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# Digital resilience in higher education in response to COVID-19 pandemic: Student Perceptions from Asia and Australia

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## Abstract

COVID-19 has transformed higher education learning and teaching practices globally. Tertiary students, internationally face both opportunities and challenges in learning and adapting to this paradigm shift in the delivery of education. It remains unclear how students in international contexts are responding to these changes in digital learning during and post-COVID-19. This paper aims to compare student perceptions of digital competence, confidence, and resilience in present times using data from surveys of tertiary students from Australia, Cambodia, China, India, and Malaysia. There are disparities not only in the teaching and learning pedagogies amongst these countries but also in the levels of technological advancement, infrastructure support, and pace of digital innovation in the delivery of courses. These differences have put in focus students' both digital competencies and resilience as they pursue higher education on various digital learning platforms. Resilience includes the ability to bounce back or adapt from stress (Smith et al., 2008) Digital resilience is students' tech-savviness and preparedness to adapt to different digital environments as they pursue higher education. This paper examines the perceptions of tertiary undergraduate students from these countries in this emerging new digital learning norm-. A total of 687 tertiary students from the aforementioned countries participated in a survey to questions related to digital competence, confidence in using and/or adapting to digital innovation, and resilience. Statistically significant attributes are identified to help better understand the challenges these culturally diverse students perceive in digital learning environments. This study will reveal barriers that impact the digital transformation of undergraduate students which can be used to recommend necessary teaching and learning support frameworks to enhance their digital competence and resilience. This will help tertiary institutions better equip all stakeholders in adapting to the new normal of higher education in the future.


## Practitioner Notes

1. That course delivery strategies should be redesigned to suit cohorts with multiple levels of digital competencies, digital, and emotional intelligence.
2. That institutions should institute novel professional development programs for staff to instill much-needed digital competencies to drive digital hardware and software efficacy.
3. Encouraging staff to undergo specially designed workshops will help them recognise the importance of emotionally engaging with their learners who may be facing social and academic isolation.
4. To develop school-level support structures for students with the leadership of student ambassadors and recent graduates to motivate and emotionally support online learners.
5. To revise assessment strategies that will better fulfill the pedagogical aspirations of the learner.


## Keywords

Digital competencies, Digital resilience, Digital technology, COVID-19



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## Introduction

Until recently, progressive digital transformation and the continuous embedding of digital delivery in tertiary education have been considered a distraction by several stakeholders, including students, academics, professionals, and other members of the community (Fidalgo et al., 2020). With the rampant onslaught of COVID-19 since March 2020, education providers at all levels in the community have been forced to adopt drastic measures to embrace digital delivery of courses to facilitate the continuance of students' educational pursuits and careers. COVID-19 has had a varied impact on the education sector across the globe (Schleicher, 2020); both developing and developed countries have faced some common and some unique challenges as they responded to the pandemic (Thomas, 2020). The main challenge was the drastic change to the learning experience for students at a fundamental level, who had to embrace online learning (Kuhfeld et al., 2020). Students, staff and other facilitators (tutors and laboratory assistants) have had to spend more time online and off-site, forcing all to continuously adjust and adapt to the changing teaching and learning pedagogy. These adaptations have further created concerns amongst students and parents about the nonuniform teaching quality driven by uneven digital competencies in both students and academics (Hietajärvi et al., 2019) in terms of using technology proficiently to deliver high quality teaching with adequate concentration and minimal interruptions (including digital noise arising from poor Internet connections, data transmissions, monotonic communication).

Another dimension to the ongoing stop-start interference of the pandemic after one year is that it has upset the nascent academic rhythms, prompting further *ad hoc* responses by administrators and academicians to incorporate greater flexibility in the delivery and management of academic courses. This is found to be commonplace in all disciplines including the arts, education, engineering, law, and sciences, among others, compounded by a myriad of discipline-specific challenges (Bose, 2021; Brown & Krzic, 2021; Flaherty, 2020; Gallagher, 2021). In short, everyone had to function out of their comfort zones to facilitate the continuance of education and careers. Attention to fundamental and core concepts was overridden by the dire need to learn, familiarise and adapt to new 'learning technologies and styles,' which in turn paved way for the need to develop a new type of 'digital resilience' in all stakeholders.

It is generally accepted that tertiary institutions in the developed countries have adopted superior Information and Communication Technologies (ICT) to deliver education as compared with their counterparts in developing countries (Palvia et al., 2018). However, the degree of impact COVID-19 has had in these environments was overwhelming in terms of the stress online delivery placed on the lack of robust digital infrastructure (Hofer et al., 2021), hardware and software, and most importantly, the bandwidths to transmit high volume and high-quality video material (Gillis & Krull, 2020). The situation in developing countries on the other hand resulted in an educational crisis (Khlaif et al., 2021; Uon, 2020) compounded by a lack of basic facilities such as electricity and the Internet. In other situations, where digital infrastructure was available, the high density of population in countries such as China (Huang et al. 2020) and India (Kundu & Bej, 2021) made digital delivery of education most challenging.

Crawford et al. (2020a) presented an intra-period response of universities from 20 countries after the first wave of COVID-19. These included a mix of developed (e.g., Australia, China, Germany, Italy, Singapore, Republic of Ireland) and developing countries (India, Malaysia, Nigeria, Indonesia, Thailand). They report that the responses by higher education providers have been diverse from having no response through to social isolation strategies on campus and rapid curriculum redevelopment for fully online offerings. This is indeed relatable to the overall scientific and technological advancements and limitations within these economies (Potashnik, 2021; Hanushek & Woessmann, 2020).

These challenges have brought into focus the digital competencies and resilience of all users. Academics and students have had to undergo intensive training using whatever support structures that were available to facilitate and promote teaching and learning. In this paper, the authors' different disciplines including science, engineering, arts and law, and hailing from Australia, Cambodia, China, India, and Malaysia, joined forces to undertake an intensive study to assess the digital competencies and resilience of students during the pandemic. This paper presents the results of surveys that were administered to 695 students from tertiary educational institutions in Australia, Cambodia, China, India, and Malaysia. Authors from diverse backgrounds and disciplines presented an in-depth analysis of the approach, methodology, survey questionnaire and recommended how tertiary educational institutions should think about and plan strategies to effectively deliver high-quality education from 2022 and beyond. The impact of COVID-19 has been far-reaching and has created unique challenges pertinent to the university sector. Students (and staff) have for the most part displayed resilience in their adoption of online learning, and this study shares important insights into the impact of this transition and how institutions can improve online learning strategies into the future. The authors conclude by setting out key policy recommendations and a future research agenda to better understand the impact of the transition to online learning due to COVID-19.

## Literature review

### *Digital competence and digital resilience*

Digital competence has emerged with the digitalisation of society, extending across work, learning, leisure, socialisation, and consumerism (Ferrari, 2012). Society's shift towards a digitalised world necessitates knowledge, attitudes, and skills of digital competence. Digital competence refers to the capacity of using digital technologies consciously and critically (Klassen, 2019), as users in public and private life (Pötzsch, 2019) conduct problem solving, communicating, information managing, collaborating, and effective knowledge building (Ferrari, 2012). In academic contexts, resilience is "a student's capacity to overcome acute or chronic adversities in academic settings that could constitute major impediments to their academic success" (Martin & Marsh, 2009, p.353). Digitally resilient students in tertiary education sustain motivation, achievement and performance in their studies while being able to overcome and deal with stressful events (Alva, 1991). The inevitable stress for such students, does not result in poor educational outcomes or lead to the risk of dropping out, as they adopt resilience into their digital competencies. Resilience thus has a positive impact on students' health, well-being, performance, and achievement (Cassidy, 2016).

Traditionally, digital resilience is related to matters concerning cyber-safety, security, or bullying. In this study, we define digital resilience as the ability of learners to overcome technological difficulties and persist with online learning as they adapted to the changing trends in higher education due to COVID-19. Existing literature largely probes into and seeks strategies for solidifying and enhancing students' general resilience such as psychological resilience (Beale, 2020) and wellbeing (Sood, & Sharma, 2020). Four themes including control, resourcefulness, involvement, and growth, were explored when considering building resilience in students (Wadi et al., 2020). Some other studies evidenced that resilience in curriculum evaluation systems facilitated students' learning outcomes and benefited curriculum design and delivery during the pandemic (Muscat-Inglott, 2020). However, how to develop digital resilience in students has been overlooked. Additionally, some studies have contributed practical implications regarding how tertiary educational institutions facilitated resilience in face of the pandemic (Crawford et al., 2020b). For example, universities across 20 countries actioned strategies, including on-campus social isolation and redevelopment for fully online education (Crawford et al., 2020a). Higher education providers have faced challenges of organisational agility (Wu, 2020), technological infrastructure (Zhong, 2020), and online environments (Xie & Rice, 2021), when reengineering resilience for students.

Another example confirmed that distance learning organised by universities improved students' resilience (Appolloni et al., 2021). Similarly, the design, development, and implementation of learning activities promoted resilience in students (Naidu, 2021). However, how well the tertiary institutions prepare for the digitalisation of learning to develop resilience remains unknown (Houlden & Veletsianos, 2020).

To fill the gap, the present study critically assesses ways to strengthen tertiary students' online academic success and cyber-based well-being by exploring the digital resilience in students during and after the pandemic. Secondly, it investigates strategies to help students to manage and bounce back from adversities through rebuilding digital supports and choreographies provided by tertiary educational institutions in the transitioning educational scenarios.

### *Measurements of digital resilience*

A plethora of resilience scales, measurements and instruments have been developed over time, but each holds a variety of limitations or lack of research application and theoretical underpinnings (Ahern et al., 2006). Within the six resilience instruments compared by Anhern et al. (2006), a selection of constructs was measured, each with its own theoretical basis. The constructs included but were not limited to protective factors that support resiliency, successful stress-coping ability, protective resources of healthy adjustment, adolescent resilience, resilient coping behaviours, and resilience as a positive personality characteristic. The review of resilience measuring instruments found that the Resilience Scale was identified as most effective within the context of the study as its psychometric properties and applications in a variety of age groups were positively supported (Ahern et al., 2006). Within this study, the authors assessed resilience from the perspective of protective factors or resources regarding personal characteristics. For example, equanimity, perseverance, self-reliance, meaningfulness, and existential aloneness were assessed (Wagnild & Young, 1993).

The Connor Davidson Resilience Scale, another instrument included in the study, evaluated characteristics of resilience including, patience, self-efficacy, faith, optimism, and sense of humour (Connor & Davidson, 2003). This study's credibility was weakened by its inability to apply to adolescents. The Ego Resiliency Scale, however, assesses an individual's ability to change form and return to the characteristic level of ego-control (Block & Kremen, 1996). Various personality characteristics were also assessed using Life Orientation Test-Revised (LOT-R) (Scheier et al., 1994), Purpose in Life (Ryff & Keyes, 1995), and Toronto Alexithymia Scale (TAS-20) (Bagby et al., 1994). Besides those, resilience was assessed concerning social relationships, such as Interpersonal Support Evaluation List (ISEL) (Cohen et al., 1985) and MOS Social Support Survey (MOS-SSS) (Sherbourne & Stewart, 1991). Additionally, Mental Health Inventory (Veit & Ware, 1983), Mood Adjective Checklist (Larsen & Diener, 1992), and the Perceived Stress Scale (PSS) (Cohen et al. 1983) focused on the assessment of health-related outcomes of resilience. While each has their own focal point, they do have weaknesses and lack of association to resilience as contextualised in this paper. The Brief Resilience Scale (BRS) developed by Smith et al. (2008) however, is unique in that it refers to characteristics that may increase the likelihood of resilience as bouncing back from digital learning stress during COVID-19. The BRS measures resilience to psychological stresses such as anxiety. While it also has weakness, its reliability was found in its simplicity and applicability as a measuring scale. This means that it is unitarily designed paves the way for relevant utilisation or adaptation to a wide variety of research projects.

Considering the resilience measurement scales mentioned above, the BRS was selected as a foundational construct for the research conducted in this paper by the authors for the following reasons. First, the authors believe that the BRS is unique in its measurement of resilience by assessing individuals' ability to bounce back, adapt to stress and thrive in the face of adversity. Most

previous studies assess protective factors or resources that constitute personal characteristics and coping styles. These include those briefly explored above: Connor Davidson Resilience Scale (2003), and the Resilience Scale by Wagnild & Yong (1993), which was the preferred instrument according to Anhern et al. (2006). For those who do not have the personal characteristics that naturally embrace resilience, strong digital resilience becomes difficult to learn and adapt when necessary personal characteristics are not strengths. Secondly, instead of coping styles that are reactive and pose "recovery" type approaches, Smith et al. (2008) focus on active adapting, thriving in adversity and bouncing back. Essentially, the scale put greater emphasis on bouncing back "during" the hard times faced rather than assessing delayed resilient recovery that individuals undertake. For example, the question "I have a hard time making it through stressful events" specifically addresses the "during" period in which an individual is actively dealing with the challenge faced. Thirdly, the BRS has been utilised in investigating the resilience of several undergraduate student samples. In the initial study, two of the four samples were tested on undergraduates, namely 128 and 64 students respectively (Smith et al., 2008). In subsequent studies, the BRS was administered to 547 Hong Kong and 268 mainland Chinese undergraduates and illustrated convergent validity both times (Lai et al., 2014). In other words, the BRS well fits the initial purpose of the present study.

### *Research aims and questions*

The present study aims to assess the digital competencies and resilience of undergraduate tertiary students from Australia, Cambodia, China, India, and Malaysia, during the pandemic and in the post-COVID-19 era. Accordingly, six research questions were developed for the quantitative and qualitative survey:

(1) How resilient are tertiary students in dealing with digital learning and the associated transitions to online education.

(2) What digital competency and skills do tertiary students from the five countries have?

(3) How effective do students believe universities' current digital models are for online learning?

(4) What are the student perceptions of transitioning from physical face to face, to online-learning using digital platforms?

(5) What are the main challenges that students faced in the transition to online learning during COVID-19.

(6) What do students feel their universities could have done better to support them more effectively in the transition to online education?

## Method

### *Research approach*

This paper investigates student perceptions of digital competence, confidence and resilience in present times by comparing survey data from the tertiary students from Australia, Cambodia, China, India, and Malaysia. The authors acknowledge that the worldviews of current and past researchers guide the approaches adopted in the research (Slife & Williams, 1995). Choosing a research paradigm that is compatible with the researchers' worldviews about the nature of reality can ensure a robust research design (Mertens, 2007). Pragmatism provides a suitable application to the present study because it provides the researchers with multiple methods, different worldviews and assumptions, and various forms of data collection and data analysis, to understand the varying problems (Tashakkori & Teddlie, 2010), allowing the authors to draw quantitative and qualitative assumptions (Creswell, 2014). Additionally, the method approach selected is highly dependent on

the research worldview held (Guba, 1990). The research approach underpinning this study is located on a mixed-methods approach, involving an integration of both qualitative and quantitative research and data (Creswell, 2014). A mixed-methods approach helps the research to best understand the research problem (Creswell & Clark, 2007) because it is more likely to strengthen merits and make up for weaknesses of both sides (Johnson et al., 2007). Therefore, the research can gain comprehensive insights into the research findings (Johnson & Turner, 2002).

### *Research design*

With a mixed-methods approach, a specific design should be carefully selected to adopt in the research, because well-designed research procedures will lead to rigorous and high-quality findings (Creswell, 2004). In the present study, a convergent parallel mixed-methods approach is used. In this design, the researchers collect quantitative and qualitative data roughly contemporaneously to conduct a comprehensive analysis (Creswell, 2014). Both forms of data are converged to interpret the overall results to further explain the findings.

### *Measures*

A survey allows the researchers to understand the characteristics of a particular set of data by collecting quantitative or numeric descriptions of attitudes and opinions of the sample population (Johnson & Christensen, 2004). As a result, the researchers could comprehend the participants' views and opinions expressed in the survey based on the specific research questions (Pallant, 2007). The proposed survey aims to assess the digital competencies of undergraduate tertiary students as they engage with and embrace a new learning paradigm during the pandemic and in the post-COVID era. The survey is designed as an opportunity for students to assess the change in their information and communication technologies (ICT) and digital competencies. Findings from the survey will provide critical insight for tertiary institutions regarding (a) the current level of digital competencies and skills that undergraduate students have; (b) how students perceive the university's current digital solutions regarding fostering learning; (c) how students perceive the impact of a move from physical to self-learning using digital platforms and (d) the future direction that universities need to think about and prioritise on the development of appropriate, supportive learning structures which will foster the uptake of digital learning tools and provide an impetus to the mechanisms which will boost student learning in the post-COVID-19 learning paradigm.

The survey was broadly divided into five sections. Section 1 commenced with questions on student demographics such as country of study, university, age, gender, level of study (undergraduate or postgraduate), discipline and location (urban, semi-urban or rural). Section 2 comprised of eight questions related to pre-COVID-19 learning styles such as teaching method, delivery style, duration of time taught face to face and online, the common ICT tools used for learning purposes and how efficient students were in using such tools. Section 3, which tries to capture how students underwent digital transition, was divided into two parts. Part A asked questions related to the pre-COVID-19 situation and students' ability and confidence in using several traditional ICT tools such as the internet, university's information management systems, search engines. Part B of this section posed the same questions of students in the COVID-19 and post-COVID-19 context. Section 4 posed questions on digital resilience centred around online safety, security and wellbeing before, during and post COVID-19 first wave. Section 5 posed questions that helped students assess their digital competencies before, during and after the first wave. These included students' ability to learn and adapt to online learning styles, using ICT efficiently., and how frequently they had to update their skills to remain up to date with the use of technology. This was followed by questions on how their Schools/universities supported their transition from face-to-face to online learning, how effective these support learning structures were and what challenges they faced in trying to make this transition. The survey concluded with some questions on how the need to transition to online

learning impacted the students' psychological wellbeing in terms of stress, ability to adjust to new routines, and seeking help. This section consisted of two open-ended questions which provided the participants with more space to express their ideas. The researchers could thus gather more information of the participants' views on digital learning and resilience.

### *Project setting, data collection methods*

Resilience is determined by negotiation with the environment for resources by which individuals bounce back during adversity (Ungar, 2004). A mixed-methods approach was employed so that resilience factors could be understood in multidimensional ways, acknowledging that resilience is unique to each context. This was necessary as the international collaboration took place across seven sites, including the University of Tasmania (UTAS), Australia; Central Queensland University (CQU), Australia; Dewey International University, Cambodia; Royal University of Phnom Penh, Cambodia; O.P. Jindal Global University, India; Taylor's University, Malaysia; and University of Jinan, China. The surveys were administered online using UTAS' REDcap – a secure web application for building and managing online surveys and databases. A mixed methods approach targeted at the undergraduate student cohort. The questionnaire (attached as Appendix 1) employed a mix of Likert scale items, binary-choice items (Yes/No) and some qualitative open response options. The Likert scale items were analysed using descriptive statistics. The open response items were coded and thematically analysed. Participants were invited on the basis of the following criterion: undergraduate students, either gender, part-time and full-time students. The network and snowball recruitment methods were used for data collection. The survey began with a statement of implied consent – meaning that when students chose to take part in the survey and fill it in, they gave consent to their participation in the survey. Participants who did not submit a survey with at least 50 percent completion rate, were considered but withdrawn from the survey and their data was omitted from subsequent analysis. Those participants who completed more than 50 percent but less than 100 percent were advised in the information sheet that their partial data will be used to analyse the survey. Furthermore, data collected from participants was not identifiable and was collected anonymously.

### *Data analysis*

Quantitative data collected from the close-ended questions in the survey were analysed by SPSS software version 26.0. First, descriptive statistics were used to analyse the participants' views on the question items. Descriptive statistics describe, and summarise the data set (Johnson & Christensen, 2004). It shows information regarding variables by median values, dispersions, and distributions. (Huizingh, 2007), because they presented the participants' degree of agreement on the question items in an interpretable form. Secondly, analysis of statistical significance for pre-and post-type analysis specifically for statistical analysis for pre-COVID and during COVID digital competency measures were analysed by a chi-square method (initial hypothesis, followed by calculation of chi-square between a pair of attributes, and chi-square to p-value). A chi-square test of independence was found to be significant if the p values were $<0.05$.

The qualitative data collected from the open-ended questions in the survey were text-formatted, in a numerical form as with the quantitative data. NVivo software was utilised to analyse the qualitative data because it helps the researchers transcribe, organise, and interpret the textual data. A thematic analysis was then used for qualitative analysis (Howitt & Cramer, 2011). The researchers could thus construct and generate key themes according to the participant's responses in the open-ended questions. Additionally, the researchers could sort out codes, find patterns, and develop theories regarding the participants' views of digital learning and resilience during analysis.

## Results

A total of 695 undergraduate students participated in the survey with 485 surveys entirely complete. The profile of the participants is summarised in Table 1. The lower survey population in Australia may be attributed to delays in obtaining approval from the institutional review boards for the surveys at UTAS and CQU. Law students from India comprised of the largest proportion (31.7 percent) of the survey. Over 93 percent of the participants were in the 18-24 years age group, which indicates that these students were mostly in their early undergraduate years. It is also noted that over 89.5 percent were full time students as compared to only 10.5 percent of part timers. The majority of respondents identify themselves as studying in an urban (48.1 percent) or suburban (38.3 percent) location. It is hypothesised that students in urban areas may have issues with access to technology and internet connectivity. For example, costs associated with studies were explained by Cambodian students. In other contexts, gender, age groups, level and year of study were not considered nor critically evaluated within the purview of this paper.

**Table 1**

*Descriptive statistics of survey population.*

| | n | % |
|---|---|---|
| **Countries** | | |
| Australia | 103 | 14.8% |
| Cambodia | 137 | 19.7% |
| China | 118 | 17.0% |
| India | 215 | 30.9% |
| Malaysia | 122 | 17.6% |
| **Universities** | | |
| UTAS | 100 | 15.1% |
| CQU | 8 | 1.2% |
| Dewey | 39 | 5.9% |
| Royal | 83 | 12.6% |
| Jinan | 105 | 15.9% |
| JGU | 197 | 29.8% |
| Taylor | 129 | 19.5% |
| **Age** | | |
| <18 | 16 | 2.3% |
| 18-24 | 652 | 93.0% |
| 25-43 | 31 | 4.4% |
| <45 | 2 | 0.3% |
| **Gender** | | |
| Male | 291 | 41.3% |
| Female | 400 | 56.8% |

| | | |
|---|---|---|
| Other | 13 | 1.8% |
| **Year of study** | | |
| Year 1 UG | 247 | 35.1% |
| Year 2 | 125 | 17.8% |
| Year 3 | 172 | 24.5% |
| Year 4 | 130 | 18.5% |
| Year 5 | 29 | 4.1% |
| **Disciplines** | | |
| Arts and Humanities | 54 | 7.7% |
| Business and Economics | 98 | 13.9% |
| Health | 114 | 16.2% |
| Computer Sciences | 10 | 1.4% |
| Education | 61 | 8.7% |
| Engineering/technology | 56 | 8.0% |
| Law | 223 | 31.7% |
| Life Sciences | 15 | 2.1% |
| Physical Sciences | 8 | 1.1% |
| Social Sciences | 16 | 2.3% |
| Others | 48 | 6.8% |
| **Study Mode** | | |
| Part-time | 74 | 10.5% |
| Full-time | 630 | 89.5% |
| **Study region** | | |
| Rural | 104 | 14.8% |
| Suburban | 266 | 37.9% |
| Urban | 332 | 47.3% |
| **Enrolment status** | | |
| International | 106 | 11.2% |
| Domestic | 691 | 88.8% |

### *Quantitative findings*

Data comparing the existing and preferred learning styles amongst all students before and during COVID-19. It is noted that there is a strong preference for face-to-face (FTF) learning with a shift from about 58 percent pre-COVID to 70 percent post-first wave of COVID-19. The respondents, for some reason, seem to prefer face-to-face learning but perhaps have had to embrace online/distance learning owing to various reasons. Cohorts that embraced blending learning preferred that style. These trends were similar across all the countries and institutions surveyed, in that an average of at least 60 percent of all respondents preferred face-to-face teaching, irrespective of the country where they were studying. Data analysis using a chi-square method between the

preferred and existing methods did show a trend towards significant difference between the two learning styles with a p-value of 0.058.

Figure 1 shows a measure of the effectiveness of digital learning tools before COVID-19 at the various institutions where the students studied. The trends were similar amongst all regions in the first two categories (extremely effective and somewhat effective) while about 5 percent more Australian respondents felt that they were *somewhat ineffective* as compared to their Indian and Asian counterparts. Nearly twice the number of Indian students felt that the digital learning tools before COVID-19 were *extremely ineffective*. It is noted that a significant number of respondents from all countries (approximately 25 percent) were either unsure or neutral about the effectiveness. The neutrality could be attributed to the transient phase students have been going through and the uncertainties around how and what learning they are expected to take up via these changing learning environments. Those in the 'not sure' category were found to be mostly in their first year of their undergraduate studies.

**Figure 1**

*Comparison of the effectiveness of digital technology tools before COVID in Australia and Asia.*

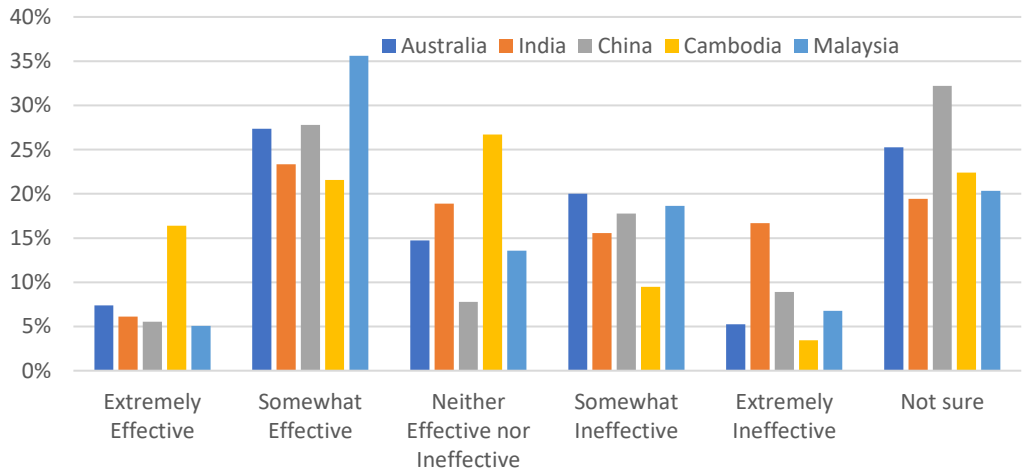


Figure 1 describes the comparison of the effectiveness of digital technology tools before COVID in Australia and Asia. Out of the six expression patterns described in three groups as Australia, India and the rest of Asia, a chi-square method of significance indicated that only *extremely effective* is significantly different between the groups with a p-value 0.018.

Table 2 presents some general trends related to the way various digital devices and tools were being used by students. It is noted that the student population used several of the identified digital devices for both study and non-study purposes with reasonable frequency. It is evident in Figure 2 which shows that over about 76 percent of the respondents possessed above *average to very high ability* in using various digital devices for both study and non-study purposes.

**Table 2**

*Use of digital technology for various purposes.*

| Criterion | Item | *n* | % |
|---|---|---|---|
| Digital devices used before COVID-19 for personal use | Phone | 513 | 72.66 |
| | Tablet | 109 | 15.44 |
| | Laptop | 425 | 60.20 |
| | Desktop | 70 | 9.92 |
| | Other | 7 | 0.99 |
| Digital devices used before COVID-19 for study use | Phone | 338 | 47.88 |
| | Tablet | 109 | 15.44 |
| | Laptop | 487 | 68.98 |
| | Desktop | 88 | 12.46 |
| | Other | 8 | 1.13 |
| As a daily average, time spent (pre-COVID-19) for personal use | Less than 1 hour | 28 | 4.61 |
| | 1-2 hours | 144 | 23.68 |
| | 3-4 hours | 250 | 41.12 |
| | 5-6 hours | 84 | 13.82 |
| | Over 6 hours | 63 | 10.36 |
| | Not sure | 39 | 6.41 |
| As a daily average, time spent (pre-COVID-19) for study use | Less than 1 hour | 42 | 6.92 |
| | 1-2 hours | 129 | 21.25 |
| | 3-4 hours | 170 | 28.01 |
| | 5-6 hours | 108 | 17.79 |
| | Over 6 hours | 131 | 21.58 |
| | Not sure | 27 | 4.45 |

**Figure 2**

*Ability to use digital devices*

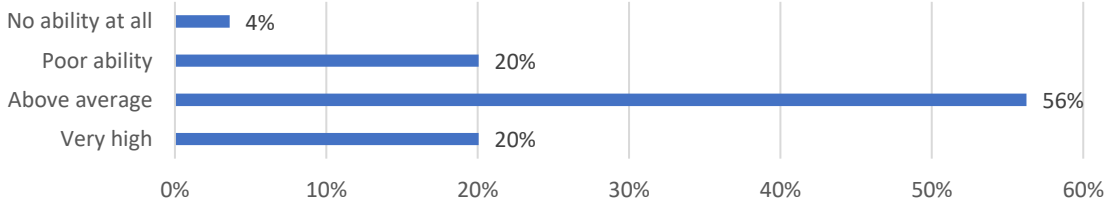

Table 3 present a comparison of the confidence levels in terms of digital competency in students before and during COVID-19. It is noted that over 50 percent of the respondents were either *extremely confident* or *confident* in using digital technology for their learning during pre-COVID-19 and during COVID-19 times. However, it is interesting to note that there were marginal spikes in the *Extremely Confident* option during COVID-19 times (in Table 3), particularly in the use of digital tools, on-line applications, and social networks for study purposes. A similar shift can be observed in the *Limited Confidence* option which underscores the fact that students with limited confidence with digital tools before COVID-19 have developed confidence in their use, and probably have realised the imperative need to learn and use digital technology to fulfill their academic aspirations.

**Table 3**

*Digital competencies pre- and during-COVID-19*

| Criteria | Extremely confident | Confident | Limited confidence | Not confident | Neutral/NA | *p* |
|---|---|---|---|---|---|---|
| Using digital tools for assignments | | | | | | |
| Pre | 23.62% | 39.25% | 11.72% | 2.31% | 23.09% | |
| During | 26.53% | 40.46% | 10.11% | 2.29% | 20.61% | 0.451 |
| Using communication tools for study purposes | | | | | | |
| Pre | 13.93% | 33.93% | 16.07% | 6.79% | 29.29% | |
| During | 23.09% | 42.37% | 9.73% | 3.44% | 21.37% | 0.121 |
| Using social networking sites for learning | | | | | | |
| Pre | 15.51% | 29.06% | 13.73% | 9.27% | 32.44% | |
| During | 20.61% | 30.34% | 14.50% | 5.53% | 29.01% | 0.831 |
| Using University information management systems | | | | | | |
| Pre | 9.98% | 30.48% | 19.61% | 8.20% | 31.73% | |
| During | 15.46% | 39.89% | 11.83% | 4.58% | 28.24% | 0.249 |
| Digitally sharing information | | | | | | |
| Pre | 20.00% | 36.43% | 12.86% | 4.29% | 26.43% | |
| During | 23.14% | 40.92% | 10.13% | 3.63% | 22.18% | 0.869 |
| Downloading and saving information/references/resources | | | | | | |
| Pre | 17.26% | 37.90% | 12.81% | 5.52% | 26.51% | |
| During | 23.33% | 39.20% | 11.85% | 3.82% | 21.80% | 0.867 |
| Searching for information using any online databases | | | | | | |
| Pre | 12.26% | 29.48% | 18.47% | 7.82% | 31.97% | |
| During | 16.60% | 36.83% | 11.83% | 5.73% | 29.01% | 0.486 |
| Searching for information using any online search engines | | | | | | |
| Pre | 22.74% | 37.83% | 12.97% | 2.31% | 24.16% | |
| During | 25.00% | 38.55% | 11.64% | 3.05% | 21.76% | 0.980 |

While there appeared to have been a noticeable trend towards students gaining confidence with the use of digital technologies during COVID-19, each of the questions related to using digital tools for learning was assessed by a chi-square method for significant differences between pre-COVID and during COVID stages. Out of all the percentage proportions for each of the answers, none of the answers was found to be significantly different between the two stages.

In examining whether tertiary institutions conducted workshops to enhance digital skills, the data analysis found that 59 percent had provided such workshops and 29 percent had not. The remaining eleven percent stated that the workshops were not applicable to their studies.

The special digital skills workshops in response to transitions to online-learning were then assessed in their helpfulness to students. Only 13 percent stated their tertiary institution's workshops were very helpful, with 37 percent and thirty five percent claiming they were somewhat helpful and neutral respectively. The remaining 15 percent were under somewhat unhelpful and not helpful at all.

### *Analysis of digital resilience in students*

The survey participants were asked a series of questions about how resilient they were while learning online. The first of these questions was about what help or alternative sources they sought to overcome digital technology shortcomings if their institute did not run any special workshops. Findings show that 66 percent of the participants sought self-help and 27 percent accessed peer help. The remaining 7 percent was split between external resources and other sources. An interesting phenomenon was found that self-help was a prominent alternative and could be associated with the isolation of students during online education. Whether peer help would be much higher in FTF settings presents an interesting future analysis.

The Brief Resilience Scale selected by the authors for use in the present study as the questions provided a sound framework for the characteristics that may increase the likelihood of resilience as bouncing back from digital learning stress. One question adapted from the BRS, explored how much trouble students experienced overcoming difficult times with digital technology and learning. Results illustrated that 5 percent never, 17 percent rarely, 43 percent sometimes, 25 percent often and 10 percent always experienced difficulties with digital technology and learning. The stress undergone in adapting to digital technology and learning that informed the previous question, found that 5 percent never, 9 percent rarely, 52 percent sometimes, 30 percent often and 4 percent always experienced stress. The authors sought to understand how helpful prior knowledge in digital technology and learning was for students studying during COVID-19. The data demonstrated that it was 4 percent not helpful at all, 8 percent was somewhat unhelpful, 22 percent neutral, 38 percent somewhat helpful and 28 percent very helpful.

Adapted from Smith's et al. (2008) BRS, Table 4 presents some measures of resilience related to students' ability to overcome digital technology challenges and associated mental stress,

**Table 4**

*Resilience in digital technology usage*

| Criteria (%) | Always | Often | Sometimes | Rarely | Never |
|---|---|---|---|---|---|
| **How stressful was it adapting to digital technology?** | | | | | |
| I tend to take a long time to get over setbacks in digital technology/ learning | 3.63 | 10.69 | 40.52 | 34.68 | 10.48 |
| It is hard for me to continue when I have a bad experience with digital technology/learning | 2.82 | 18.95 | 38.71 | 29.84 | 9.68 |
| It does not take me long to recover from a stressful digital technology/learning event | 11.31 | 26.87 | 43.84 | 13.94 | 4.04 |
| I have a hard time making it through stressful digital technology/learning events | 6.45 | 20.97 | 42.74 | 25.40 | 4.44 |
| I tend to bounce back quickly after hard times in digital technology/learning | 14.11 | 27.82 | 45.16 | 10.48 | 2.42 |
| I usually come through difficult times with digital technology/learning with little trouble | 9.07 | 27.02 | 38.51 | 20.77 | 4.64 |
| | **Very helpful** | **Somewhat helpful** | **Neutral** | **Somewhat unhelpful** | **Not helpful** |
| Helpfulness of prior digital technology knowledge during COVID | 30.91 | 40.40 | 20.40 | 5.86 | 2.42 |
| Helpfulness of workshops held by your university to improve your digital skills | 12.67 | 39.73 | 36.64 | 7.88 | 3.08 |
| | **Self-help** | **Peer-help** | **Others** | | |
| If your university did not provide digital learning workshops, where did you seek help to adjust to the use of digital tools for your studies? | 64.67 | 26.67 | 8.67 | | |

### *Common themes across Asia and Australia*

The survey asked the participants to (i) highlight three main challenges that they faced due in the transition to online learning during COVID-19 and (ii) what they felt their universities could have done better to support them more effectively in this transition. The responses were analysed using manual coding and several themes emerged as highlighted below.

#### *Online learning*

Within the theme of online learning, almost all students felt that the transition could have been progressive with a reduced academic load, better preparing them to receive online lectures. For example, a student suggested there should be "no group assignments and reduced load of assignments". Second, universities took too many factors for granted. These included principally, the preparedness of lecturers and students, based on the assumption that facilitation of technology would get the job done. Third, the rapid transition induced high-stress levels for students. "With the second wave of the pandemic becoming ever more [sic] apparent, it's gotten much tougher to

balance work and home, with health concerns take [sic] the priority over any assignment or classes, it becomes close to impossible to do justice to both. Assignments especially have been a huge source of this stress." Fourth, physical isolation adversely affected students' motivation and confidence to learn. Disconnection from traditional academic spaces and ad hoc home environments were not found to be ideal to undertake professional learning. Finally, students expressed their experience of serious mental fatigue and anxiety because of social isolation. One student described how they were "not able to socialize and develop skills" while another noted there was an "inability to communicate and make friends as a first-year" which leads to them not being able to "explore the new atmosphere and have a full-on university experience". These seemed to be exacerbated by long and monotonous lectures and wavering attention and concentration.

### *Information and communication technology*

Poor, inefficient, or underprepared infrastructure was encountered in all instances, which fell under the information and communication technology theme. A student wrote that a challenge was "adapting to online learning systems". Second, latency and transmission issues, internet dropouts in the developed country's tertiary education institutions, along with electricity blackouts and poor networks in the less developed country's institutions. For example, a student stated, "I had connectivity issues which hampered my learning process." Third, lack of prompt help and guidance on hardware and software issues resulted in students missing some lectures and scheduled study time. Fourth, students felt there should have been a survey of their ICT capabilities, with which some support measures could have been instituted earlier/at all. Fifth, some lecturers were less competent in using ICT media which reduced students' motivation to participate in lectures and online learning activities. A student's top three challenges were "technical issues, unstable internet and self-motivation". Finally, students faced challenges in describing their difficulties to IT helplines.

### *Teaching modalities*

Students found the delivery of lectures monotonous, long, lacking in or with minimal interaction. A student described "sometimes it is too boring studying online as it is very difficult to ask some [sic] questions to [sic] teachers and classmates". This was typical because lecturers adopted static lesson plans and were very business-like. Second, learning expectations remained largely the same. "The transition was initially very rocky, the lecturers were not prepared with sufficient resources to teach us virtually [and] we had a hard time to [sic] adapt to the new learning style. Some students felt that lecturers were not concerned if students were learning what was being taught. Third, timetabling and lecture scheduling were not carefully planned and as such, students felt that the assessments were not well designed to suit online learning. Fourth, group assessments were extremely difficult to carry out but were often mandatory for study units. Fifth, online exams were very challenging. Some were designed for three hours just like traditional exams which made it extremely difficult when affected by the loss of power or Internet connection. For example, "dealing with the University technical difficulties and the stress of online exams and anticipating technical difficulties". Additionally, students faced difficulty in typing answers in exams, as their speed of typing on the keyboard was slow and they made many spelling mistakes. Finally, a large number of the students felt that the online teaching load was very overwhelming and stressful.

In addition to the above themes, some participants voiced acute concerns about the justification of fees for online classes, Universities' lack of empathy for the difficulties students were facing on a personal level and their lack of knowledge of the ground realities to enforce online learning on students. Table 5 provides a summary of the country-wise challenges that students highlighted in the survey.

## Discussion

The study data derived from student perspectives in five different countries (7 different sites) across Australia and Asia brings out interesting aspects of the COVID-19 pandemic's impact on digital competencies and resilience. Despite the difference in the country profiles (developed versus developing), there was an obvious consistency between the different countries in student perception and voice in terms of the preferred mode of learning. A large section of students gave their vote to face to face teaching-learning as the most preferred mode of learning. This section will discuss the results of the quantitative results in light of the qualitative themes that emerged and present the highlights in terms of the key similarities and differences across countries.

### *Digital competencies*

Students were largely amenable and adaptable to the unavoidable and imperative transition to online learning due to COVID-19. Fifty percent of the respondents across Australia and Asia were either extremely confident or confident in using digital technology for various study aspects during pre-COVID-19 and during COVID-19 times. This indicates that students were already confident in their technical abilities prior to the transition to forced shifts to online learning due to the pandemic. However, it is interesting to point out that there were marginal spikes in the *Extremely Confident* option during COVID-19 times (see Table 3), particularly in the use of digital tools, apps and social networks for study purposes. A similar shift can be observed in the *Limited Confidence* option which underscores the fact that students have definitely developed confidence in their use, and probably have realised the imperative need to learn and use digital technology to fulfill their academic aspirations. This suggests that those who had preferred more traditional methods of learning such as reading books or using pen and paper to make notes, had no option but to make the switch to digital modes of learning, and as a result their confidence has improved in digital learning as a direct result of this transition.

While most institutions across Australia and Asia organised workshops or undertook similar efforts to improve student digital skills, students were split on the usefulness of such workshops with most choosing the somewhat useful or the neutral option. An overwhelming majority did not find the workshops extremely useful. Possible reasons could include a lack of awareness of the availability of specific training sessions or that such workshops were hosted during timeslots that were difficult to attend. Further research is needed to check with the various universities on the level of student participation and engagement for these workshops.

While a positive finding was that students had high levels of digital resilience, pointing to their prior knowledge of digital technology tools as can be seen in Figure 1, a concerning finding is that over 60 percent of the respondents admitted that it was at times hard for them to continue with their online learning when they had a bad experience with digital technology (see Table 4). The difficulties perceived by students was likely because most universities were not readily prepared for the complete transition to digitalised learning (Houlden & Veletsianos, 2020). The qualitative data collected from open-ended response questions perhaps holds the clue to this finding. Students revealed their deep anguish over the lockdowns, the physical isolation, the disconnect from their peers, a normal routine and social interaction and discussions with teachers and friends. The lack of social interaction placed several students in a dark place where they felt demotivated and lost the urge to engage productively in the online environment.

The wellbeing and feeling of disconnect among students are big red flags that universities need to consider. As evidenced by previous studies, resilience plays an important role in controlling students' negative feelings in the face of difficult situations (Sood & Sharma, 2020). Lower levels

of resilience, coupled with the challenges of social isolation, may be considered as major sources for student attrition and educators must recognise the need to mitigate any negative experiences that students may face or put in place as correction/remedial measures to help students overcome such experiences as quickly as possible. Despite these red flags, data obtained from the survey also underscores the reasonably high level of resilience in the participants to endure difficult times. Indeed, approximately 42 percent of students acknowledged that they bounce back quickly all or most of the time after facing a difficult situation with digital technology, with another 45 percent of respondents noting that they bounce back quickly some of the time. This seems to be a function of prior knowledge and experience with digital technology before the pandemic. Indeed, more than 70 percent of students noted that their prior knowledge and experience with digital technology was either *very helpful* or *somewhat helpful* in their transition to online learning (Table 4). This is consistent with previous studies which have suggested that a student's technological and digital competence during the pandemic would assist them in maintaining their academic performances (Arora et al., 2020). These trends were again found to be similar across all universities and nations. While an individual examination of these trends is beyond the scope of this paper, further research may be required to assess whether there is a correlation between prior knowledge and digital resilience.

While it is impossible to talk about digital competencies and digital resilience as separate issues, we have attempted to put these in two separate sections for two reasons. First, the survey design distinguished these two elements, and second, there were some interesting and interestingly disparate findings for both sections.

**Table 5**

*Country-wise themes for challenges*

| Country | Challenges |
|---|---|
| Australia | • Lack of knowledge and guidance concerning online platforms<br>• Poor quality of online teaching-learning<br>• Poor and/or inconsistent quality of teaching<br>• Lack of practical skills across several streams (teaching, nursing, health sciences, physical sciences)<br>• Physical isolation and lack of social bonding with peers, friends, teachers |
| China | • Internet connectivity issues<br>• Teacher-related<br>  o Limited tech knowledge<br>  o Inability to make online classes interactive<br>• Student-related<br>  o Lack of concentration in the presence of online temptations (including social media and movies)<br>  o Missed discussions with peers<br>  o Health issues (strained eyes, stress) |
| India | • Technological challenges<br>  o Limited internet connectivity<br>  o Students and staff need training on digital skills<br>• Teacher-related<br>  o Online classes were not interesting/engaging<br>• Student-related<br>  o Lack of concentration in the presence of online temptations (including social media and movies)<br>  o Missed discussions with peers<br>• Health issues (including strained eyes, stress, backache, anxiety as to how peers were coping and learning) |
| Cambodia | • Technological challenges<br>  o Limited internet connectivity<br>  o Students and staff need training on digital skills<br>• Teacher-related<br>  o Online classes lacked fun elements |
| Malaysia | • Technological challenges<br>  o Limited internet connectivity<br>  o Students and staff need training on digital skills<br>• Teacher-related<br>  o Online classes were not interesting/engaging<br>• Student-related<br>  o Unable to attend online lectures because of time-zone differences<br>  o Missed peer interaction<br>  o Missed practicals<br>  o Health issues (strained eyes) |

### *Digital resilience*

Over half of the respondents seemed to have adapted and exhibited high resilience in accepting the transition. This is well reflected in their ability to troubleshoot problems around online learning through perseverance and collaboration amongst themselves, as found in independent and formative inquiry respectively (Lin, 2008). While a majority of respondents displayed signs of digital resilience, the qualitative data presents interesting findings which explain how and why students struggled with the transition to online learning. While students were digitally resilient and might have persisted through the challenge of never-ending online lectures and assessments, many respondents noted that they were struggling with *Zoom fatigue* and *Screen exhaustion*. Students reported issues such as back aches and eye-strains as physical manifestations of their commitment to online learning. There were concerns about mental health issues as well on account of unsympathetic teaching staff – who did not consider the physical isolation, the stress of having sick family members, or increased monetary burden on account of paying for better internet, for example. As a result, several students suggested that there is scope for institutions to acknowledge a student's home and personal circumstances and display greater empathy for their situation, especially in times of crisis (see Table 6).

A positive outcome is that given the reliance on digital learning, students have either undertaken workshops or learnt through practical experience. There are many very interesting changes that were observed: (1) Large increase in the competency of using academic databases. This is a skill that was largely used by students even pre-COVID and the move to online learning has encouraged students to improve this skillset, which will serve them well even after face-to-face learning resumes; (2) A similar pattern with the University Management Systems (UMS). This finding is consistent with recently scholarly literature that suggests strong IT knowledge and development of digital skills can help students retrieve information, handle projects and tasks, improve communication with others, enhance the ability to present knowledge, and solve problems (Hadiyanto et al. 2021). Further research is required here from a country-specific basis given that UMS has been used in Australian institutions for several years but may be relatively new in other Asian countries. With respect to the usage of social networks in their education including communication with peers or lecturers, there seems to be stark contrast between Asia and Australia. While students from Asian countries in general have relied on Facebook, WhatsApp, or other national alternatives (such as WeChat in China) whereas in as Australia, where social networks have been mostly restricted to social, not formal education at a tertiary level. Another common expected trend is that there appears to be a big leap in using apps for communication – there are no surprises here given the move to online tools such as MS Teams and Zoom by almost all tertiary institutions.

### *Online teaching modalities*

The online learning aspects indicate high-stress levels induced by the rapid digital transition. A critical aspect that has filtered through the qualitative responses is the disregard of psycho-physical awareness of students and academics concerning online learning. Universities have been more focused on making the necessary digital infrastructure and ad hoc learning tools to deliver classes online but paid much less attention to the way they would be delivered and how students would receive them. It is pointedly conveyed through several qualitative responses that many academics were not well prepared to embrace online delivery, and this seems to be an omnipresent challenge across all geographical regions and disciplines. This seems to have largely a negative impact on student learning in the first instance, along with several peripheral influences such as diminished interest and concentration and lack of motivation. This aspect is supported by several other research papers (Chaturvedi et al., 2021; Son et al., 2020) indicating the real need for institutional considerations during a similar transitional process. Students from all countries identified many

areas of institutional reform to counter the perceived preparedness of faculty members and students in online teaching/learning (see Table 6). These suggestions largely focussed on additional training programmes and workshops for digital tools, online learning pedagogy and monitoring of quality over time.

Mental fatigue from social isolation also emerges as an important point to consider in digital education. Recent work by Chaturvedi et al. (2021) shows that social isolation may lead to dire consequences such as anxiety, poor cognitive performance, aggressive behaviour, and even suicidal tendencies amongst students. While an immediate solution is difficult for the issue of social isolation, there could be measures, such as targeted user group meetings face-to-face, from institutions that can mitigate this issue. On the question of ICT issues, there is a clear divide between public and private institutions where private institutions seem to be better prepared than their public counterparts. A major issue identified is that the institutions should have surveyed their capabilities and specifically addressed the needs of students for digital transformation, including training the lecturers to be digitally competent. Another major theme that has emerged in our study is the issue of learning modalities. Student concerns in this theme included problems with internet quality and outage, poorly prepared lecture materials and the pressure of assessments. Many other research groups have also opened these issues and the over-arching findings (Frissa & Dessalegn, 2020; Singh et al., 2020) indicate that universities need to work more towards relieving common stressors identified by students across Australia and Asia. The significant differences between student perceptions from the participating countries have been specifically presented to highlight their particular needs. Additionally, it is apparent that universities have been largely reactive to the rapid and drastic transition that they had to make to help students continue with their studies in face of COVID19. Such ad hoc measures do not measure up to the long-term and sustainable pedagogical thought. Such measures also do not take into account the varied challenges that learners are facing which are far beyond the digital classrooms.

**Table 6**

*Country-wise themes for suggestions*

| **Australia** | **China** | **Cambodia** | **India** | **Malaysia** |
|---|---|---|---|---|
| Build more interaction and discussion in online classes<br>Monitor quality of online teaching<br>Some training on digital skills<br>Acknowledgement of student's home/personal life and empathy | Provide two-way communication to make learning interactive and effective<br>Provide high-quality learning material/ more learning resources | Provide workshops on digital and IT skills to both students and staff<br>Reduce the fees as the cost of the internet (and device) is being borne by students<br>Improve student support and ensure two-way communication | Staff training to make online learning interesting/engaging<br>Basic training to staff and students on digital skills<br>Provide greater flexibility by providing asynchronous learning | Staff and student training on digital skills<br>Guidance on how to make up for the loss of practical experience |

While a strength of our study is the large number of respondents who have studied in Asia and Australia during the COVID-19 pandemic, a potential limitation is that the number of respondents for each country could be increased to n=200 to aggregate the data from each country to identify country-specific trends. Another potential limitation of this survey is that respondents were (by design) from specific universities within each country. However, the researchers acknowledge that the impact of the transition to online learning is likely to have impacted students from varying institutions differently. The researchers hypothesise that this is particularly the case for students from well-resourced universities who have had access to digital technology prior to the pandemic, and for students in urban centres who have stronger internet connectivity and digital resources. Further, the researchers hypothesise that students studying at well-resourced private universities in Asia, which often have stronger online capabilities, are likely to have been better prepared for the transition to online learning. Indeed, Puteh, and Hussin (2007, p. 1886) note that "… private universities in Malaysia have gone far in e-learning compared to public universities which are now crawling to find their niches in e-learning. Perhaps, public universities could learn from private universities in running e-learning program and would avoid mistakes made in the past." Given the distinction between different types of institutions within each country, further research must seek to disaggregate the data on the impact on students of the transition to online learning. As such, further research is warranted in this area, with a larger sample size, targeting respondents from a wide range of universities across each of the countries sampled.

## Conclusion

The researchers recommend further research on the impact of the transition to online learning and whether there is any distinction between undergraduate and postgraduate students. There are two plausible hypotheses in this regard. On the one hand, that younger students who have had consistent exposure to digital tools, and limited experience with face-to-face learning, may be more resilient to adopting online learning. Whereas older students, who have for example engaged in their previous undergraduate programmes in a face-to-face learning format, may struggle to adapt to the changing online environment. Conversely, older more mature students may be more resilient to change, and indeed more experienced with online learning tools from previous blended learning experiences. Further research on the different impact, if any, on undergraduate and postgraduate students is recommended.

Although the surveys were circulated to students from across disciplines in each institution, it is acknowledged that members of the research team are faculty members in different disciplines within their institutions, and as such, students from their disciplines may have been more inclined to have completed the survey. Further research is warranted at a discipline-specific level. The research team hypothesises that students from certain disciplines, for example computer science or business, may have found the transition to online learning easier because assessment and pedagogy may be more easily adaptable than, for example, a physical sciences or health degree programme which may require physical lab work. More empirical research with a larger sample size for each field of study (discipline) is recommended by the research team.

In addition, while the qualitative questions included in the survey design have provided some valuable insights why students felt the way they did during the transition to online learning and how they feel institutional changes could facilitate this transition, it is acknowledged that a focussed qualitative study may yield even deeper insights into these questions.

In conclusion, our research work addressing the student perception concerning digital resilience during the COVID-19 pandemic in Australia and Asia shows several findings that will be useful for higher institutions and policy makers. Findings underscore the dire need for universities to bring

about six transformations. First, redesign course delivery strategies to suit cohorts with multiple levels of digital competences, digital and emotional intelligence. Second, institute novel professional development programs for staff to instil much-needed digital competencies to drive digital hardware and software effectively. Third, ensure staff undergo specially designed workshops that will help them recognise the importance of emotionally engaging with their learner who may face social and academic isolation. Fourth, develop school-level support structures for students with the leadership of student ambassadors and recent graduates to motivate and emotionally support online learners. Fifth, revise assessment strategies that will better fulfill the pedagogical aspirations of the learner. Finally, engage academics to be more empathetic, not just to the professional needs of their student, but to their emotional needs as well.

The paper also recommends a future research agenda to further understand the impact of the transition to online learning on higher education students. While this study provides valuable quantitative insights, and some preliminary qualitative data, detailed qualitative analysis with respect to digital competencies and resilience would provide further useful insights into the themes covered in this paper. As outlined throughout the paper, further research is required to understand country-specific trends, especially with respect to different aspects of digital competencies and resilience such as with the use of UMS which has been used in Australian institutions for several years but may be relatively new in other Asian countries. In addition, further research with respect to any discipline-specific trends, or differences between undergraduate and postgraduate students, or domestic and international students would be valuable to policy makers and institutions. To this end, an extension of the existing study using larger sample size and including respondents from a wider range of universities across each of the countries sampled may yield valuable results.

While the impacts of COVID-19 have been far-reaching, they have been particularly challenging on students. Students (and staff) have for the most part displayed resilience in their adoption of online learning, and this study shares important insights into the impact of this transition and how institutions can improve online learning strategies into the future.

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