Geographic and demographic variables. Residential location was measured with three options: (1) rural area, (2) semi-urban area and (3) urban area. Household income was measured with three options: (1) bottom 40% (B40) with household income of below RM4,850 per month, (2) middle 40% (M40) with household income between RM4,850 to RM10,959 per month and (3) top 20% (T20) with household income of RM10,960 or higher per month (Department of Statistics Malaysia, 2020).

Independent and dependent variables. Factor operationalisation specifies what each factor means and how they will be measured (Johnson and Duberley, 2000). The aims are to develop a set of items that focus directly and unambiguously on the research topic (Schwab, 2005), as well as possessing reliability and validity properties (Churchill, 1979; Melewar and Jenkins, 2002). The procedures to operationalise the factors of ICT equipment and Internet, training, resources and support, discipline for e-learning, actual or perceived advantages of e-learning, actual or perceived disadvantages of e-learning, learning outcomes and future preference for e-learning followed the recommendations in the measure development literature (Churchill, 1979; Zaichkowsky, 1985; Malhotra, 2010). Step one searched for the definitions of factors from the literature. Step two generated an initial list of items and scales. Step three sought expert judgement on the face validity of the items. Step four purified the items, addressed common method biases, five types of faulty questions, and item wording to generate the first draft of the questionnaire. Step five of pilot test with 30 undergraduates generated correlations, Cronbach's alphas and factor analysis statistics to further improve the items in each factor. Step six refined the items and generated the final questionnaire.

The ICT equipment and Internet factor was measured by five items (sample item: "I have access to a laptop, personal computer, tablet, or smart phone for e-learning"). The training, support and resources factor was measured by six items (sample item: "I attended online workshops to make the best out of e-learning"). The discipline for e-learning factor was measured by six items (sample item: "I maintained good learning habits, including hours of self-learning, before and during e-learning"). The actual or perceived advantages of e-learning factor was measured by six items (sample item: "I think e-learning is an undergraduate-centric education model"). The actual or perceived disadvantages of e-learning factor was measured by six items (sample item: "I feel socially isolated using e-learning"). The learning outcomes factor was measured by eight items (sample item: "Using e-learning, I am able to effectively learn the subject knowledge"). The future preference for e-learning factor was measured by four items (sample item: I prefer e-learning in future semesters). Participants' responses for all items were recorded using the Likert scale of 1 = strongly disagree, 2 = disagree, 3 = neutral, 4 = agree and 5 = strongly agree.

Data collection procedures

The survey was carried out in July 2020 when all IHL in Malaysia were closed to contain the spread of the SARS-CoV-2; thus, all courses were conducted using one hundred per cent e-learning for the first time. The link to the self-administered questionnaire hosted on the Google Forms was distributed to economics and business undergraduates only.

Participation in this survey was on a voluntary basis and participants consented online before answering this questionnaire. This study followed standard survey approaches to

minimise response biases (Hughes, 2019), such that there was no social pressure to influence responses, no questions that would provoke defensiveness or threaten esteem and no payoff or cost for particular responses.

Data analysis

During data cleaning, the three screening questions (i.e. level of study, major/specialisation and prior experience of e-learning) deleted all non-targeted participants. A total of 352 qualified responses were analysed with Statistical Package for the Social Sciences (SPSS) version 26 and STATA version 15 statistical software for psychometric properties, descriptive and inferential statistics. Cronbach's alpha checked the psychometric properties of reliability for all factors. Exploratory factor analysis (EFA) checked convergent and discriminant validities for all factors. Next, participants' geographic and demographic characteristics were analysed.

To achieve the first purpose, this study used hierarchical multiple linear regression where the dependent variable of future preference for e-learning was regressed on geographic and demographic factors and the challenges of ICT equipment and Internet, training, support and resources, discipline for e-learning, advantages of e-learning, disadvantages of e-learning and learning outcomes.

However, using standard regression model based on survey data can cause endogeneity (Bascle, 2008; Papies *et al.*, 2017). Endogeneity refers to the correlation between the explanatory factors (i.e. the challenges) and the error term of a regression equation. Thus, threatening causal inferences from regression analyses (Bascle, 2008; Hult *et al.*, 2018; Papies *et al.*, 2017; Sande and Ghosh, 2018). As such, endogeneity must be addressed as part of regression analyses (Hult *et al.*, 2018). The sources of endogeneity are measurement errors, omitted factors and simultaneous causality (Wooldridge, 2002). To examine the presence of endogeneity, this study adopted the steps suggested by Papies *et al.* (2017) and Sande and Ghosh (2018). First, this study theoretically evaluated whether context suggests the possibility of omitted factors and simultaneity. Given the scarcity of empirical research on this sudden, involuntary and unprecedented scale of switching to e-learning, the likely sources of endogeneity for this study were omitted factors and simultaneous causality. Next, this study adopted instrumental variables method of two-stage least squares (2SLS) to test endogeneity (Germann *et al.*, 2015; Hult *et al.*, 2018; Papies *et al.*, 2017). Discipline for e-learning, advantages of e-learning and disadvantages of e-learning were selected as explanatory variables. Learning outcomes were selected as the endogenous variable as it is most likely to be correlated with unobservable factors in this study. Sande and Ghosh (2018) suggest to select instrumental variables from outside the unit of analysis. In this study, future preference for e-learning was at individual level of analysis, whereas ICT equipment and Internet, and training, support and resources were at institutional level of analysis. Thus, ICT equipment and Internet, and training, support and resources were selected as instrumental variables.

Results

Psychometric properties, geographic and demographic characteristics

Table 1 presents the geographic and demographic characteristics of the surveyed participants. The Cronbach's alphas for all factors were above 0.7, indicating reliability of factors (Table 2). In EFA, Kaiser–Meyer-Olkin measure of sampling adequacy was above 0.7 and p-value was less than 0.01, indicating adequacy of factor analysis. After deleting two statements (thinking skills under advantages of e-learning and social isolation under disadvantages of e-learning), all items loaded correctly onto its theorised factors, indicating

convergent and discriminant validities of factors. Additionally, Harman's single factor criteria (Podsakoff *et al.*, 2003) suggested the absence of common method variance as the first factor extracted in EFA for all items included in the analyses explained less than 50% of the variance in the items. Table 2 also presents bivariate correlations.

Multivariate analysis

The hierarchical multiple linear regression results (Table 3) showed that in Step 1, geographic and demographic factors were not significantly associated with future preference for e-learning. In Step 2, learning outcomes have the strongest relationship with undergraduates' future preference for e-learning, followed by disadvantages of e-learning (negatively) and discipline for e-learning. The additional variation in future preference for e-learning explained by interaction terms between geographic/demographic factors and challenges (i.e. discipline for e-learning, advantages of e-learning, disadvantages of e-learning and learning outcomes) was tiny ($\Delta R^2 = 0.005$). Consequently, interaction terms were excluded from analysis. From 2SLS regression in STATA, the p-value for Durbin X^2 and Wu and Hausman F-statistic were more than 0.05, suggesting the absence of endogeneity problem.

The multiple linear regression by gender (Table 4) showed that for male undergraduates, learning outcomes followed by disadvantages of e-learning were negatively associated with their future preference for e-learning. For female undergraduates, disadvantages of e-learning (negatively) followed by learning outcomes and discipline for e-learning were associated with their future preference for e-learning.

Discussion

This study empirically identified that in the aggregate sample, achieving learning outcomes, disadvantages of e-learning (negatively) and discipline for e-learning, in descending order, were salient challenges associated with future preference for e-learning of undergraduates in the Malaysian context.

The results suggested that undergraduates who achieved learning outcomes using e-learning will prefer e-learning in the future. This future preference for e-learning can be short term (i.e. during full or intermittent closure of IHL depending on the severity of the COVID-19 pandemic) or longer term (i.e. during future crises). In the short term, this insight is useful to reduce undergraduates' psychological resistant toward e-learning as e-learning can achieve the intended learning outcomes, similar to face-to-face learning. In the longer term, this insight can prepare undergraduates to voluntarily switch to e-learning during future crises and help them to settle in quickly. Indeed, it is important for undergraduates to recognise that

Table 1. Geographic and demographic characteristics

	Category	Frequency	Per cent
University	Public	101	28.7
	Private	251	71.3
Gender	Male	130	36.9
	Female	222	63.1
Household income	Bottom (B40)	76	21.6
	Middle (M40)	178	50.6
	Top (T20)	98	27.8
Residential location	Rural area	47	13.4
	Semi-urban area	171	48.5
	Urban area	134	38.1

Table 2.
Bivariate correlations

	Cronbach's alpha	1	2	3	4	5	6	7	8	9	10
Household income	–	1									
Residential location	–	0.20**	1								
Gender	–	−0.02	0.02	1							
ICT equipment and Internet	0.83	0.23**	0.15**	−0.04	1						
Training, support and resources	0.86	0.09	0.03	−0.11*	0.45**	1					
Discipline	0.92	0.03	0.03	−0.04	0.39**	0.52**	1				
Advantages	0.87	−0.01	0.01	−0.02	0.42**	0.51**	0.66**	1			
Disadvantages	0.84	−0.07	−0.07	−0.05	−0.22**	−0.23**	−0.25**	−0.31**	1		
Learning outcomes	0.93	−0.05	−0.02	−0.07	0.26**	0.47**	0.58**	0.70**	−0.32**	1	
Future preference	0.94	0.03	−0.04	−0.07	0.28**	0.36**	0.48**	0.54**	−0.51**	0.60**	1

Note(s): * Correlation is significant at the 0.05 level (2-tailed). ** Correlation is significant at the 0.01 level (2-tailed)

	Step 1 Standardised beta	Step 2 Standardised beta	Step 3 Standardised beta
Household income	0.035	0.022	0.126
Residential location	−0.048	−0.077	0.001
Gender	−0.066	−0.046	0.044
ICT equipment and Internet	–	0.031	−0.058
Training, support and resources (TSR)	–	−0.017	0.028
Discipline	–	0.115*	0.203*
Advantages	–	0.092	−0.058
Disadvantages	–	−0.323**	−0.235**
Learning outcomes	–	0.370**	0.494**
Gender × Location × Income × ICT equipment and Internet	–	–	0.337
Gender × Location × Income × TSR	–	–	−0.126
Gender × Location × Income × Discipline	–	–	−0.231
Gender × Location × Income × Advantages	–	–	0.403
Gender × Location × Income × Disadvantages	–	–	−0.255
Gender × Location × Income × Learning outcomes	–	–	−0.321
Adjusted R^2	−0.001	0.484	0.490
ΔR^2	–	0.485	0.006

Note(s): * Significant at the 0.05 level, ** Significant at the 0.01 level
The dependent variable is future preference for e-learning

Table 3.
Hierarchical multiple linear regression for aggregate sample

	Standardised beta	
	Male	Female
ICT equipment and Internet	0.065	0.010
Training, support and resources	−0.075	0.023
Discipline	0.127	0.127*
Advantages	0.056	0.136
Disadvantages	−0.258**	−0.416**
Learning outcomes	0.533**	0.189**
Adjusted R^2	0.481	0.502

Note(s): * Significant at the 0.05 level, ** Significant at the 0.01 level
The dependent variable is future preference for e-learning

Table 4.
Multiple linear regression by gender

what is important during crises are continuity of education and achievement of learning outcomes. Therefore, under the new norm, undergraduates should be versatile, rather than clinging on to the old habit of face-to-face learning. This mentality and ability to be versatile should be an additional learning outcome to prepare undergraduates for future working challenges. As such, it is critical for various IHL stakeholders to continuously ensuring that learning outcomes are achieved using e-learning during the current and future crises.

Because the surveyed undergraduates were inexperienced with one hundred per cent e-learning for all courses, it was natural for them to experience disadvantages of e-learning which negatively affected their future preference for e-learning. The elements of disadvantages of e-learning operationalised in this study were the lack of interactions with lecturers and other learners, feeling overloaded, confused, stressed and wanting to give up. These actual or perceived disadvantages of e-learning can be concertedly addressed by various IHL stakeholders, such as IHL management, parents, Teaching and Learning Unit, student

counsellors, lecturers and undergraduates themselves. Online interaction activities, such as communiqué, synchronous e-learning, online counselling and motivational talks should be conducted regularly during IHL closure. As time passes, lecturers gained e-teaching experience and became better at their pedagogy to address the problems of overloading and confusion. In sum, it is crucial that various IHL stakeholders constantly monitor and promptly address undergraduates' actual or perceived disadvantages of e-learning (Looi, 2021). Equally important, undergraduates should realise that the COVID-19 pandemic has created many new norms in their daily lives, including the way education is delivered. Stated differently, it is not e-learning vis-à-vis face-to-face learning, rather it is e-learning vis-à-vis halted learning. If undergraduates are able to shift to this new mentality that e-learning is the only option available during this prolonged period of IHL closure, many perceived disadvantages of e-learning may just disappear.

Although e-learning proffers the flexibility of learning anytime and anywhere, the surveyed undergraduates realised the importance of discipline for e-learning. Consequently, having discipline for e-learning in terms of good learning habits, good learning strategies, self-direction, self-organisation skills, good study skills, independent learning and motivation should be emphasised by lecturers throughout the semester to maintain interest in using e-learning. Parenthetically, discipline for e-learning can be maintained by means of scheduled synchronous meetings or tutorials with the attendance of undergraduates closely monitored.

In the disaggregate analysis by gender, male undergraduates reported achievement of learning outcomes followed by disadvantages of e-learning as salient challenges related to their future preference for e-learning. In contrast, female undergraduates reported disadvantages of e-learning followed by achievement of learning outcomes and discipline for e-learning as associated with their future preference for e-learning. As such, there exists nuanced differences in salient challenges associated with future preference for e-learning across gender which require special attention by various IHL stakeholders.

In terms of theoretical implications, this study synthesised the recent e-learning literature to develop an integrated model of future preference for e-learning against the background of a sudden and involuntary adoption of e-learning due to the closure of IHL. The scientific findings contributed to our scholarly understanding of salient challenges of e-learning during the COVID-19 pandemic and provided insights to deal with future crises that are expected to disrupt the delivery of higher education again. This study also provided useful insights to nuanced differences in salient challenges associated with future preference for e-learning across gender.

With respect to practical implications, an understanding of salient challenges associated with e-learning enables various IHL stakeholders to design and coordinate efforts to reap maximum benefits from e-learning during present and future crises. For undergraduates, preference for e-learning can develop their transferable skills. In the short term, e-learning prepares fresh graduates to work from home under the new norm. In the longer term, e-learning facilitates life-long learning to acquire essential working skills for the twenty-first century.

There are several limitations inherent in the current study that may inform future inquiry opportunities. Because the literature on e-learning during the closure of IHL is evolving, some challenges may not be captured in this study. Next, this survey was carried out in July 2020 when all courses were conducted using one hundred per cent e-learning for the first time. Over time, undergraduates become accustomed with e-learning and/or lecturers improved their e-teaching pedagogy. Hence, future replication studies may produce different results. Lastly, findings are not generalisable to other contexts as learners may face dissimilar challenges associated with e-learning during the closure of IHL under different spatial, temporal, social and institutional contexts. Hence, more replicated research in other contexts remains to be done.

Conclusion

In contrast to conventional voluntary adoption of e-learning, this study explored a new trail to investigate sudden and involuntary adoption of e-learning during the closure of IHL. This study empirically identified the salient challenges associated with future preference for e-learning as well as nuanced gender differences on the relative importance of salient challenges associated with future preference for e-learning in the Malaysian context. Thus, adding to the body of knowledge on e-learning during the closure of IHL due to the COVID-19 pandemic.

The COVID-19 pandemic is an unprecedented disruptive force on the delivery of higher education. At the same time, it has accelerated technology-enhanced learning, with e-learning or hybrid learning likely to be a new norm in the future. An important lesson from the present crisis is that IHL must attach great importance to the development of e-learning readiness in order to respond rapidly to future crises, rather than treating e-learning as a stop gap solution.

Consequently, a future crisis response plan for the education system facing major emergencies should be in place right now. For example, in every semester, at least one course should be delivered via hybrid or one hundred per cent e-learning so that undergraduates and lecturers are always well prepared to deal with future crises. With a well-planned and progressively implemented e-learning, both undergraduates and lecturers will be versatile to deal with future uncertainties.

A lot of research is still needed to better comprehend various challenges of e-learning during the closure of IHL due to the COVID-19 pandemic in other contexts. Much needs to be done in the future to mitigate the negative impact of various challenges of e-learning and achieve better learning outcomes using e-learning. Informed by cumulative body of knowledge from scientific findings, concerted efforts by all stakeholders to address these challenges will shift e-learning in higher education closer to a panacea during present and future crises.

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