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The second and third levels of digital divide among Malaysian university students during the Covid-19 pandemic

Latha Subramaniam[1], Farah Waheeda Jalaludin[1], Kai Wah Hen[2], Ching Seng Yap[3]
[1]Department of International Business, Faculty of Accountancy and Management, Universiti Tunku Abdul Rahman, Selangor, Malaysia
[2]Department of International Business Administration, International College, Tunghai University, Taichung City, Taiwan
[3]Department of Management, Marketing and Digital Business, Faculty of Business, Curtin University, Miri, Malaysia

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ABSTRACT

Adaptation of online learning among Malaysian universities during the Covid-19 pandemic stressed the dire need to tackle digital divide. Lack of empirical evidence, generic highlights on accessibility to technologies and lack of focus given on gaps in skills, usage and outcomes obscures the extent of digital divide among Malaysian students. Data was collected from 356 undergraduate students of private and public universities to identify the differences in second and third levels of digital divide, where the former entails divide in terms of digital skills and digital usage, then the latter concerns online learning outcomes between students from both types of Malaysian universities. Descriptive results unveiled the persistence of digital divide in the second and the third level among both public and private university students, with exception of students from public universities showing an advanced grasp of digital skills. Path analysis have also highlighted that having digital skills would encourage digital usage. Although digital usage equips students with resources and support for their learning attainment, at the same it also creates digital distraction, which diverts students from acquiring online learning fulfilment.

Corresponding Author:

Latha Subramaniam
Department of International Business, Faculty of Accountancy and Management
Universiti Tunku Abdul Rahman
Sungai Long Campus, Jalan Sungai Long, Bandar Sungai Long, Cheras 43000, Kajang, Selangor, Malaysia
Email: latha.s2996@1utar.my

1. INTRODUCTION

Malaysian universities are comprised of institutions from both public and private sectors. Post-colonization, Malaysian higher education consists of only six public higher education institutions. Booming economy in the late 20th and early 21st century in conjunction with the implementation of affirmative policies in higher education enrolment prompted development of private universities [1]-[3]. Students' personal funding for private education suggests that they have higher accessibility to resources and facilities, whereas students from public university heavily rely on state funding to have the same resources. This prompts a notion that students from private universities have better opportunities and socioeconomic privileges in digital inclusion compared to students from public universities.

Azubuike *et al.* [4] highlights Nigeria's digital divide between private and public institutions. Private students are more digitally included than public students. Public and private educational institutions exhibit similar digital divide patterns. Public educational institutions enroll more students from underprivileged socioeconomic or marginalised demographic backgrounds, so they are more likely to face the digital divide than private educational institutions [5]-[8].

Previous studies by [4]-[8] highlighted digital disparities between students from public and private educational institutions, with the former facing digital marginalization. In Malaysia, past studies by authors [9]-[13] have addressed the digital divide from various perspectives but lack comprehensive investigation into digital skills, usage, and outcomes among Malaysian students, and the disparity between public and private institutions. This study aims to fill this research gap by examining the second and third levels of digital divide, including skill and usage inequalities, and offline outcomes, to assess potential marginalization of public university students compared to their private counterparts.

The internet users survey 2020 [14] by the Malaysian communication and multimedia commission (MCMC) reported a meager 1.3% growth in Internet users during the pandemic, with substantial student participation contributing to this low rate. Several studies in Malaysia [10], [11], [13] explored digital divide indicators, but there is still a lack of empirical data, especially concerning higher education institutions during Covid-19. Van Dijk [15], [16] emphasizes that focusing solely on digital technology accessibility and engagement does not fully address the digital divide; it only tackles part of the issue. To effectively address the issue, studies must consider digital skills, usage, and outcomes. The challenges of the pandemic, the shift to online learning, and rapid digitalization underscore the urgent need to create a resilient and digitally inclusive post-pandemic environment.

This study aims to address 1. The extent of the second level digital divide, encompassing digital skills and usage, and the third level digital divide, which pertains to online learning outcomes among public and private university students in Malaysia, and 2. Assess the relationships between digital skills, usage, and online learning outcomes during the Covid-19 pandemic among Malaysian public and private university students.

2. LITERATURE REVIEW

2.1. Second level of digital divide

The second level of digital divide devised by Hargittai [17] includes two important indicators; digital skills and digital usage that progressed from the acquisition of elements of motivational access and material access in the first level. Digital skills and digital usage are often overlooked in tackling the issue of digital divide. However, developing digital competencies or literacy and engaging in digital activities are equally important to combat digital divide regardless of accessibility to technologies [15]-[19].

Digital skills encompass the possession of information and communication technology (ICT) skills, competencies; digital literacy levels, which refer to the cognitive ability to effectively handle digital facilities [20], [21]. Helsper and Eynon [22] stressed the importance of digital skills in guiding and navigating individuals through technological or digital sphere. The absence of these skills would hinder individuals from actively participating in digital activities or utilizing digital technologies [18], [23], [24].

Additionally, digital usage addresses individuals' actual utilization or engagement in digital or online activities. According to [15], [16], digital usage can be explored in terms of usage time or frequency, the numbers and diversity of applications used, as well as whether it involves creative or active usage or whether it occurs over a broadband or narrowband network. van Deursen and van Dijk [25] investigated usage through the categorization of different usage activities. They validated the existence of inequalities in terms of digital usage and affirmed that marginalized portions of societies were left out from engaging in diverse activities.

2.2. Third level of digital divide

The third level of digital divide, as proposed by van Deursen and Helsper [26], emphasizes the outcomes or returns of digital use. Individuals who overcome issue of accessibility, acquire digital skills, and engage in digital activities would eventually strive to achieve beneficial offline outcomes or returns. However, van Deursen and Helsper [26] together with [23], [27]-[29], reiterated that digital inequality persists in the form of outcomes, as not every individual who engages in online activities would achieve beneficial outcomes.

Helsper *et al*. [30] evaluated offline outcomes of digital use by considering the levels of satisfaction and achievement derived from engagement in digital activities. Satisfaction tackles contentment from engaging in certain digital use whereas achievement highlights attainment of benefits from engagement in digital activities. They investigated various other outcome aspects from different types of uses. The aspect of digital outcome that was studied in this paper are online learning outcomes.

Two prominent variables that are used in pedagogical or educational studies to evaluate students learning outcomes in both technology-mediated learning environment and physical learning environment were adapted to measure online learning outcomes. Students' satisfaction and perceived learning align with the concepts of satisfaction and achievement adapted by Helsper *et al*. [30]; where the former explores the level of fulfilment from online learning and the latter measures the attainment of knowledge or skills from

online learning [31]-[34]. These variables capture students' overall online learning outcomes and gauge the level of beneficial outcomes of digital use that they have achieved.

2.3. The second level of digital divide and online learning outcomes

The second level digital divide encompasses both digital skills and digital usage, as proposed by Van Dijk [15], [16], acquisition of digital skills drives digital usage. Development of digital skills motivates diversity of internet usages [25], [35]. Helsper and Eynon [22] highlighted that to engage in online activities, an individual needs to have sufficient digital capabilities. Necessary skills are vital for people to mobilize in a digitalizing environment, a lack of digital knowledge and cognitive ability negatively affects digital usage [18]. The development of digital skills enables active engagement with the Internet [19], [36], [37].

Engaging in a variety of online activities enhances students' online learning, leading to effective outcomes. Students' ICT engagement would lead to improvement in their academic performances [38]. Online engagement also increases learning efficiency and supports their curriculum. Limiting technological engagement of students would be detrimental for their learning [39]. Independent exploration and utilization of ICTs resources would contribute positively to their online learning [40].

Van Deursen and van Dijk [25] found that diverse internet activities benefit individuals. It boosts education, job, and social status. Dray *et al*. [41] identified that ICT engagement affects online learning results as well as technological abilities. ICT engagement increases online learning. Digital usage or engagement and offline or tangible outcomes of online activities are indeed two different elements of digital divide. Digital usage can yield offline benefits [26]. Diverse internet activities lead to beneficial outcomes [23], [29], [42], [43]. Different level of engagement in online activities among individuals would cause differences in achievement of outcomes [25], [44], [45]. Figure 1 illustrates the research model of this study. This study proposed the following hypothesis.

H1: Digital skills have a positive and significant relationship with digital usage.

H2: Digital usage has a positive and significant relationship with (a) students' satisfaction and (b) students' perceived learning in online learning during the Covid-19 pandemic.

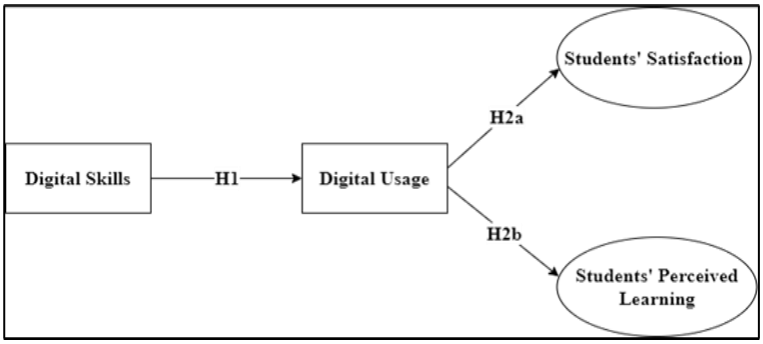

Figure 1. Research model

2.4. Digital divide between students from public and private universities

During the Covid-19 outbreak in Nigeria, Azubuike *et al*. [4] examined how the digital divide affected academic achievements in public and private schools. Public and private school students have different access to technology and academic engagement. The study found that students from public education institutions are more digitally excluded compared to students from private education institutions.

In Pakistan, students from public education institutions are more likely to struggle with technology and online learning due to their lower socioeconomic status [6]. Similar findings were discovered by [7]. These researchers discovered a prominent digital gap between educators who work in public and private universities. Educators in public universities face divides in material access and digital skills, impacting technology-enhanced teaching and learning negatively. The lack of technological accessibility and digital competencies among educators creates adverse effects.

Mendoza-Lozano *et al.* [8] found students who attend public education institutions are fifteen percent less likely to have ICTs accessibility than their peers who are in private institutions. A lack of infrastructures and funding budget are the main reasons for a wider gap of digital divide among public schools in China [5]. From the literature, it could be deduced that public education institutions are at a digitally disadvantageous position compared to private education institutions.

3. METHODS

Questionnaire items for constructs digital skills, digital usage, students' satisfaction and perceived learning were adopted and adapted from [20], [25], [32], and [33] respectively. SPSS 25 was used for mean score evaluation and independent sample t-test while measurement model assessment and structural model assessment were conducted using SmartPLS 3.3.3. Since digital skills and digital usage were comprised of sub-dimensions, hierarchical component model (HCM) was constructed [46].

This study recruited 356 undergraduate students from ten public and private universities that span across nearly every geographical region in Malaysia. Using quota sampling, 178 student respondents were chosen from each type of institution, as shown in Table 1. Students were gathered through snowball and self-selected sampling techniques.

Table 1. Student respondents by universities

Public higher education institutions (n=178)	n	%
University of Malaya (UM), KL Campus	40	11.24
Universiti Malaysia Sabah (UMS), Kota Kinabalu Campus	35	9.83
Universiti Malaysia Sarawak (UNIMAS), Kota Samarahan Campus	38	10.67
Universiti Sains Malaysia (USM), Penang Campus	40	11.24
Universiti Tun Hussein Onn Malaysia (UTHM), Pagoh Campus	25	7.02
Private higher education institutions (n=178)		
AIMST University, Kedah Campus	39	10.96
Curtin University, Miri Campus	39	10.96
INTI International University, Nilai Campus	26	7.30
Multimedia University (MMU), Melaka Campus	39	10.96
Universiti Tunku Abdul Rahman (UTAR), Sg.Long Campus	35	9.83

4. RESULT AND DISCUSSION

Table 2 shows the mean scores of digital skills, digital usage, students' satisfaction and students' perceived learning, as well as the mean scores of sub-dimensions of digital skills and digital usage. Public university students' digital skills show a narrowing indication with a mean score value of more than four, whereas private university students are facing substantial gap with a value less than four. A mean score value of less than four for both university students' digital usage, students' satisfaction and perceived learning during the Covid-19 pandemic indicates an alarming gap. Through an independent t-test, it was found that these variables do not statistically differ between student respondents from both universities.

Table 2. Mean score values

Constructs	Public		Private	
	Mean	Standard deviation	Mean	Standard deviation
Digital skills	4.046	0.631	3.954	0.805
Operational skills	4.535	0.948	4.498	1.108
Information navigation	3.460	1.083	3.527	1.201
Social	4.625	0.743	4.302	0.933
Creative	3.371	1.049	3.261	1.079
Mobile	4.614	0.742	4.431	1.034
Digital usage	3.836	0.545	3.860	0.544
Personal development	4.162	0.686	3.781	0.789
Leisure	3.742	0.878	3.951	0.858
Commercial transaction	3.243	1.080	3.650	0.945
Social interaction	4.170	0.827	4.303	0.762
Information	4.466	0.736	4.317	0.690
News	3.635	1.069	3.419	1.003
Gaming	2.730	1.260	3.163	1.294
Students' satisfaction	2.768	0.988	2.917	1.035
Students' perceived learning	3.306	0.897	3.259	0.921

Measurement model validity and reliability for both reflective lower order constructs (LOCs) and higher order constructs (HOCs) were established. For reflective LOCs, outer loadings of each indicators were more than 0.7. Table 3 displays the establishment of Cronbach's Alpha, composite reliability and convergent validity values for all LOCs.

Additionally, measurement model validity was established for all indicators of formative HOCs with VIF of less than 5, which signifies that there are no issues of collinearity among HOCs. Subsequently, the outer weights of all indicators of formative HOCs were significant at 0.05 significance level except that of Gaming. In this case, as suggested by [46] and [47], outer loading can be substituted to test measurement

model validity, the construct of Gaming did portray a result of significant outer loading at 0.05 significance level.

Table 4 exhibits the path coefficient outputs of all proposed hypotheses in this study. The results of path analysis between constructs of the second and third levels of digital divide signify that H1 and H2b were supported, however, H2a was not supported This finding ascertain those digital skills positively affects digital usage, while digital usage has no significant impact on students' satisfaction and positively associates with their perceived learning.

Table 3. Cronbach's Alpha, composite reliability and AVE of LOCs

Reflective LOCs	Cronbach's Alpha	Composite reliability	AVE
Operational skill	0.976	0.979	0.822
Information navigation	0.941	0.950	0.706
Creative	0.919	0.931	0.629
Social	0.954	0.963	0.814
Mobile	0.928	0.954	0.874
Personal development	0.776	0.854	0.594
Leisure	0.745	0.855	0.665
Commercial transaction	0.890	0.932	0.820
Social interaction	0.845	0.906	0.764
Information	0.826	0.920	0.852
News	0.927	0.965	0.932
Gaming	1.000	1.000	1.000
Students' satisfaction	0.950	0.957	0.762
Students' perceived learning	0.955	0.964	0.816

Table 4. Path analysis results

Hypothesis	Descriptions	Beta coefficient	Standard error	t Value	Decisions
H1	Digital skills->Digital usage	0.355	0.059	5.658***	Supported
H2a	Digital usage->Students' satisfaction	0.020	0.070	0.273^{ns}	Not supported
H2b	Digital usage->Students' perceived learning	0.154	0.065	2.342**	Supported

Note: * < 0.10, ** < 0.05, *** < 0.01, ns = non-significant

This study found significant differences in digital skills between public and private university students, with students from public universities showing higher development compared to their private university counterparts. Although digital capabilities were not statistically different, the mean score differences indicated noticeable skill disparities, highlighting the issue of digital inequality in the Malaysian higher education system. Van Dijk [15], [16] explains that the issue of digital divide extends beyond existing structural and socioeconomic inequalities. The facilities surrounding Malaysian public and private universities reveal the true disparity between the two types of institutions. Public universities in Malaysia, as state-backed institutions, have access to federal financial resources, especially after the implementation of affirmative action policies following the New Economic Policy in 1971. This led to increased funding for public higher education institutions. Public university students acknowledged their institution's technological advancements and extensive skill development opportunities, which might have provided them with a stronger foundation for developing digital skills compared to students from private universities [3], [48], [49].

The rapid development of private universities in Malaysia, following affirmative policies, has opened opportunities for students from both privileged and underserved backgrounds to pursue higher education in the private sector. The establishment of the National Higher Education Fund Corporation (PTPTN) has eased financial burdens for students from underserved backgrounds, making private higher education more accessible to a diverse student population, including those from lower or middle socioeconomic backgrounds [48]-[52]. The findings of this study corroborate previous research, emphasizing how socioeconomic and positional marginalization play a role in perpetuating the digital divide. Undeniably, socio-demographic characteristics of the respondents also played significant roles in widening gaps in digital skills, usage, and online learning outcomes during the Covid-19 pandemic [17], [19], [26], [27], [32].

As proposed, development of digital skills encourages digital usages, students who have sufficient digital skills would participate in more online or internet activities [20], [23], [39], [40]. However, it shows an insignificant association with students' satisfaction. On one hand, online engagement enhances learning experience and promotes development of skills and knowledge attainment, but on the other hand, it can lead to digital distraction, diverting students from achieving satisfactory online learning experiences [53], [54].

5. CONCLUSION

This study aimed to identify differences in the second and third levels of the digital divide among public and private university students in Malaysia. It found that both levels of the digital divide persisted between students from both types of universities, except for public university students who demonstrated higher digital skills. However, path analysis showed an insignificant association between digital usage and students' satisfaction in online learning during the Covid-19 pandemic, contradicting what have been previously proposed. Socioeconomic and demographic factors, contributed to the divide. Lack of prior online learning experience also played a role. Public university students' advanced digital skills were attributed to higher governmental support and incentives for digitalization efforts. The study highlighted the importance of considering digital distraction's impact on digital usage and online learning experiences to better understand the relationships between digital skills, usage, and online learning outcomes. Addressing these contradictions is crucial for advancing digital divide research.

This study significantly addresses the second and third level digital divide among Malaysian university students. It has helped policymakers, government, and institutions tackle the digital divide. Digital skills, broad usage, and offline benefits are just as vital as physical access to technology in bridging the digital divide. Thus, this study seeks to promote second and third-level digital divide activities and policies. However, the non-probability sampling approach used lead to increased representation of samples from developed states. Thus, future studies might examine the issue among Malaysian students from rural or undeveloped areas to better understand the digital gap and its effects on different student populations. To better understand the second and third levels of digital divide, future studies should examine digital distraction. Understanding how digital distractions affect digital abilities, usage habits, and learning outcomes can assist create methods to improve students' digital engagement and academic achievement.

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BIOGRAPHIES OF AUTHORS

Latha Subramaniam is a postgraduate student, pursuing Master of Philosophy and serves as a graduate researcher under a project endorsed by Fundamental Research Grant Scheme from Malaysian Ministry of Higher Education (MOHE) and Universiti Tunku Abdul Rahman (UTAR). She can be contacted at email: latha.s2996@1utar.my.

Farah Waheeda Jalaludin is an assistant professor in the Faculty of Accountancy and Management, Universiti Tunku Abdul Rahman. She is also a certified trainer for Alibaba Global Digital Talent. Her research interest includes e-commerce, mobile commerce, social commerce and business information systems. She can be contacted at email: farah@utar.edu.my.

Kai Wah Hen is an assistant professor at Tunghai University, Taiwan. His research interest is e-commerce, social media marketing, knowledge management and cross-border e-commerce. He can be contacted at email: henkw@thu.edu.tw.

Ching Seng Yap is an adjunct associate professor at Curtin University Malaysia. His research interest lies in knowledge management, business information systems, e-commerce, and e-government. He can be contacted at email: Csyap.Yap@curtin.edu.au.