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Technology readiness in enterprise resource planning gamification to improve student learning outcomes

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ABSTRACT

In online learning, students often experience problems related to the use of technology. One of them is enterprise resource planning (ERP) technology. Therefore, this study aimed to analyze the technology readiness index (TRI) to measure the extent to which students' readiness for ERP gamification. This research targets students who use ERP gamification during management information systems and accounting information systems courses. The technique of determining the sample is using a census. So that all the population is used as a sample of 153 students in Indonesia, then analyzed using TRI. Through TRI analysis using SEM PLS, most students studying ERP gamification have a medium readiness index. The findings of this research showed that students are very close to technology, so they have a strong adoption of technology. Most students have an explorer character where they are enthusiastic and have high curiosity about learning ERP gamification. Pioneers who need a little encouragement from external parties to adopt ERP gamification. However, typical skeptics should be given a concrete example of the benefits of using ERP in learning. This research is also a benchmark for developing technology-based learning media according to the characteristics of students who are intended for technology in higher education.

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1. INTRODUCTION

Various learning methods have been developed and applied in universities, including industrial-preferred skills-based learning [1]. One of the goals of industry-based learning is to close the gap between theoretical knowledge of higher education and practical activities in the industry [2]. Several higher educations in Indonesia that have accounting, economics and business study programs have implemented enterprise resource planning (ERP) learning methods in their curriculum. ERP is an integrated software and system implemented by many commercial and non-commercial organizations worldwide [3]. So that if accounting students are given ERP lessons during lectures, it will make them better master the practical skills needed by the industry [4].

Enterprise resource planning learning with a gamification approach will be an interesting and exciting experience for students because it will improve student learning outcomes [5], [6]. Students will learn an integrated ERP system through business game simulation media, with various scenarios and real possibilities presented in the game. Furthermore, Hernández-Lara stated that learning with the business game simulation method will stimulate students to play an active role in a group while increasing experiential learning [7]. By applying gamification-based learning, students can learn happily, increase productivity [8] and reduce stress levels [9]. One of the ERP lessons through business game simulation is provided by the MonsoonSIM application. MonsoonSIM enables lecturers and students to understand how companies operate with an integrated ERP system [10].

ERP plays a crucial role in the real business world because ERP is not just software [11]. Implementing an ERP system can increase the efficiency and effectiveness of business organization operations, increase the speed of communication and information between departments, and optimize other business functions [12]. In its implementation in various industries, ERP systems can be challenging to learn and understand. Thus a comprehensive training program will be essential to carry out [3].

In higher education, MonsoonSIM learning adopts an ERP system implementation that is simulated as a business game. This game can be played both asynchronously and in face-to-face education classrooms. However, the readiness of students to use MonsoonSIM seems to need to be investigated further, considering that during the pandemic period, MonsoonSIM was carried out remotely using asynchronous methods. So that the readiness of students to accept technology such as MonsoonSIM tends to be challenging to identify, and the impact of which online learning methods can cause learning outcomes are not fully achieved [10]. Furthermore, SMR research supports this fact where 92% have online learning problems, namely lack of guidance from teachers (38%) and inadequate internet infrastructure (25%) [13]. As a result, students experience difficulties, especially in understanding online learning, especially in courses related to practicum (56%), so most of the students (78%) want face–to–face learning [10].

Therefore, to prevent students from having problems in online learning using technology, it is necessary to measure the technological readiness of students. One of the appropriate models to measure a person's technological readiness is technology readiness index (TRI) [14]. TRI measures a person's readiness to accept new technology [14]. TRI can measure accounting students' readiness in learning MonsoonSIM ERP's gamification. Because MonsoonSIM can be categorized as a new technology in accounting student learning [15]. Through the TRI measurement method, the characteristics of accounting students in gamified ERP learning will be seen. Students will be classified into explorers type to laggards type using this MonsoonSIM [14], [16]. Previous researchers revealed that male students have better technology readiness than female students [17], [18]. This is because male students have higher optimism and innovativeness toward technology [10].

This study reveals accounting students' readiness level in ERP gamification learning. This study will assess and disclose aspects such as optimism, innovativeness, discomfort and insecurity. This will be crucial in higher education, especially in learning ERP systems. Even in the industry, ERP systems tend to be challenging to understand if not through comprehensive training [11], [12]. Therefore, students' perceptions, characteristics and readiness to learn ERP gamification needs to be assessed and known. So that lecturers can continuously develop the ERP learning method and the gamification system in the MonsoonSIM ERP simulation will continue to experience continuous improvement.

2. RESEARCH METHOD

This study focuses on students who use ERP gamification in learning by using MonsoonSIM in the subject of management information systems and accounting information systems in Indonesia. The method of determining the sample used is the census so that all 153 populations are determined to be the research sample. After conducting a learning simulation, students will be asked to fill out a questionnaire regarding the readiness of technology in using MonsoonSIM, which will later be used in work and the business world.

The research stages consist of data collection, validity and reliability analysis, measurement of technology readiness index, conducting data analysis, and finally making a conclusion and implication, as illustrated in Figure 1. The research instrument was arranged on a Likert scale of 1 to 5 (strongly disagree=1 to strongly agree=5). The question items were adopted from Parasuraman [14] regarding the TRI 2.0. The questionnaire is divided into four measured variables, namely optimism (5 question items), innovativeness (5 question items), insecurity (5 question items), and discomfort (4 question items). Meanwhile, the analytical tool uses a structural equation model through a partial least squares (PLS) approach.

The PLS method is used to measure the validity and reliability of the data. The correlation between variable structures through measurement and structural analysis [19]. The first measurement of the fact of the data is by analyzing the outer loading in each construct and the average variance extracted (AVE). While the reliability of the data using Cronbach alpha (CA) and composite reliability (CR). After the data reached the standard of validity and reliability, then the TRI analysis was measured based on Parasuraman [14] with the categories of low TRI (TRI value<2.89), medium TRI (TRI value=2.9–3.51) and high TRI (TRI value>3.51). After the data is analyzed, then the writer makes conclusions and implications.

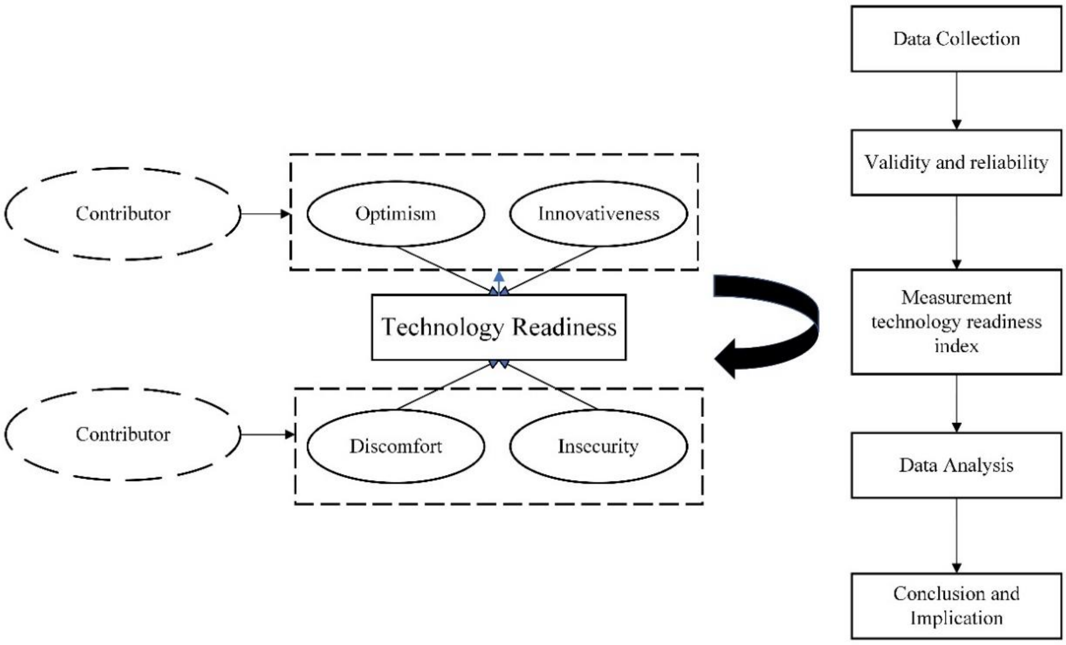

Figure 1. Research design

3. RESULTS AND DISCUSSION

3.1. Respondent profile

Table 1 shows the characteristics of the respondents who have filled out the research questionnaire. 143 students are willing to fill in the respondents. Based on the results of distributing questionnaires, most students involved in this study were 70.6% women, while 29.4% were male. Most of the 143 students, 62.2% of them are in the second year, while 37.8% are in the third year. In addition, the characteristics of students in TRI are categorized into five segments [14], [20], namely explorers (High Optimism/OPTM, High Innovativeness/INNV, Low Insecurity/INSC, Low Discomfort/DISC), pioneers (High OPTM, High INNV, High INSC, High DISC), skeptics (Low OPTM, Low INNV, Low INSC, Low DISC), paranoid (High OPTM, Low INNV, High ISC, High DISC), and laggard (Low OPTM, Low INNV, High INSC, High DISC) according to dimensions in TRI.

Based on Table 1, most students have the characteristics of skepticism, as many as 50 students or 35%. Then the type of student explorers as much as 47 or 32.9%. At the same time, the kinds of pioneer students are 36 students or 52.2%. At the same time, the rest have paranoid characteristics of seven students or 4.9% and laggards of three students or 2.1%.

Table 1. Respondent profile

		Amount	Percentage
Gender	Man	42	29.4%
	Woman	101	70.6%
Student level year	Second year	89	62.2%
	Third year	54	37.8%
Segment	Explorers	47	32.9%
	Pioneers	36	25.2%
	Skeptics	50	35.0%
	Paranoids	7	4.9%
	Laggards	3	2.1%

3.2. Discriminant validity and reliability

Before performing data analysis, the first step is to determine discriminant validity through outer loading, AVE, CA, and CR. Based on Table 2, the value of outer loading for all constructs exceeds 0.7. This follows the recommendation of Hair *et al.* [19] regarding the minimum limit for the outer loading value of 0.7. The smallest outer loading value is in the INNV5 construct of 0.707. in comparison, the most extensive outer loading is at 0886. thus, all the constructs in the study have met the element of validity.

Furthermore, the validity measurement can also be done by testing the AVE value according to the recommended one, which is 0.5 [19]. Based on the table, the lowest AVE value is 0.587 in the innovativeness construct. In contrast, the highest value is at 0.713 on the insecurity construct. Thus, all constructs in this study have met the element of validity.

After testing the validity, the next step is to test the reliability using CA and CR. According to Hair *et al*. [19], the recommended value is more than 0.7. The smallest CA value in this study is on the construct of discomfort and innovativeness of 0.826. in comparison, the enormous CA value is in the optimism construct of 0.895. then the most excellent CR value in this study is in the optimism construct, which is 0.923. In comparison, the minor construct on discomfort is 0.885. Based on this explanation, the CA and CR values exceed 0.7. Thus, all constructs in the study are reliable. Based on the evaluation according to the previous description, the data have met the elements of validity and reliability.

Table 2. Construct validity and reliability

Construct	Outer loading	AVE	CA	CR
Optimism (OPTM)		0.705	0.895	0.923
OPTM1	0.856			
OPTM2	0.857			
OPTM3	0.835			
OPTM4	0.842			
OPTM5	0.807			
Innovativeness (INNV)		0.587	0.826	0.876
INNV1	0.779			
INNV2	0.816			
INNV3	0.703			
INNV4	0.817			
INNV5	0.707			
Insecurity (INSC)		0.713	0.865	0.909
INSC1	0.814			
INSC2	0.886			
INSC3	0.870			
INSC4	0.806			
Discomfort (DISC)		0.658	0.826	0.885
DISC1	0.759			
DISC2	0.783			
DISC3	0.857			
DISC4	0.841			

3.3. TRI analysis

After analyzing the validity and reliability, the next step is to analyze the technology readiness using TRI. Table 3 shows the results of technology readiness values based on the male segment and the level of student entry into college. Students who enter earlier (third year) have lower technological readiness than the second year. Second-year students have higher optimism on optimism, discomfort, and insecurity factors. However, it is lower than the innovativeness factor. This shows that students are filled with an increased sense of positivity at the beginning of the lecture. However, entering the third year, this student is more innovative in viewing technology.

Table 3. Segmentation based on respondent characteristics using TRI

Segment	Second years	Third years	Man	Woman
Optimism	3.90	3.80	3.90	3.84
Innovativeness	3.53	3.55	3.68	3.48
Insecurity	3.42	3.34	3.30	3.42
Discomfort	3.11	3.09	3.06	3.12
Overall TRI	3.49	3.44	3.49	3.47
Categories	Medium TRI	Medium TRI	Medium TRI	Medium TRI

Meanwhile, if we look at the gender impact of student users, there is no significant difference. Based on the Table 3, the scores between men (3.49) and women (3.47) are not too different. Male students have greater technological readiness than women. The striking difference is that women have higher insecurity and discomfort factors, but lower optimism and innovation compared to male students. Caisson and Bulman's findings [21] illustrate that technology should be designed to support the needs of women student. Parasuraman and Colby [14] also found a high skepticism among older technology users where technology utilization did not always lead to better results. These results make it easier for students to accept the techniques taught more effectively and efficiently [10]. The results of this study are also in line with other research where men tend to have higher technology readiness compared to women [17], [22]. In addition to measuring technology readiness based on gender and year of admission, this research also categorizes students based on five segments in technology readiness, as shown in Table 4.

Table 4. Latent class segmentation using TRI

Segment	%	Optimism	Innovativeness	Insecurity	Discomfort	Total TR	Categories
1. Explorers	32.9%	3.98	3.71	3.26	2.94	3.47	Medium TRI
2. Pioneers	25.2%	4.16	3.92	3.83	3.38	3.82	High TRI
3. Skeptics	35.0%	3.56	3.16	3.09	2.98	3.20	Medium TRI
4. Paranoids	4.9%	3.98	3.26	3.91	3.44	3.65	High TRI
5. Laggards	2.1%	3.28	3.13	3.79	3.39	3.40	Medium TRI
Overall TRI	100%	3.86	3.54	3.39	3.10	3.47	Medium TRI

Based on Table 4, most of the types of students in this study were categorized as explorers (32.9%), pioneers (25.2%), and skeptics (35%). At the same time, the rests are paranoids (4.9%) and laggards (2.1%). The table shows that most students have good technological readiness to use technology-based learning such as ERP with a TRI value of 3.47 with a medium TRI category. In this research, the explorer type has a TRI value of 3.47, which is included in the TRI medium. They have high optimism (3.98) and innovativeness (3.71) compared to technology readiness inhibitors such as insecurity (3.26) and discomfort (2.94). As revealed by Parasuraman that explorers-type students have a high sense of motivation but have a low degree of resistance [14]. The pioneer-type students in research have a reasonably large portion of 25.2%. They have very high optimism (4.16) and innovativeness (3.92) compared to other types. Although on the side of insecurity (3.83) and discomfort (3.38), different varieties are more significant. Students with the pioneer type tend to have positive and negative views about technology. So, they are role models with the highest technological readiness level compared to other types.

Meanwhile, skeptical students tend to have a different perception of the existence of technology [14]. Skeptics also have positive and negative views that are not too extreme about the presence of technology use. This is following the results of this study, where 35% of respondents have high optimism (3.56) but have low innovativeness (3.16), insecurity (3.09), and discomfort (2.96). This study illustrates that skeptical students have high contributory factors but have low inhibitors. This student learns ERP gamification well but is still afraid of missing data. In addition, they are also uncomfortable if they have not confirmed to the lecturer whether the results of student learning reach the lecturer. Then students with the paranoid type tend to have strong views about technology. The results of this study prove that the paranoid type students have high TRI than the pioneer kind. The paranoid type has high optimism (3.98). They also have the most heightened insecurity among other types (3.91). In contrast, the laggard-type students intend to avoid optimism and innovativeness. As evidenced by the results of this study, the laggard type has low optimism (3.28) and innovativeness (3.13) but has high insecurity (3.79) and discomfort (3.39).

Table 4 also shows that overall, students have high optimism, which is 3.86, compared to innovativeness which is 3.54. the result is also higher when compared to insecurity (3.39) and discomfort (3.1). The results of this study are consistent with the results of other researchers where technology contributors such as optimism and innovativeness dominate [23]. This means that technology control is essential, considering that students in this study can positively view the use of ERP gamification. Optimistic students tend to be more active because they are not worried about the possible negative impact of using ERP gamification. They also tend to favor happiness over adverse effects. This opinion is supported by several researchers, who encourages users can face technology more openly [24], [25].

Optimism and innovativeness illustrate that students are ready to adopt new technologies. Meanwhile, insecurity and discomfort act as inhibitors that can prevent someone from using new technology [26], [27]. High technological readiness can affect a person’s perception of the ease and usefulness of viewing technology [28]. Insecurity for technology users occurs because there is no guarantee for the products and services of the technology [17].

Students who have high innovativeness tend to try new things. As a result, they are more comfortable using technology than the manual method [16]. Meanwhile, insecurity and discomfort in this study had a low score. Insecurity shows that users are unsure about the security and privacy of the technology [14]. In other words, students become more suspicious and distrustful of the technology process and the existence of new functions or trials of its use. Meanwhile, discomfort can be seen in the lack of control over technology. So that students feel overwhelmed by the presence of the technology. In the context of education, students with high discomfort show that students think that learning to use technology causes difficulties in understanding learning. So, they feel disappointed and frustrated.

Nagle suggested that technology should be integrated into the curriculum and not taught separately [29]. So that this method can directly improve students' technological readiness, COVID-19 supports this model. Students and lecturers are required to do online learning. Especially when lecturers apply gamification, which can help students learn well unconsciously [30]. So that both students and lecturers can be in touch with technology every day, other literature also proves that technology adoption can sustainably increase the adoption of the technology itself [31], [32]. In other words, the higher the technology readiness, the more students will be able to learn the lesson well [26], [33].

4. CONCLUSION

The result of the study shows that most accounting students have a high readiness (medium-high technology readiness index) in accepting and learning new technologies on campus, especially enterprise resource planning gamification in the MonsoonSIM application. Most students have an "explorer" character where they are always enthusiastic and highly curious about learning enterprise resource planning gamification. Some are "pioneers" who need a little encouragement from external parties to adopt ERP gamification technology. They are typical "skeptics" who must be given concrete examples of the benefits of using ERP technology in university learning. The results also reveal that accounting students close to technology will more readily adopt ERP gamification technology so that, in the end, these students have more practical skills in the industrial world.

This research also contributes to the world of education in theory and practice, especially regarding online learning using gamification. Adjusting the delivery method according to the characteristics of students toward technology orientation (explorers, pioneers, skeptics, paranoids, and laggards) can make it easier for lecturers and universities to apply learning methods that suit students' needs for technology-based learning. This research also contributes to developing learning methods for accounting students in universities. With the different characteristics of students in ERP gamification learning, both lecturers and application developers can adapt and develop various learning methods so that they are easier to understand and also applied by students. However, the limitation of this research is that only observations and surveys are carried out in Indonesia in the accounting department and on specific subjects (Management Information System and Accounting Information System). So that further researchers can conduct research with lecture objects more generally to obtain different generalizations of data. Future research also can examine the causal relationship between the technology readiness index and student perceptions of using ERP gamification.

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