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Analysis of the Extended Technology Acceptance Model as A Basis for the Adoption of Educational Technology Startup Platforms

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ABSTRACT

The growth of startups in the Educational Technology (EdTech) sector in Indonesia has demonstrated rapid progress, aligning with global advancements in this field. The COVID-19 pandemic, coupled with the increasing demand for future-oriented skills, has driven EdTech startups to innovate in learning methods, approaches, and strategies. These innovations aim to create individuals equipped with skills relevant to the demands of the future. This research seeks to explore how technology-based learning processes developed by EdTech startups can be adapted and utilized by users to enhance their skills in facing the challenges of the modern era. The study adopts the Technology Acceptance Model (TAM) framework with the addition of a facilitating condition variable as an external factor to understand the impact of environmental conditions on technology adoption and usage. A quantitative approach was employed, collecting data from active learners using EdTech startup services in Indonesia during the 2018–2024 period. Data analysis was conducted using Structural Equation Modelling (SEM) techniques. The findings reveal that TAM effectively explains the factors influencing the acceptance and use of e-learning on EdTech startup platforms, particularly in supporting learning processes. Additionally, significant relationships were identified between facilitating conditions, perceived ease of use, and perceived usefulness. The study also confirms the interrelations among the main components of TAM, further reinforcing the model's validity in the context of digital learning.

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1. INTRODUCTION

Digital technology, particularly the internet, has become an inseparable element of daily human life and routine activities. Virtually all aspects of modern life rely heavily on this technology. Recent data indicates that approximately 60% of the global population, or around 4.5 billion people, are connected to the internet—a 7% increase since early 2019 [1]. During the COVID-19 pandemic in 2021, the number of global internet users surged by an estimated 30% [2]. The internet is now an integral part of daily activities worldwide, with average usage time reaching 6 hours and 42 minutes per day [1].

In Indonesia, one of the world's

most populous countries, 64% of the population, or about 175.4 million people, are internet users—a 17% increase compared to the previous year [3]. During the COVID-19 pandemic, this figure rose significantly by 40% [4], and the trend is expected to continue. This growth highlights Indonesia's increasing dependency on the internet, driven by the need to stay connected and the appeal of available digital content [5]. These changes have transformed information consumption patterns and how people interact, learn, and work in the digital era.

The average Indonesian internet user spends nearly 8 hours daily online, placing the country eighth globally in internet usage duration [3]. This high usage reflects an improvement in information and communication technology (ICT) literacy. The internet, beyond serving as a communication tool, has become a strategic instrument for various business activities [5]. Consistent internet penetration has fostered the development of applications across various sectors, including education, which increasingly relies on technology for its processes [6].

In recent years, Indonesia's education sector has seen significant progress, particularly in terms of broader accessibility [7], [8]. A key driver of this advancement is the integration of ICT into education, commonly referred to as Educational Technology (EdTech). EdTech plays a strategic role in enhancing access and quality in education while introducing new innovations to tackle the challenges of the digital era.

EdTech offers technology-driven solutions to address educational challenges, providing new ways to solve existing problems [9]. By leveraging ICT-based tools, technologies, procedures, resources, and strategies, EdTech enhances learning experiences across all forms of education—formal, non-formal, and informal [10].

This potential has been embraced by startups in the education sector, which have increasingly integrated ICT into their operations and interactions with users. Over the past six years, the EdTech startup sector in Indonesia has grown rapidly, paralleling global developments in the industry [7] and the country's high internet penetration rate [11]. This trend is expected to continue, given Indonesia's diverse educational system and accelerating technological innovation, creating significant opportunities for EdTech to become a sustainable solution for improving education access and quality.

The EdTech sector in Indonesia has expanded rapidly, particularly in response to the COVID-19 pandemic. In March 2020, the surge in COVID-19 cases forced educational institutions to transition from face-to-face learning to remote learning. This shift affected approximately 7.6 million university students in Indonesia [12], who had to adapt to online learning systems, accelerating the adoption of EdTech services. A World Bank survey on the EdTech landscape revealed a 200% increase in users and downloads of EdTech applications in Indonesia in March 2020 [7]. About 39.6% of these EdTech services focused on online tutoring, with Ruangguru emerging as a dominant player in the market [13].

The COVID-19 pandemic also introduced new challenges in the labor market, accelerating the emergence of future jobs. Economic uncertainty during the pandemic and the global recession in 2020 exacerbated inequalities more significantly than previous crises [14]. In this context, skill development became crucial for driving economic growth and improving societal well-being. This created significant opportunities for EdTech startups to develop innovative learning approaches, processes, and strategies aimed at producing individuals with skills aligned with future labor market demands.

To study the application of technology in education, the Technology Acceptance Model (TAM) is frequently used to analyze the success of platforms like e-learning across countries, particularly in higher education [15]–[17]. Most studies

have shown that e-learning can be effectively implemented. However, in developing countries like Indonesia, where the EdTech sector has only recently experienced rapid growth, technology adoption requires adequate support. This support includes the provision of information, infrastructure, and resources from the user's environment, which play a critical role in encouraging the adaptation and utilization of technology in EdTech-based learning [18], [19].

The development of the EdTech sector in Indonesia not only broadens access to education but also introduces innovations to address global challenges. With the right support, EdTech can become a sustainable solution for improving education quality while preparing a generation ready to compete in the future labor market.

Based on this background, the research problem addressed in this study is: What factors influence the adoption of technology platforms in EdTech startups by adapting the Technology Acceptance Model (TAM)? This study aims to identify and understand the factors that affect the adoption of technology platforms in EdTech startups using the TAM framework, as well as to explore the relationships between exogenous and endogenous variables within the TAM framework. In this study, the TAM model is extended by incorporating the facilitating condition variable. This addition aims to analyze how users' environmental conditions, such as technical support, resource access, and ease of technology use, contribute to the adoption and adaptation of technology platforms in EdTech startups.

The expected benefits of this study include understanding the extent to which EdTech startups in Indonesia have aligned their processes, approaches, and learning strategies with the demands of 21st-century skills. This research is anticipated to make a significant contribution to learners, particularly in preparing them with relevant skills needed for the future. Thus, the study not only provides insights for developing EdTech platforms but also contributes to enhancing individuals' readiness to face challenges in the digital era workforce

2. LITERATURE REVIEW

2.1 Education Technology

Educational Technology (EdTech) is a rapidly growing sector that bridges the gap between education and technology. The solutions and services offered within this sector have revolutionized traditional educational systems and practices. EdTech's presence has shifted paradigms in teaching and learning processes, creating opportunities for learners to become more independent and proactive in developing their learning skills. For educators, EdTech fosters innovation in teaching methods, enabling more creative and interactive approaches that capture students' attention and enhance their engagement. Moreover, EdTech features a systematic nature, wherein its technological processes are structured to improve the overall quality of education. Thus, EdTech not only supports more efficient teaching but also enriches the learning experiences of all stakeholders involved.

Educational Technology (EdTech) refers to the use of technology to enhance teaching, learning, and educational management. EdTech includes a broad range of tools and platforms, such as learning management systems (LMS), mobile apps, online tutoring services, and virtual classrooms [5]. In essence, Educational Technology (EdTech) refers to the utilization of technology, tools, techniques, resources, and processes to support and facilitate learning, performance, and instruction, with the primary aim of enhancing educational quality. Its applications span three main domains:

1. Technology as a Tutor: Where technology provides direct

instructions and guidance to users.
2. Technology as a Teaching Tool: Supporting educators in delivering educational content more effectively.
3. Technology as a Learning Tool. Enabling students to learn independently and interactively, thus increasing their engagement in the learning process.

Consequently, EdTech plays a crucial role in transforming education, benefiting both educators and learners. It serves as a medium for improving accessibility, fostering innovation, and addressing the evolving demands of modern education systems.

2.2 *Technology Acceptance Model*

The Technology Acceptance Model (TAM), introduced by Davis in 1986, is one of the most widely used theoretical frameworks for analyzing user acceptance of technology. TAM posits that two key factors—Perceived Usefulness (PU) and Perceived Ease of Use (PEOU)—directly influence users' attitudes and intentions toward adopting technology [1].

1. Perceived Usefulness (PU): Refers to the degree to which a user believes that using a particular technology will enhance their performance or productivity.
2. Perceived Ease of Use (PEOU): Refers to the degree to which a user believes that using the technology will be free of effort.

Subsequent studies expanded TAM by incorporating external variables, such as subjective norms, facilitating conditions, and system quality, to account for variations in different contexts [3]. In the context of educational technology, TAM has been instrumental in evaluating factors influencing the adoption of e-learning platforms and EdTech tools.

3. RESEARCH METHOD

This study's research model is based on the work of Sukendro et al. (2020), which assessed learners' acceptance of e-learning during the COVID-19 pandemic by applying the Technology Acceptance Model (TAM) framework, specifically within the context of sports education in Indonesia [20]. However, this study broadens the scope of its user base. While the previous study focused solely on university students, the present research includes a more diverse range of users, including workers seeking to develop skills and competencies to meet the demands of relevant modern skills.

Based on this background, the research model adopted in this study is as follows:

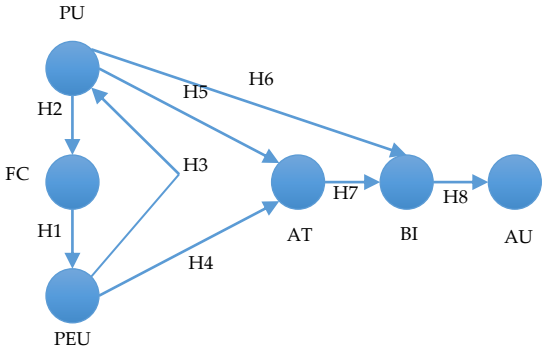

Figure 1. Research Model Extended TAM

This study adopts the variables of Facilitating Condition (FC), Perceived Usefulness (PU), Perceived Ease of Use (PEU), Attitude (AT), Behavioural Intention (BI), and Use of E-Learning Platform (AU). Data collection was conducted from March to October 2024 through an online questionnaire distributed to learners actively utilizing services from EdTech startups in Indonesia during the 2018–2024 period. The questionnaire was designed to include parameters or indicators representing the study's variables, focusing on the use of e-learning technology platforms developed by EdTech startups. The collected data will be analysed using Structural Equation Modelling (SEM) to evaluate the relationships among these variables. The questions were structured to reflect user experiences in utilizing the e-learning technologies provided by EdTech startups as part of their learning processes.

This study employs purposive sampling to select a relevant sample. The sampling criteria combine theoretical, practical, and contextual aspects to ensure that the selected sample possesses characteristics aligned with the research objectives. If the study were to focus solely on theoretical criteria, including all EdTech startups, the resulting population would encompass companies with varying scales, business models, target markets, and stages of development. This diversity could complicate data analysis and reduce the validity of the conclusions. Therefore, more specific boundaries were set by adding practical and contextual criteria. This approach aims to produce a more homogeneous and relevant sample, making it better suited to the study's objectives.

To ensure a more homogeneous sample, the study limits its population to EdTech startups established between 2018 and 2024 with a primary user base comprising young individuals aged 17 and above. This time frame allows the research to highlight recent developments in the EdTech field, while the focus on user age helps identify the specific needs and preferences of younger generations, who are often the primary target of innovations in this sector.

To ensure the study's relevance to the local context and the development of the EdTech industry in Indonesia, the population is further narrowed to EdTech startups operating within Indonesia. Additionally, by focusing on active learners during the 2018–2024 period, the study captures the latest dynamics in EdTech development and user experiences that are both up-to-date and relevant to the current conditions.

4. RESULT AND DISCUSSION

The findings of this study confirm the applicability of the Technology Acceptance Model (TAM) in understanding the factors influencing the use of e-learning platforms developed by EdTech startups in Indonesia. The inclusion of the Facilitating Condition variable in the extended TAM model provides a more comprehensive understanding of how external factors, such as technical support and access to resources, impact users' perceptions of ease of use and usefulness. These factors play a crucial role in fostering positive attitudes towards e-learning platforms, which, in turn, increase users' behavioral intention to use them.

Based on the respondent profile data, the majority of participants who filled out the questionnaire in this study were male, with the main age range being between 18-24 years and 25-35 years, and with a minimum education level of a Bachelor's degree (S1). In terms of age, most respondents were between 18 and 35 years old, making up approximately 91% of the sample. This indicates that this age group is familiar with technology. They tend to be more adaptable to technological innovations and have a high interest in the development of new technologies [21].

4.1 Outer Model Test

The initial test conducted was the outer model test (measurement model), which aimed to identify the relationship between each indicator and the latent variable it represents. In this test, data from 270 respondents were

processed using SmartPLS software version 3.0. The results of this test are as follows:

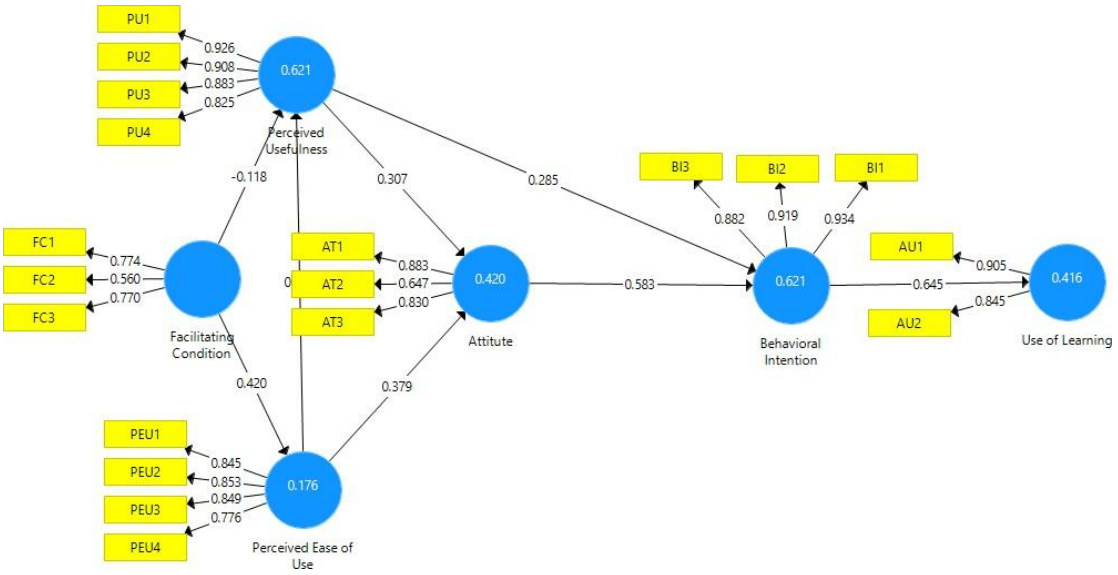

Figure 2. First Path Analysis

In the initial modeling, as shown in Figure 2, there are six constructs represented as circles, with a total of 19 indicators, each depicted as squares. These constructs consist of five exogenous variables: Facilitating Condition (FC), Perceived Usefulness (PU), Perceived Ease of Use (PEU), Attitude (AT), and Behavioral Intention (BI), as well as one endogenous variable: Use of E-Learning Platform (AU).

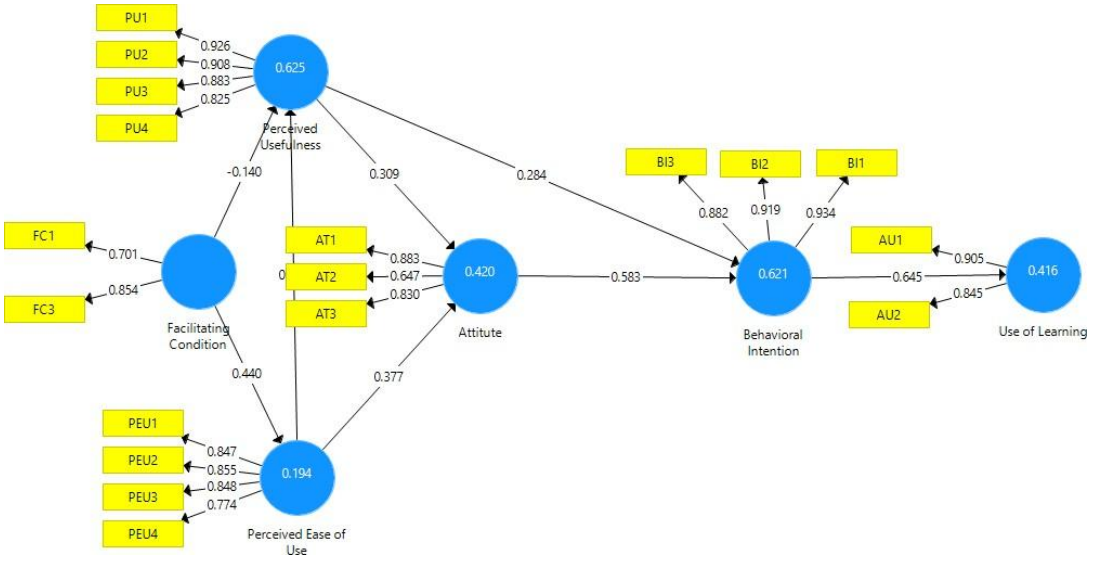

Figure 3. Path Analysis Last

4.2 Validity Test

To assess the validity of each construct, the outer loading of each indicator must exceed 0.60. This value indicates that the indicator has sufficient convergent validity and quality. Based on the analysis results, one indicator was found to be invalid because its outer loading was below 0.60, namely indicator FC2, with a value of 0.56. This indicator refers to the statement, "When I need help to use E-Learning during the online learning process, someone will teach me." As a result, indicator FC2 was excluded from the model in the path diagram of the research.

The invalidity of this indicator is likely due to the diversity of the respondents' locations, as the questionnaire was distributed nationally. The geographical differences might have influenced the respondents' understanding of the statement.

4.3 Reliability Test

The next stage of testing is reliability testing for each construct in the model, which is assessed using Composite Reliability and Cronbach's Alpha. A construct is considered reliable if both values exceed 0.70. Values above 0.70 indicate that the indicators within the construct have good internal consistency and can be trusted to measure the respective construct. Therefore, the construct is deemed to have a high level of reliability in the context of this research.

The data processing results show that the Composite Reliability and Cronbach's Alpha values for each construct are above 0.70. Thus, all constructs in this research model can be considered to have good reliability. This indicates that the indicators within these constructs exhibit sufficient internal consistency and can be relied upon for further analysis in this research model.

4.4 Inner Model

The testing of relationships between variables (Inner Model) aims to analyze the relationships between latent variables by observing the R-Square and Path Coefficient values. Based on the research model used (as shown in the final path diagram), and the R-Square calculation results, it was found that the Perceived Usefulness (PU) variable can be explained by the Facilitating Condition (FC) and Perceived Ease of Use (PEU) variables by 62.5%, while the remainder is influenced by other factors. The Perceived Ease of Use (PEU) variable is predicted by the Facilitating Condition (FC) by 29.4%, with the remaining variance influenced by other factors. The Attitude (AT) variable is explained by the Perceived Usefulness (PU) and Perceived Ease of Use (PEU) variables by 42%. Furthermore, the Behavioral Intention (BI) variable is influenced by Attitude (AT) by 62.1%, while the Use of E-Learning Platform (AU) variable can be explained by Behavioral Intention (BI) by 41.6%. With R-Square values greater than 0.2 for each variable, this research model can be considered to provide a good explanation of the relationships between the tested variables.

5. CONCLUSION

This study applies the Technology Acceptance Model (TAM) framework to identify factors influencing the use of e-learning among users of EdTech startup platforms, particularly in supporting the learning process. The findings show a significant relationship between facilitating conditions and perceived ease of use and perceived usefulness. Additionally, the study confirms a significant relationship between the main components of the TAM framework, which strengthens the relevance of this model in the context of digital learning.

The application of TAM in this study makes a significant contribution to academic literature, particularly in understanding the conditions and dynamics of learning platforms in the EdTech sector. The research emphasizes the importance of

support from the surrounding environment to enhance user adaptation, ease of use, and perceived benefits from EdTech platforms. This support has been proven to contribute to increased platform usage intensity, which ultimately has a positive impact on learning outcomes.

Therefore, investment in the development and optimization of EdTech platforms is essential. Priority should be given to strengthening the user's supportive environment to maximize the benefits of this technology. Furthermore, a comprehensive evaluation of the factors influencing the use of learning platforms should be conducted in various contexts and settings. This step aims to ensure the sustainability and effectiveness of technology implementation in the EdTech sector, providing a broader and more lasting impact.

Moreover, the study highlights the importance of understanding the specific needs and preferences of young learners in the context of EdTech. As this demographic is the primary user base for many EdTech startups, their experiences and attitudes toward e-learning platforms are critical in designing platforms that meet their expectations and learning requirements.

This research also offers practical implications for EdTech startups in Indonesia. By focusing on improving facilitating conditions, such as providing better technical support and resources, and enhancing the ease of use and perceived usefulness of their platforms, these companies can increase user satisfaction and engagement. Furthermore, fostering a positive attitude towards e-learning can contribute to higher levels of behavioural intention and, ultimately, greater usage of the platform.

While this study provides valuable insights into the factors influencing the adoption and use of e-learning platforms in Indonesia, future research could explore other variables that may impact technology acceptance, such as social influence, trust, and user satisfaction. Additionally, longitudinal studies could provide a deeper understanding of how users' perceptions and behaviors evolve over time as the EdTech industry continues to develop and mature.

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