

UTAUT3 Analysis of Online Learning Implementation in Higher Education

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Abstract

The COVID-19 pandemic has pushed higher education institutions to transform their learning towards digital systems and online learning. These changes have also increased the need to understand student acceptance of learning technology and the factors influencing its continued use (Kamalasena & Sirisena, 2021). In practice, various obstacles remain in the implementation of online learning, despite ongoing improvements. Meanwhile, the Minister of Education, Culture, Research, and Technology stated that online learning in educational institutions in Indonesia will be implemented permanently. Therefore, this study aims to gain a better understanding of the acceptance of online learning through the Learning Management System (LMS) and Zoom Cloud Meeting among students at the State Polytechnic of Malang. This study used the Structural Equation Modeling (SEM) method to analyze factors derived from the Unified Theory of Acceptance and Use of Technology - 3 (UTAUT-3) model. Policy recommendations to relevant parties are formulated based on factors derived from the analysis of student acceptance of online learning in higher education. The results of the study indicate a significant influence between the variables of Social Influence, Hedonic Motivation, Habit, Facilitating Conditions, and Personal Innovativeness in IT on Behavioral Intention and Use Behavior. However, no significant influence was found between the variables of Performance Expectancy, Effort Expectancy, and Price Value.

Keywords: Online Learning, UTAUT-3, Higher Education Institute, Structured Equation Modelling

1. Introduction

The COVID-19 pandemic has transformed various aspects of human life, including the education sector. The learning process in educational institutions across the world has undergone changes since the outbreak of COVID-19, with universities adapting to online and blended learning (Choi et al., 2021). In March 2020, UNESCO reported that more than 100 countries had implemented national closures of educational institutions, impacting more than half of the world's student population, as shown in Figure 1. This condition has prompted governments and educational institutions to seek various alternatives to maintain the continuity of the learning process (UNESCO, 2020).

To maintain the continuity of educational activities during the COVID-19 pandemic, educational institutions shifted from conventional learning to online learning. E-learning then became an alternative to maintain the learning process when face-to-face activities were restricted (Adeoye et al., 2020). However, the implementation of online learning is not without various obstacles. Barriers can arise from limited facilities and infrastructure, user readiness, the quality of learning interactions, and access to networks and resources supporting online learning. These condi-

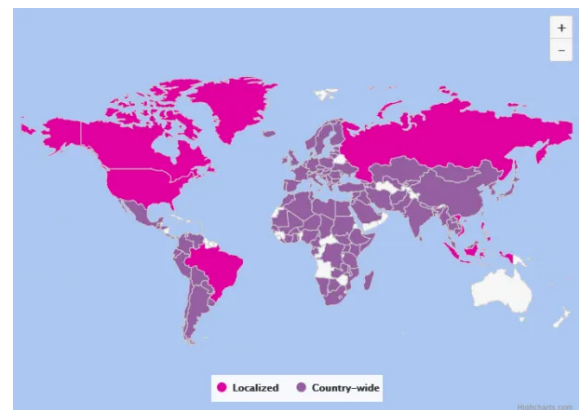


Figure 1. School Closures Caused by COVID-19

tions indicate that the success of online learning depends not only on the availability of technology, but also on the readiness of users and the supporting environment.

In the Indonesian context, online learning has also driven changes in learning patterns in higher education and opened up opportunities for broader technology utilization. Distance learning is even seen as having the potential to become part of post-pandemic learning practices. Therefore, it is crucial to understand the factors influencing student acceptance of online lectures.

Based on these conditions, this study aims to gain an understanding of the factors influencing the acceptance of online learning through the Learning Management System (LMS) and Zoom Cloud Meeting by students at the State Polytechnic of Malang. The analysis results are used to formulate policy recommendations for the institution. This study uses the Unified Theory of Acceptance and Use of Technology - 3 (UTAUT-3) and Structural Equation Modeling (SEM) to analyze the factors influencing the acceptance and use of online learning.

2. Literature Review

2.1 Related Research

Previous research serves as a foundation for understanding the development of research on the acceptance and use of learning technology, particularly e-learning, in higher education. It also serves to identify variables, analysis models, respondent characteristics, and research findings that can serve as a basis for determining the position and novelty of this research.

(Kamalasena & Sirisena, 2021) through a study entitled *Factors Influencing the Adoption of E-Learning by University Students in Sri Lanka: Application of UTAUT-3 Model during Covid-19 Pandemic* analyzed the factors influencing the adoption of e-learning by university students in Sri Lanka using the UTAUT-3 model. The study was conducted on 191 students using a questionnaire. The results showed that Performance Expectancy, Facilitating Conditions, Habit, Price Value, and Personal Innovativeness in IT influenced the adoption of e-learning, while Behavioral Intention also showed a positive influence on the adoption of e-learning platforms. The study has similarities with this study because both used UTAUT-3 to analyze the acceptance of learning technology in students. The difference lies in the research context, because this study was conducted on students of the State Polytechnic of Malang and compared acceptance based on the fields of Information Technology, Engineering, and Non-Engineering.

(Rahmadani et al., 2022) in a study entitled *Analysis of Determinants of Students' Acceptance and Actual Use of e-Learning Systems* analyzed the factors influencing the acceptance and actual use of e-learning systems among Indonesian students. The study used an extended UTAUT model with the variables course design, course content support, course assessment, and instructor characteristics. Data were analyzed using PLS-SEM with SmartPLS. The results showed that course content support, course assessment, and Behavioral Intention to Use significantly influenced the actual use of e-learning systems. Meanwhile, Performance Expectancy and Social Influence influenced Behavioral Intention to Use. This study is relevant because it also analyzes the accep-

tance and actual use of e-learning among students using the PLS-SEM approach. The difference is that this study uses the UTAUT3 model and includes Hedonic Motivation, Price Value, Habit, and Personal Innovativeness in IT as additional constructs.

(Khan et al., 2022) conducted a study entitled *"A Meta-analysis of Mobile Learning Adoption in Higher Education Based on the Unified Theory of Acceptance and Use of Technology 3 (UTAUT-3)"*. This study conducted a meta-analysis of the relationships between UTAUT-3 constructs in the context of mobile learning adoption in higher education. The results showed variations in the strength of the relationships between UTAUT-3 constructs in previous studies. These findings indicate that the relationships between variables in UTAUT-3 can be influenced by the context of technology application and user characteristics. This study provides an important foundation because it shows that testing UTAUT-3 in different contexts and user characteristics is still needed.

(Lehmann et al., 2023) analyzed the acceptance of digital learning in higher education through their study, *"Accept It or Forget It: Mandatory Digital Learning and Technology Acceptance in Higher Education."* They used student data and a Structural Equation Modeling approach to examine the relationship between technology acceptance factors and digital learning usage. This study demonstrated that acceptance of learning technology does not always produce the same relationship as predicted by the technology acceptance model. These findings reinforce the importance of testing technology acceptance models within specific institutional contexts and user characteristics. These studies share similarities in their use of the SEM approach and focus on the acceptance of learning technology in higher education.

(Azizah et al., 2024) in the study *Examining Indonesian College Students' Behavioral Intention of Using Moodle App for E-Learning Platform* analyzed the acceptance of Moodle as an LMS platform among college students in Indonesia. The study involved 510 students and used the UTAUT and PLS-SEM models. The results showed that most UTAUT constructs influenced Behavioral Intention, while Effort Expectancy and Facilitating Conditions did not show a significant influence. This study is relevant because it has an Indonesian context, college students, LMS, and uses PLS-SEM. The difference is that Titis' study used UTAUT-3 and not only analyzed one LMS platform, but also considered the use of Zoom Cloud Meeting and compared students based on their academic fields.

Based on previous research, the UTAUT and UTAUT-3 models have been widely used to analyze the acceptance of learning technology in higher education. Research (Kamalasena & Sirisena, 2021) demonstrated the relevance of UTAUT-3 in explaining student e-learning adoption, while also indicating that additional factors beyond the main UTAUT constructs

may also influence actual e-learning use. A meta-analysis (Khan et al., 2022) demonstrated variations in the relationships between UTAUT-3 constructs in higher education contexts, thus applying the model to different user and institutional contexts remains relevant.

However, previous studies generally analyzed the acceptance of learning technology in general or within a specific user group/platform. Few studies have tested UTAUT-3 by comparing student acceptance patterns based on academic fields that have different learning characteristics, particularly in polytechnic educational environments that combine theoretical and practical learning. Therefore, this study applies UTAUT-3 to analyze the acceptance of online learning through LMS and Zoom Cloud Meeting among students at Malang State Polytechnic by differentiating respondents into Information Technology, Engineering, and Non-Engineering fields.

2.2 Online Learning

Online learning is a learning process that utilizes internet technology to deliver material, facilitate interaction, and support learning activities without requiring lecturers and students to be in the same location. In higher education, online learning can be delivered through various digital technologies, including Learning Management Systems (LMS), video conferencing, and other digital media. Online learning can take place synchronously or asynchronously. Synchronous learning allows lecturers and students to interact directly at the same time through a video conferencing platform, while asynchronous learning allows students to access materials and engage in learning activities at different times according to their individual needs and availability (Cahyadi et al., 2022; Fabriz et al., 2021).

In practice, an LMS serves as a learning environment that provides asynchronous materials, activities, communication, and learning management, while video conferencing technologies like Zoom can be used to support synchronous learning interactions. The use of both technologies allows universities to combine time-independent learning activities with direct interaction between faculty and students (Camilleri & Camilleri, 2022).

Thus, online learning in this study is understood as a student learning process that utilizes internet-based technology through LMS and Zoom Cloud Meeting as the main media to support the delivery of material, learning interactions, and the implementation of lecture activities.

a. Learning Management System (LMS)

A Learning Management System, hereinafter referred to as an LMS, is a technology-based system used to support the management and implementa-

tion of online learning. An LMS provides a digital learning environment that allows lecturers to manage materials, assignments, communication, and evaluation, while students can access materials and carry out learning activities through the system. In higher education, an LMS is a crucial technology in supporting the implementation of online learning because various learning activities can be managed within a single digital environment (Camilleri & Camilleri, 2022; Maslov et al., 2021).

In this study, the LMS used by students is the Polinema LMS. The Polinema LMS is a learning platform used to support the implementation of online lectures at the Malang State Polytechnic. Unlike the Moodle-based LMS used at several educational institutions, the Polinema LMS, which is the object of this study, does not use Moodle as the main platform. Student access to the Polinema LMS is integrated with the Academic Information System (SIKAD) so that students can carry out the authentication process using an account connected to their academic data. This integration makes it easier for students to access the online learning environment without having to create a separate user account from the academic system.

To illustrate the platform used in the study, Figure 2 shows a screenshot of the Polinema LMS used by students to support online lectures. This screenshot illustrates the digital learning environment students use to access various course activities and information.



Figure 2. Polinema LMS

The Polinema LMS provides a learning environment integrated with students' academic activities. Students can access the LMS using an account connected to the academic system, making the learning process part of the academic service ecosystem of Malang State Polytechnic. In this study, the use of the Polinema LMS is one form of online learning technology whose acceptance is analyzed using the UTAUT-3 model.

b. Zoom Cloud Meeting

Zoom Cloud Meeting is a video conferencing application that allows users to communicate and interact directly over the internet. In higher education, Zoom can be used as a synchronous learning medium, allowing lecturers and students to interact simultaneously even though they are in different locations.

During the COVID-19 pandemic, video conferencing technologies like Zoom are being used by universities to support online learning (Camilleri & Camilleri, 2022; Putri H. & Wulandari, 2021).

In this study, Zoom Cloud Meeting is one of the technologies used in online learning for students at Malang State Polytechnic. Zoom is used to support synchronous lectures, while the Polinema LMS is used to manage learning materials and activities. The combination of these two technologies allows online learning to be implemented through asynchronous activities on the LMS and synchronous activities via video conferencing.

3. Method

3.1 Unified Theory of Acceptance and Use of Technology (UTAUT-3)

Unified Theory of Acceptance and Use of Technology-3, hereinafter referred to as UTAUT-3, is a development of UTAUT-2 introduced by (Farooq et al., 2017). UTAUT-3 was developed by adding the construct of Personal Innovativeness in Information Technology (PIIT) to UTAUT-2 to explain individual tendencies in accepting and using new technology. The model was tested on the use of the Lecture Capture System by students and showed that Performance Expectancy, Effort Expectancy, Social Influence, Facilitating Conditions, Hedonic Motivation, Price Value, Habit, and Personal Innovativeness in IT play a role in the acceptance and use of technology. In this study, UTAUT-3 consists of eight exogenous constructs, namely Performance Expectancy (PE), Effort Expectancy (EE), Social Influence (SI), Hedonic Motivation (HM), Price Value (PV), Habit (HB), Facilitating Conditions (FC), and Personal Innovativeness in IT (PI). These eight constructs are used to explain Behavioral Intention (BI) and Use Behavior (UB). In addition to influencing BI, Habit, Facilitating Conditions, and Personal Innovativeness in IT are also hypothesized to have a direct influence on UB, while BI is hypothesized to influence UB.

The UTAUT-3 model used as the basis for this research was then adapted to the context of online learning technology acceptance among students at Malang State Polytechnic. The relationships between the constructs tested in this study are presented in Figure 3.

Figure 3 shows that PE, EE, SI, HM, and PV are hypothesized to influence BI. Meanwhile, HB, FC, and PI are hypothesized to influence both BI and UB. Furthermore, BI is hypothesized to influence UB. This structure illustrates that students' intention to use learning technology can be a link between technology acceptance factors and actual usage behavior.

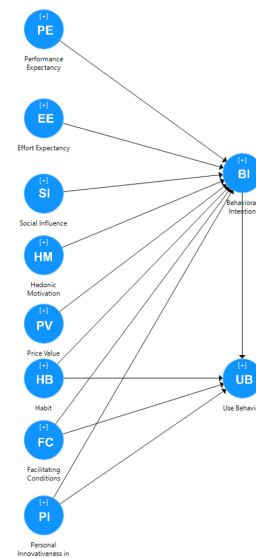


Figure 3. Conceptual Model of UTAUT-3

a. Performance Expectancy

Performance Expectancy, hereinafter referred to as PE, is the level of individual belief that the use of a technology can provide benefits in improving performance or helping achieve desired goals. In the context of online learning, PE refers to students' beliefs that the use of learning technology can help increase the effectiveness and efficiency of the learning process, facilitate the achievement of academic goals, and support the completion of lecture activities. The concept of PE is one of the main constructs in UTAUT and UTAUT-2 which is used to explain an individual's interest in using a technology (Venkatesh et al., 2012).

In the context of higher education, students who believe that e-learning benefits their learning tend to have a higher interest in using the technology. Research (Abbad, 2021) shows that PE influences students' BI in using e-learning systems. Similar findings were also demonstrated by research (Kamalasena & Sirisena, 2021), which found a positive influence of PE on students' use of e-learning. Furthermore, research (Abbad, 2021) shows that PE significantly influences students' BI in adopting e-learning.

Based on this description, the greater students' confidence that using Polinema's LMS and Zoom Cloud Meeting can benefit the learning process, the greater their likelihood of interest in using these online learning technologies. Therefore, the following hypothesis is proposed:

H1: PE has a positive influence on students' BI in using online learning.

b. Effort Expectancy

Effort Expectancy, also known as EE, is the level of ease an individual perceives in using a system or technology. This construct reflects the belief

that using a technology is easy, does not require excessive effort, and does not cause difficulties for the user (Venkatesh et al., 2012). In the context of this research, EE refers to students' beliefs that online learning platforms, namely Polinema LMS and Zoom Cloud Meeting, are easy to learn, easy to use, and do not require excessive effort in supporting lecture activities.

Ease of use of technology is one factor that can encourage students' interest in using online learning systems. If students perceive learning technology as easy to use and that it doesn't require significant effort to understand the features or carry out learning activities, their tendency to use the technology will increase. Research (Abbad, 2021) shows that EE is one of the factors in the UTAUT model related to student acceptance of the e-learning system. Research (Kamalasena & Sirisena, 2021) also uses EE as one of the constructs explaining the adoption of e-learning by students in the context of the COVID-19 pandemic.

Based on this description, the easier it is for students to use Polinema's LMS and Zoom Cloud Meeting, the greater their tendency to be interested in using online learning technology. Therefore, the proposed hypothesis is:

H2: EE has a positive influence on students' BI in using online learning.

c. Social Influence

Social Influence, hereinafter referred to as SI, is the level of individual perception that people who are considered important or have influence over him believe that the individual should use a technology (Venkatesh et al., 2012). SI can originate from various parties within the user's environment, such as peers, lecturers, and institutions. In the context of this research, SI refers to the extent to which students perceive encouragement or influence from significant others and the institutional environment to use online learning technologies, namely the Polinema LMS and Zoom Cloud Meeting.

In higher education, students' decisions to use learning technologies are influenced not only by their perceptions of the technology's benefits and convenience, but also by their social environment. When lecturers, peers, or institutions encourage the use of online learning technologies, students may perceive them as an essential part of their learning. Research (Abbad, 2021) shows that SI is one of the factors related to student acceptance of the e-learning system. Meanwhile, (Kamalasena & Sirisena, 2021) included SI as one of the constructs in the UTAUT-3 model to explain the adoption of e-learning by students during the COVID-19 pandemics.

Based on this description, the stronger the influence or encouragement from a student's social environment to use online learning technology, the greater the student's tendency to be interested in using that

technology. Therefore, the proposed hypothesis is:

H3: SI has a positive influence on students' BI in using online learning.

d. Hedonic Motivation

Hedonic motivation, hereinafter referred to as HM, is the level of pleasure, comfort, or satisfaction an individual obtains when using a technology (Venkatesh et al., 2012). In the context of online learning, HM refers to the extent to which students feel happy, comfortable, and enjoy using learning technology, both when accessing the Polinema LMS and when attending lectures via Zoom Cloud Meeting. Enjoyable technology experiences can shape students' positive perceptions, thus encouraging their interest in continuing to use the technology in their lectures.

In online learning, students' experiences interacting with technology are one aspect that can influence their acceptance. Students who feel comfortable and enjoy using learning technology tend to have more positive perceptions of it. Research (Kamalasena & Sirisena, 2021) included HM as one of the UTAUT-3 constructs used to explain student e-learning adoption during the COVID-19 pandemic. The study demonstrated that the factors in the UTAUT-3 can be used to explain student acceptance of online learning technology.

Based on this description, the higher the level of enjoyment, comfort, and satisfaction experienced by students when using Polinema's LMS and Zoom Cloud Meeting, the greater their tendency to be interested in using online learning. Therefore, the proposed hypothesis is:

H4: HM has a positive influence on students' BI in using online learning.

e. Price Value

Price Value, hereinafter referred to as PV, is the level of individual perception regarding the balance between the benefits obtained from using a technology and the costs that must be incurred to use it (Farooq et al., 2017). PV relates to users' assessment of the suitability between the benefits of a technology and the sacrifices made. If the perceived benefits of using a technology outweigh the costs or sacrifices incurred, then the technology is perceived as having a positive value.

In the context of this research, PV refers to students' perceptions of the appropriateness of the benefits gained from using Polinema's LMS and Zoom Cloud Meeting compared to the costs or sacrifices required to support their use. These sacrifices can include internet quota requirements, learning devices, and other costs directly or indirectly required during online learning. The greater the perceived benefits compared to the sacrifices incurred, the more posi-

tive students' perceptions of the value of using online learning technology.

Research (Kamalasena & Sirisena, 2021) shows that PV is one of the constructs used in the UTAUT-3 model to explain student adoption of e-learning. This construct is relevant in the context of online learning because technology use can impose certain sacrifices on students, particularly regarding the need for internet access and learning support devices.

Based on this description, the higher the students' perception that the benefits gained from using Polinema LMS and Zoom Cloud Meeting are comparable to or greater than the costs and sacrifices incurred, the higher their interest in using online learning. Therefore, the proposed hypothesis is:

H5: PV has a positive effect on students' BI in using online learning.

f. Habit

Habits, hereinafter referred to as HB, are the extent to which individuals tend to carry out a behavior automatically as a result of previous experience and learning (Venkatesh et al., 2012). Habits are formed through repeated experiences using technology, so that technology use can become a behavior that is carried out without requiring significant consideration. In the context of online learning, habits refer to students' tendency to routinely use the Polinema LMS and Zoom Cloud Meeting in carrying out lecture activities. The more frequently students use learning technology in their academic activities, the more likely it is that such use will develop into a habit.

Habits play a crucial role in explaining technology acceptance and use because habitual behavior can influence an individual's tendency to continue using the technology. In the UTAUT-2 and UTAUT-3 models, HB can influence both BI and UB. Research (Farooq et al., 2017) shows that HB is a construct that plays a role in explaining technology acceptance and use. Meanwhile, (Kamalasena & Sirisena, 2021) used the HB construct in the UTAUT-3 model to analyze e-learning adoption by college students during the COVID-19 pandemic.

In this study, students who are accustomed to using Polinema's LMS and Zoom Cloud Meeting for lectures are expected to be more likely to maintain their interest and behavior in using online learning technologies. Therefore, this study examines the effect of HB on BI and UB online learning. Based on this description, the proposed hypothesis is:

H6a: HB has a positive influence on students' BI in using online learning.

H6b: HB has a positive influence on UB online learning.

g. Facilitating Conditions

Facilitating Conditions, hereinafter referred to as FC, are the level of individual belief that the resources, knowledge, technical support and infrastructure needed to use a technology are available (Venkatesh et al., 2012). FC reflects the extent to which the user environment provides facilities and support that can facilitate technology use. In the context of this study, Facilitating Conditions refer to the availability of devices, internet access, knowledge or ability to use technology, and the technical support needed for students to use the Polinema LMS and Zoom Cloud Meeting in lectures.

The availability of adequate facilities and support can help students use learning technology more easily and sustainably. Students who have access to adequate devices and internet connections and receive support when experiencing technology difficulties will have a more supportive environment for online learning. In the UTAUT-2 model, FC has a relationship with BI and UB. Research (Kamalasena & Sirisena, 2021) also includes FC as one of the constructs in the application of UTAUT-3 to explain the adoption of e-learning by students.

In this study, conditions that support the use of learning technology are seen as influencing both students' interest in using online learning and their actual usage behavior. The more adequate the facilities, knowledge, access, and support available to students, the greater their tendency to be interested in and use online learning technology. Based on this description, the proposed hypothesis is:

H7a: FC has a positive influence on students' BI in using online learning.

H7b: FC has a positive impact on UB online learning.

h. Personal Innovativeness in IT

Personal Innovativeness in Information Technology, hereinafter referred to as PI, describes an individual's tendency to try and use new information technology before others in their social environment (Farooq et al., 2017). This construct reflects individual characteristics in responding to technological developments, especially the tendency to explore, try, and accept technologies that have never been used before. In the development of UTAUT-3, PI was added as a construct to explain differences in individual characteristics in the acceptance and use of technology.

In the context of this research, Personal Innovation in IT refers to students' tendency to try and use online learning technologies, specifically Polinema's LMS and Zoom Cloud Meeting. Students with higher levels of personal innovation tend to be more open to new technologies, willing to try unfamiliar learning features or technologies, and more prepared to adapt to technological changes in the learning process.

Individual innovative characteristics can be one of the factors that explain differences in student interests and behavior in using online learning technology. (Farooq et al., 2017) included PI as an additional construct in UTAUT-3 and tested its influence on technology acceptance and use. Research (Kamalasena & Sirisena, 2021) also used PI in the application of UTAUT-3 to analyze the adoption of e-learning by students during the COVID-19 pandemic.

Based on this description, the higher the tendency of students to try and accept new information technology, the greater the likelihood of students having interest in and using online learning technology. Therefore, the proposed hypothesis is:

H8a: PI has a positive influence on students' BI in using online learning.

H8b: PI has a positive influence on UB online learning.

i. Behavioral Intention

Behavioral Intention, hereinafter referred to as BI, is the level of an individual's desire or intention to use a technology. In the UTAUT model, BI describes a user's tendency to have a plan and willingness to use a technology, while UB describes the actual usage behavior of the technology (Venkatesh et al., 2003). In the context of this study, BI refers to students' desire to use and continue using the Polinema LMS and Zoom Cloud Meeting as supporting technologies for online learning.

BI is an important construct in explaining technology usage behavior. When students have a strong intention to use online learning technology, there is a tendency for this intention to be realized in actual usage behavior. The relationship between BI and UB is one of the main relationships in the UTAUT model. Research on e-learning acceptance also shows that intention to use technology is an important factor in explaining actual use of online learning systems (Abbad, 2021).

In this study, students with a high interest in using Polinema's LMS and Zoom Cloud Meeting are expected to be more likely to use these technologies in their lectures. Therefore, the higher a student's BI for online learning, the higher their tendency to demonstrate UB in practice. Based on this description, the proposed hypothesis is:

H9: BI has a positive influence on UB online learning.

j. Use Behavior

Use Behavior, hereinafter referred to as UB, is an individual's actual behavior in using a technology. In the context of technology acceptance, UB describes the extent to which individuals actually use the technology they have accepted or chosen to support their activities. In this study, UB refers to students'

actual use of the Polinema LMS and Zoom Cloud Meeting in carrying out online learning activities.

Technology UB can be reflected in the intensity and frequency of students' access and use of learning technology to participate in lecture activities. Actual use not only indicates a desire to use technology but also indicates that the technology is actually utilized in learning activities. In the UTAUT model, UB is a construct influenced by Behavioral Intention and conditions that facilitate technology use (Venkatesh et al., 2003, 2012).

In this study, Use Behavior is a variable that describes students' actual use of online learning through the Polinema LMS and Zoom Cloud Meeting. Use behavior was measured based on indicators established in the research instrument. Therefore, Use Behavior represents the actual outcome of students' acceptance and use of online learning technology.

3.2 Structural Equation Modeling–Partial Least Squares (SEM-PLS)

Structural Equation Modeling–Partial Least Squares, hereinafter referred to as SEM-PLS, is a variance-based SEM approach used to analyze relationships between latent constructs simultaneously. SEM-PLS allows researchers to evaluate measurement models to determine the ability of indicators to represent latent constructs, as well as structural models to test relationships between constructs within the research model (Hair & Alamer, 2022). This approach is appropriate when research aims to explain predictive relationships between constructs and involves multiple latent variables measured through a number of indicators.

In this study, SEM-PLS was used to test the UTAUT-3 model in explaining the acceptance and use of online learning technology by students of the State Polytechnic of Malang. The analysis was conducted to evaluate the measurement and structural models, and to test the hypotheses regarding the influence of PE, EE, SI, HM, PV, HB, FC, and PI on BI and UB.

a. Outer Model

The outer model is part of the PLS-SEM model used to evaluate the relationship between indicators and the latent constructs they measure. The outer model evaluation aims to ensure that the indicators used are capable of measuring the construct validly and reliably. In this study, the measurement model evaluation was conducted through tests of convergent validity, discriminant validity, and construct reliability (Hair & Alamer, 2022).

Convergent Validity. Convergent validity indicates the extent to which the indicators used to measure a construct have a high correlation. In reflective constructs, convergent validity can be evaluated based on the outer loading value and Average Variance Ex-

tracted (AVE). The recommended outer loading value is ≥ 0.708 , although indicators with loading values between 0.40–0.70 can still be considered for retention if their removal does not significantly increase the composite reliability value or AVE. A construct is declared to have adequate convergent validity if the AVE value is ≥ 0.50 , indicating that the construct is able to explain at least 50% of the variance of its indicators (Hair & Alamer, 2022).

Discriminant Validity. Discriminant validity is used to ensure that a construct is truly different from other constructs in the model. Discriminant validity can be evaluated using the Heterotrait-Monotrait Ratio (HTMT) criterion, which is currently recommended as one of the main approaches in evaluating discriminant validity in PLS-SEM. An HTMT value below 0.90 generally indicates that the construct has adequate discriminant validity. In addition to the HTMT, the Fornell-Larcker criterion and cross-loading can be used as additional analyses to evaluate discriminant validity (Hair & Alamer, 2022).

Construct Reliability. Construct reliability is used to assess the internal consistency of indicators in measuring latent constructs. Reliability evaluation can be performed using Cronbach's Alpha and Composite Reliability (CR). A reliability value ≥ 0.70 generally indicates that the construct has adequate internal consistency. However, Cronbach's Alpha values tend to provide more conservative reliability estimates, so Composite Reliability also needs to be considered in PLS-SEM evaluations. Meanwhile, the AVE value is not used as a measure of reliability, but is used to evaluate convergent validity (Hair & Alamer, 2022).

b. Inner Model

The inner model describes the relationships between latent constructs based on the conceptual framework and research hypotheses. Structural model evaluation is conducted to determine the ability of exogenous constructs to explain endogenous constructs and to test the relationships between hypothesized constructs. In this study, the inner model evaluation is conducted by examining the coefficient of determination (R^2) and goodness of fit (GoF), while the relationship between constructs is tested using path coefficients and significance testing.

The coefficient of determination (R^2) indicates the proportion of the variance of an endogenous construct that can be explained by its predictor construct. R^2 values range from 0 to 1, with higher values indicating greater explanatory power of the model (Hair & Alamer, 2022). In this study, R^2 was used to evaluate the ability of the UTAUT-3 construct to explain BI and UB in online learning. As a reference used in the thesis, R^2 values of 0.67, 0.33, and 0.19 indicated substantial, moderate, and weak explanatory power, respectively.

3.3 Population and Sample

This study used a quantitative approach with a survey method to test the relationship between variables based on the research hypothesis. Empirical data were collected through a questionnaire distributed online using Google Forms. The research instrument consisted of two parts. The first part was used to obtain data on the characteristics or demographics of respondents, while the second part consisted of 30 statements representing constructs in the UTAUT-3 model. Each statement was measured using a five-level Likert scale, ranging from 1 = "strongly disagree" to 5 = "strongly agree".

Before being used in primary data collection, the research instrument was piloted on 300 students outside the Malang State Polytechnic. The pilot test was conducted to evaluate the instrument's validity and reliability. Based on the test results, the instrument met the criteria set in the study, namely a Cronbach's Alpha value > 0.60 and an r-count value greater than the r-table. Thus, the instrument was declared suitable for use in primary research data collection.

The research population consisted of 9,122 students of Malang State Polytechnic based on data (PDDIKTI, 2021). Sampling was conducted using a simple random sampling technique covering students from all departments and resulting in 1,050 respondents who met the criteria for use in the analysis and drawing of research conclusions.

3.4 Hypothesis Testing

Hypothesis testing is conducted to determine the significance of the relationships between constructs formulated in the research model. In PLS-SEM analysis, the significance of path coefficients can be tested using a bootstrapping procedure. This procedure produces path coefficients, T-statistics, and p-values, which are used to evaluate the relationships between constructs in the structural model (Hair & Alamer, 2022).

In this study, the path coefficient was used to determine the direction and magnitude of the relationship between constructs. Path coefficient values range from -1 to +1. Positive values indicate a unidirectional relationship, while negative values indicate an inverse relationship. Furthermore, the significance of the relationship was tested using the T-statistic and p-value.

The testing criteria used follow a 10% significance level. The hypothesis is declared supported if the T-statistic is greater than 1.64 and the p-value is less than 0.10. Conversely, if the T-statistic is not greater than 1.64 or the p-value is not less than 0.10, the hypothesis is declared unsupported.

4. Results and Discussion

4.1 Respondent Characteristics

This study involved 1,050 students from Malang State Polytechnic who served as respondents and were used in the analysis. Respondents came from all majors within the study scope. Respondent characteristics were analyzed based on gender, major, and grade level, as shown in Table 1, to provide an overview of the sample composition.

Table 1. Respondent Characteristics

Characteristics	Profile	Frequency	Percentage (%)
Gender	Male	412	39
	Female	638	61
	Electrical Engineering	53	5
	Information Technology	333	32
Jurusan	Chemical Engineering	96	9
	Civil Engineering	105	10
	Accounting	366	35
	Business Administration	97	9
	Grade 1	326	31
Grade Level	Grade 2	317	30
	Grade 3	263	25
	Grade 4	144	14
Total		1.050	100

Overall, the characteristics of the respondents indicate that the research sample included students of various genders, fields of study, and grade levels. This composition provides an overview of the respondent profile that serves as the basis for analyzing student acceptance of online learning using the UTAUT-3 model. Furthermore, the characteristics of the fields of study were used as the basis for grouping the analysis into Information Technology, Engineering, and Non-Engineering, so that the research results can indicate possible differences in factors of acceptance of online learning based on the characteristics of the scientific fields.

In addition to demographic characteristics, the study also identified respondents' experiences in using online learning media. The survey results showed that most respondents were familiar with using online learning support media. A total of 233 respondents (22%) were accustomed to using video conferencing, 96 respondents (9%) used learning platforms, while the remaining respondents used a combination of video conferencing, learning platforms, and email/WhatsApp. Fifty-four respondents (5%) stated they were not familiar with using online learning media. Therefore, most respondents had experience using online learning technology before assessing the

LMS and Zoom Cloud Meeting, which were the context of the study.

4.2 Descriptive Statistics

Table 2. Descriptive Statistics of UTAUT-3 Constructs

Construct	Number of Indicators	N	Average
PE	5	1.050	3,70
EE	4	1.050	3,61
SI	3*	1.050	3,67
HM	3	1.050	3,52
PV	2	1.050	3,16
HB	2	1.050	3,75
FC	4	1.050	3,97
PI	3	1.050	3,69
BI	3	1.050	3,52
UB	1	1.050	3,97

Descriptive statistics are used to provide a general overview of the respondents' response tendencies towards the constructs used in the UTAUT-3 model. The analysis is conducted by calculating the average (mean) value of the respondents' responses to each construct using a five-level Likert scale, with a value range of 1 to 5. A higher average value indicates a tendency for respondents to provide a more positive assessment of the construct being measured as shown in Table 2.

Based on the results in Table 2, the average scores for all constructs ranged from 3.16 to 3.97. Most constructs had average scores above 3.50, indicating a tendency among respondents to positively assess the implementation of online learning.

Overall, descriptive statistics indicate that students have a relatively positive perception of online learning, both in terms of benefits, convenience, environmental and infrastructure support, habits, and tendency to use technology. However, the relatively low average scores for PV and BI indicate that a positive perception of online learning does not necessarily mean that all aspects of acceptance are rated equally. These descriptive findings further serve as the basis for evaluating the outer model and testing structural relationships to determine which constructs empirically influence BI and UB.

4.3 Outer Model Evaluation

An outer model evaluation was conducted to ensure that the indicators were able to measure the research constructs validly and reliably. The evaluation included convergent validity, discriminant validity, and construct reliability. Assessment was based on outer loading, cross-loading, Cronbach's Alpha, Composite Reliability (CR), and Average Variance Extracted (AVE) values according to the PLS-SEM

approach (Hair & Alamer, 2022; Sarstedt et al., 2022).

a. Convergent Validity

Table 3. Indicator Purification Results Based on Outer Loading

Group	Indicators Issued	Discriminant Validity Results	Reliability Results
Information Technology	PE2, EE4, SI1, FC3	Fulfilled	Fulfilled
Engineering	PE4, EE4, SI1, FC3	Fulfilled	Fulfilled
Non-Engineering	PE2, EE4, SI1, FC3	Fulfilled	Fulfilled

Convergent validity was evaluated based on the outer loading and AVE values. An outer loading value of around 0.70 or higher and an AVE of at least 0.50 indicate convergent validity (Hair & Alamer, 2022). The test results indicated that several indicators had to be removed because their loading factors fell below the criteria. The results of the indicator refinement are presented in Table 3.

After indicators with low loading factor values were removed, retesting was conducted. The final results showed that the retained indicators met the convergent validity criteria.

b. Discriminant Validity

Discriminant validity is used to ensure that each construct is empirically distinct from the others. In this study, cross-loading was used for testing. The results show that the loading value of each indicator on the construct it measures is the highest compared to other constructs, as shown in Table 4.

c. Construct Reliability

Construct reliability was evaluated using Cronbach's Alpha and Composite Reliability, while AVE was used as a measure of convergent validity. The test results based on the thesis are presented in Tables 5, 6, and 7.

Based on Tables 5, 6, and 7, the Cronbach's Alpha and Composite Reliability values for the research constructs have met the reliability criteria, while the AVE value indicates that convergent validity has been met. Thus, the measurement model is declared reliable and suitable for use in evaluating the inner

Table 4. Summary of Discriminant Validity Results

Kelompok Bidang	Metode	Hasil
Information Technology	Cross Loading	Fulfilled
Engineering	Cross Loading	Fulfilled
Non-Engineering	Cross Loading	Fulfilled

Table 5. IT Construct Reliability Results

Construct	CA	CR	AVE
PE	0,852	0,900	0,693
EE	0,788	0,877	0,705
SI	0,614	0,795	0,583
HM	0,902	0,939	0,837
PV	0,800	0,909	0,833
HB	0,795	0,907	0,830
FC	0,860	0,914	0,780
PI	0,795	0,879	0,709
BI	0,898	0,936	0,830
UB	1,000	1,000	1,000

Table 6. Results of Engineering Construct Reliability Results

Konstruk	CA	CR	AVE
PE	0,832	0,888	0,666
EE	0,846	0,907	0,766
SI	0,818	0,917	0,846
HM	0,908	0,943	0,846
PV	0,827	0,920	0,852
HB	0,785	0,903	0,823
FC	0,897	0,936	0,830
PI	0,811	0,888	0,726
BI	0,901	0,938	0,834
UB	1,000	1,000	1,000

Table 7. Non-Engineering Construct Reliability Results

Konstruk	CA	CR	AVE
PE	0,846	0,897	0,685
EE	0,836	0,902	0,754
SI	0,833	0,923	0,857
HM	0,929	0,955	0,877
PV	0,831	0,922	0,855
HB	0,799	0,909	0,833
FC	0,861	0,915	0,782
PI	0,856	0,913	0,777
BI	0,908	0,942	0,844
UB	1,000	1,000	1,000

model.

4.4 Inner Model Evaluation

In this study, the evaluation of the inner model was carried out in three scientific field groups, namely Information Technology, Engineering, and Non-Engineering.

a. Coefficient of Determination (R^2)

The coefficient of determination (R^2) is used to determine the proportion of variation in an endogenous construct that can be explained by its predictor

Table 8. R-Square Value of Endogenous Constructs

Major	Endogenous Construct	R ²	Percentage of Variation Explained	Category
Information Technology	BI	0,785	78,5%	Substansial
	UB	0,633	63,3%	Moderate
Engineering	BI	0,779	77,9%	Substansial
	UB	0,619	61,9%	Moderate
Non-Engineering	BI	0,813	81,3%	Substansial
	UB	0,624	62,4%	Moderate

Table 9. Summary of Hypothesis Testing Results

Hypothesis	Connection	IT	Engineering	Non-Engineering
H1	PE → BI	×	✓	×
H2	EE → BI	×	×	×
H3	SI → BI	×	×	✓
H4	HM → BI	✓	✓	✓
H5	PV → BI	×	×	×
H6a	HB → BI	✓	✓	✓
H6b	HB → UB	✓	×	✓
H7a	FC → BI	×	×	×
H7b	FC → UB	✓	✓	✓
H8a	PI → BI	✓	×	✓
H8b	PI → UB	✓	✓	✓
H9	BI → UB	✓	✓	✓

constructs. The higher the R² value, the greater the model's ability to explain variation in the endogenous construct. In research, R² interpretation uses criteria of 0.19 (weak), 0.33 (moderate), and 0.67 (substantial) (Hair & Alamer, 2022). The data is shown in Table 8.

Thus, the model has strong explanatory power for Behavioral Intention, while the explanatory power for Use Behavior is in the moderate category.

b. Discussion

The discussion is based on the results of structural model testing in three groups of scientific fields, namely Information Technology, Engineering, and Non-Engineering. Differences in test results between groups indicate that student acceptance of online learning is not entirely influenced by the same factors as in Table 9. Testing was conducted through a bootstrapping procedure using SmartPLS 3.9, with the criteria of t-statistics > 1.64 and p-value < 0.10, with the results displayed.

Of the 12 hypothetical paths tested in three groups of scientific fields, there is a fairly clear pattern which can be seen in Table 10.

Table 10. Results of Pattern Findings

Factor	BI	UB	Pola
PE	Inconsistent	–	Significant only for Engineering
EE	Inconsistent	–	No effect
SI	Inconsistent	–	Significant only for Engineering
HM	Consistent	–	Effects all groups
PV	Inconsistent	–	No effect
HB	Consistent	Inconsistent	Very important for BI
FC	Inconsistent	Consistent	Important for UB
PI	Inconsistent	Consistent	Important for UB
BI	–	Consistent	Important factor for UB

5. Conclusion

Based on the research results, students' acceptance and use of online learning are influenced by different factors in each academic group. HM and HB are the factors that most consistently influence BI, while FC, PI, and BI play a role in explaining UB. These findings indicate that the sustainability of online learning is determined not only by the technical aspects of the system, but also by students' experience, habits, user characteristics, and interest in using technology.

The differences in results across disciplines also indicate that the implementation of online learning policies requires consideration of user characteristics. Therefore, institutions need to develop online learning that is easily accessible, supported by adequate infrastructure, provides a positive user experience, and encourages the development of technology habits in academic activities. The results of this study can serve as a basis for institutions to evaluate and develop policies for the use of LMS and Zoom Cloud Meetings to ensure their effective and sustainable use.

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