



NAVIGATING E-LEARNING PARTICIPATION: A LOOK AT SABAH SCHOOL STUDENTS' POST-PANDEMIC EXPERIENCES

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Abstract

The aftermath of the COVID-19 virus began to sweep across Malaysia again at the end of 2023, with uncertainties about whether educational institutions should reopen online teaching. It is important to note that during and in the post-era of the COVID-19 pandemic, the level of participation among primary and secondary school students in Sabah, Malaysia, was at the centre of educators' discussions. Yet, it did not receive adequate attention from researchers. Despite its advantages, e-learning proved to be challenging to engage school students, which inevitably affected students' learning productivity. This study aimed to investigate the level of participation in E-learning among school students in Kota Kinabalu during COVID-19 and identify whether there was any difference in the level of e-learning participation based on demographic variables. A Google Forms survey was distributed to 247 students from various schools in Kota Kinabalu, who were selected through simple random sampling. The data was analysed using SPSS 29.0. The descriptive findings revealed a moderate level of participation with e-learning among the school students, with an average score of 3.37. Contrary to expectations, ANOVA results indicated that student participation in e-learning remained consistent across age groups, with both primary and secondary students demonstrating similar levels of participation, suggesting that both male and female students adapted equally well to e-learning. While the immediate impact of COVID-19 on education is easing, its long-term effects will require sustained focus and effort to mitigate. Enhancing student participation in e-learning is crucial for improving the educational process and ensuring meaningful learning during unexpected crises.

Keywords: COVID-19 Lockdown; e- Learning; Students' Participation; Sabah School Students; School Suspension

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INTRODUCTION

The COVID-19 pandemic's immediate impact is lessening, according to the World Health Organisation's (WHO) (2024) epidemiological update published on June 17, 2024. Global new COVID-19 cases decreased by 11% during the 28 days of April 29th to May 26th, 2024, compared to the previous reporting period. However, the Western Pacific Region experienced an increase in new cases, with over 42,000 reported. Malaysia saw a notable proportional increase within this region, with new cases rising 39% (from 2,183 to 3,035).

Looking back to the COVID-19 lockdown, it provided a critical opportunity to examine the intersection between quality education and e-learning. While e-learning offered potential benefits in terms of accessibility and flexibility, it also highlighted existing inequalities and the need for further investment in infrastructure, teacher training, and innovative learning approaches to achieve the United Nation's Sustainable Development Goals (SDGs) for quality education in the post-pandemic era (Zhao et al., 2022). The rapid shift to digital learning, though accelerating technical proficiency among students, came at a cost, which is the erosion of comprehensive development. Critical competencies such as interpersonal communication, collaborative problem-solving, and hands-on experiential learning were sidelined in fully virtual environments (Namiri & Rahmat, 2022).

E-learning has proven more viable in Malaysian higher education than in primary and secondary education (Selvanathan et al., 2023). At the school level, challenges such as insufficient communication among students, teachers, and peers have complicated instruction, necessitating reforms to curricula and teaching methods (Abdullah et al., 2022). This disparity highlights a critical divide: While Generation Z (Gen Z) students are often assumed to be inherently tech-savvy due to their familiarity with information and communication technologies (ICT), many exhibited resistance to the abrupt transition to e-learning during the pandemic lockdown. This contradiction between perceived ICT competence and actual reluctance to adapt underscores a gap in preparedness for digital learning under stressful conditions. These challenges are further exacerbated by potential issues, including inadequate resource allocation, rushed implementation, and poorly integrated technology and information systems (Lestaria & Riatun, 2024).

Compounding this, school students, unlike their higher education counterparts, lack prior exposure to structured e-learning environments, making them "newcomers" to digital pedagogy. To ensure that Malaysian school students successfully adopt e-learning, policymakers must leverage insights from students' experiences with online platforms during the pandemic lockdown. These lessons can inform targeted policies to foster sustained student engagement and equitable access to digital education, particularly given the documented challenges in continuing student engagement during the unprecedented shift to online learning under COVID-19 (Hollister et al., 2022).

Given that prior studies have explored e-learning participation in broader Malaysian contexts, gaps persist in understanding the unique challenges faced by school students in Sabah. This study addresses these gaps by investigating two underexplored dimensions: (1) the level of e-learning participation among Kota Kinabalu school students during the lockdown and (2) the influence of gender and educational background on their e-learning participation. By focusing on Sabah, this research provides critical insights into equity and accessibility in under-resourced regions, contributing to the broader discourse on achieving the SDGs for inclusive, quality education.

LITERATURE REVIEW

This section delves into the relevant literature surrounding ICT infrastructure and e-learning in the Malaysian context. It then examines the theoretical foundation underpinning this study, as well as demographic considerations. Each of these areas is discussed in detail below.

ICT Infrastructure and E-learning in Malaysia

E-learning is inextricably linked to digital infrastructure, which provides the foundation for students to access e-learning platforms, resources, and technological tools. The advent of the Fourth Industrial Revolution (Industry 4.0), characterised by the move towards intelligent industry and manufacturing objectives (Hock & Ayub, 2024), further underscores the importance of a robust digital infrastructure for education. In Malaysia, the Ministry of Education emphasises leveraging ICT to scale up quality learning across the country, based on its Education Blueprint (2013-2025) (Malaysian Ministry of Education, 2013). This blueprint, currently in its third stage (2021-2025), aims to roll out ICT innovations and programs for groups with specific needs, with the goal of continuously raising learning standards nationally. While the impact of COVID-19 on education over the past few years has undoubtedly affected the full implementation of this blueprint, the outcomes of the first two stages can be reflected in previous studies. For example, a case study conducted by Cheok and Wong (2016) found that teachers from 12 different schools in Peninsular Malaysia reported poor ICT infrastructure, such as slow internet connections and an inadequate number of computers, as obstacles to the implementation of e-learning in schools. Ramli and Saleh (2019) indicated that science teachers from North Malaysian secondary schools acknowledge the advantages of using Frog VLE, though some unresolved issues hinder its full potential.

However, challenges remain. These challenges are particularly pronounced in Sabah, one of the poorest states in Malaysia. Sabah's inadequate infrastructure, with ICT facilities lagging other Malaysian states (Jafar et al., 2022), creates significant barriers to e-learning adoption. For instance, a survey by Hu et al. (2020) examining Sabahan English teachers' readiness for e-learning revealed critical gaps in training and resources. Another striking example is the story of an 18-year-old Sabahan public university student who had to sit on a tree to obtain stable internet connectivity for her examinations (Ibnu et al., 2021). These stark realities raise concerns about the successful implementation of e-learning among school students in Malaysia, particularly during times of crisis like the school suspension during the COVID-19 lockdown. Despite national ICT initiatives, a substantial gap persists between the ideal and the actual, proving challenging to bridge.

Participation Engagement as the Theoretical Framework

E-learning holds the potential to enhance student engagement, a key factor in successful learning (Hu & AlSaqqaf, 2022). Essentially, achieving learning goals requires active participation from learners. Individuals must engage with the provided activities to gain meaningful learning experiences (Ahn et al., 2013). However, measuring student engagement in e-learning environments is challenging for teachers due to the lack of direct observation and interaction (Bergdahl, 2022). Therefore, this study adapted Handelsman et al.'s (2005) measure of traditional classroom student engagement as the theoretical framework. Figure 1 illustrates each dimension of student engagement. This measure identifies four factors that present how students invest time and energy in the classroom: engagement in skills, engagement in emotions, engagement in participation, and engagement in performance.

Concerns about student engagement in e-learning are valid. Bao (2020) outlines six instructional strategies designed to enhance student learning engagement and facilitate a smooth transition to e-learning during the lockdown. Rizvi et al. (2019) emphasise the importance of considering variables such as engagement alongside gender and educational level to improve the accuracy and consistency of research findings. However, it is important to note that much of the past research on engagement has focused on traditional classroom settings in schools and universities, neglecting the specific context of e-learning (Jawthari & Stoffa, 2022). Furthermore, participation engagement measurements have been conducted by various researchers in different contexts, including a university in the U.S. (Young & Bruce, 2011), a regional midwestern university (Dixson, 2015), higher education in Korea (Kim et al., 2019), and high school students in Saudi Arabia (Oraif & Elyas, 2021).

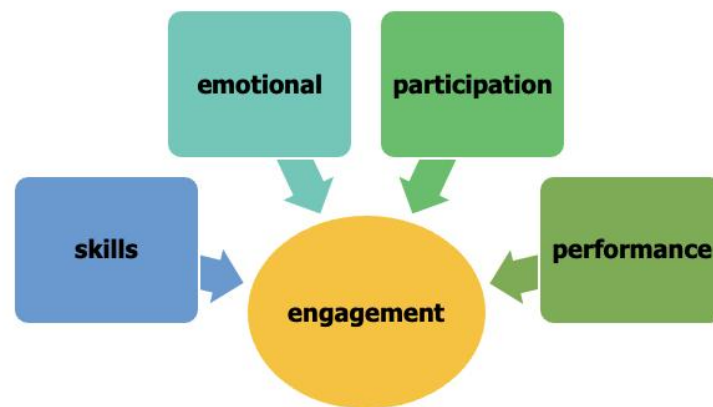


Figure 1: Student Engagement Scale Adapted from Handelsman et al. (2005)

Importantly, this study focuses on participation engagement to investigate the level of e-learning participation among school students in Kota Kinabalu, Sabah, Malaysia, during the COVID-19 lockdown. While other aspects of engagement are crucial components of overall engagement, they can be more challenging to assess accurately during the lockdown. Participation engagement, which focuses on engagement at the activity level, offers a more objective and simpler approach to assessment and monitoring using scales (Henrie et al., 2015). Given that, it becomes necessary to apply such a theoretical framework to investigate the level of e-learning participation among school students in Kota Kinabalu, especially during the lockdown. This aims to provide valuable insights into the local context and contribute to the broader body of knowledge on e-learning participation.

Demographic Concerns in E-learning

Numerous studies have shown that e-learning learners' performance is strongly associated with their demographic characteristics, highlighting the potential for differential impacts on individuals from diverse backgrounds. To better understand this relationship, this study examines the influence of gender and education level on e-learning participation. Research suggests that gender can significantly influence the relationship between e-learning opportunities and participation (Falola et al., 2022). Jawthari and Stoffa (2022) further confirm this, finding a positive correlation between gender and participation levels in e-learning environments. Nikou and Maslov (2021) argue that educational institutions must prioritise gender as a critical factor when designing e-learning strategies. Other demographic variables, such as education level, have also been linked to e-learning participation. Islam et al. (2011) indicated that respondents with higher levels of education may be more receptive to e-learning,

potentially contributing to its effectiveness. However, Yu (2021) found that while educational level contributed significantly to learning outcomes, gender did not. Given the inconsistent findings regarding the influence of gender and education level on e-learning participation, this study proposes the following alternative hypotheses:

Hypothesis 1 (H_1): There is a significant difference in the level of e-learning participation between male and female school students in Kota Kinabalu during the COVID-19 lockdown.

Hypothesis 2 (H_2): There is a significant difference in the level of e-learning participation between primary and secondary school students in Kota Kinabalu during the COVID-19 lockdown.

METHODOLOGY

This section delves into the methodological heart of this study, outlining the research approach, design, participant selection, and the development and implementation of the instruments used to gather data on e-learning participation during the COVID-19 lockdown.

Research Approach and Design

This study employed a quantitative research approach with a cross-sectional survey design. This design allows for a broader understanding of the views of subjects on a certain topic rather than restricting the study to a limited number of participants (Creswell & Creswell, 2018). This study randomly selected student respondents from Kota Kinabalu, the capital city of Sabah, for several reasons. First, students in capital cities often have different experiences and perspectives than students from other district-level cities in Sabah, Malaysia. Second, access to technology and reliable internet connectivity for school students in rural areas of Sabah is often limited, as documented in the literature review. This disparity in digital infrastructure highlights the need for research that specifically explores the impact of these factors on e-learning adaptation, identifies gaps between cities, and informs future policy decisions aimed at bridging the digital divide.

Participants and Sampling Technique

A total of 247 school students, from both primary and secondary schools in Kota Kinabalu, Sabah, participated in the study. Participants were randomly selected using a survey questionnaire distributed via Google Forms (<https://www.google.com/forms>). This approach ensured that all students in the population had an equal chance of being selected, aligning with the principles of random sampling (Creswell & Creswell, 2018). The study was conducted during the COVID-19 lockdown, allowing for an examination of e-learning experiences within this specific context.

Table 1: Demographics of survey participants (N=247)

Factors	Descriptions
Gender	Male: 81 (32.8%); Female: 166 (67.2%)
Level of study	Primary school: 18 (7.3%); Secondary school: 229 (92.7%)

Based on the findings shown in Table 1, most students are female (67.2%), while 32.8% are male, and almost all students are in secondary school (92.7%), with only a small percentage in primary school (7.3%).

Instrument

This study used a survey questionnaire to measure the level of students' participation in e-learning during the COVID-19 outbreak. The questionnaire, which initially consisted of 17 items adapted from Dixon (2015) and Watkins et al. (2004), was originally constructed in English. However, considering this is a second language research, it was deemed necessary to translate the questionnaire into Malay for the respondents to ensure the accuracy of the data collected, then a bilingual version of the questionnaire was created using a back-translation method to ensure the equivalence of both versions of the questionnaire from qualified translators (Dörnyei & Taguchi, 2010).

Before distribution, the questionnaire underwent content and face validation to identify any potentially confusing items (Creswell & Creswell, 2018). Content validity refers to the extent to which an instrument comprehensively measures the construct it is intended to measure, and it is typically determined by experts (Gay et al., 2012). In this study, the content validity was evaluated by two experts holding Ph.D. degrees with expertise in the e-learning field. They examined the questionnaire and provided comments ranging from suggestions to remove certain items due to apparent similarities to technical comments related to spelling errors. Based on this feedback, modifications were made to the questionnaire items for future use. Face validity refers to an evaluation of whether a test seems to measure what it purports to measure from a non-expert perspective (Gay et al., 2012). The face validity of the questionnaire items was verified by seven school students (four from primary and three from secondary schools) based on the degree of clarity. The students found the items to be unambiguous and comprehensible. Following this validation process, a pilot study was conducted to assess the reliability of the questionnaire. Questionnaires were then distributed via Google Forms for real data collection.

Following the completion of data collection, construct validity was conducted on the initial questionnaire, which consisted of 17 items designed to measure the level of e-learning participation. After conducting an exploratory factor analysis (EFA) using Principal Component Analysis (PCA) and Oblimin with Kaiser normalisation, a KMO value of 0.908 and a significant Bartlett's Test ($p < .001$) were obtained (see Table 2). This led to the extraction of two components (eigenvalues greater than 1), with a cumulative variance of 51.543 (Pallant, 2020). Component 1, which is the subscale highlighting the students' proactive approach to e-learning, with a focus on attending classes, completing assignments, engaging with materials, and even helping classmates, was named "students' active e-learning engagement" (AEE). This component had factor loadings ranging from .438 to .783. Component 2, named "technical readiness for e-learning" (TRE), focuses on the essential technical prerequisites for online learning participation and has factor loadings ranging from .371 to .851.

Reliability refers to the consistency of an instrument, as stated by Gay et al. (2012). The reliability of the questionnaire items in this study was assessed using Cronbach's alpha. A Cronbach's alpha coefficient of ≥ 0.7 is generally considered acceptable for reliability (Cohen et al., 2018). Reliability tests were conducted twice in this study. The first test, conducted during a pilot study with 43 school students, aimed to identify the initial items proposed for the questionnaire. The second test, conducted after construct validity was established through factor analysis in the actual study involving 247 school students, addressed reliability after the questionnaire was refined. Cronbach's alpha values obtained from these tests were 0.84 and 0.90, respectively, indicating satisfactory reliability (Cohen et al., 2018). Thus, the instrument was deemed reliable and ready for data collection.

RESULT AND DISCUSSION

This section focuses on the results derived from respondents' demographic data, the level of students' e-learning participation, and the comparison between male and female school students and primary and secondary school students based on the level of e-learning participation during the lockdown imposed during the COVID-19 outbreak.

The Level of Students' E-learning Participation

As revealed in Table 2, a total of 17 items dealing with school students' e-learning participation during the COVID-19 lockdown were obtained from 247 respondents from primary and secondary schools across Kota Kinabalu, Sabah.

Table 2: The results of students' e-learning participation level

Description of Items	Factor loadings		<i>M</i>	<i>SD</i>	New codes
	1	2			
Active E-learning Engagement (AEE)					
S14. I completed watching all the videos until the end as assigned by my teachers when I had to learn online from home during the COVID-19 lockdown.	.783		3.43	1.079	AEE1
S7. During the COVID-19 lockdown, I studied on a regular basis.	.757		3.32	1.066	AEE2
S11. I participated actively during my online classes when I had to learn online from home during the COVID-19 lockdown.	.756		3.36	1.118	AEE3
S17. I was able to schedule a time to provide timely responses to other students and/or the instructors when learning online from home during the COVID-19 lockdown.	.753		3.18	1.008	AEE4
S13. I watched all the recorded videos assigned by my teachers when I had to learn online from home during the COVID-19 lockdown.	.735		3.46	1.023	AEE5
S3. During the COVID-19 lockdown, I listened to the instructor attentively during online classes.	.735		3.49	.987	AEE6
S12. I participated actively in my offline tasks (e.g., worksheets given by the teachers) when I had to learn online from home during the COVID-19 lockdown.	.734		3.56	1.010	AEE7
S5. I took notes over readings, PowerPoint presentations or video lectures in online classes during the COVID-19 lockdown.	.721		3.46	1.054	AEE8
S6. During the COVID-19 lockdown, I was able to complete my work even when there were distractions (e.g., social media, streaming websites, games, television, children, chores) when I learnt online from home.	.691		3.49	1.175	AEE9
S4. I read the materials available through E-learning properly during the COVID-19 lockdown.	.644		3.53	.873	AEE10
S9. I attended all my online classes when I had to learn online from home during the COVID-19 lockdown.	.627		3.59	1.175	AEE11

S16. During the COVID-19 lockdown, I posted regularly on the discussion forum when I had to learn online from home.	.626	2.89	1.012	AEE12
S10. I was able to remain focused during my online classes when I learnt online from home during the COVID-19 lockdown.	.620	2.49	1.259	AEE13
S8. During the COVID-19 lockdown, I helped my fellow classmates to complete their work during E-learning.	.438	3.23	1.074	AEE14

Technical Readiness for E-learning (TRE)

S1. I had access to a computer/laptop/tablet with an internet connection to learn online from home during the COVID-19 lockdown.	.851	3.62	1.269	TRE1
S2. I had access to a fairly new computer (e.g., enough RAM, speakers, and USB ports) to learn online from home during the COVID-19 lockdown.	.835	2.96	1.226	TRE2
S15. I was able to communicate effectively with my classmates using online technologies (e.g., email, chat, digital/online platforms) when I learnt online from home during the COVID-19 lockdown.	.371	3.74	1.132	TRE3

Overall level of e-learning participation (skewness: -.250, kurtosis: .212) 3.37 .69

Note. M=Mean value, SD=Standard deviation. Mean value: 1.00-2.33 (Low); 2.34-3.67(Moderate); 3.68-5.00(High)

The collected data exhibited a normal distribution, as indicated by its skewness value of -0.250 and kurtosis value of 0.212. A mean value index was employed for the interpretation of the e-learning participation level, classified into three categories: 1.00-2.33 (Low), 2.34-3.67 (Moderate), 3.68-5.00(High) indicating the degree of levels perceived by school students (Oxford & Burry-Stock, 1995). It is seen that school students from Kota Kinabalu experienced a moderate level of e-learning participation (M=3.37). Surprisingly, TRE3 scored the highest mean value of 3.74, indicating that even though students were bound by lockdown restrictions, they still completed online activities while attending e-learning instruction.

However, AEE13, AEE12, and TRE2 obtained mean values below 3 (e.g., AEE13: 2.87; AEE12: 2.95; TRE2: 2.74), suggesting that students behaved relatively negatively towards engaging in online discussion, and their attention was easily interrupted by their surroundings. This could be attributed, in part, to the ill-equipped devices used for e-learning during school suspension.

Difference in the Level of E-Learning Participation Regarding Demographic Variables

As shown in Table 3, primary school students (mean 3.40, SD 0.51, n=18) showed slightly higher e-learning engagement than secondary students (mean 3.35, SD 0.76, n=229), although engagement was more variable among secondary students. Similarly, female students (mean 3.36, SD 0.72, n=166) exhibited slightly higher engagement than male students (mean 3.34, SD 0.78; n=81), with greater variability in engagement among male students.

Table 3: The descriptive analysis of school students' gender and educational level in the level of e-learning participation

	Demographic variables	N	Mean	Std. Deviation
E-learning participation	Gender			
	Male	81	3.38	.72
	Female	166	3.37	.67
	Education level			
	Primary school	18	3.40	.46
	Secondary school	229	3.36	.70

Table 4 presents the results of independent sample t-tests comparing e-learning participation levels. First, the participation of male and female students was compared. Levene's test for equality of variances was not significant ($F = .749$, $p = .387$), indicating that the assumption of equal variances was met. The t-statistics based on the equal variances t-test ($t(245) = -.108$, $p = .914$, two-tailed) showed no statistically significant difference between the groups at the 5% level. The 95% confidence interval ranged from $-.172$ to $.193$. This suggests no significant difference in e-learning participation between male and female students. Second, the participation of primary and secondary school students was compared. Levene's test for equality of variances was significant ($F = 4.893$, $p = .028$), indicating a violation of the equal variance assumption. Therefore, the t-statistics were based on the unequal variances t-test ($t(23.576) = .695$, $p = .494$, two-tailed). The mean difference between the two groups was not statistically significant at the 5% level, with a 95% confidence interval ranging from $-.163$ to $.328$. This suggests no significant difference in e-learning participation between primary and secondary school students.

Table 4: The results of independent samples test on demographic variables in the level of e-learning participation

		Levene's Test for Equality of Variances				t-test for Equality of Means		
						Significance	95% Confidence Interval of the Difference	
		F	Sig.	t	df	Two-Sided p	Lower	Upper
Gender	EVA	.749	.387	-.108	245	.914	-.172	.193
	EVNA			-.106	148.827	.916	-.179	.199
Educational Level	EVA	4.893	.028	.491	245	.624	-.238	.413
	EVNA			.695	23.576	.494	-.163	.328

Note. Equal variances assumed (EVA); Equal variances not assumed (EVNA)

This section delves into a detailed discussion of e-learning participation during the COVID-19 lockdown, exploring the factors that influenced student participation. Specifically, it examines the role of demographic variables, such as gender and educational level, in shaping individual participation patterns.

The Level of Students' E-learning Participation

This study approaches the topic from the perspective of students' e-learning participation experiences and reports that students' e-learning participation level during the lockdown was at a medium level of 3.37. This result is similar to some previous research findings. For example, a study conducted before COVID-19 showed that the effectiveness of the forum conducted in e-learning was medium (average value = 3.5), while the practicality and ease of use of the e-learning platform were higher among Malaysian university students, with average values of 4.12 and 4.18, respectively (Masood & Musman, 2015). However, Malaysian students were dissatisfied with the

online learning environment (Annamalai, 2021). Finally, the results of the present study showed that among students in Thailand, Malaysia, China, and Indonesia, 74.7% of participants had a moderate level of participation in online learning, and only 20.1% of participants had a high level of participation (Siaw et al., 2022). Contradictory to these findings, Oraif and Elyas (2021) conducted a survey in a high school in Saudi Arabia with a sample of 379 female learners taking a general English course, and the results showed that Saudi English learners had a high level of participation in e-learning during COVID-19 outbreak.

There are some justifications for the results presented in the study. Firstly, not all school students in Kota Kinabalu or other regions have access to devices and reliable internet, which are essential for e-learning. This lack of access could be due to several factors, such as poverty, location, and so on. According to a study, the schools in Kota Kinabalu were not adequately equipped to support the infrastructure needed for the implementation of e-learning during the school suspension caused by the lockdown (Hu & AlSaqqaf, 2022). In addition, the unfamiliarity with e-learning was experienced by many students and teachers who had been unable to adapt to e-learning before the pandemic, despite its long-standing presence. This could have hindered their ability to adapt to the new learning environment and participate effectively. It was found that neither the primary school teachers nor the primary school students were prepared for this unprecedented method of teaching and learning. Furthermore, the difficulties and lack of engagement experienced by students could also be attributed to ineffective e-learning platforms. This could result in students feeling frustrated and disengaged from their learning. During the COVID-19 pandemic, it was found that some Malaysian school teachers lacked the necessary support to cope with instructions that utilise advanced technology, such as Google Classroom and other learning management systems (Tahir et al., 2021). This highlights similar issues that existed before the outbreak, indicating a critical need for ongoing support for the Frog VLE to receive continuous and consistent training in the use of e-learning systems for teaching in the future (Rahayu et al., 2018). In addition to this, the absence of actual social interaction can make e-learning a solitary experience for students, even with the introduction of more tools in schools (Al-Hail et al., 2023). Students are deprived of the chance to engage with their peers and instructors in a traditional setting, potentially leading to feelings of decreased inspiration and involvement in their studies.

Demographics Difference in E-learning Participation

The suggestion that there is no significant difference in the level of e-learning participation between male and female school students is supported by the findings and the rejection of H_1 . This aligns with earlier research. For example, the absence of gender difference in online activities participation was highlighted by Korlat et al. (2021) discovered that females students exhibited higher levels of perceived teacher support, intrinsic value, and learning participation in e-learning than male students, but no significant differences were found in competence beliefs about e-learning between genders. Besides that, Kurniawan et al. (2022) found that gender and other factors did not significantly impact e-learning self-efficacy in participating e-learning activities during the COVID-19 pandemic. Similarly, Shaafi et al. (2023) found no significant difference in perspectives towards e-learning participation during the COVID-19 pandemic between male and female students.

Moreover, the findings also suggest that there is no significant difference in the level of e-learning participation between male and female school students, indicating the rejection of H_2 . This contradicts previous studies. For instance, significant effects of age, program of study, and level of education on the effectiveness of e-learning were confirmed by Islam et al. (2011). Hsu and Efendi (2021) found significant differences in e-learning

participation when students were compared by academic year or class level. Yu (2021) concluded that postgraduates participated better than undergraduates in e-learning activities. Differences in students' participation based on demographic factors such as gender, age, and field of study were indicated in further analysis by Adams et al. (2021).

There are several possible justifications for the lack of significant differences in e-learning participation during lockdown, based on demographic variables. Zainal and Zainuddin (2020) corroborate this, noting the Malaysian government's ICT initiatives to promote e-learning in education, including the introduction of the Smart School concept. This initiative highlights the significant role of ICT in school management and classroom practice. The government's substantial investment in infrastructure, including the 1BestariNet project, aims to connect all 10,000 primary and secondary schools in Malaysia. Furthermore, the e-learning environment was primarily teacher-driven, relying on method such as live online lessons, pre-recorded lectures, assignments posted online, and the presentation of information (Le, 2022; Li et al., 2019), which may have overshadowed any potential differences based on gender or educational level. This teacher-centered approach could have created a more standardized experience, minimizing the impact of demographic factors. Based on the insignificant results of Hypotheses 1 and 2, which compared demographics to e-learning participation levels, it is believed that teachers need to make e-learning instruction more innovative and engaging to capture the attention of all students.

CONCLUSION

This research has several limitations. First, the study was conducted solely with students from primary and secondary schools in Kota Kinabalu, Sabah, limiting the generalizability of the findings. While Sabah's unique characteristics make it difficult to fully represent all Malaysian students, previous literature suggests that other states across Malaysia face similar obstacles with ICT facilities, even though those facilities are generally more developed compared to Sabah (Fang et al., 2022). The experiences from Sabah could provide some insights, although a broader sample would be necessary for more generalizable conclusions. Second, the study only utilised one measurement variable from Handelsman et al.'s (2005) framework of student engagement due to physical constraints. To gain a more comprehensive understanding, future research should explore participation from both cognitive and affective perspectives by incorporating multiple elements from the framework. Furthermore, identifying the most effective e-learning strategies for student engagement would significantly contribute to existing knowledge. Finally, the study would benefit from extending its scope to schools in diverse regions across Malaysia, including both public and private institutions. Additionally, incorporating qualitative data, such as semi-structured interviews with students and teachers, could provide an in-depth understanding and validate the quantitative findings obtained from the survey.

Due to the unprecedented health crisis, all sectors of society were forced to rethink their adaptation to e-learning. However, the effectiveness of e-learning participation remains a subject of debate. Learning from past experiences and lessons can help to solidify e-learning, particularly in school education. The study found that the e-learning participation of primary and secondary school students in Kota Kinabalu, Malaysia, during the lockdown was at a moderate level. There was no significant difference in e-learning participation between male and female school students or between primary and secondary school students. This suggests that there is still much work to be done to improve student acceptance of e-learning. The study also aimed to reveal the level of

formal e-learning participation, improve the quality of the e-learning experience, and promote further research in the field of e-learning adoption in the post-pandemic era. It is undoubtedly that e-learning will become one of the concerns of education in the future.

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