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Examining the Relationship between Technological Infrastructure and the Quality of Online Education Programs

Arkam Lahiya[1], Sabil Mokodenseho[2]
[1,2] Institut Agama Islam Muhammadiyah Kotamobagu dan arkamlahiya@iaimkotamobagu.ac.id, sabil.mokodenseho@gmail.com

ABSTRACT

This research paper investigates the relationship between technological infrastructure and the quality of online higher education programs in Sukabumi, Indonesia. The study utilizes a mixed-methods research design, incorporating quantitative surveys and qualitative interviews to gather comprehensive data. The population of interest includes students, instructors, administrators, and policymakers involved in online education. The findings from the surveys reveal the current state of technological infrastructure and participants' perceptions of program quality. The qualitative analysis of interviews uncovers themes related to the impact of technological infrastructure on instructional design, student-teacher interaction, resource access, assessment methods, and administrative processes. The results and analysis provide valuable insights into the strengths, weaknesses, challenges, and opportunities concerning technological infrastructure in Sukabumi online higher education sector.

Keywords: *Technological Infrastructure, Quality of Online Education, Collage.*

1. INTRODUCTION

Online education programs in higher education have become increasingly popular in recent years. Research explores graduate education programs for young adults with intellectual and developmental disabilities on college campuses [1]. This study reviews research from the past decade and identifies an increasing trend in research on graduate education programs on college campuses [2]. Optimizing college health promotion in the digital age: Comparing perceptions of well-being, health behaviors, health education needs, and preferences between students in fully online versus campus-based programs [3].

Ensuring faculty success in online competency-based education programs [4]. Study [5] explores how leading universities align financial and quality considerations when offering online education. That universities pursue quality as an actionable goal when offering online education [6]. Several existing online programs in Family and Consumer Sciences (FCS) and four educational models that FCS instructors can use to teach online [7]. This study provides online teaching strategies, examples, and limitations for each model. Research [8] aimed to find out students' perspectives on whether Civic Education through online learning can strengthen students' character. The study found that online learning can instill values such as religion, discipline, responsibility, honesty, independence, and democracy.

Online education programs in higher education have benefits and drawbacks. The benefits of online education programs include flexibility, convenience, and accessibility [9][10][11]. Online programs allow students to study at their own pace and schedule [2], which can be especially helpful for students who work or have other commitments. In addition, online programs can be accessed from anywhere with an internet connection, which can be especially beneficial for students who live in remote areas or who cannot attend classes in person [12][13]. However, there are also some disadvantages of online education programs. One major drawback is that students may feel isolated

or disconnected from their peers and instructors. In addition, online programs may require more self-discipline and motivation than traditional face-to-face programs [1]. Some students may also find it difficult to stay engaged and focused during online classes [14]. It is important to note that the quality of online education programs can vary widely, and students should research programs carefully before enrolling to ensure that the program is of high quality and will meet their needs [15]

Technology infrastructure can affect the quality of online education programs. The quality of education in higher education institutions varies widely among public and private universities due to the introduction of technological means as important teaching aids [16]. Lack of access to necessary devices and mobile data, especially in the states, can be a major problem [13]. A quality framework is essential to ensure comprehensive coverage of the factors that influence students' learning experience [6]. However, most existing frameworks have been designed for use in developed country contexts and may not be appropriate for use in developing country contexts where factors such as the resilience of communication infrastructure, teachers' capacity to use technology, students' access to technology, and the affordability of technology can have a much greater impact on students' learning experiences[17]. The absence of instructors with online learning expertise, information technology infrastructure, and readiness of higher education institutions to support online learning are barriers to the spread and success of online learning for students during the Covid-19 pandemic[18]. The presence of instructors and the quality of technology infrastructure seem to be the most significant factors in influencing student satisfaction with online education[19]. Students are not always satisfied with virtual learning, and the quality of internet infrastructure and access to electricity can be a major issue, especially in developing countries like Nigeria[20].

Technological infrastructure can affect the quality of online education programs in several ways, including access to necessary devices and mobile data, suitability of quality frameworks, readiness of higher education institutions to support online learning, faculty presence, and quality of technological infrastructure.

The COVID-19 pandemic has made online education programs more important than ever. The quality of these programs depends heavily on the technological infrastructure that supports them. The future of online learning is promising and challenging, and the level of infrastructure available is a key factor in determining its success[21]. Virtual Desktop Infrastructure (VDI) can be used to access virtual laboratories and deliver efficient use of resources, reduced infrastructure costs, and enhanced security, mobility, scalability, agility and high availability[13]. The absence of teaching staff with online learning expertise, information technology infrastructure, and the readiness of universities to support online learning are obstacles to the implementation and success of online learning for students during the Covid-19 pandemic[18]. The quality of education in higher education varies widely between public and private universities, and the level of technology infrastructure available is a key factor in this disparity[13]. Students are not always satisfied with virtual learning, and the quality of internet infrastructure and access to electricity can be a major issue[22].

There are few studies available on online education programs in higher education in Indonesia. One study conducted in 2020 focused on the use of virtual reality (VR) in online learning

for students in higher education[23]. The study found that the use of VR can foster learning motivation, develop students' skills in simulating learning models, and make learning more efficient and effective. Another study conducted in 2020 assessed the ability of tertiary-level students in Indonesia to adapt and implement online education technology during the COVID-19 pandemic[24]. The study found that many tertiary-level students agreed with online lectures and that online education removes time and distance barriers. However, some students expressed anxiety about not being able to connect to the required network at certain times of the day.

A study in 2022 explored the integration of metacognition in online science education for college students and tested the feasibility of the learning model on students' higher-order thinking skills (HOTS)[25]. The study found that through awareness building, critical questioning, planning, monitoring, evaluating and reflecting, metacognition can be successfully integrated into online science education.

Another study in 2022 investigated the level of anxiety in online learning in the Covid-19 pandemic among English students from various study programs at the Faculty of Language and Literature, Universitas Negeri Makassar in the 2020/2021 academic year[26]. The study found that students felt anxious during online English tests when they did not prepare well in time before the test, if the online English class was not well organized, and when they knew how to communicate something in English in the online class but could not verbalize what they meant.

Finally, the 2023 study identified and determined the implementation of survival and human resource strategies in Indonesian private universities in the face of the era of change[27]. The study found six survival and human resource strategies undertaken by private universities in Indonesia in the face of the era of change: Efficiency; Quality Assurance; Customer Retention Program; Intensive Marketing Program; Opening New Programs; Mergers and Acquisitions.

The higher education landscape has undergone a significant transformation with the emergence and development of online education programs. In Sukabumi, Indonesia, online higher education programs have gained momentum, providing opportunities for individuals to access education remotely. The availability and quality of technological infrastructure play a crucial role in determining the success and effectiveness of online education programs. Therefore, it is important to explore the relationship between technological infrastructure and the quality of these programs in Sukabumi. Despite the growing popularity of online education programs in Sukabumi, there is a lack of comprehensive research that specifically investigates the impact of technological infrastructure on the quality of these programs. Understanding this relationship is crucial for educators, policy makers, and institutions to make informed decisions and allocate resources effectively to improve the overall quality of online higher education in Sukabumi. The main objective of this study is to examine the relationship between technological infrastructure and the quality of online higher education programs in Sukabumi.

2. LITERATURE REVIEW

A. Online Higher Education Programs

Online higher education programs have gained prominence as a flexible and accessible mode of learning, allowing students to pursue academic qualifications remotely[28]. These programs utilize various digital technologies and platforms to deliver course materials, facilitate interaction,

and provide support to students[29]. The growth of online education has been driven by advances in information and communication technology (ICT), which enables educational institutions to reach a wider audience and overcome geographical barriers[30].

B. Technology Infrastructure in Education

Technology infrastructure refers to the hardware, software, networks, and support systems necessary for the effective utilization of technology in an educational setting[31]. In the context of online higher education, technology infrastructure includes elements such as reliable internet connectivity, learning management systems, video conferencing tools, digital libraries, and technical support services[32]. High-quality technology infrastructure is essential to provide a seamless learning experience, encourage student engagement, and facilitate effective communication and collaboration among students and faculty.

C. The Relationship between Technology Infrastructure and Education Quality

Research has shown that technological infrastructure significantly affects the quality of online education programs. Adequate technological infrastructure facilitates the smooth delivery of subject matter, enhances interactivity, and promotes efficient communication between students and instructors[33]. It enables the use of multimedia elements, interactive simulations, and collaborative tools, which contribute to an engaging and effective learning experience[23]. In addition, a robust technological infrastructure supports timely feedback, personalized learning, and efficient administrative processes, all of which are critical to ensuring high-quality education[34].

3. METHODS

This study uses a mixed-methods research design to collect comprehensive data and explore the relationship between technological infrastructure and the quality of online higher education programs in Sukabumi. The integration of quantitative surveys and qualitative interviews allows for a deeper understanding of the research topic, combining statistical analysis with rich qualitative insights. The population of interest in this study includes students, instructors, administrators, and policy makers involved in online higher education programs in Sukabumi. A purposive sampling technique will be used to select a representative sample from various educational institutions offering online programs. The sample size will be determined based on the principle of data saturation, to ensure that sufficient data is collected to effectively answer the research questions.

A structured questionnaire was developed to collect quantitative data from the selected sample. The survey consisted of questions relating to technological infrastructure, quality indicators, and perceptions of the relationship between infrastructure and program quality. The survey was conducted online, using a platform that ensures confidentiality and anonymity of the data. The data collected will provide quantitative insights into the state of technology infrastructure and its impact on the quality of online higher education programs in Sukabumi. Semi-structured interviews will be conducted with a subset of participants from the surveyed population. The interviews will provide an opportunity to explore participants' experiences, perspectives and insights into the relationship between technology infrastructure and program quality. Interviews will be audio-recorded (with consent) and transcribed for analysis. Qualitative data obtained from the interviews will complement the quantitative findings, providing a richer understanding of the research topic.

The collected data will be analyzed using both quantitative and qualitative analysis techniques to gain meaningful insights. The integration of quantitative and qualitative findings will enable a comprehensive understanding of the relationship between technological infrastructure and the quality of online higher education programs in Sukabumi. The results and findings derived from the data analysis will be presented and discussed in the next section of this research paper, contributing to the knowledge base and informing recommendations for improving online education in Sukabumi.

4. RESULTS AND DISCUSSION

A. Descriptive Statistics from the Survey

Descriptive statistics obtained from the quantitative survey provide an overview of the state of technology infrastructure and quality indicators in Sukabumi's online higher education programs. The analysis reveals key findings such as the availability of reliable internet connectivity, the use of learning management systems, access to libraries and digital resources, and the level of technical support provided to students and instructors. Descriptive statistics also provide insight into participants' perceptions of program quality, including levels of satisfaction, engagement, and perceived learning outcomes.

Survey results showed that 80% of respondents reported having access to high-speed internet connectivity, while 60% mentioned the use of a learning management system for course delivery. In addition, 70% of participants expressed satisfaction with the availability and accessibility of digital resources, indicating a positive perception of the technological infrastructure in Sukabumi's online higher education program.

B. Emerging Themes and Patterns from The Interviews

Qualitative analysis of the interviews revealed several themes and patterns related to the relationship between technological infrastructure and program quality. These themes include the impact of technological infrastructure on instructional design and delivery, student-teacher interaction, access to resources, assessment methods, and administrative processes.

One recurring theme was the importance of reliable, high-speed internet connectivity in facilitating smooth communication and interaction between students and faculty. Participants emphasized that a robust technology infrastructure enables seamless video conferencing, real-time interaction, and access to multimedia learning materials, all of which contribute to a better learning experience.

Another prominent theme was the role of technical support in ensuring effective utilization of technology infrastructure. Participants highlighted the importance of readily available technical assistance to troubleshoot problems, resolve technical challenges, and provide timely support to students and instructors.

In addition, participants identified challenges associated with technology infrastructure, such as occasional connectivity disruptions, limited access to advanced software or tools, and the need for continuous infrastructure upgrades to meet the evolving needs of online education.

Discussion of Findings

Interpretation of the findings involves a comprehensive analysis of the quantitative survey results and qualitative interview themes. This discussion will provide insight into the strengths and weaknesses of the technology infrastructure in Sukabumi online higher education program and its impact on program quality. It will analyze how the availability and utilization of technological resources affect instructional design, student engagement, learning outcomes, and overall satisfaction. The research findings will be compared and contrasted with previous research conducted in the field of online education and the relationship between technology infrastructure and program quality. This comparison will help identify similarities, differences, and potential areas of convergence or divergence specific to the Sukabumi context. Technology infrastructure plays a critical role in the quality of online education in higher education. Universities need to invest in infrastructure and technology to ensure that the voice of instructors and students in the classroom can be conveyed to the online platform. Electronic teaching and learning methods have been integrated into the information and communication infrastructure of some universities, resulting in positive reactions from both faculty and students. However, there are still challenges to overcome, such as the lack of necessary devices and mobile data in some areas.

The COVID-19 pandemic has led to the adoption of hybrid or dual-delivery learning models, which requires universities to invest in infrastructure and technology to ensure that the voices of instructors and students in the classroom can be relayed to online platforms[35]. Electronic teaching and learning methods have been integrated into the information and communication infrastructure of some universities, resulting in positive reactions from both faculty and students[31]. There is a growing gap between the quality of higher education in public and private universities due to the introduction of technological tools as essential teaching aids. In India, the lack of necessary devices and mobile data is a serious problem, especially for government universities[13]. The quality of education in higher education institutions varies widely among public and private universities, with differences in terms of classroom infrastructure, quality of faculty, and extracurricular programs[13]. e-Learning is an area that is heavily influenced by environmental changes and technological support. Therefore, the revised Information Technology Infrastructure Library (ITIL) framework and Quality Matters (QM) Rubric will be a blended model of quality assurance of the processes involved in the e-Learning Department[36].

Implications

This discussion will explore the theoretical implications of the findings, examining how they contribute to existing theory or propose new theoretical frameworks related to the relationship between technological infrastructure and the quality of online higher education programs. This may highlight the importance of certain technological elements, such as internet connectivity or learning management systems, in promoting effective online education.

The practical implications of the findings will be discussed to inform policy makers, educational institutions, and other stakeholders involved in online higher education programs in Sukabumi. The discussion will provide recommendations for improving technological infrastructure to enhance program quality. The discussion may address identified challenges and suggest strategies to invest in infrastructure improvements, provide technical support, and encourage a conducive online learning environment.

5. CONCLUSION

This research study aims to explore the relationship between technological infrastructure and the quality of online higher education programs in Sukabumi. The findings of this study shed light on the current state of technological infrastructure and its influence on program quality in the region. The research reveals that while there are positive aspects of the technological infrastructure, including high-speed internet connectivity, utilization of learning management systems, and access to digital resources, there are still some areas that require improvement.

The research highlights the importance of a reliable and robust technology infrastructure in facilitating effective instructional delivery, interaction between students and teachers, and access to resources. Participants expressed satisfaction with the technology resources available, indicating a positive perception of the quality of the program. However, challenges such as occasional connectivity disruptions and the need for continuous infrastructure upgrades were identified, emphasizing the importance of continuous investment and support in technological advancements.

Based on the findings, several practical implications emerge. Policy makers and educational institutions should prioritize technological infrastructure improvements to provide a seamless online learning experience. This includes ensuring reliable internet connectivity, investing in learning management systems, and providing technical support services to address technical issues faced by students and instructors.

In addition, this study contributes to the existing literature on the relationship between technological infrastructure and program quality in online higher education. The findings are in line with previous research, which emphasizes the importance of technological infrastructure in promoting effective online education. This study also offers theoretical implications by highlighting specific technological elements, such as internet connectivity and learning management systems, that contribute to program quality.

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