

The Barriers and Readiness to Deal With Digital Transformation in Higher Education

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Abstract – During the recovery from the COVID-19 pandemic, stakeholders in higher education institutions have been encouraged to adapt to the changes caused by digital transformation. This study employs a case study approach to investigate the barriers and readiness of students, educators, and higher education institutions for digital transformation. Data were collected through questionnaires and interviews with stakeholders in a higher education institution in Indonesia. The data from the questionnaire were analysed using qualitative descriptive analysis, while the transcripts of the interview data were run into the ATLAS.ti Qualitative Data Analysis application and analysed thematically. Codes developed from digital transformation barriers were suggested by Volgesang and later interpolated during data analysis into readiness and strategy codes. The emerging themes related to students and lecturers, and universities obstacles, readiness and strategies in dealing with digital transformation could then be identified. The findings are crucial for higher education institutions to thrive in the digitally evolving environment. Understanding how the university's stakeholders perceive the transformation would help anticipate a more knowledgeable and organized method to handle the intricacies and difficulties associated with such a profound change.

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Keywords – Case study, digital transformation, digital transformation in education, digital transformation readiness.

1. Introduction

Due to its emerging importance, digital transformation in education has captured the world's attention, as education is the primary focus of digital transformation development. Despite the fact that such transformation has been conceptualised as converting all types of information into digital language [1], it is not merely about how to use digital technology, but also the ability to interpret information technology and its benefits in daily life [2]. Marks and Al-Ali [3] argue that digital transformation refers to organisational process modifications. The development of new competencies and models through digital technology is reflected in such transformation. Additionally, digital transformation improves organisational effectiveness and operational efficiency. During the recovery from the COVID-19 pandemic, higher education institution stakeholders have been compelled to adapt to the situation presented.

Digital transformation influences lifestyle changes. Information and communication technology development will continue until its implementation is incorporated into the educational process. The digital evolution has spawned a new concept of education: the digital transfer of knowledge. For instance, an online learning model could employ a Learning Management System (LMS) or video conference. Therefore, universities are required to develop online learning platforms to enhance the effectiveness of education [4].

Education's digital transformation can be both a challenge and an opportunity. While students, lecturers and university management are the determining stakeholders for the success of such a transformation, the primary beneficiaries of university education are the students, who inevitably must accept and undergo digital transformation.

Unlike lecturers and universities themselves, students must have the opportunity to prepare for rapid digital transformation. The lecturer has been responsible for such transformation in universities. Its success, therefore, depends on the level of lecturers' proficiency in implementing digital technology in education. Moreover, universities are the leading proponents of digital transformation, meaning their support is vital. Consequently, special preparations must be made for the digital transformation of higher education. This study explores students' view about their university's digital transformation efforts, their lecturers and university readiness to face such transformation, and whether a certain strategy has been determined by the university to anticipate the transformation.

2. Methods

Digital transformation is changing the fundamentals of the education system in higher education. Therefore, it is necessary to investigate digital transformation from the perspective of students, lecturers, and management of the university as a comprehensive view of the phenomenon. In the following sub-sections, the design of the research, coding technique, data analysis, and the result of the analysis are presented.

2.1. Research Design

To obtain answers to the research questions, a qualitative case study design [5] was adopted. The approach was chosen to gain deep insight into the knowledge and experience of the participants concerning the effort to adapt to the changes and circumstances resulting from the post-COVID-19 transformations. The real-life situations conceived in the research were considered an important part of research to comprehend the development of digital transformation within subunits of the organisation; the anticipation and preparations made; and the strategies to mitigate threats that may potentially arise during the process.

The research was conducted in an Indonesian higher education institution. Students, lecturers, and management of three engineering education study programs were selected to speak about their experience before, during, and after the pandemic struck the country. The study programs were the Bachelor of Informatics Education (BIE), Bachelor of Mechanical Engineering Education (BMEE), and Bachelor of Civil Engineering Education (BCEE). It was expected that the participants would elaborate on their experience of observing the digital changes and the circumstances surrounding them.

The data were collected from questionnaires and in-depth interviews. This research questionnaire was in the form of close-ended questions with answers ranked from one to seven. The in-depth interviews were used to re-confirm the questionnaire data and analyse it more deeply. The questionnaire and interview indicators adopted Vogelsang, Liere-Netheler, Packmohr and Hoppe's [6] variables, including missing skills, technical barriers, individual barriers, organisational barriers, barriers, and the environment.

The analysis of the questionnaire results was conducted descriptively. Instead of calculating statistical parameters, descriptive analysis in qualitative research interprets the number of answers to the questionnaire to be analysed. Finally, thematic analysis procedures [7] were adopted to analyse the interview transcripts. The coding process was conducted using ATLAS.ti qualitative data analysis software.

Table 1. Digital Transformation Barrier Codes [6]

Barrier Scope	Code
Missing skills	<ul style="list-style-type: none"> IT knowledge Information about and decisions on technologies Process knowledge
Technical barriers	<ul style="list-style-type: none"> Dependency on other technologies Security (data exchange) Current infrastructure
Individual barriers	<ul style="list-style-type: none"> Fear of loss of control over data Fear of transparency/acceptance Fear of job loss
Organisational and cultural barriers	<ul style="list-style-type: none"> Keeping traditional roles/principles No clear/vision strategy Resistance to cultural change/mistake culture Risk aversion Lack of financial resources Lack of time
Environmental barriers	<ul style="list-style-type: none"> Lack of standards Lack of laws

The research adopted the 'barrier to digital transformation' concept [6] for the research codes. Barriers can be used to analyse participants' perspectives on digital transformation undertaken in their institution [8]. The interpolation of "barrier codes" resulted in readiness and strategy codes. Interpolation is the process of guessing data values by paying attention to the data possessed. This technique was applied to find missing variable deals in the known data. In this study, it was assumed that the out variables were "readiness" and "strategy", while the available data were "barriers". The two variables can be interpolated with the barrier because all three have the same pattern.

Therefore, 17 barrier codes, 17 readiness codes, and 17 strategy codes could be added to the ATLAS.ti qualitative data analysis software, as shown in Figure 1, while the code generalisation process is shown in Figures 2 and 3.

The code generalisation process was conducted by inputting the code and three subjects (student, lecturer, and university) into ATLAS.ti.

The three subjects were entered into ATLAS.ti as codes, as shown in Figure 3. In this process, the codes that intersected one another were emerged. The interviews were conducted and analysed in Bahasa Indonesia, the native language of Indonesian, where the research took place. The reports were subsequently presented in English. This strategy was adopted to prevent the loss of richness and meaning in language due to translation [9].

Code Groups	Name	Grounded	Density	Groups
dosen (0)	barrier	57	0	
mahasiswa (0)	barrier: current infrastructure	6	0	
universitas (0)	barrier: dependency on other technology	6	0	
	barrier: fear of data loss of control	7	0	
	barrier: fear of job loss	0	0	
	barrier: fear of transparency /acceptance	7	0	
	barrier: information about and decision on tech...	1	0	
	barrier: IT knowledge	2	0	
	barrier: keeping traditional roles/principles	3	0	
	barrier: lack of financial resources	2	0	
	barrier: lack of laws	0	0	
	barrier: lack of standars	9	0	
	barrier: lack of time	0	0	
	barrier: no clear vision/ strategy	7	0	
	barrier: process knowledge	13	0	
	barrier: resistance to cultural change / mistake c...	7	0	
	barrier: risk aversion	0	0	
	barrier: security (data exchange)	0	0	
	kesiapan	37	0	
	strategi	115	0	

Figure 1. Code manager in ATLAS.ti

The screenshot displays the ATLAS.ti interface with a transcript titled "TRANSKRIP WAWANCARA:" on the left and a list of applied codes on the right. The transcript includes three main questions and their answers in Indonesian. The applied codes are color-coded and linked to specific parts of the text, such as "barrier: no clear vision/ strategy" and "barrier: process knowledge".

Figure 2. Code generalisation process in ATLAS.ti

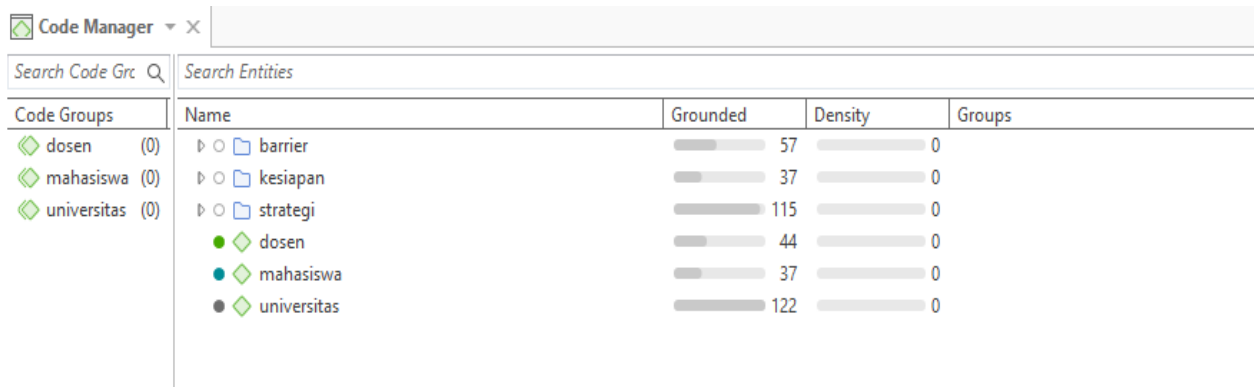


Figure 3. Code generalisation process in ATLAS.ti

2.2. Results

Based on the results of the generalisation of the code, several themes were determined based on the subject, namely students, lecturers, and management.

2.2.1. Students

It was found that the three study programs had similar patterns in the process of code generalisation and theme search. These are shown in Tables 2, 3 and 4. Details of the codes are discussed below.

In *barrier::current infrastructure*, the theme of students' lack of IT infrastructure was found. This means that they do not have adequate facilities and infrastructure to support digital learning. This theme is related to *barrier::dependency* on other technologies, in which it was found that the students have problems or are constrained by signals. During online learning, signals are an important factor in student success.

This finding aligns with that of Iivari *et al.* [2], that some students have difficulty accessing the Internet, and may lack devices and online applications, especially in remote areas. Students in remote areas have more limited access to electricity, internet connections, and technological facilities than those in large cities [10]. This theme can be reviewed as students lacking IT equipment.

In *barrier::IT knowledge*, it was found that students lacked such knowledge, which relates to the ability to use digital tools or technology. In digital learning systems, IT knowledge is crucial. However, it takes a long time to become familiar with digital technology [11]. Because of this, rapid digital change means students have difficulty adapting to technology. This theme can be viewed as students lacking digital literacy.

Table 2. Student themes: barriers

CODE	BIE	BMEE	BCEE
IT knowledge		Students are familiar with the technology	Students are familiar with the technology
Process knowledge	Students are familiar with the technology	Students accept university policies and individualisation	Learning is easier; students are motivated
Fear of loss of control over data	Students accept university policies	Students accept university policies	Guaranteed data security
Fear of transparency /acceptance		Ease of communication; search for material from various sources; getting used to technology.	
Keeping traditional roles/principles			Students are motivated
Resistance to cultural change / mistake culture			Students are motivated

In *barrier:: fear of transparency /acceptance*, it was found that the students became inactive, passive, or silent. This is because they were still not used to changing learning patterns from offline to online ones, and may have the tendency to not to see any benefits from changing the learning platform. As a result, they use signal reasons to turn off the camera, be passive, and be silent during lessons. This theme can be viewed as a passive student.

In *barrier::fear of loss of control over data*, themes of students' lack of information, individualization, and fear of data loss were found. However, the lack of information cannot be generalised to all students; it may be caused by a lack of signal or their efforts to find information. Another theme is data loss concerns. Some students are concerned about data being stored on university platforms because of frequent errors. Therefore, these themes can be reviewed into individualization and data concerns.

Furthermore, in: *barriers::keeping traditional roles/principles* and *barriers::resistance to cultural change/mistakes culture overlap* the same theme was found, namely that students became inactive, and were not ready to accept learning; were passive; were not used to online patterns; and had poor learning ethics. These themes arose because students felt they were not ready to accept online learning and preferred the offline method, in which lecturers are present and pay attention to the students. This follows Stone's [12] argument that students wish to secure the attention of lecturers. Changes in learning patterns affect student scores. Therefore, these themes can be seen as passive students and long adaptation times.

In *barrier:: the lack of standards* relate to *strategy:: lack of standards*, digital transformation eliminates the standards of time and place in the learning process. Aini, *et al.* [13] state that learning flexibility allows lecturers and students to be connected anytime and anywhere. However, such learning flexibility can be both a barrier and a strategy. As a strategy, flexible learning allows lectures to be conducted anytime and anywhere, without being bound by place or time. Nevertheless, it becomes a barrier because students sometimes have misunderstandings with lecturers regarding lecture and assignment times due to the loss of time standards in online learning. Therefore, this theme can be reviewed as learning flexibility.

In *barrier::process knowledge*, themes of individualization, self-paced learning, a lower level of student understanding, learning loss, and students not being ready to accept learning are found. The use of technology in learning causes students to have difficulties [2] because the interaction between them and lecturers is more limited. Piyatamrong, Derrick, and Nyamapfene [14] state that the use of technology in learning causes students to lose opportunities to learn and socially interact. Therefore, these themes can be viewed as individualization, learning loss, and self-paced learning.

As shown in Table 3, the BIE, BMEE, and BCEE study programs show two similarities in student *readiness: process knowledge* and fear of data loss of control.

Meanwhile, in the BCEE and BMEE study programs, one type of readiness was found, namely *readiness::IT knowledge*. In *readiness:: process knowledge*, the following themes were found: students are familiar with technology; they accept all university decisions; individualization; learning is easier; and students are motivated. Students' readiness to process knowledge is based on receiving all kinds of university and lecturer decisions related to education. This acceptance is continuous with the readiness to keep traditional roles/principles and resistance to cultural change/mistake culture; in other words, students are more motivated. They are interested in the features of digital learning [15], [16] because they are considered to be easier and more structured [17].

Table 3. Student themes: readiness

CODE	BIE	BMEE	BCEE
IT knowledge		Students are familiar with the technology	Students are familiar with the technology
Process knowledge	Students are familiar with the technology	Students accept university policies and individualisation	Learning is easier; students are motivated
Fear of loss of control over data	Students accept university policies	Students accept university policies	Guaranteed data security
Fear of transparency /acceptance		Ease of communication; search for material from various sources; getting used to technology.	
Keeping traditional roles/principles			Students are motivated
Resistance to cultural change / mistake culture			Students are motivated

Moreover, students can undertake semi-online learning with the same digital platform before full online learning occurs. Universities tend to use the same learning and service methods as before. This aligns with Brink *et al.* [8], in that the students are open to cultural changes and new learning concepts, and with Gonçalves, Sousa, and Pereira [18], who state that students are more satisfied with online learning.

Therefore, these themes can be viewed as individualisation, and students are open to the new learning system.

In *readiness:: fear of loss of control over data*, the theme is that students accept all university decisions and ensure data security. Data vulnerability is a common phenomenon in digital transformation [19]. In this study, the students tend to trust universities to handle data generated using digital platforms. This trust is based on the existence of data security standards and the absence of data abuse to date. Therefore, these themes can be reviewed as data security.

Table 4. Student themes: strategy

CODE	BIE	BMEE	BCEE
Process knowledge	Independent learning; recorded learning material; searching for material in various sources	Record learning	Independent learning; record learning
Fear of loss of control over data			Back up data
Lack of standards	Flexible learning	Flexible learning	

In *readiness::IT knowledge*, the theme of students being familiar with technology was found. Being accustomed to using technology means they can operate digital platforms correctly. Over time, students become accustomed to and able to adapt to new learning patterns using technology. Therefore, this theme can be reviewed as the need for time to adjust to technology.

For students, the *strategy::lack of standards* has been discussed on students' "barrier". It was explained that this strategy is undertaken by learning without being bound by time or place. With digital transformation, learning at universities tends to be more flexible. Gonçalves *et al.* [18] state that flexible learning allows lecturers and students to connect whenever, wherever, which removes the limitations of place and time in learning. Therefore, these themes can be reviewed as flexibility of learning.

In the *strategy::process knowledge*, the theme of independent learning, recording learning and searching for material from various sources is found. Students can make online class recordings to overcome material incomprehension during the online learning process. The recording can be watched repeatedly at the student's convenience.

Misunderstanding of material can also be overcome by independent study using material obtained from various sources. Therefore, the review of these themes is independent learning, individualisation, and flexibility of learning.

Table 5. Lecturer themes: barriers

CODE	BIE	BMEE	BCEE
IT knowledge		Lecturers lack digital literacy	Lecturers lack digital literacy; lecturers need time to adapt
Information about and decision on technologies	Use of third party technology	Use of third party technology	
Process knowledge	Limited communication; passive students; lower learning standards.	Use of the university's learning platform; use of third party technology; lecturers facilitated by technology	
Fear of loss of control over data	Data loss worries; use of third party technology; difficult to monitor students	Lecturers are worried about excessive transparency and data loss	Loss of control over data
Fear of transparency /acceptance	Lecturers are worried about excessive transparency and data loss		
Keeping traditional roles/principles	Passive learning; online learning begins with compulsion		
Resistance to cultural change / mistake culture	Passive learning; online learning begin with compulsion		
Lack of standards	Flexibility of learning		

Furthermore, in *strategy::fear of loss of control over data*, the theme of data backup is found, which students perform to overcome the fear of losing their data.

However, the success of the learning process depends on the students' nature and abilities [20]. Therefore, the strategies applied depend on the students, such as making recordings and backing up data. Therefore, the review on this theme is data management.

2.2.2. Lecturers

It was found that the three study programs had similar patterns in the process of code generalisation and theme search. Tables 5, 6, and 7 present the similarities in the generality of codes and themes revealed from the data collected from the participating lecturers.

In *barrier:: IT knowledge*, it was found that lecturers lacked digital literacy and needed time to adapt. At the beginning of online learning, some had difficulty in managing the digital platform provided by the university because of their lack of related digital literacy. Lecturers need extensive knowledge support in developing digital learning media, which all will need to create [21]. Universities tend not to hire new staff to help teach lecturers, so they need separate time to learn to use the technology. However, the time needed to become more familiar with digital technology is very long [11]. Therefore, the lack of digital literacy by lecturers is significant. Consequently, these themes can be seen as a lack of digital literacy and a long adaptation time.

In *barrier::fear of loss of control over data*, themes include fear of data loss; use of third-party technology; difficulty in monitoring students; lecturers' worries over excessive transparency; and loss of control over data. Data are crucial in digital transformation yet easy access to information leads to the loss of individual privacy. Lecturers are worried about the openness of the university; data and information that are considered private can spread anywhere in a very short time. Therefore, these themes can be viewed as the loss of control over data.

Table 6. Lecturer themes: readiness

CODE	BIE	BMEE	BCEE
IT knowledge			Facilitating lecturer performance ; becoming more familiar with the technology
Information about and decisions on technologies	Universities provide digital platforms; lecturers offer a choice of learning platforms	Lecturers use the university's learning platform; use third-party digital platforms; lecturers are facilitated by technology	
Process knowledge	Simplifies the learning process	Lecturers use the university's learning platform; use third-party digital platforms; lecturers are facilitated by technology	Synchronous and asynchronous learning
Fear of loss of control over data	Guaranteed data security; integration between university digital platforms		Reliable data control
Keeping traditional roles/principles		Lecturers use digital platforms in learning; administrative services have changed to online; lecturers are facilitated by technology	
Resistance to cultural change / mistake culture		Lecturers use digital platforms in learning; administrative services have changed to online; lecturers are facilitated by technology	

In *barrier:: information about and decisions on technologies*, the theme of the use of third-party platforms was found. Digital learning platforms have also become an important part of learning and the foundation of the current education system [22]. Some lecturers continue to use media developed by third parties, such as Google Mail, Google Classroom, Google Drive, and Google Forms, because they are more familiar with these. The university also provides facilities for lecturers to use a Google account with a UNS domain and access to Zoom Pro. As a result, the variety of platforms that lecturers can use increases. Therefore, this theme can be reviewed as the importance of learning platforms.

In *readiness::fear of loss of control over data*, the themes of guaranteed data security, integration between digital platforms, and trustworthy data control were found. Lecturers trust the university in handling their data. According to Edwards [23], data protection means that each individual has the right to control the collection, processing, and reuse of personal data. Lecturers also have access to management of their data. They believe that the university will not misuse their data, as the system created by its IT support unit is based on existing regulations, meaning data management authority is guaranteed. These themes can therefore be reviewed as data security.

In *readiness:: information about and decisions on technologies*, it was found that the university provides digital platforms, and lecturers are given a choice of learning platforms; use the university's digital learning platforms; use third-party digital platforms; and are facilitated by technology. Digital learning media are also an important part of learning and the foundation of the current education system [22]. Lecturers can choose the digital learning media to use in the learning process. Therefore, these themes can be reviewed into the importance of digital learning platforms.

In *readiness:: processing knowledge*, themes emerged of facilitating the learning process; using digital learning platforms belonging to the university; lecturers using third-party digital platforms; lecturers facilitated by technology; and synchronous and asynchronous learning. Lecturers are ready to conduct online learning using digital platforms, which facilitate the learning process. The data become more centralized. The learning strategy used also determines the success of learning. During online learning, synchronous and asynchronous plans emerged. These themes can be reviewed into the importance of digital learning platforms and learning strategies.

In *strategy:: lack of standards*, similar themes were found to student strategy, namely the existence of flexible learning and making learning contracts.

Aini *et al.* [13] state that the flexibility of learning allows lecturers and students to be connected anytime, anywhere. Flexible learning can be a barrier or a strategy, depending on how students and lecturers interpret it. With flexibility in learning, lecturers can participate virtually in various activities; therefore, this theme can be viewed as flexibility of learning.

Table 7. Lecturer themes: strategy

CODE	BIE	BMEE	BCEE
IT knowledge	Lecturers take part in training/workshops and adapt to technology	Lecturers take part in training and watch learning videos	Lecturers take part in training/workshops; provide team of IT support; increased IT infrastructure.
Information about and decision on technologies		Synchronous and asynchronous learning; block learning system	
Process knowledge	Synchronous, asynchronous and blended learning		Development of new technologies and block learning system
Fear of job loss	Lecturers take part in training/workshops and adapt to technology	Lecturers take part in training	Lecturers take part in training/workshops; provide team of IT support; increased IT infrastructure.
Lack of standards	flexibility of learning and creating learning contracts.	Flexibility of learning	Flexibility of learning

Strategy::IT knowledge and strategy::fear of job loss intersect. In these two strategies, the themes of lecturers participating in training/workshops; adapting to technology; provision of IT support teams; and adding IT infrastructure were found. To overcome fears of job loss and limited knowledge related to technology, lecturers attend workshops or training. This is an important strategy for increasing work capacity and competitiveness [24]. Trained teachers can focus on creating content and long-term learning media. Universities tend to train lecturers to improve their digital literacy, so these themes can be reviewed as conducting training.

In *strategy:: process knowledge learning* themes of blended learning, synchronous and asynchronous learning models, block learning systems and development of new technology were found. The method lecturers apply to overcome learning loss that occurs in students is to change learning strategies. These allow students to acquire digitalisation skills, knowledge, and abilities [25]. The learning strategy used in online learning is blended learning with synchronous and asynchronous models. Therefore, the themes can be reviewed to become learning strategies.

2.2.3. The University

It was found that the three study programs had similar patterns in the process of code generalisation and theme search. These can be seen in Tables 8, 9, and 10.

Barrier::keeping traditional roles/principles and *barrier:: resistance to cultural change/mistake culture* overlap each other. In these two barriers, it was found that the campus administration process still requires hard files, activities are not yet fully online, and digitalisation is not fully running. All the students and lecturers are unable to accept the culture of using digital transformation in learning. This cultural rejection is also due to the existence of *barrier::no clear vision/strategy*. In this barrier, the theme is a lack of digital transformation vision and strategy socialization. Students and lecturers tend to know that universities have a clear vision and strategy for supporting digital transformation, but do not know what these are. Ignorance of this vision and strategy results in digitalization not being fully implemented. Therefore, these themes are reviewed to increase the digitisation of activities.

Barrier::dependencies on other technology is caused by *barrier:: current infrastructure*. In the former, the theme of lecturers still using third-party digital platforms was found. Problems in university IT infrastructure and long adaptation time make lecturers use such platforms that they are familiar with. Therefore, this theme can be reviewed as optimization IT infrastructure.

The barriers::dependency on other technology and *current infrastructure* are caused by *barrier::lack of financial resources*. In this barrier, the theme of insufficient fund allocation and IT staff was found. This demonstrates the lack of university IT staff and the problems with digital learning platforms. Consequently, these themes can be reviewed as managing IT infrastructure and allocating funds for IT needs.

In *readiness:: information about and decisions on technologies*, university themes regarding the creation of IT divisions and digital learning platforms and provision of platform usage policies were found.

Universities create special divisions that handle IT and also tend to integrate digital transformation into learning systems. They also allow lecturers to be innovative in developing digital transformation-based learning. Of course, this freedom is still controlled by *readiness::lack of standards*. In this, the theme of developing policies related to the use of digital platforms was found. The university creates policies on using its learning management system platforms, such as Spada and Open Course Ware (OCW), to align the digital platforms used. This concerns the university's tendency to create new curriculums to support digital transformation in learning. Based on these themes, we can develop new policies.

Table 8. University themes: barriers

CODE	BIE	BMEE	BCEE
Dependency on other technologies	Still using third-party digital platforms	Dependent on digital platforms created by third-party vendors	
Current infrastructure	The learning platform often has errors	Lack of IT infrastructure; learning platform errors	Lack of IT infrastructure; learning platform server down time; lack of integration between platforms
Keeping traditional roles/principles	Administrative processes still require hard files	Digitisation has not been fully implemented	Digitisation has not been fully implemented
No clear vision/strategy	Lack of socialization	Lack of socialisation of the vision of digital transformation	Lack of socialisation
Resistance to cultural change / mistake culture	Administrative processes still requires hard files	Digitisation has not been fully implemented	Digitisation has not been fully implemented
Lack of financial resources	Lack of IT staff and IT infrastructure	Lack of IT infrastructure	
Lack of standards	Lack of standards; university is too open		

Readiness:: current infrastructure overlaps with *strategy::dependency on other technologies*. In these cases of readiness and strategy, the themes of creating and optimising digital platforms, developing policies related to using digital platforms, and providing sufficient IT infrastructure were found.

Universities have created special platforms and offer services to support learning using digital transformation, including Spada and OCW. Platform creation can occur because universities tend to have sufficient IT infrastructure. With such platforms, they do not need to use learning platforms managed by third parties. Therefore, these themes can be reviewed as the creation of digital platforms.

Table 9. University themes: readiness

CODE	BIE	BMEE	BCEE
IT knowledge			Conduct outreach and provide a helpdesk
Information about and decisions on technologies	The university creates IT divisions and digital learning platforms		Transparency of data and provision of platform usage policies
Dependency on other technologies	Dependence on existing technology	Granting premium access to third party accounts	
Current infrastructure	Creation and optimisation of digital platforms; provision of platform usage policies	Provide IT infrastructure; create digital learning platforms	Create digital learning platforms
Fear of data loss of control	Data transparency		
Keeping traditional roles/principles	Change in the form of activities from offline to online		
Lack of financial resources			Requires large funds
Lack of standards			Provision of platform usage policies

It was also found that *readiness::dependence on other technologies* intersects with *current strategy::infrastructure*. Two sub-themes emerged from the intersection of the two main themes, namely the dependency on technology and the lack of access to third-party accounts. It was elucidated that despite the existence of digital platforms in universities, there was a deficiency in staff utilization of these platforms. Thus, the university's approach to addressing the absence of digital platforms involved acquiring full licenses for lecturers.

However, the digitisation of the education system depends on the level of ICT infrastructure in each university [26]. These themes can be reviewed as optimisation of digital platforms.

Table 10. University themes: strategy

CODE	BIE	BMEE	BCEE
IT knowledge	Conduct training and outreach; provide a helpdesk.	Provide a helpdesk	Conduct outreach and provide a helpdesk.
Information about and decisions on technologies	Provide helpdesk; digital platform policies; integration between platforms.	Provide digital platform policies	
Process knowledge	Optimise digital classes; reduce the level of learning outcomes		
Dependency on other technologies	Create and optimise digital platforms; develop policies regarding the use of digital platforms	Provide adequate IT infrastructure and create a digital learning platform	Create digital platform
Current infrastructure	Dependent on other technologies	Provide premium access to third party accounts	
Fear of loss of control over data	Service integration	Service integration	
Keeping traditional roles/principles	Digitalisation activity; conduct outreach supervision		Digitalisation activity
Resistance to cultural change / mistake culture	Digitalisation activity; conduct, outreach and supervision		Digitalisation activity

Universities tend to try to keep learning and improving their digital transformation. The main strategies to support such transformation are *strategy::keeping traditional roles/principles* and *strategy::resistance to cultural change/mistake culture*.

In these two codes, the same theme was found, namely universities' change in the form of activities from offline to online, conducting outreach and supervision, while digitising services and learning. The university carries out these two strategy codes by digitising all campus activities, from services and learning. In accordance with Machekhina [1], digitalisation or digital transformation means changing all types of information into digital language. Universities' learning processes and services tend to have been digitized, so these themes can be reviewed as digitization of services and learning.

In *strategy::fear of loss of control over data*, the theme of service integration was found. This is the relationship or continuity between one platform and another. The university created a Single Sign On (SSO) access system to overcome the loss of control over data. This system allows users to use one login account for multiple platforms, so lecturers and students tend to be able to manage their data. Synchronising data between platforms reduces the risk of losing data control. This theme can there be reviewed in management data.

The university also has *strategy::IT knowledge*. In this, the theme of holding training/workshops, conducting outreach, and providing helpdesk was found.

The same theme was found in *strategy::information about and decisions on technologies*. In this strategy, the theme of provision of a helpdesk for using digital platforms, policies for using digital platforms, and integration between platforms was found. The university conducts socialisation and provides information for the academic community regarding the use of digital platforms. In addition, it also provides a helpdesk if there is a disturbance or error on the platform. Therefore, these themes can be reviewed in managing IT infrastructure and making digital platform policies.

3. Discussion

The study investigated the barriers and readiness of higher education institutions to adapt to digital transformation. A thorough understanding of the factors underlying a university's transition is essential to identify specific methods. This study examines stakeholders' viewpoints on the university's efforts to undergo digital transformation. The subsequent subsections delineate three themes derived from the data: Student Perceptions of Digital Transformation, Lecturer Readiness for Digital Transformation, and University Readiness for Digital Transformation. Excerpts of data originating from interviews or questionnaire responses justify each finding.

The finding is compared or contrasted with previous literature.

3.1. Student Perceptions of Digital Transformation

A focus on students is the key to success in facing digital transformation in learning [27]. As beneficiaries of education, students must be able to adapt to all university policies that apply. Therefore, their perceptions of digital transformation in learning need to be continuously improved. They can be identified from the themes obtained from the barrier code and readiness. Eight themes were found related to the student barrier: lack of IT equipment, lack of digital literacy, passive students, individualisation, fear of data loss, long adaptation time, learning flexibility, learning loss, and the need for self-paced learning. In addition, four themes were found regarding student readiness: individualisation, students being open to new learning systems, data security, and the need for a long time to adapt.

The availability of learning tools is an important aspect of implementing digital transformation in education. IT equipment is needed to change the learning system from face-to-face to distance learning [28]. Without adequate equipment, students cannot participate in distance learning appropriately. Livari *et al.* [2] state that some students have difficulty accessing the Internet, with limited use of devices and online applications. These limitations mean students may be unable to take part in learning because they cannot go online.

According to Korepin, *et al.* [29], the Internet users between 18 to 24 years old tend to use the Internet to learn independently. Students' ability to implement digital transformation in education is influenced by their ability to learn independently [30]. However, not all students can learn independently, due to their passivity, lack of digital literacy, difficulties in adapting to technology, and the emergence of learning loss. Students tend to want attention from lecturers [12], but digital transformation in education makes the interaction between lecturers and students limited. Piyatamrong *et al.* [14] state that the use of technology causes students to lose opportunities to learn and interact socially.

On the other hand, some students are open to the new learning system. Several stated that they preferred the online learning system. Brink *et al.* [8] argue that students are open to cultural changes and new learning concepts, while Gonçalves *et al.* [18] also state that students are more satisfied with online learning. With such a system, students do not need to go to campus to attend lectures. They can also perform various activities at once, making it more efficient in terms of time and cost.

3.2. Lecturer Readiness for Digital Transformation

Lecturers serve as catalysts for digitalising services and learning [8], [30]. Universities are encouraged to hire a large number of qualified teachers to improve the efficacy of their educational programmes. The more capable a teacher is, the better they are at imparting knowledge to their students. Therefore, it is necessary to understand the work of digital transformation in universities based on the perceptions and preparedness of teaching staff regarding digital transformation. The barrier and readiness themes provide insight into the preparedness of instructors. The lecturer barrier revealed four themes: lack of digital literacy, slow adaptation to technology, loss of data control, and the significance of digital learning platforms. Regarding lecturer preparedness, three themes were identified: data security, the significance of digital learning platforms, and the significance of learning strategies.

Digital transformation in higher education institutions encourages lecturers to think about and implement digital technology in learning [31] in collaborative manner [32]. They are required to improve their competence and develop technology-based learning media. They must also consider innovative teaching strategies to apply digital technology in their learning. To better master the use of digital platforms and changes in learning strategies, lecturers need digital literacy, which is not limited to knowledge and abilities in IT. Instead, it is necessary to master various complex cognitive, motivational, social, emotional, and methodological skills to work effectively in any digital environment [33].

According to Block [11], familiarising oneself with digital technology is a lengthy process. This is consistent with the lecturer theme: adapting to digital technology is lengthy. Using technology in the learning process necessitates that instructors are familiar with, understand the benefits and drawbacks of, and reflect on the optimal application of this technology. However, time constraints may prevent them from experimenting with new technologies [34].

3.3. University Readiness for Digital Transformation

The principal proponents of digital transformation in education are universities. To achieve such transformation, universities must be ready and continue to evolve. Therefore, they must understand possible obstacles and their management's readiness for digital transformation. The barrier and readiness themes can be used to achieve universities' readiness.

Three themes were identified as university barriers: managing IT infrastructure, digitising activities, and inadequate IT staff allocation. New policies regarding the use of digital platforms, the creation of digital learning platforms, and the optimisation of digital learning platforms were identified as themes in university readiness.

According to Dneprovskaya *et al.* [26], an institution's IT infrastructure level influences the digital transformation of learning. To meet digital transformation requirements, universities must provide digital equipment as the primary learning resource [35]. UNS possesses sufficient IT infrastructure to create a digital platform; however, maintenance and troubleshooting of the digital platform are still limited. Moreover, even though universities already have their digital platforms, they need to optimise the use of these, leading some lecturers to utilise platforms owned by third parties.

The key to successful digital transformation is improving the education system [36]. Therefore, universities must know that they have a strategy to deal with digital transformation, which is based on three themes: student strategy, lecturer strategy and university strategy. This is because these stakeholders manage and run the university education system. Four themes were found in the student strategy: flexibility in learning, self-paced learning, individualisation, and data management. Three were found in the lecturer strategy, namely learning flexibility, conducting training and workshops, and the important learning platform, while in the university strategy, four themes were identified: creation of university education platforms, optimisation of digital platforms, digitalisation of services and learning, and data management.

Learning flexibility is learning according to individual requests [37], with students and lecturers coming to an agreement about learning times. Aini *et al.* [13] state that flexibility in learning allows lecturers and students to be connected anytime and anywhere. This eliminates time and place constraints on the learning process. Learning does not have to take place at the educational establishment, nor does it have to take place during normal hours. Such flexibility in learning allows students and lecturers to perform their various activities simultaneously. The problem that occurs because of the lack of time and place limits is that learning can be done during holidays and even late at night.

Digital transformation in learning requires students to be more independent and to apply the do-it-yourself concept [38]. Dorofeeva and Nyurenberger [20] also explain that student success depends on their characteristics and abilities.

Students are expected to be able to discipline their time and solve learning problems. This strategy is important, because by studying independently, students can think critically, have a sense of responsibility, and empathise with others when working on group assignments [39].

Universities that play an active role in developing digital transformation state that three aspects must be prepared: the creation of online courses, creation of educational platforms, and provision of training to staff [38]. Creating a digital learning platform is the responsibility of the university, while creating online courses on the university's platform is that of lecturers. Learning using digital platforms makes it easier for students to access material [40]. Learning becomes more flexible because it can be accessed anywhere, anytime. Creating a digital learning platform provides an additional task for universities in managing data. Omar [41] states that good data management should be a university's digital transformation management strategy. UNS created two digital platforms to support online learning: Spada and OCW. Spada is a learning platform, while OCW is for administration, such as attendance. The two platforms have been integrated with the Academic Information System.

The next theme is to provide training to the staff. Plotnikova [42] demonstrates that universities that have implemented digital transformation give training to their lecturers. This is an important strategy for increasing people's work capacity and competitiveness [24]. The university provides learning platform training to improve the digital literacy of lecturers, who are expected to be able to implement digital transformation in learning.

4. Conclusion

This study has analysed the student perspective, lecturer readiness, university readiness, and strategies to deal with digital transformation in learning, finding from which can later be used as evaluation material for further learning. Student perceptions relate to barriers and readiness to implement digital transformation in learning. The barriers experienced by students in the implementation of digital transformation at their university are (a) lack of IT equipment, (b) lack of digital literacy, (c) their passivity, (d) individualisation, (e) fear of data loss, (f) long adaptation time, (g) the flexibility of learning, (h) learning loss and (i) the need for independent learning (self-paced learning). At the same time, students' readiness to face digital transformation at their university is related to (a) individualisation, (b) students' openness to new learning systems, (c) data security, and (d) the long time needed to adapt.

Lecturer readiness is related to barriers and readiness in implementing digital transformation in learning. The obstacles experienced by lecturers in implementing digital transformation at their universities are the need for digital literacy, the long time needed to adapt to technology, loss of control over data, and the importance of digital learning platforms. In contrast, the readiness of lecturers to face digital transformation at their universities is connected to (a) guaranteed data security, (b) the availability of digital learning platforms, and (c) the existence of blended learning strategies.

The university's readiness relates to the barriers and readiness of its management in facing digital transformation. The obstacles experienced by universities during the digital transformation process are (a) managing IT infrastructure, (b) digitising activities and (c) insufficient allocation of IT staff. At the same time, university readiness to face digital transformation concerns (a) new policies related to the use of digital platforms and (b) the availability of digital platforms.

The strategy implemented by the university is in the form of a three-theme approach: students, lecturers, and the university itself. First, the strategies implemented by students to deal with digital transformation are (a) independent learning and (b) personal data management, while those taken by lecturers are (a) flexible learning, (b) conducting training and workshops, and (c) optimising learning platforms. Finally, the strategies implemented by the university to deal with digital transformation are (a) creation of a platform, (b) digitalisation of services and learning, and (c) integration of services.

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