Wireless Local Area Network and Analytical Hierarchy Process: Technology Acceptance Model for Increasing Use of Online Learning

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ARTICLE INFO	ABSTRACT
	Online learning is currently very much needed for the development of science in schools, the covid 19 outbreak has made changes to learning methods. The change in the learning model must also be supported by supporting learning devices and media, including computer networks and the internet in schools, the network that is used to support online learning is currently widely used by schools using WLAN, because it can reach parts of the hard one. The use of WLAN learning devices and media as a support for online learning can be an obstacle for some teachers and students, this is because not all teachers and students can understand the online learning system and not all areas have a fast internet access network, with these constraints in need a technology acceptance measurement model (TAM) for online learning using WLAN, so that online learning can be carried out properly and the achievement of successful learning can be carried out.

1. Introduction

Network computer used and increase with very fast. Lots organization and school use network computer for finish work they. Suite incident This has increase request customer will quality network Good in LAN nor WAN [1]. Quality network computer can solve the problem transfer information which slow, the need for data exchange in each section and real-time transactions, with the existence of a computer network that is connected to each work unit on an ongoing basis no direct can increase efficiency work and can improve data processing in an organization [2].

Need current information must be realtime to be able to speed up data processing which can produce information needed by the network computer, especially need fast transfer of data, effective and efficient. With an integrated computer network between one user and another, it can

improve the performance of an institution, especially schools which are currently implementing an online learning model [1].

with online learning, a reliable network is needed, moreover media used to communicate distance Far moment this is media which fence lots used. The need for a network that has high capabilities for implementing online learning can use the Wireless Local Area Network (WLAN) network type. WLAN can reach area LAN which difficult through link for reach various client. Profit from innovation This is use link. This offer convenience swap data as well as complicated system for connect a number of computers on moment which same [2,3].

There are still many institutions that do not use integrated network installations that can connect each computer in a work unit within an institution or organization, the use of LAN and WLAN computer networks that can connect parts of each work unit is very limited, so the need for data acceleration in institutions by combining network method is needed. Especially in schools which currently require a network connected to the internet to represent online learning [3-5]. This need is very important, after the covid 19 outbreak the need for online learning was really needed, therefore an integrated network system was needed [6].

The existence of integrated networks and online learning systems in schools really helps teachers and students in the learning process, but not all schools can apply and accept technology directly, for this reason a technology acceptance model is needed to align and equalize the use of WLAN-based integrated online learning in schools [7].

AHP and WLAN studies for online learning have been carried out by many researchers, but previous research mostly highlighted the quality of online learning, for this reason this research will observe the extent to which users accept online learning technology.

For this reason, a model for measuring the acceptance of the use of online learning technology is needed by schools. By providing a conceptual framework that captures the important variables that influence decisions about the use of WLAN in online learning, by combining the WLAN variable with the Technology Acceptance Model (TAM) variable measurement. The main objective of this research is to create a framework model that integrates the most significant variables used in manipulating the level of acceptability of the WLAN Variable for online learning in schools.

2. Method

The research method will be explained in detail according to the steps taken in this model development research as shown in Figure 1.

First, the initial study was carried out by making initial preparations, namely literature studies, and preparing the model to be developed, including looking for criteria used in online learning tools [8]. In addition to reviewing the literature, it is also carried out to formulate a research program that will be carried out.

The second stage is to develop a model by adopting and combining existing models. In carrying out model development, attention must be paid to the continuity of the model to be built so that there is no overlap between models.

The third and fourth stages are the design of the resulting model and the instruments used as variables and indicators. At this stage the selected criteria are obtained and the results of data processing using the AHP method [9].

Instrument development must refer to the theories that have been put forward before. The outcome instrument is the definition of each criterion and indicator. criteria are the focus of research that distinguishes them can vary from each object and are used to answer research problems [10].

Meanwhile, indicators are criteria that show or give us instructions about a certain situation so that it can be used to measure change [11].
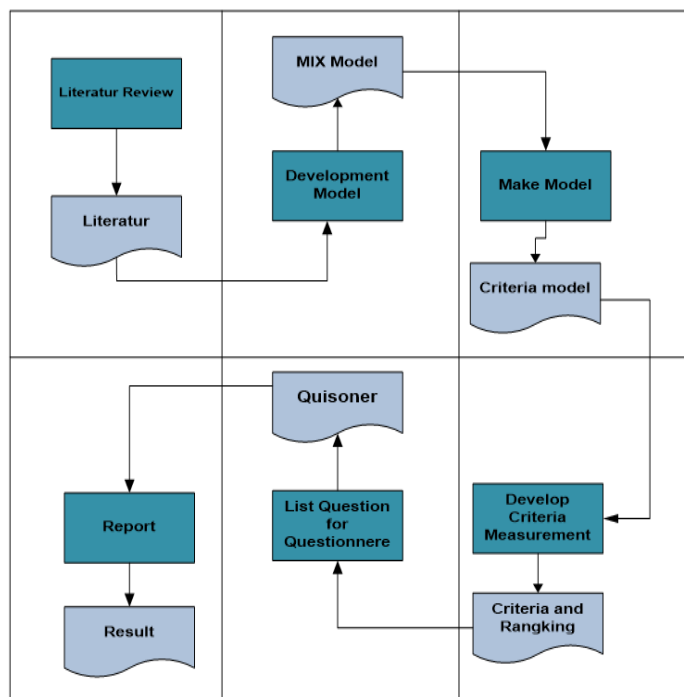

Fig. 1. Research Design

The fifth part is to make an analogy from instrument development to questions or statements on the questionnaire. This section is most important because it requires carefulness and psychological understanding of prospective respondents to clearly understand the list of questions and statements [12]. The entire list of questions submitted will be tested for validity and reliability at a later stage. However, in research the expected output is only up to the proposed model, list of indicators.

2.1 Design of Wireless Local Area Network

The WLAN framework available is the media as a measure of technology acceptance of online learning, in the WLAN framework for online learning consists of laboratories, teachers, students and devices used as shown in Figure 2 below.

The WLAN framework is indispensable for online learning, while the criteria that must be met in the online learning process are Teacher Competence (TC), Student Readiness (SRD), Competitive Pressure (CPR), and Equipment readiness (DRD) this is an online learning feature using WLAN devices, and TAM variables include Perceived Usefulness (PU), Perceived Ease of Use (PEU), and Attitude Toward Using (ATU) [13-20]. From the WLAN and TAM integration model, an online learning technology (AOL) acceptance model is obtained. The importance of technology in carrying out online learning at this time can improve students' ability to absorb knowledge without being limited by time and distance. This can maximize the work of teachers in imparting knowledge to students.
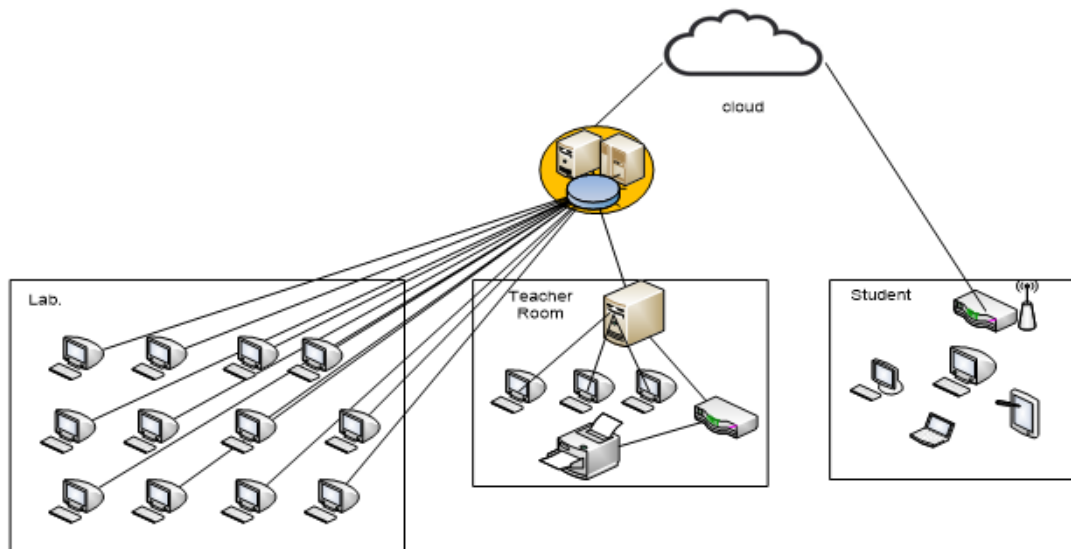
Fig. 2. WLAN Framework

3. Results and Discussion
3.1 Criteria for WLANs

The criteria were obtained from the three components of the WLAN framework for learning online, namely Computer LAB, Teacher, and Student. From these three components the right alternative was sought to be used as an online learning criterion, from the alternatives obtained, the criteria were sought for online learning using AHP such as the Table 1 below determines the best criteria of several alternatives based on the technology acceptance model (TAM).

Table 1
Criteria's

Component WLAN learning online	Criteria	Author
Computer LAB	Devise Readiness	Salim [3]
		Sui and Yang [7]
Teacher	Teacher competence	Chu *et al.,* [21]
	Competitive presseur	Hmoud *et al.,* [22]
Student	Student readiness	Judd *et al.,* [23]

From the graph below, there are four criteria for WLAN which are obtained from data processors using AHP, the WLAN criteria have different weights, such as the Figure 3 below.
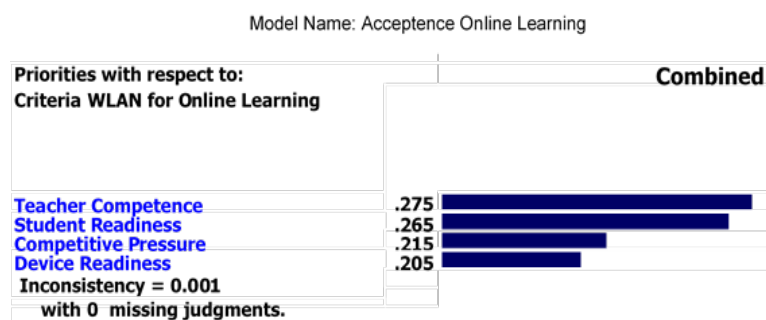

Fig. 3. WLAN Criteria

3.2 Technology Acceptance Model (TAM)

Figure 4 below explains the combination of two models, namely the Wireless Local Area Network (WLAN) model and the Technology Acceptance Model (TAM), the integration of these two models can produce online learning acceptance (AOL) that is used by schools or educational institutions.
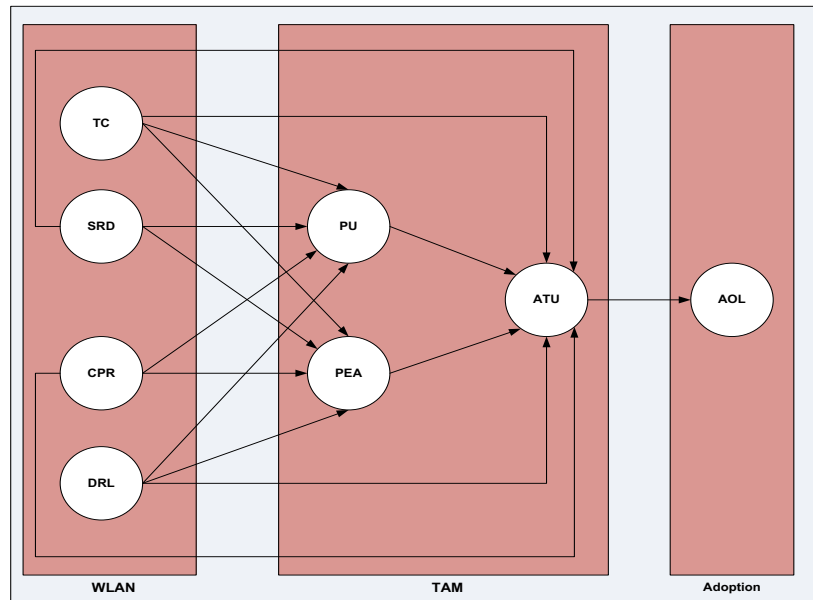

Fig. 4. Research Model Design

Figure 4 is an image of the research model design, namely the adoption model of the relationship between the WLAN criteria which will be integrated with the Technology acceptance model resulting in an online learning (AOL) adoption model. From the image above it can be defined as in Table 2 and Table 3 below.

Table 2
Definition of WLAN Criteria

Code	WLAN Criteria	Definition
TC	Teacher Competency	The level of trust in teachers who have the ability to use technology
SRD	Student Readiness	The level of student confidence in the ability to use technology
CPR	Competitive Pressure	Level of confidence and ability to develop technology against competition in learning
DRD	Device Readiness	The level of confidence in the readiness of the hardware and software that will be used in learning

Table 3
Definition of TAM criteria

Code	TAM criteria	Definition
PU	User Perception	The level of trust in the use of the system used in online learning
PEA	User's perceived ease of use	The level of trust in information technology in online learning
ATU	Attitudes Toward Use	The level of trust in the evaluation of the online learning system

The TAM criteria are taken from the TAM model construct which refers to the research of Kautsar *et al.,* [16], he measures the use of Google Meet and Zoom research applications comparing the two applications using the construction of the technology acceptance model (TAM).

3.3 AOL's Model

This model in Figure 5 explains that the competence of a teacher or teacher has high points because it will affect the level of acceptability of online learning so that the material delivered can be understood by students, the competencies that must be mastered by the teacher are not only in the academic field but there are five contents that must be fulfilled by the teacher or teacher, among others.
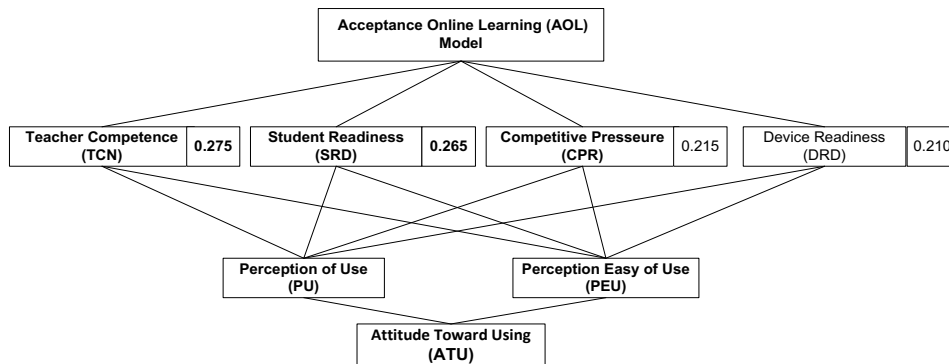
Fig. 5. AOL's model

3.4 Competency Teacher (TCN)

In carrying out online learning a teacher must have academic abilities, be able to use learning media, and be active in communication in electronic media using social media or electronic mail in answering student questions that ask about learning material, there is no definition of the competence of a teacher like the Table 4 below.

Table 4
Competency Teacher (TCN)

Code	Competence	Definition
TCN 1	Academic	The level of confidence in the acceptability of the learning material conveyed
TCN 2	Internet	The level of usefulness of internet technology in online learning
TCN 3	intranets	The level of confidence in the active use of technology in contributing to fellow users or teachers
TCN 4	email	The level of trust by increasing electronic mail services every incoming letter
TCN5	Software and hardware	Understand the performance of the software used and the function of the hardware used

3.5 Student Readiness (SRD)

The readiness of students in carrying out the online learning process can also reflect technology's acceptance of online learning, while student readiness includes, among others, as shown in Table 5 below.

Table 5
Student Readiness

Code	Readiness	Definition
SRD1	Academic	The level of confidence in the acceptability of the learning material conveyed
SRD2	Internet	The level of utilization of internet technology in online learning
SRD3	Area	The level of technology use in a location and area
SRD4	email	The level of utilization and use of e-mail in the online learning process
SRD5	Software and hardware	Understand the performance of the software used and the function of the hardware used

3.6 Competition Pressure (CPR)

Competition puts pressure on schools to carry out online learning methods so that schools must carry out online learning, while school readiness in competition to improve the quality of schools through online learning can be seen from the Table 6 below.

Table 6
Competition Pressure

Code	Pressure	Definition
CPR 1	Pressure	Capability level teams working in developing online learning systems, both from learning materials, learning tools or SOPs
CPR 2	Internet	Increase bandwidth capacity in the online learning process
CPR 3	Integration	The level of mutual cooperation between users in the online learning process
CPR 4	Structure	The level of school ability in dealing with technological changes in online learning
CPR 5	Software and hardware	There is an increase in the capacity of devices that are used both software and hardware

3.7 Equipment Readiness (DRD)

Learning Equipment or devices to be used must have readiness and specifications for online learning, while the readiness of devices and equipment to support online learning to improve school quality can be seen from Table 7 below.

Table 7
Equipment readiness

Code	Competence	Definition
DRD 1	Electrical Power Source	The level of trust is available in the power source that will be used to activate online learning devices
DRD 2	Internet	The level of trust in the device for the strength of the internet provider network used in online learning
DRD 3	Network Provider	The level of trust in providers who work in implementing online learning
DRD 4	Hardware	Confidence level with Enhanced hardware capacity to enhance online learning
DRD 5	Software	The level of trust in media applications or systems used for online learning

3.8 Perceptions of Use

The four WLAN mixes above are then integrated with the Technology Acceptance Model using Table 8 below.

Table 8
Perceptions of Use

Code	Competence	Definition
PU 1	Effectiveness	The level of measurement of the effect on online learning systems
PU 2	Quality	Measurement of the level of usefulness of the online learning system
PU 3	Productivity	Measurement of user productivity against online learning systems
PU 4	show	Measurement of the performance of the online learning system
PU 5	Finish	Measurement of the desired achievement of the online learning system

3.9 Perceived Ease of Use

Table 9 shows the user's perception has competency with the existing assessment definition of online learning users in schools, both from teachers, students and implementing staff of this online learning.

Table 9
Perceived Ease of Use

Code	Competence	Definition
PEU 1	Controllable	The level of the relationship between the user and the operational readiness of the online learning system
PEU 2	Understandable	Measurement of the use of an online learning system that is easy for users to understand
PEU 3	Complicated	Measurement of a complex system that runs on the user's ability to implement an online learning system
PEU 4	frustrated	There are stages that users are very desperate in using the online learning system
PEU 5	Mental Effort	There is confidence in using the online learning system

3.10 Attitudes toward Using

Table 10 shows as for the perceived ease of use that exists in online learning by measuring the WLAN variable.

Table 10
Attitudes toward Using

Code	Competence	Definition
ATU 1	Attitude	The culture carried out in the implementation of the online learning process
ATU 2	Evaluation	The relationship between user attitudes and the process of online learning systems
ATU 3	User	The way that is done by users in using the online learning system
ATU 4	Curiosity	The level of user desire to learn how to use the online learning system
ATU 5	Forecast	Predictive relationships that can occur with online learning systems

4. Conclusion

From the research, it was found that there were four main variables or criteria owned by WLAN, from each of these criteria the one that had the highest weight was the teacher competency criteria with a weight value of 0.275 indicating that teacher competence has a very high role in realizing online learning, with its teachers who have good competence can carry out online learning optimally, then student readiness in the learning process also has a weight that is not too far from teacher competence, namely 0.265, this explains that student resilience must also be an emphasis on online learning. Students must play an active role in implementing online learning so that students can understand the subject matter being studied, while competitive pressure has a very significant weight with a student readiness weight of 0.215, this shows that competitive pressure is also a measure in competition for implementing online learning, other schools those around him will compete to improve the quality of learning by using online learning methods. The criterion that has the smallest weight of the main WLAN feature is the readiness feature which has a weight of 0.210, although the small weight of this feature will affect the level of success in online learning, with a good device it will support maximum online learning performance.

References

[1]   Huang, Hao-Yang, Kun-Zhi Hu, Jie Deng, Dong Yan, Jinfeng Xie, and Yan Zhang. "A single-layer differential-fed dual-band filtering antenna for WLAN application." *Microwave and Optical Technology Letters* 65, no. 7 (2023): 1982-1990. https://doi.org/10.1002/mop.33638

[2]   Wu, Peng, Peng Li, Xi Chen, Peng Cheng, and Jian Zhu. "A Low Phase Noise Crystal Oscillator with a Fast Start-Up Bandgap Reference for WLAN Applications." *Applied Sciences* 13, no. 9 (2023): 5652. https://doi.org/10.3390/app13095652

[3]   Salim, Ahmed. "An approach for data routing in wireless body area network." Wireless Personal Communications 130, no. 1 (2023): 377-399. https://doi.org/10.1007/s11277-023-10290-x

[4]   Okumura, Masaru, and Sho Fujimura. "Wireless LAN Operation and Behavioral Inferences from Usage Analysis." In *Proceedings of the 2023 ACM SIGUCCS Annual Conference*, pp. 58-63. 2023. https://doi.org/10.1145/3539811.3579565

[5]   Ali, Ali Mohd, Mohammad R. Hassan, Ahmad Al-Qerem, Ala Hamarsheh, Khalid Al-Qawasmi, Mohammad Aljaidi, Ahmed Abu-Khadrah, Omprakash Kaiwartya, and Jaime Lloret. "Towards a smart environment: optimization of WLAN technologies to enable concurrent smart services." *Sensors* 23, no. 5 (2023): 2432. https://doi.org/10.3390/s23052432

[6]   Rayan, Ahmad. "Psychological impacts of transition to distance learning due to COVID-19 on nursing students." *International Journal of Mental Health Nursing* 32, no. 3 (2023): 767-777. https://doi.org/10.1111/inm.13139

[7]   Sui, Jinxue, and Li Yang. "Effectiveness and Evaluation of Online and Offline Blended Learning for an Electronic Design Practical Training Course." *International Journal of Distance Education Technologies (IJDET)* 21, no. 1 (2023): 1-25. https://doi.org/10.4018/IJDET.318652

[8]   Abadi, Satria, Setyawan Widyarto, and Nur Syufizah Ahmad Shukor. "Customer and stakeholder perspective using analytical hierarchy process method for evaluation performance of higher education." *International Journal of Supply Chain Management* 8, no. 3 (2019): 1057-1064.

[9]   Silva, Hernán A., Luis E. Quezada, A. M. Oddershede, Pedro I. Palominos, and Christopher O'Brien. "A Method for Estimating Students' Desertion in Educational Institutions Using the Analytic Hierarchy Process." *Journal of College Student Retention: Research, Theory & Practice* 25, no. 1 (2023): 101-125. https://doi.org/10.1177/1521025120971227

[10] Abadi, Satria, and Setyawan Widyarto. "The designing criteria and sub-criteria of University Balance Scorecard using Analytical Hierarchy Process method." *International Journal of Engineering and Technology (UAE)* 7, no. 2.29 (2018): 804-807. https://doi.org/10.14419/ijet.v7i2.29.14260

[11] Xu, Sheng-li, Tang Yeyao, and Mohammad Shabaz. "Multi-criteria decision making for determining best teaching method using fuzzy analytical hierarchy process." *Soft Computing* 27, no. 6 (2023): 2795-2807. https://doi.org/10.1007/s00500-022-07554-2

[12] Parizad, Ahmad, Aeen Mohammadi, Rita Mojtahedzadeh, and Mandana Shirazi. "Designing a Model of Student Support in e-Learning Using Qualitative Content Analysis and Analytic Hierarchy Process." *Tehnički Glasnik* 17, no. 1 (2023): 59-67. https://doi.org/10.31803/tg-20220517223720

[13] Sytniakivska, Svitlana, Nataliia Seiko, Nadiia Pavlyk, Tetiana Borovyk, Nadiia Yurkiv, Serhii Tereshchenko, and Ilona Rozhko. "Methods of evaluation of the latest educational technologies: marketing aspect." *Journal of Hygienic Engineering and Design* 41 (2022): 363-374.

[14] Iriani, Tuti, and Prastiti Laras Nugraheni. "The role of instructional quality on online learning intentions of university students: The technology acceptance model of Zoom." *International Journal of Evaluation and Research in Education (IJERE)* 12, no. 2 (2023): 969-978. https://doi.org/10.11591/ijere.v12i2.24021

[15] Wang, Zhonglin. "Evaluation of Higher Education System." In *International Conference on Edge Computing and IoT*, pp. 145-165. Cham: Springer Nature Switzerland, 2022. https://doi.org/10.1007/978-3-031-28990-3_11

[16] Kautsar, Hanggoro Aji Al, Asep Sayfulloh, Kartika Handayani, Abdul Latif, and Muhammad Rifqi Firdaus. "The comparison of Zoom meeting and Google Meet acceptance toward the online learning using TAM method." In *AIP Conference Proceedings*, vol. 2714, no. 1. AIP Publishing, 2023. https://doi.org/10.1063/5.0128534

[17] Widiartha, Ida Bagus Ketut, and Ahmad Zafrullah Mardiansyah. "Measuring and analyzing students' acceptance toward a new learning framework a case in Indonesia using extension of technology acceptance model." In *AIP Conference Proceedings*, vol. 2609, no. 1. AIP Publishing, 2023. https://doi.org/10.1063/5.0135028

[18] Ajibade, Samuel, and Abdelhamid Zaidi. "Technological acceptance model for social media networking in e-learning in higher educational institutes." *International Journal of Information and Education Technology* 13, no. 2 (2023). https://doi.org/10.18178/ijiet.2023.13.2.1801

[19] Szymkowiak, Andrzej, and Kishokanth Jeganathan. "Predicting user acceptance of peer-to-peer e-learning: An extension of the technology acceptance model." *British Journal of Educational Technology* 53, no. 6 (2022): 1993-2011. https://doi.org/10.1111/bjet.13229

[20] Valencia, Daniel Cardona, and Fray Alonso Betancur Duque. "Technology Acceptance Model (TAM): A Study of Teachers' Perception of the Use of Serious Games in the Higher Education." *IEEE Revista Iberoamericana de Tecnologias del Aprendizaje* 18, no. 1 (2023): 123-129. https://doi.org/10.1109/RITA.2023.3250586

[21] Chu, Juan, Ruyi Lin, Zihan Qin, Ruining Chen, Ligao Lou, and Junfeng Yang. "Exploring factors influencing pre-service teacher's digital teaching competence and the mediating effects of data literacy: empirical evidence from China." *Humanities and Social Sciences Communications* 10, no. 1 (2023): 1-11. https://doi.org/10.1057/s41599-023-02016-y

[22] Hmoud, Hazar, Ahmad Samed Al-Adwan, Omar Horani, Husam Yaseen, and Jumana Ziad Al Zoubi. "Factors influencing business intelligence adoption by higher education institutions." *Journal of Open Innovation: Technology, Market, and Complexity* 9, no. 3 (2023): 100111. https://doi.org/10.1016/j.joitmc.2023.100111

[23] Judd, Belinda, Jennie Brentnall, Justin Newton Scanlan, Kate Thomson, Felicity Blackstock, Allison Mandrusiak, Lucy Chipchase, Anna Phillips, and Sue McAllister. "Evaluating allied health students' readiness for placement learning." *BMC Medical Education* 23, no. 1 (2023): 70. https://doi.org/10.1186/s12909-023-04005-w