



The Task-Technology Fit, Technology Induced Engagement, and Technology Induced Motivation on Higher Education Students Learning Performance during COVID-19

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ABSTRAK

Indonesia adalah salah satu negara yang terdampak pandemi COVID-19. Kondisi ini mendorong implementasi berbagai kebijakan, termasuk pembelajaran online bagi mahasiswa untuk mencegah penyebaran virus. Sayangnya, teridentifikasi mahasiswa yang mengalami kesulitan dengan sistem pembelajaran ini. Oleh karena itu, penelitian ini bertujuan untuk menganalisis faktor kondisi yang mendukung kinerja pembelajaran bagi mahasiswa perguruan tinggi di Indonesia, yaitu Task-Technology Fit (TTF), Technology-Induced Engagement (TIE), dan Technology-Induced Motivation (TIM). Faktor demografis, seperti lokasi dan gender, juga turut dipertimbangkan dalam analisis. Keberhasilan pembelajaran dikaji dari Indeks Prestasi (IP) mahasiswa selama satu semester mengikuti perkuliahan online. Pengumpulan data dilakukan dengan strategi kuesioner online, yang berhasil menjangkau 40 responden yang valid. Metode fuzzyset Qualitative Comparative Analysis (fsQCA) digunakan untuk menganalisis model konfigurasi keberhasilan pembelajaran online mahasiswa. Penelitian ini berhasil memformulasikan enam kombinasi kondisi faktor yang cukup untuk mencapai keberhasilan pembelajaran online. Pembelajaran online sukses diantaranya ada yang terkait gender maupun tidak, serta lokasi rumah mahasiswa, dan kombinasi kondisi faktor yang lain. Tiga kombinasi kondisi yang harus ada dalam setiap konfigurasi keberhasilan pembelajaran online mahasiswa di Indonesia adalah, lokasi belajar area perkotaan, mahasiswa memiliki TIE, dan juga TIM yang tinggi. Hasil kajian ini berkontribusi bagi dosen dan manajemen pendidikan tinggi mengenai kondisi-kondisi yang perlu dipersiapkan untuk mendukung keberhasilan pembelajaran online mahasiswa.

ABSTRACT

Indonesia was one of the countries affected by the COVID-19 pandemic. This condition encourages the implementation of various policies, including online learning for students to prevent the spread of the virus. Unfortunately, students have difficulties with this learning system. Therefore, this research aims to analyze the condition factors that support learning performance for university students in Indonesia, namely Task-Technology Fit (TTF), Technology-Induced Engagement (TIE), and Technology-Induced Motivation (TIM). Demographic factors, such as location and gender, were also considered in the analysis. Learning success is assessed from the student's Grade Point Average (GPA) during one semester of online lectures. Data collection was carried out using an online questionnaire strategy, which succeeded in reaching 40 valid respondents. The fuzzyset Qualitative Comparative Analysis (fsQCA) method was used to analyse the configuration model for student online learning success. This research succeeded in formulating six combinations of factor conditions that were sufficient to achieve online learning success. Successful online learning includes whether it was related to gender or not, as well as the location of the student's home, and a combination of other factors. Three combinations of conditions that must exist in every successful configuration of student online learning in Indonesia are, urban study location, students having a high TIE, and also a high TIM. The results of this study contribute to lecturers and higher education management regarding the conditions that need to be prepared to support the success of students' online learning.

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1. INTRODUCTION

During the pandemic, countries worldwide focused on changing teaching and learning techniques from physical to online. Previously, this teaching mechanism had not been implemented in Indonesia and was a challenge for higher and other levels of education (Mahmud, 2019; Wang & Liu, 2020). Therefore, higher

education stakeholders must explore the factors that support the success of online learning methods during the pandemic. Therefore, higher education stakeholders must explore the factors that support the success of online learning methods during the pandemic. This exploration is crucial for ensuring that the rapid shift to digital learning not only addresses immediate educational needs but also lays a solid foundation for future advancements in education technology (Mandasari et al., 2022; Sari et al., 2022; Syahrudin et al., 2021). Stakeholders, including educators, administrators, policymakers, and technology providers, need to consider several key factors.

Task-Technology Fit (TTF) refers to the extent to which the technology used in an educational environment matches the needs and characteristics of the tasks to be completed by students and teachers. In an educational context, TTF assesses the match between software, applications, or digital tools and students' learning objectives, teaching methods, and learning needs (Wu & Nian, 2021; Zhang & Dang, 2020). For example, an e-learning platform that supports student-teacher interaction, provides appropriate learning materials, and offers efficient evaluation tools, can be considered to have a high TTF. Good TTF can increase the effectiveness of the teaching and learning process, improve student performance, and make it easier for teachers to deliver material (Falck et al., 2018; Reidelbach et al., 2021). Technology-Induced Engagement (TIE) refers to the extent to which the use of technology in education is able to increase student involvement and participation in the learning process. Well-designed technology can make learning more interesting and interactive, so that students are more motivated to be actively involved in learning activities (Budi et al., 2021; Code et al., 2020). For example, the use of gamification applications, virtual simulations, and online collaboration tools can increase student interaction with course material and with fellow students. High TIE is characterized by increased student participation, curiosity, and active involvement in learning tasks. Technology-Induced Management (TIM) refers to how technology can be used to support the management and management of learning processes in education. TEAM involves the use of technology tools and platforms to plan, implement, and evaluate learning activities effectively. In an educational context, TEAMS include the use of learning management systems (LMS), scheduling applications, assessment tools, and communication platforms (Tran et al., 2020; Vidić, 2021). This technology allows teachers to manage classes more efficiently, track student progress, provide real-time feedback, and communicate with students' parents. An effective TEAM can reduce the administrative burden on teachers, increase transparency, and ensure that all aspects of learning are managed well.

Previous study successfully formulated a model to support online learning systems using Task-Technology Fit (TTF), Technology-Induced Engagement (TIE), and Technology-Induced Management (TIM) (Elçi & Abubakar, 2021). Other study defined TTF as the extent to which technology performs or can fulfill a task requirement (Khoa et al., 2021; Vanduhe et al., 2020). TTF was associated with the benefits of technology, which helps an individual carry out students' tasks to achieve high individual performance. TIE was the amount of physical and psychological energy students devote to academic activities and university learning to conceptualize their engagement. Meanwhile, TIM is the concept that allows students to have a sense of accessing and reading and collaborating with peers online to achieve the competence needed to complete their school assignments. TIE and TIM are facilitators for learning outcomes (performance) (Garcia-Cabot et al., 2020; Heflin et al., 2017). The two demographic factors potentially impacting learning performance were location and gender. The place of residence was determined in order of importance, namely rural, comprising villages, small towns, small settlements, and urban, including metropolis. Others include age, disability, geographical area, first language, gender, number of children in a household, technological facilities, religion, belief, and ethnic origin (Hsia et al., 2016; Vidić, 2021). Study in Indonesian school, representing rural and urban areas, and based on preliminary studies, adolescents in urban areas achieve better academic achievement than those in rural regions, while in terms of gender, female were better than male (Anwar et al., 2019; Yulianti et al., 2019). Regarding internet usage, it was reported that 79% of people between the ages of 16 and 74 used information technology more often, with 84,7% and 73,3% of this percentage allocated to men and women. Syiah Kuala University, Banda Aceh, Indonesia, conducted a study to compare the level of intelligence between men and women, specifically in university learning. The results indicated that female students have 125.5% potential to complete the study period faster than male. In terms of disciplines studied, female students have 127% potential to be faster in completing their study period in Social, Economics, and Humanities and 123.9% for Science and Technology (Mulyani et al., 2021; Setiawardhani, 2013).

In this study, the learning performance was measured based on the student's Grade Point Average (GPA), which was the average of all final courses in a program, weighed by their individual unit value (Assari, 2019; Sarid et al., 2020). The five factors, namely TTF, TIE, TIM, gender and location were analysed to determine the learning performance using a fuzzy-set Qualitative Comparative Analysis (fsQCA). This method was utilized to find a configuration model that provides information on factors that can make students' learning performance successful during online education. This study was conducted to analyze the factors responsible for the successful conduction of online learning in higher education in Indonesia. Novelty of this study is focus on the factors analysed were related to technological context to enable students to study anytime and anywhere. Online learning has been activated in several global institutions in the last two years due to the pandemic. The transition from offline to

online learning was essential to ensure students remain acquainted with their studies irrespective of the lockdown rules implemented to prevent further virus spread.

2. METHOD

This study was adapted which examined learning a performance based on five causal conditions, namely TTF, TIE, TIM, gender, and location, during the pandemic in Turkey using fsQCA (Elçi & Abubakar, 2021). The fsQCA was a method that relies on the variable condition in terms of theoretical set relationship, hence, this study obtained the combination of various variable conditions compared to individuals and also designed to support causal asymmetry, effects, and assumptions. The steps in the fsQCA method consisting of calibration, necessity, and sufficiency were applied as a students' performance measurement tool through a questionnaire and processed using the fsQCA 3.0 software. The analysis result was a successful model of student learning performance. Figure 1 shows the flowchart methodology of this study.

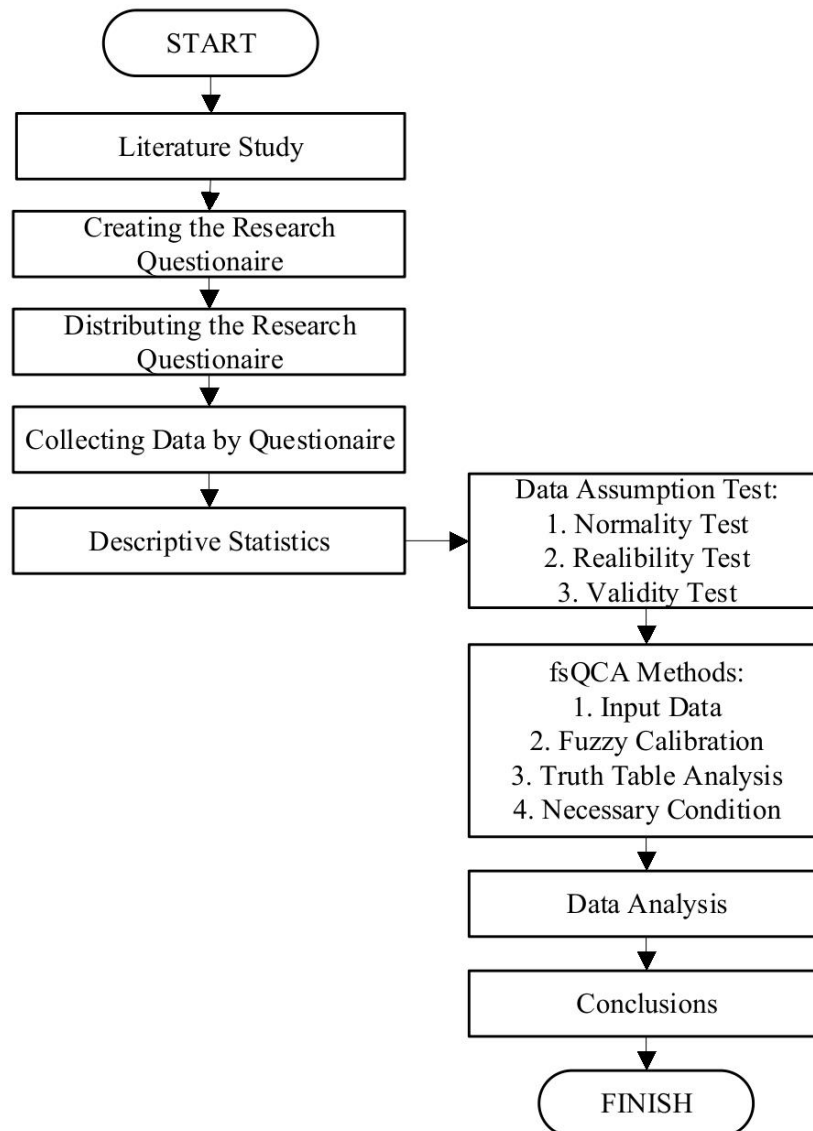


Figure 1. Flowchart Methodology

This study aims to explore the configuration of TTF, TIE, TIM, gender, and location for the best learning performance outcome based on GPA scores in one semester. The conceptual model was shown in Figure 2.

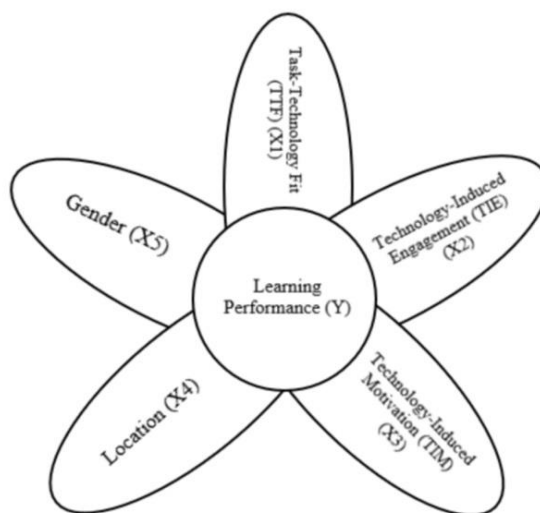


Figure 2. Conceptual Model

Data were collected through an online questionnaire containing statements representing five causal conditions variables. The questionnaire instruments comprise four sections, including TTF adopted from (Yüce et al., 2019), TIE developed from (Mejia, 2020), TIM developed from (Hsia et al., 2016) to captures both intrinsic and extrinsic learning motivations, and learning performance adopted from (Yogendra & Andrew, 2017). The items used in this study were customized and anchored on a 1 to 5-point Likert scale (Hohne et al., 2021) for TTF, TIE, and TIM instruments and dichotomous for learning performance instruments. The 40 respondents who filled out the questionnaire were selected from Indonesian university students that carry out online learning activities using various technology media such as Zoom, Google-meet, Kahoot, Teacher's room. Furthermore, the data was cleaned and assumed to determine their normality, reliability, and validity. This was followed by identifying the respondents' characteristics through descriptive statistics analysis. After that, the data obtained from the questionnaire results were analysed using the fsQCA method. The fsQCA mechanism consisting of the data calibration, truth table processing, sufficiency, and necessary conditions calculation, was processed by inputting the data into the fsQCA 3.0 software. The output of the configuration model was used to determine the successful students' learning performance during the pandemic. The statistics characteristics and the fsQCA configuration model were analysed and synthesized to obtain information that could support decision-making in higher education to improve the online study policy and mechanism. The threshold for the student's outcome high learning performance if the GPA point in the semester observed was beyond .

3. RESULT AND DISCUSSION

Result

The demographic data from students consist of age, gender, study major and residential location during the pandemic. Based on the questionnaire results, 97.5% of respondents were aged between 20 to 23 years, and the rest were less than 23 years old. Furthermore, the majority of 67.5% were female, and the rest were male. Regarding location, 65% live in urban areas, and the rest in rural areas. For the learning performance, 97.5% have a GPA of more than 3.3, and the rest were less than this score. This study used maximum, mean, and minimum points from the aggregate data of causal conditions for the fuzzy calibration process. The direct calibration method was used to determine its threshold, which includes non-full, full, and crossover membership points, with fuzzy scores of 0.05, 0.95, and 0.5, respectively. The data processing was carried out with the fsQCA 3.0 software and comprised six configuration models sufficient for high student learning performance. Only causal conditions with a raw consistency of more than 0.80 and the frequency threshold of two cases were stated as sufficient models. The configuration model resulting from this study was shown in Table 1.

Table 1. Configuration Model for High Student Learning Performance

Solution	Combination Solution	Raw Consistency
1	Gender*FuzTTF*FuzTIE	1
2	Location*FuzTTF*FuzTIE*FuzTIM	0.99422

Solution	Combination Solution	Raw Consistency
3	~Gender*~Location*~FuzTTF*~FuzTIE*~FuzTIM	1
4	~Gender*Location*~FuzTTF*~FuzTIE*FuzTIM	1
5	Location*FuzTTF*~FuzTIE*~FuzTIM	0.933094
6	~Gender*Location*FuzTTF*~FuzTIM	1

The first combination of causal conditions that produced the high learning performance was female students supported by technology and increased engagement. The second causal condition combination for high learning performance achievement was female or male students living in urban areas who use technology and were highly engaged in the online learning environment. The results indicated a striking difference between students' academic achievements in the two regions, with outstanding average scores obtained in urban areas. Digital platforms do not need to be used as mere utilities but as learning media amid the COVID-19 pandemic. Therefore, in accordance with the combination of these conditions, the support of learning technology can help produce good learning performance.

The third combination of conditions that produce high learning performance was female students who live in rural areas with no support for learning technology, low engagement, and poor motivation. Despite these inconsistencies, they still could achieve high learning performance due to more motivation to do assignments. The results revealed the insignificant difference between the performances of students who were taught certain educational technology concepts using Webinar and those educated with conventional lecture methods. In accordance with the third configuration model, even low technology support conditions produced good learning performance.

The fourth condition combination was female students living in urban areas with high motivation in technological learning without support and engagement. Female students tend to be good at managing their emotions, feelings, language, melodies, and temporary tones. Male students were better at using logic that they think makes more sense. Therefore, in a combination of these conditions, it was found that female students were better at adapting to online learning.

The fifth combination of online learning success performance was the location of students living in urban areas with technology support, but without engagement and motivation from the environment. Meanwhile, students with low motivation also potentially produce high learning performance due to achievement motivation which has an insignificant effect on their cumulative achievement index. Based on results from preliminary studies, the reasons students who live in urban areas produce high learning performance with technological support compared to those who live in rural areas can be determined. The sixth combination condition was female students living in urban areas who support learning technology but without motivation was produce good learning outcomes. This case showed that extrinsic motivation does not directly affect learning behaviour.

Discussion

Preliminary studies also indicated that TTF significantly affected learning performance. These results have received empirical support and validation from previous work and meta-analyses that found a positive relationship between TTF and personal performance (Khoa et al., 2021; Vanduhe et al., 2020). Previous study investigated the effect of Webinar Multimedia Platform in selected Educational Technology Concepts on Student Academic Performance at Ilorin University (Ugwu, 2019). Other study on gender relations in student learning achievement, found that male and female students think differently (Jain & Jain, 2022). Other study which conducted study on the urban-rural education gap, found that children who grow up in urban areas have parents who consistently select to invest more in their education than those in rural settings (Khusaini & Muvera, 2020; Yulianti et al., 2019). Children growing up in rural areas do not seem to enjoy or take the same educational opportunities as those in urban regions, even in a country such as the Netherlands, where rural areas were relatively accessible. Furthermore, the advent of technology potentially increases learning performance in students. According to previous study, students with low engagement also produce high learning performance due to its insignificant correlation (Chen, 2017).

The pandemic led to the use of digital technology to carry out teaching and learning activities. Understanding the relationship between TIE and learning performance was significant. Several studies conducted before COVID-19 found that technology increased student engagement in learning culture (Dennis, 2021; Heflin et al., 2017). This means that technology helps to stimulate students' engagement and motivation, which in turn generates learning achievement. Previous study stated that using clickers can also help increase students' engagement and attention, which were determining factors of learning performance (Sun, 2014). These conditions can help achieve high engagement and produce good learning performance. Other study stated that motivation was critical for learning using technological media (Yüce et al., 2019). It determines student achievement and performance. Based on these descriptions, it can be concluded that students who live in urban areas produce high learning performance with the support of technology, engagement, and motivation.

This configuration model was also strengthened by preliminary studies, which showed an insignificant correlation between student engagement and academic achievement. For instance, other study stated that students' engagement did not predict mean scores among African Americans (Kibirige & Teffo, 2014). Other study was unable to find a significant correlation between students' engagement in technology and academic achievement (Maziyah et al., 2022). This finding was similar to the technology motivation in causal condition combination. Based on the description, it can be synthesized that female students who live in rural areas, with technological support, low engagement, and inadequate motivation, also potentially have high learning performance.

Previous studies have not found a significant correlation between student engagement and academic achievement. For instance, other study stated that their engagement did not ensure the GPA (Jong Jek Siang, & Santoso, 2016; Niehaus et al., 2012). Other study also did not find a significant correlation between student engagement and academic achievement (Chen, 2017). Therefore, even low engagement can result in good learning performance according to these conditions. Other study stated that motivation was critical for learning, impacting educational technology outcomes (Yüce et al., 2019). Digital technology motivation related to technology and innovation was proven to affect academic achievement (Irhandyaningsih, 2020; Lin et al., 2017). The combination of these conditions explains why female students who live in urban areas with motivational support in learning and none in technology were able to produce high learning performance.

Those result indicated that to gain the successful learning performance of university students during online learning in pandemic era, the study performance depend on the context. Nevertheless, though the context were variance, the three condition that necessary exist to support the university students gained the high learning performance during online study were location (i.e. urban area, due to it was relate to the internet network that more stable); high Technology Induced Engagement (student engagement), and high Technology Induced Motivation.

Based on those research findings, some suggestions given as follows: First, even though online study, the university need to issue the policy that student must be allowed came and using campus facility with highly health standard protocol. Second, relate to the student engagement and motivation, the lecturer be suggested using the more creative and variation approach during online learning, such as game, gift for the student, breaking ice with discussion outside the learning topic, etc. For the further studies, it needs to add some new variables to influence the learning results to ensure the combination is more accurate. Also, this variables model could be used to analysed the current relevant context, such as hybrid learning.

4. CONCLUSION

Six condition combinations resulted high online learning performance outcome in Indonesia. The first stated that female students who are supported by technology and have a high engagement produce increased learning performance. The second reported that male students living in urban areas without high engagement and motivation also produce high learning performance. The third indicated that students living in urban areas, with the support of learning technology, engagement in the environment, and motivation, produce high learning performance. The fourth stated that female students living in rural areas without support for learning technology, low engagement, and poor motivation obtain high learning performance. The fifth combination reported that female students living in urban areas with motivational support in learning but none for technology and low engagement can produce high learning performance. The sixth indicated that those living in urban areas with better technology support were able to produce high learning performance despite not being involved and motivated.

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