INTI JOURNAL | Vol.2023:05
eISSN:2600-7320

Digital Transformation in Higher Education – A Study on Productivity and Environmental Sustainability

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Abstract

Tertiary education is essential as it helps to boost economic growth, reduce poverty, and promote shared prosperity, leading to a higher demand for higher education worldwide. International business promotes not only the exchange of goods and services but also the transfer of resources, ideas, and people. As a result, tertiary education institutions are expanding their abroad programmes in order to attract students interested in international education. However, the unprecedented outbreak of COVID-19 has strongly affected tertiary education, as most countries have implemented travel restrictions and prohibited people from entering or leaving. Therefore, online learning was implemented worldwide in order to overcome the challenges. Nonetheless, students are able to attend classes at any location as long as they have a stable internet connection. In addition, the concept of online learning reduces the time and travel costs for students to attend physical classes. Moreover, online lectures are able to be recorded, allowing students to review and revise previous lectures they would have missed. However, there are challenges to online learning, such as a lack of motivation and interaction between students and lecturers, poor teaching quality due to a lack of technical skills, and students who are easily distracted. This study will examine the adoption of online platforms for teaching and learning in the higher education industry and its prospects for higher productivity and a positive impact on environmental sustainability.

Keywords

COVID-19, environmental sustainability, online platform, lecturers, students, tertiary education

Introduction

According to Arnhold (2021), tertiary education is valued greatly as it benefits economic growth, reduces poverty, and promotes shared prosperity, resulting in increased demand for higher education globally *(Appendix 1)* (UNESCO, 2018). International trade fosters the transmission of people, ideas, and resources in addition to the interchange of products and services (Mueller, 2022). Consequently, tertiary educational institutions are giving prominence to their international programmes to attract students who are interested in receiving education abroad. Martins et al. (2018) claimed that students must spend extra money and time travelling each day from their neighbourhood to the school in order to join physical education classes. In addition, physical

Submission: 10 November 2022; **Acceptance:** 12 January 2023

education classes are deemed to be less flexible because students must show up for class and tests at a certain time and place. Adversely, Gautam (2020) asserted that because online programmes are less costly than traditional ones, they can help students ease their financial stress. Notwithstanding, the unexpected COVID-19 outbreak has had a significant impact on tertiary education as the majority of countries have imposed travel restrictions and banned both entry and departure. Moreover, the Movement Control Order (MCO) in many countries has even restricted students from being physically present in their respective universities and colleges. Therefore, online learning took place worldwide in order to overcome these challenges.

The goals of this study are to investigate the productivity of digital higher education and to identify the environmental issues that digital higher education alleviates. This study may benefit tertiary educational institutions around the world as it discusses the effectiveness and challenges of online learning as well as possible solutions that can be carried out to overcome these challenges. In addition, the study would enable a critical understanding of online learning from both students' and lecturers' perspectives.

Methodology

For the investigation and data collection, an online-based survey is applied to discover students' perspectives on the challenges and effectiveness of using e-learning systems. The questionnaire is designed using Google Forms. Subsequently, they were distributed among tertiary students in Malaysia. Journals from the period of 2018 to 2022 were reviewed and compared to the primary data findings.

Background of the Study

In the midst of the COVID-19 pandemic, higher education institutions underwent radical transformations in terms of digitising the education and training processes to mitigate the negative impacts of the pandemic on the academic performance of students. In this section, the effectiveness of digital transformation will be discussed, such as increasing productivity, and reducing environmental issues.

Frolova & Rogach (2021) stated that digitalization is closely relevant to improving the quality of education. Online learning platforms provide a competitive advantage to the course providers as digital technologies gain popularity due to the profits they provide to universities and colleges due to their scalability, increasing the economic efficiency of institutions (as cited in Frolova & Rogach, 2021). Castro & Tumibay (2019) examined the effectiveness of virtual learning in higher education institutions. The digitization of education has created new markets for universities and colleges, as many adult learners are attending university courses online due to the flexibility it provides, allowing them to balance their education and work. This increases student intake rates, as the institutions have entered a brand-new market, allowing them to gain more profit (Castro & Tumibay, 2019). However, in order to sustain enrolment rates, institutions must be attentive to their students' demands and requirements, ensuring that the students have a pleasant online learning environment (as cited in Castro & Tumibay, 2019).

On the contrary, Rasheed, Kamsin, and Abdullah (2019) discussed the challenges faced by institutions due to blended learning. A major obstacle is the amount of technological complexity encountered by institutions in order to conduct an online course. The complexities include the actual hardware installation in the university's system and training staff to navigate the e-learning platform (Rasheed, Kamsin, & Abdullah, 2019). Furthermore, blended learning institutions face the challenge of seamlessly integrating new technology with their current existing technology in order for the virtual courses to operate smoothly (as cited in Rasheed, Kamsin, & Abdullah, 2019).

Diverse features of online learning platforms, such as Blackboard and Google Classroom, are playing significant roles in improving the educational process among students in higher education institutions. In addition, lecturers and students should understand how to integrate technology into the teaching and learning process in order to favourably influence the collaboration and performance of digital education. According to Coma et al. (2020), there are three important elements that determine the effectiveness of the educational process via online learning platforms: institutions, students, and technology. In the research paper, they stressed that lecturers should know how to utilise the tools on the online platforms to enhance learning and interact with students to create a comfortable learning environment. Second, students must be engaged with each other to establish connections and avoid the feeling of isolation due to the absence of physical colleagues. Third, technical knowledge and digital literacy information skills are important and must be possessed by the lecturers to deliver education to the students smoothly and ensure the smoothness of distance learning.

Lacka et al. (2020) examined the significance of virtual learning and social media in tertiary education. The research reveals that virtual learning enhances students' cognitive outputs and assists them in achieving their learning and knowledge transfer goals. However, time and resources are essential for such enhancement to occur (Lacka et al., 2020). Since virtual learning has a positive influence on students (as cited in Lacka et al., 2020), higher education institutions must equip students with the additional resources required to effectively utilise virtual learning. Stefanovic and Klochkova (2021) investigated the digitalization of teaching and learning as a method of improving students' satisfaction and educational efficiency. According to the findings of the research, integrating mobile applications during virtual learning has a significant effect in terms of boosting students' comprehension and academic accomplishment (Stefanovic & Klochkova, 2021). The study indicated a positive shift in students' motivation and satisfaction in comparison to traditional education, but it is nevertheless crucial to monitor the system during lessons to ensure students are paying full attention (Stefanovic & Klochkova, 2021).

Machekhina (2017) mentioned that the digitization of education is a phenomenon of reformation and modernization. According to this article, "education reform" refers to the usage of digital educational materials for both curricular and extracurricular activities. Digitalization can personalise the learning process for students, enabling them to customise the programme to fit their own requirements, which contributes to improved comprehension and retention of class content (Machekhina, 2017). According to Bilyalova (2019), the benefits of digital transformation in education outweigh the disadvantages. Technology is an efficient tool for fostering a positive learning environment for students. It encourages student participation in the learning process by allowing teachers to receive immediate questions and feedback from students (Bilyalova, 2019). Although digitization has undoubtedly transformed traditional classroom learning, integrating

virtual learning and traditional classroom learning into blended learning will provide students with the best aspects of both learning methods (Bilyalova, 2019).

Mustapha et al. (2021) examined the transition of digital education to virtual learning during the COVID-19 pandemic. Digital education has enabled students in their final year to complete their studies and graduate rather than being confined at home due to the pandemic, resulting in more highly skilled workers in the labour market (Mustapha et al., 2021). Furthermore, digital education connects academics from all over the globe. The digitization of education has created a new platform for global interaction and knowledge sharing since global classes can take place in several locations across the world without students crossing national borders (Mustapha et al., 2021).

While there are benefits and drawbacks to online learning, the environmental advantages are well established and should be taken into account as the educational system changes. According to Nicholas et al. (2020), the COVID-19 pandemic has increased environmental consciousness worldwide. Businesses are now more concerned about addressing environmental challenges and committed to changing their business models or operational procedures to improve sustainability. Although many higher education institutions make an effort to improve environmental sustainability through green building retrofits, encouraging green habits among their staff and students like recycling and setting the air conditioning temperature at 24°C, as well as forbidding the use of plastic bags on campus, it is not efficient enough to mitigate the impact of global climate change. However, COVID-19 has highlighted that environmental sustainability can be achieved through the role of tertiary education providers in offering courses via distance education mode (Snyder et al., 2020).

Yin et al. (2022) examined the impact of online education on carbon emissions in the midst of the COVID-19 pandemic in China. It has been proven that the digital transformation of higher education institutions could lower carbon emissions efficiently in two ways. First, distance learning allows 60% of students to study at home instead of going to campus by car. Hence, there has been a large reduction in travel between different locations, which has reduced the carbon emissions generated by transportation, such as trains and cars. Second, the expansion of online learning has resulted in the closure of several higher education institutions and their electricity facilities in terms of technology, lighting, and cooling systems, which then greatly lower the carbon emissions from electricity generation. However, Prasetyanto et al. (2022) argued that distance learning does not fully eliminate the requirement for campus trips in Indonesia, in contrast to the findings of the study by Yin et al. (2022). As mentioned by Prasetyanto et al. (2022), students in Indonesia still have to travel for e-learning, such as to campus, cafes, or internet stations, as a consequence of the inaccessibility of the Wi-Fi connection. Hence, the reduction in GHG emissions brought on by e-learning is less substantial than anticipated.

Prior to the pandemic, face-to-face learning significantly used a massive amount of paper, from handouts and textbooks to printed copies of assignments, tests, and projects. As mentioned by Ryan (2022), a typical higher education institution will consume an average of 2000 sheets of paper per day, which means over 320,000 sheets of paper have been used per year in the United States and require the use of many trees. According to Vu (2020), the digital transformation of higher education institutions has changed the learning and teaching processes of students and

lecturers. For example, students use online learning platforms, such as Blackboard Learn, to watch the lecture session, join class discussions, consult with the lecturer, and submit their assignments. In addition, online learning has allowed all learning resources to be evaluated online, and students generally receive study materials and class information electronically via WhatsApp or email. As a result, this improves environmental sustainability by reducing paper waste and saving millions of trees annually.

Nasir et al. (2022) investigated the lockdown impact on energy consumption in university buildings in Malaysia. In the midst of the COVID-19 pandemic, most nations closed their schools and universities and switched to distance learning, which then resulted in less energy being used in building structures used for education. For example, in Florianopolis, Brazil, it was discovered that the energy consumption of administrative buildings, elementary schools, and higher education institutions was lowered by about 38.6%, 50.3%, and 50.4%, respectively (Geraldi et al., 2021). Furthermore, it was found that the energy used in the library was the most affected by the closure of the campus compared to the research category at the University of Almeria in Spain. This is due to the fact that the majority of the research equipment was still functional even though the library was completely closed, which reduced the amount of electricity used during the lockdown (Chihib et al., 2021).

Results

According to the field study (2022), the responses were collected from 60 undergraduate students who had experienced online learning. 77% of the respondents were female and 22% were male. Of the respondents, 75% were between the ages of 21 and 25, and 87% had earned or were pursuing a degree. 82% of respondents find online classes more cost-effective than physical classes, as they reduce costs and expenses such as travel, food and beverage, accommodation, and tuition. Nevertheless, 18% of respondents find physical classes more cost-effective. 55% of respondents believed that online classes have improved students' learning efficiency. The majority of them indicated that recorded lectures could be replayed by students indefinitely, increasing their learning efficiency. Besides, 69% and 60% of respondents stated that students can be more focused when studying alone and can clearly see the lecturer's content in an online learning environment, respectively.

By contrast, 45% of respondents argued that online classes reduce students' learning efficiency. Among these respondents, 100% indicated that students are easily distracted during online classes, reducing their learning efficiency. Hence, in order to keep students engaged in online classes, the researchers suggested that lecturers enrich the courses with interesting activities, such as integrating content with news articles, videos, and podcasts, opinion pieces, and emerging trends, as well as leveraging real-world examples. For instance, Sandhya (2020) suggested that lecturers should test their students through creative applications, such as Kahoot, with scores reflecting students' level of interest and engagement in lessons. Besides, there are other reasons that reduce students' learning efficiency, such as having low self-discipline, not actively participating in discussions, and being prone to technical issues. Therefore, to ensure that an e-learning system or online platform is always running smoothly, the researchers proposed that university management teams should regularly inspect and upgrade the systems, as well as provide

training programmes for all lecturers to enhance their technical skills. Additionally, since online learning requires students to utilise technological devices, it demonstrates the technological devices respondents invest in. 88% of respondents have invested in laptops for online learning, while 35% and 25% of respondents have invested in headphones and smartphones, respectively. Furthermore, on-campus facilities used by respondents during online learning have resulted in 72% of respondents using the library and information centre, with the counselling centre being the least used on-campus facility during online learning. Nevertheless, 15% of respondents indicated that they did not use any on-campus facilities while studying online. Hence, respondents felt that it would be unnecessary if higher education institutions implemented 100% online learning. The majority of respondents believe that institutions no longer need to provide transportation, cafeterias, seminar halls, sports facilities, and classrooms for online learning, and 2 out of 60 respondents advocate that online learning does not require any on-campus facilities. 70% of respondents strongly agreed that the high living and travel costs are a concern for them when considering studying abroad, and thus 50% of respondents strongly agreed that they would choose a foreign university if they could attend online classes in their home country. Besides, 70% of respondents strongly agreed that online learning reduces paper usage.

Additionally, 42% of respondents strongly agreed that clubs and societies are critical to enriching their resumes, yet online learning may greatly reduce those on-campus activities. 37% of respondents strongly agreed that online learning reduces interactions between students and lecturers. Due to a lack of interactions and motivation, 38% of respondents agreed that online learning increases psychological issues. In response to this challenge, the researchers advocated that lecturers should be responsible for incorporating forums, chats, and social media groups into course planning and engaging students in the evaluation processes to stimulate conversation among students and transfer the lively debated campus experience to virtual learning (Bali & Liu, 2018). For instance, Hamdan & Amorri (2022) suggested that lecturers should develop a creative pedagogy by allowing students to decide on the online learning content. By implementing this method, students and lecturers are encouraged to learn about compelling issues, propose solutions to real problems, and take action using inquiry- and challenge-based learning techniques. Before publishing their solutions to a global audience, students are expected to reflect on their learning, the effects of the campaign, and their strategies. Furthermore, 47% of respondents strongly agreed that online learning requires strong technical support, and thus 60% of respondents strongly agreed that it increases the demand for technological equipment. Therefore, 52% of respondents strongly agreed that online learning accelerates technological progress.

Conclusion

In conclusion, digital higher education is effective, as it enables higher institutions to enhance productivity and increase environmental benefits. First, the flexibility of online learning increases student admission rates and expands higher education into new markets. Second, digital higher education enhances students' cognitive output and improves their academic performance through integration with mobile applications. Lastly, online learning reduces the use of paper, transportation, and electricity on campus, reducing carbon dioxide emissions. Nevertheless, digital higher education also faces challenges, such as technological complexity, a lack of interaction, and easily getting distracted by other mobile applications. Therefore, the researchers proposed that

lecturers should enrich the lessons by combining lesson content with news articles, videos, and podcasts to keep students engaged in online classes. Besides, the researchers also suggested that the university management team should regularly upgrade the online learning system and provide training programmes for lecturers to enhance their technical skills.

Limitations

There are several limitations to this study. First, the primary data for this study was collected from students in Malaysia. Since digital higher education is a global trend, researchers should take a global perspective. However, due to limited resources, researchers do not have access to students in other countries, which limits their ability to gain more insights from students in other countries. Therefore, there is a lack of samples to further expand the study. Second, due to the nature of the research questions, the researchers neglected the lecturers' points of view. Hence, this study is limited to the students' perspectives. Third, the randomly selected small subset of participants limited the data's reliability. Thus, the small sample size in this study may lead to bias due to higher variability.

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