Case Report

DIGITAL TECHNOLOGY DEVELOPMENT IMPACT ON ONLINE LEARNING QUALITY

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ABSTRACT

Digital technological development has made a remarkable contribution to online education improvement although challenges to universities have still been existing during the process of quality management implementation. Particularly, there is a noticeable relationship between learning amenities and outcomes. The paper aims at exploring the factors affecting the online classroom quality on the background of technological applications and showing how to overcome online learning issues. The research significantly improves the quality of online teaching and learning activities at universities. The qualitative approach was utilized in the paper to answer theoretical framework questions, interpret and describe data. The quantitative approach support was involved in the process of data collection and variable analysis. The most outstanding findings that have positive effect on online learning quality are related to (1) available learning facilities, (2) adaptability to have access to the source, (3) challenges to cooperation during process of learning and self-study, (4) interaction effectiveness, (5) guide to content, (6) assistance from instructor, and (7) learning quality assessment. These research results are very helpful for universities or institutions to adjust online learning activities and ensure reliable evaluation quality.

Keywords: online learning quality, online learning evaluation, learning facilities, etc…

INTRODUCTION

Technological development has marked innovative progress in education quality. Via technology application students can have access to modern education around the world and receive attainable guidance from any location. For this reason, it is necessary to facilitate technology development in online courses and to enhance learning quality, universities need to equip themselves with technological expertise.

The unexpected shift to online learning has made great differences in access to technology and internet connection. Moreover, the computer-using competence of students has a significant effect on online learning results. Particularly, there is a close rapport between virtual learning infrastructure, students' cooperation, adaptability to electronic facilities, and e-learning outcomes (Sharif *et al.*, 2004). In another research, online learning is known as a formal education approach where instructors and students are geographically separated, and course instructions are supplied through using digital technology. Online learning systems and tools are utilized to ensure the quality of synchronous or asynchronous instruction (Ghoneim, Aljedaani, Bryce, Javed, & Zafar, 2024).

The study purpose is to improve the quality of online learning on digital technology development background and overcome some issues students can encounter during the learning process. The qualitative research approach is mainly applied to the article to answer theoretical questions, investigate research management, and draw findings. The quantitative research approach supports the process of collecting data and analyzing statistics. The article explores research management questions such as (a) What factors have impact on online learning quality via technology facilities application? (b) How does technological development affect online course quality? (c) What measures can instructors take to deal with online learning issues? The research scope is mainly related to learning amenities, accessibility to content, cooperation, interaction, self-study, assistance from instructors, and learning assessment. Despite the research limits related to data collection, the article significantly contributes to making a positive online learning environment and helps universities to deal with online learning problems if they are in the same setting.

LITERATURE REVIEW

Digital technology development has made an impressive breakthrough in online education. Furthermore, it has resulted in remarkable quality changes in higher education, especially for virtual classes in terms of the following factors: learning facilities, challenges to accessibility, cooperation, self-study competence, interaction effectiveness, content instruction, instructor assistance, and learning outcome evaluation.

Advanced Learning Facilities Accessibility

The internet intervention has a significant contribution to social needs and distant guides to online learning courses despite challenges (She *et al.,* 2021). The most noticeable issue is inconsistency in the implementation process. In online learning settings, students are required to have access to learning facilities, and the shortage of accessibility has effect on education quality (Ghoneim *et al.,* 2024). Apart from benefits, the greatest online learning limitation is the insufficient access to necessary technological infrastructure for students with low living conditions, which prevents them from online learning engagement (Malenya & Ohba, 2023). Therefore, the authors reckon that digital disparities can lead to educational integration effectiveness. Uneconomic students are unable to find similar opportunities to benefit from technological progress.

Huang *et al.* (2020) emphasized the crucial role of advanced technology infrastructure and access to digital learning resources through massive open online courses, e-books, and e-notes,

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especially in circumstance where traditional learning environments were in poor condition. Similarly, Brown, Strigle, and Toussaint (2020) advised that students needed to be provided with services, investments in resources and connections to enhance students' participation, and improve learning quality because online learning could bring students convenient access to course materials, surmount geographical obstacles, and facilitate their global interaction (Akhter, Javed, Shah, & Javaid, 2021). Laksana (2022) appreciated assignment delivery to students in any place and at any time, and they could find unique learning opportunities. Also, it was available for instructors to personalize course content to further advance learning experience (Laksana, 2022). Ahmed (2020) confirmed that technological accessibility features were able to hinder students from access to various needs. Nevertheless, mobile learning was known as a critical tool to maintain educational continuity and assist students' diverse demands (Barrot, Llenares, & Del Rosario, 2021). Instructors should optimize platforms to support other accessibility features and accommodate various student needs effectively. The utility of educational platforms and video conferencing tools made a profound impression on visual and interactive content in online learning circumstance (Ødegaard *et al.,* 2021).

Barriers to Access Learning Facilities

Lomellini and Lowenthal (2022) investigated perspectives on accessible online learning and revealed the remarkable challenges such as resource limitations, technological constraints, and institutional culture. Moreover, cultural and social aspects, including language barriers and diverse expectations as to educational experiences, can affect student perceptions of online learning (Pham & Tran, 2020). Likewise, Fenneberg (2022) added that online learning environment transformation has created noticeable challenges in making sure of accessible learning experiences. Simpson (2018) confirmed online support services and regular communication to replace traditional interactions are crucial for students' academic success. Maphosa (2021) and Dhawan (2020) showed technological infrastructure and internet connectivity as major barriers to e-learning, particularly in developing countries. They emphasized the important part of educational guide and access to digital learning resources. Hart (2012) and Nes *et al.* (2021) concluded that there were a lot of effects on e-learning acceptance and satisfaction among students with computer competency and skills in general.

It is vital to ensure that students facing educational barriers receive sufficient assistance, securing air access to quality education via e-learning platforms (Moosavi *et al.,* 2022). Also, it is important to address diverse student needs (Baguma & Wolters, 2021; Stentiford & Koutsouris, 2020). In addition, improving access to electronic amenities is essential for ensuring equal engagement in modern education systems across all areas. The insufficient educational infrastructure has led to boredom among students and staff, and limit cooperation opportunity in virtual environments (Jahanbakhsh, Ahmadi, Saghaeiannejad, & Najimi, 2021).

Communicative Cooperation and Individual Self-Study Competence

Sharif, *et al.,* (2024) found that student collaboration via electronic learning facilities infrastructure reflected student computer competency and e-learning outcomes. Student technology competency had significant effect on collaboration in virtual class. Students' positive cooperation was known as a facilitator in e-learning environments (Jowsey, Foster, Cooper, & Jacobs, 2020). In another research, Lowenthal and Lomellini (2023) emphasized the importance

of clear instructions and peer-assisted learning to support various students. Anderson and Dron (2020) highly appreciated personalized learning paths, adaptation to technologies as leverage to tailor educational experiences to individual student needs, cooperative engagement and learning outcomes improvement. Hodges *et al.,* (2020) revealed that flexible learning approaches were vital to reduce disparities and allowed students to make more personalised and adaptive learning experiences. In argument, students' success in e-learning environments completely depends on possessing a set of prerequisite skills for e-learning (Ojaghi *et al.,* 2019). Likewise, it allowed instructors to personalize course content to further enhance learning experience (Laksana, 2022). Particularly, Sharif-Nia *et al.,* (2023) remarked that online learning created a positive connection to an increase in behavioural, affective, and cognitive student engagement, as well as motivated students' academic confidence and satisfaction. Personally, the authors reckon that technology competence could encourage students to have active cooperation and autonomous learning.

Online Learning Interaction Experience

According to Gu, Song, Zhong, and Comite (2022), there is a problem with students' lack of interest in continuing their online learning and feedback mechanism. Also, the continual willingness of online learning has a remarkable impact on learning interaction, and instructors need to support students via class mediation and learning experience. Bernard and Abrami (2009) explored that connection to tools, platforms, and forums to interact can create learning resources. The features of autonomy, positive engagement, openness and interactivity lead to a result that more students keep interaction well on the platform. Students' interaction could be modified through exchange and discussion in forums, mutual assignment evaluations, and real-time communication through built-in forums or social tools. Rogers, Mercado, and Decano (2025) discovered the close rapport between Moodle interactions and academic performance, especially in higher education and online learning. Moreover, optimizing the use of Moodle was able to foster a supportive digital learning environment. Ziraba, Akwene, and Lwanga (2023) completely agreed that LMS was one of the most popular online learning platforms to deliver flexible and blended learning modalities. LMS was feasible in higher educational institutions in developed and developing countries. Controversially, Cantabella *et al.* (2019) recommended some available platforms such as Blackboard, Google Classroom, Canvas, and Moodle. Roberts (2019) advocated for a blended learning model. Face-to-face interaction and online instruction were the indispensable factors to enhance student-instructor interactions and support various learning preferences. Despite limitations, Innab *et al.,* (2022) strongly believed that online learning interaction experience was very useful because it could boost inter personal engagement, sense of community, or hands-on experiences as traditional learning approaches. Finally. Tamada, Giusti, and Netto (2022) concluded that technological advancements could assist students' comprehensive learning experience.

Lesson Content Guide & Assistance from Instructors

Content instruction is an important work in online class. Also, it's a challenging task because It is involved in visual impairments or cognitive processing issues (Brown, Strigle, & Toussaint, 2021). Therefore, educators and instructors must consider content design, learning program delivery, learning approach adaptation, and ongoing evaluation to optimize learning outcomes for students (Pham & Tran, 2020). Additionally, another research highlights students' online course preparation and computer proficiency for reaching optimal learning outcomes in online class (Rahmani & Nazemi Jenabi, 2020;

Regmi & Jones, 2020). The process design should follow the three stages: (1) self-regulated learning, namely planning and preparation, (2) execution and control, (3) evaluation and reflection. Particularly, the self-regulated learning process needs to be supported via a diversity of structured learning activities (Sun & Yue, 2015).

While online learning supplies students with faster access to course content, it is essential to realize that insufficient learning support can have a detrimental impact on students. It is a great challenge if students have unequal access to technology and resources, especially in economically under-resourced regions (Tate & Warschauer, 2022). For this reason, instructors need to help students reduce difficulty in interaction participation, guide students to learn autonomously and efficiently, and enable them to gradually build up their own knowledge system in the interaction process. It is instructors that take an important part in orienting students learning experience and system support (Yue *et al.,* 2012). Students should be comprehensively supported in terms of three elements: "autonomous support", "cognitive support" and "emotional support". Similarly, instructors need to supply students with sufficient autonomy and flexibility, resource assistance and approach instructions, positive attention and emotional feedback (Biqing, Weili, Shiyong, Xiaoguang, 2015). Consequently, instructor experience is the core factor to motivate learning activities, especially for students with visual impairments. It is related to a comprehensive approach that considers Instructors' location, learning environment, content selection, and effective teaching experience (Ghoneim *et al.,* 2024). It is necessary to help students bridge the gap and obtain equal learning opportunities by supporting or training students with insufficient skills (Al-Maskari *et al.,* 2022).

Learning Quality Assessment

Hlatywayo, Mapolisa, and Hlatywayo (2024) offered a series of assessment choices, including written assignments, presentations, and projects. Assessment needed to meet individual disparities in learning preferences and allowed students to illustrate their comprehension in diverse ways. It was interesting to consider assessment criteria based on strengths and challenges of individuals, leading to unequitable results. As a result, assessment implementation with the same measures and expectations applied to various students remained rigid. However, online learning outcomes assessment should not be overstated. It was a good idea to optimize learning effectiveness and increase student satisfaction (Yekefallah *et al.,* 2021). In short, the factors that had a remarkable effect on online learning results consisted of electronic learning facility accessibility, student computer competency, content delivery, course design, instructor feedback quality and support, and student active engagement (Cohen *et al.,* 2013).

METHODOLOGY

Research Design

A qualitative research methodology was mainly utilized to reach in-depth insights into the experiences and perspectives, investigate the issues involved in theoretical framework, and answer the research questions. The survey technique was applied to the paper to explore data from participants' feedback. This methodology was very useful because it could facilitate the exploration of the complexities and nuances of the issues, leading to a comprehensive understanding of the challenges and opportunities involved in online learning quality via digital technology application. However, the quantitative research method was added to the research to support the process of data collection and facilitate statistics analysis.

Participants

The survey participants were students from Van Lang University, Hong Bang International University, and Open University. Most of them had interesting experiences in learning online, which was very remarkable for research results. Because this research was investigated on the foundation of unlimited population, the sampling population was randomly selected; and the sample population size was 400 students estimated for the survey. There was no great difference during the sampling selection process. In another way, participants had the same opportunities to participate in responding to the questionnaire now that it was to ensure the objectivity of research results.

Data Collection

The Google form was used as a helpful tool to collect data and deal with time management issues. The data was received from the survey instrument based on the theoretical framework foundation of the literature that explored the events related to technology development and online learning quality. The data was analyzed to find out the online learning quality through interpretation, analysis, and descriptive statistics. Participants were positively encouraged to contribute to the questionnaire with honest responses that were very significant for findings and emphasized validity and reliability in the paper. The authors highly appreciate the enthusiasm and wholehearted assistance of the survey participants, and it has great effect on the result analysis.

DATA ANALYSIS - RESULTS AND DISCUSSIONS

This part illustrates the outstanding findings through collecting data from the survey. In addition, the following charts support data analysis process as well as results description and interpretation in detail.
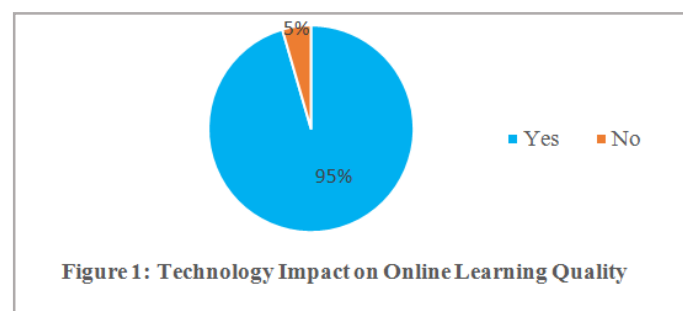

Figure 1: Technology Impact on Online Learning Quality

Figure 1 shows technological advancement that has a remarkable effect on learning outcomes. Most of participants were in favor of learning quality related to technology change. Their interest in this area took up a very impressive rate (95%).
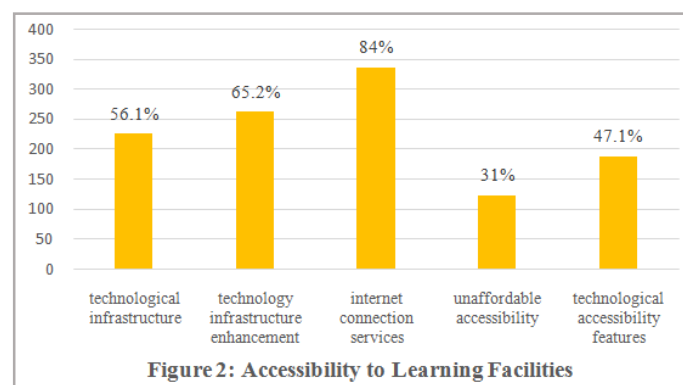

Figure 2: Accessibility to Learning Facilities

Figure 2 indicates the conditions that can assist students to have access to learning amenities. The most important facility was internet

connection that reached the highest rate (84%). However, a noticeable point was that only one third of students had difficulty in accessibility due to finance. Over half of students thought that technological infrastructure prevented them from accessibility. Technology enhancement was also involved in accessibility and occupied 65.2% of students, while technological features kept the lower rate (47.1%).
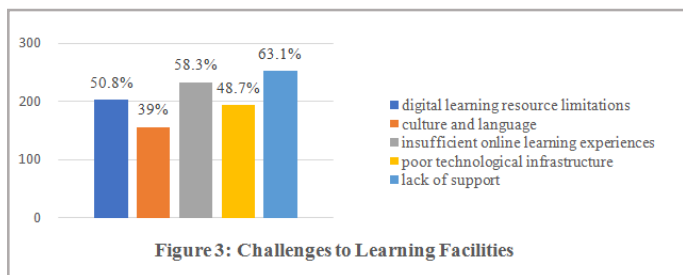

Figure 3: Challenges to Learning Facilities

Figure 3 presents barriers to learning amenities. The most remarkable point was the support from instructors, which peaked at the highest rate (63.1%). 58.3% of students did not feel confident about learning experience, whereas digital learning resource limits were 50.8%. Nearly half of students reckoned that poor technology infrastructure was one of the controversial factors. Culture and language hit the lowest rate (39%).
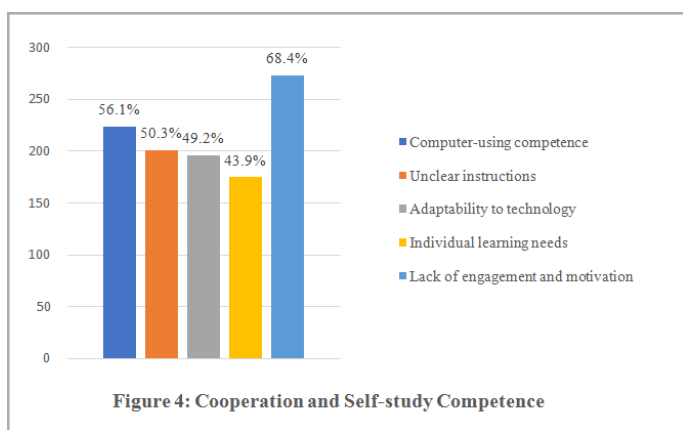

Figure 4: Cooperation and Self-study Competence

Figure 4 depicts students' cooperation and autonomous learning ability. It was necessary to encourage and motivate students during the learning process and hit the highest rate (68.4%). Additionally, 56.1% of students recognized that computer using competence took an important part in self-study. Half of students confirmed that the unclear instructions hindered them from learning. Similarly, technology adaptability (49.2%) had a considerable effect on autonomous learning and cooperation; and the lowest rate was 43.9% for individual learning needs.
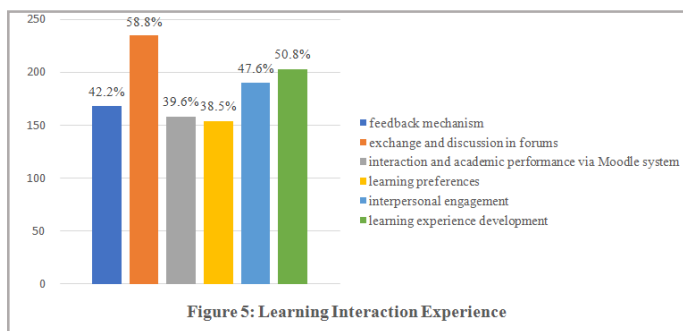

Figure 5: Learning Interaction Experience

Figure 5 demonstrates students' learning experience through interaction. The rate of students taking part in forum discussion was the highest (58.8%). 50.8% of students appreciated learning experience growth; and the following was 47.6% for interpersonal engagement. The feedback mechanism took up 42.2%. Not many

students (39.6%) used Moodle system to perform academic assignments. The rate of students interested in learning preference was the lowest (38.5%).
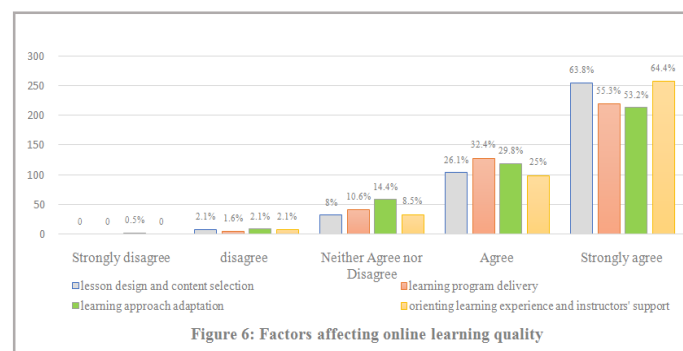

Figure 6: Factors affecting online learning quality

Figure 6 recommends the aspects involved in the quality of online learning. First, 89.4% of students agreed that learning experience orientation and assistance from instructors were very essential; while disagreement was only 2.1%, and 8.5% of students were neutral. Next, 83% of students were pleased with the learning approach adaptation. In contrast, 2.1% of students were against this idea; and the undecided responses were 14.4%.Then, learning program distribution took up 87.7%. The unpleasant students were merely 1.6%, and 10.6% for unclear responses. Finally, designing lesson content reached the highest rate (89.9%), whereas 8% were unsure and 2.1% disagreed.
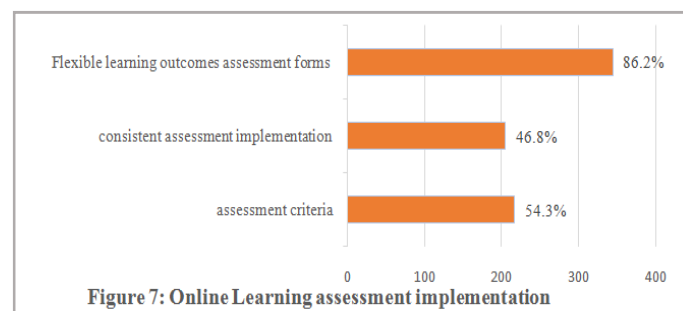

Figure 7: Online Learning assessment implementation

Figure 7 describes the process of course evaluation performance. The flexible evaluation achieved the highest rate (86.2%). The consistent assessment only obtained 46.8%, and over a half of students thought that assessment implementation needed to meet standards.

CONCLUSIONS AND RECOMMENDATIONS

In conclusion, digital technology development has brought a lot of benefits to online education at universities. However, there are some considerable effects on online learning quality. First, the available access to learning amenities takes a decisive part in learning quality, especially for internet support services, technology infrastructure improvements, and technological accessibility features. Second, some obstacles from learning facility accessibility are involved in digital learning resources, insufficient learning experience, difficulties in language and culture, and lack of infrastructure investment and assistance from instructors. Third, the indispensable aspects can support the learning process in terms of adaptability to using technology, learning demands, positive participation, clear instruction and motivation. Fourth, it is very significant to keep interaction in discussion forum via Moodle system, feedback mechanism, learning experience development, and learning preference. Fifth, other factors also contribute to learning quality such as learning orientation, feasible program delivery, online learning approach, and content selection. Last, it is essential to ensure the process of assessment implementation consisting of form, consistency, and criteria.

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