

Effectiveness of Technology Use in Indonesian High Schools: Student Engagement, School Capacity, Teacher Performance

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ABSTRACT

The present research investigates the intricate interplay among student engagement, school capacity, teacher performance, and the proficient implementation of technology within secondary institutions in Indonesia. This study employs quantitative methodology to incorporate these constructs into a comprehensive model by utilizing Structural Equation Modeling with Partial Least Squares. The study surveyed 243 educators using a stratified random sample, which yielded valuable information regarding demographic characteristics, patterns of technology usage, and the intricate interrelationships among the variables identified. The robust validity and reliability of the measurement model validated the efficacy of the chosen indicators. Significant positive correlations were identified through path analysis among student engagement, school capacity, teacher performance, and technology effectiveness. By drawing inspiration from the Integrated Educational Technology Ecosystem theory, this model enhances the theoretical comprehension of technology integration specifically within the domain of secondary schools in Indonesia. In addition, recommendations and practical implications for policymakers, educators, and future research are addressed.

Keywords:

Technology, Education, Student, Schools, Teacher, Indonesia High Schools

INTRODUCTION

As the global educational landscape evolves at an accelerated rate, technology influences pedagogical approaches and enriches learning experiences. Mobility, interactivity, artificial intelligence, and technological learning aids such as games and augmented reality are focal points of both technological and pedagogical efforts (Hawkrige, 2022). The integration of technology into the classroom can serve as a significant asset in fostering students' cognitive growth (Alam & Mohanty, 2023). In an age of globalization, the implementation and adjustment of technology in the educational sphere have emerged as essential measures to address transformations (da Costa & Gomes, 2023). A technological advancement and its integration into education have a significant historical background, both in terms of fostering an environment that supports higher-order learning opportunities and advancing knowledge (Nurbayanni et al., 2023). The proficient integration of technology into secondary schools is critical in the Indonesian context as it serves to equip the upcoming generation for a digital future. Nonetheless, educational authorities must prepare for the integration of technology into education and invest in technological infrastructure (Thapa, 2022).

Preserving its cultural heritage while modernizing education is a challenge Indonesia confronts. The integration of technology into education is crucial, yet its effective execution necessitates a comprehension of the particular circumstances and obstacles at hand. There is a need to investigate the interrelationships between technology effectiveness, student engagement, school capacity, and teacher performance. Highlighted is the significance of multicultural education for elementary school pupils that is grounded in indigenous knowledge (Nurwahid, 2023). The level of

education in Indonesia continues to be substandard, and the competence of educators remains a deficiency (Andrews et al., 2013). The achievement of universal access to education in Indonesia is hindered by regional disparities and social status distinctions (Lestari et al., 2022). The COVID-19 pandemic has witnessed the significant contribution of technology in facilitating online learning, thereby enhancing the flexibility and caliber of education (Putri & Antriandarti, 2022). It is crucial that industry and academic institutions collaborate, and technology can serve as a remedy for obstacles encountered during the educational process (Widiyanti et al., 2023). Global trends support the significance of technology in education; however, effective implementation of technology necessitates a comprehensive comprehension of local circumstances, obstacles, and prospects. This research endeavors to offer insights that can guide policy-making and practical implementation by examining the interplay between technology efficacy, school capacity, student engagement, and teacher performance. By doing so, it hopes to cultivate an atmosphere that is supportive of comprehensive and technology-driven education.

A multitude of factors, such as teacher efficacy, school capacity, and student engagement, impact the achievement of technology integration in the classroom. In order to maximize the learning experiences of students, it is crucial to grasp the connection between these variables. The interconnections among technology integration, teacher performance, student engagement, and school capacity in Indonesian high schools remain poorly comprehended (Faustino & Kaur, 2023). To facilitate the development of targeted interventions, it is essential to identify the components that facilitate or hinder the efficient operation of technology. Previous research has emphasized the importance of a range of factors, such as time, the attitudes and beliefs of teachers, their level of comfort with technology utilization, and other elements (Garner & Bonds-Raacke, 2013). An increased focus has been directed towards the imperative of establishing policies that ensure fair and equal access to technology for all individuals, regardless of their socioeconomic status, gender, race, disability, linguistic proficiency, or linguistic heritage (Sofyan & Hidayat, 2022). In order to enhance the effectiveness of technology integration in the classroom, instructors should consider the aforementioned factors and employ the most appropriate interventions (Aljarrah et al., 2022; Mulaudzi et al., 2023).

Presently, secondary educational institutions in Indonesia are confronted with the task of integrating technology in a manner that adequately equips students to meet the challenges of the twenty-first century (Maharani & Putra, 2023). The incorporation of technology into the domain of education presents prospects for revitalization and enhancement across multiple facets (Ozila & Zen, 2023). Nevertheless, additional attention must be paid to the Indonesian education system, which encompasses both internal obstacles encountered by institutions and external endeavors implemented by the government (Norman et al., 2023). It is vital in this age of knowledge-based economies and disruptive innovation to have an educational structure that can produce a skilled labor force (Ferdinan, 2021; Judijanto et al., 2023). In order to enhance students' learning processes, the ongoing COVID-19 pandemic and the rapid advancement of technology have highlighted the critical need for a flexible educational framework and collaboration between parents and school personnel (Ardi & Ade, 2022). In Indonesia, the establishment of an educational system ought to prioritize the cultivation of life skills and the development of a positive mentality, in addition to cognitive development. It is the responsibility of educators to furnish students with the

requisite proficiencies in the fields of education, technology, global affairs, and counseling in order to adequately prepare them to confront the forthcoming challenges. Incorporating technology into secondary schools in Indonesia in a manner that effectively addresses the opportunities and challenges of the digital age requires a comprehensive approach.

Literature Review

a. Grand Theory

The Integrated Educational Technology Ecosystem (IETE) is a conceptual framework that underscores the comprehensive integration of technology within the realm of education. It acknowledges the intricate and ever-changing relationship among factors such as teacher performance, technology efficacy, student engagement, and school capacity (Hashim et al., 2023). This underscores the necessity for an all-encompassing, interrelated framework that takes into account the cultural milieu of Indonesian secondary educational institutions and integrates mechanisms for ongoing enhancement (Widiasanti et al., 2023). The IETE places significant emphasis on informed engagement among students, a concept that is shaped by the wider educational ecosystem and bolstered by pertinent materials, individualized learning encounters, and constructive teacher-student exchanges (Kovaliuk & Kobets, 2021). The IETE underscores the importance of a robust technological infrastructure, proficient leadership, and an innovative culture in relation to school capacity (Rocha et al., 2023). Concerning the performance of educators, the IETE emphasizes the significance of continuous professional development and the relationship between competence and confidence (Fischer & Isenmann, 2023). In conclusion, the IETE assesses the efficacy of technology by examining its influence on student learning outcomes while also considering obstacles like inequitable access and resistance to change.

b. Student Engagement in Technology-based Learning

Student engagement is a complex notion encompassing various dimensions such as cognitive involvement, motivation, and active participation in the learning process. It is particularly crucial for educational effectiveness in environments enabled by technology. Literature emphasizes the significance of student engagement in their own education for optimal results (Bedi, 2023; Makarim & Primana, 2023; Sharma & Giannakos, 2020). Student engagement is influenced by various factors, including autonomy support from instructors, self-efficacy, and motivation (Andrés et al., 2022; Villa et al., 2023). Data collected during activities and over the course of a student's academic career can also be utilized to assess and analyze student engagement. Measuring student engagement in online education poses distinct challenges; however, advanced models have been devised to appraise engagement and emotions within virtual learning environments.

c. School Capacity for Technology Integration

The capacity of an educational institution to incorporate and support technology in an efficient manner is referred to as its "school capacity." It includes the availability of technical support, technological infrastructure, organizational elements, leadership support, and teacher professional development. A comprehensive comprehension of the capacity of an educational institution is imperative for the effective integration of technology (Harsono et al., 2023; Liebenberg, 2023). The significance of leadership support in promoting teacher work discipline and collaboration has been underscored by research (Piggott & Cariaga-Lo, 2019). Moreover, teacher professional development

is an essential element, as it contributes to the growth of students' interpersonal and personal competencies (Ferguson-Patrick, 2023). In addition, technical support is crucial for schools to foster equity and inclusion and effectively address the diverse requirements of students (Beckmann & Klein, 2023; Suraya & Kasman, 2022). Hence, it is imperative to conduct a thorough investigation into these elements in order to evaluate the preparedness of Indonesian secondary schools to adopt and incorporate technology into their pedagogical methodologies.

d. Teacher Performance in Technology Integration

Perceived technological competence and self-assurance among educators have a substantial impact on their capacity to successfully incorporate technology into the classroom environment (Marzuki, 2023). The proficiency levels of educators in utilizing ICT differ, and assistance in ICT utilization is vital for their self-assurance and efficient assimilation (Fütterer et al., 2023). Pedagogical competence of teachers, academic oversight, and principal leadership are additional factors that influence teaching performance, which encompasses the integration of technology (Riristuningsia et al., 2017; Sirait, 2021). To adequately equip pre-service teachers to incorporate technology, it is imperative to consider various elements including technological proficiency and aptitude, constructive mindsets, and pedagogical acumen (Christensen & Trevisan, 2023). Although instructors in rural primary schools encounter obstacles when attempting to integrate technology, they remain receptive to its use and value its effectiveness in instructional endeavors. The implementation of further technological integration in-service training is advised for these educators (Maja, 2023; Marlianti et al., 2017).

e. Technology Effectiveness in Education

Meta-analyses provide support for the efficacy of technology in education, specifically in Indonesian secondary schools, by demonstrating favorable impacts on student learning outcomes, with a particular emphasis on mathematics and language proficiency. Understanding these effects is crucial for evaluating the comprehensive influence of technology in the field of education (Widiasanti et al., 2023). But in order to optimize the efficacy of technology implementation in various educational settings, certain obstacles must be surmounted. Access disparities, resistance to change, and the digital divide are examples of these obstacles (Sofyan & Hidayat, 2022). To ensure that technology can be implemented in education to its fullest capacity, it is critical that these obstacles be surmounted (Faustino & Kaur, 2023; Jumardi et al., 2023; Mulaudzi et al., 2023).

f. Synthesis of Literature and Gaps

Student engagement, school capacity, instructor performance, and technology efficacy are intricately intertwined, according to a review of the relevant literature. While extensive research has been conducted on individual components, there is a scarcity of scholarly literature that provides a comprehensive examination of their interrelation, particularly as it pertains to Indonesian high schools. The existing body of research often focuses on educational settings in the West. Consequently, there is a need for inquiries that consider the unique cultural and contextual factors that impact the incorporation of technology in secondary schools in Indonesia.

METHOD

This quantitative study investigated the relationship between student engagement, school capacity, teacher performance, and effective technology use in Indonesian secondary schools using a cross-sectional design. The present study employs the Partial Least Squares (PLS) approach of Structural Equation Modeling (SEM) to examine the intricate interrelationships among the aforementioned variables. The study's population comprises senior high school educators in Indonesia who are actively involved in technology-based learning. Data collection commenced on August 30, 2023, and concluded on October 1, 2023, utilizing both online and offline survey methodologies. To guarantee the inclusion of various regions, school categories, and demographic characteristics, a stratified random sampling strategy will be implemented. Geographic location, school type (public or private), and socioeconomic factors all contribute to stratification. Before disseminating the data, the author engaged in discussions with education professors who were well-versed in the research proposal and possessed access to numerous indexed studies, including Scopus and Sinta. Ultimately, the initial questionnaire was disseminated on August 30, 2023, following two revisions. In total, 210 samples were examined for this study. The determination of the sample size was conducted in accordance with the guidelines for structural equation modeling (Kline, 2016). This involved considering both the number of latent and observed variables in the model and the number of indicators. In this particular study, there are 21 indicators; therefore, in accordance with Hair's (2019) recommendation, the sample size was multiplied by 10. An initial distribution of 250 questionnaires occurred; however, seven prospective respondents declined to participate, resulting in a sample size of 243 questionnaires containing complete data.

A systematic survey questionnaire was constructed, comprising validated scales and items derived from prior scholarly works, with the purpose of assessing technology efficacy, student engagement, school capacity, and teacher performance. Responses will be gathered using a Likert scale, as detailed in Table 1.

Structural Equation Modeling (SEM) utilizing Partial Least Squares (PLS) is well-suited for investigations involving formative indicators and exploratory research due to its capacity to estimate relationships with reduced sample sizes and model complexity. PLS-SEM will be performed utilizing SmartPLS software for model estimation, which enables the evaluation of reliability, validity, and interrelationships among latent constructs while simultaneously examining measurement and structural models. To ensure that the proposed structural model is adequate, model fit will be evaluated utilizing indices including the goodness-of-fit index (GoF), standardized root mean square residual (SRMR), and normed fit index (NFI). In order to validate the model and assess the significance of the path coefficients, 5000 samples will be utilized in a bootstrapping procedure to ensure the estimated parameters' stability and dependability.

RESULTS AND DISCUSSION

a. Demographic Participants

The study's participants comprised individuals with a mean age of 36.2 years and a standard deviation (SD) of 4.8, suggesting that the age distribution was relatively uniform. The sample's gender distribution exhibited a marginal preponderance of females (55%) over males (45%). The mean teaching experience of the educators in our sample was 9.3 years, with a moderate standard deviation of 3.1. A minor

proportion of the participants possessed a Doctorate degree (10%), while those with a Master's degree (55%) held the lowest positions. 35% held a Bachelor's degree. The participants in our study indicated that they utilized a diverse range of technologies on a regular basis, as indicated by mean scores that varied between 3.8 and 4.5 on a scale of 1 to 5. The devices that were reported by the most participants in terms of frequency of use were laptops (80%), smartphones (60%), tablets (45%), and interactive displays (35%). The educators comprising our sample were varied and balanced with regard to age, gender, teaching experience, and level of education. The participants' reported frequency of technology use and high level of education indicate that they possess considerable expertise in integrating technology into their pedagogical approaches.

b. Measurement Model

Table 1. Measurement Model

Variable	Items	Code	Loading Factor
Student Engagement (STE)	CA = 0.846, CR = 0.896, AVE = 0.683.		
	1. As a teacher, I can make students feel enthusiastic and excited in participating in learning activities at school.	STE.1	0.802
	2. Teaching effectiveness gets students involved in class discussions and group activities.	STE.2	0.867
	3. Students actively ask questions or participate in discussions during lessons.	STE.3	0.867
	4. Students are empowered to come up with new ideas in learning.	STE.4	0.764
School Capacity (SCC)	CA = 0.874, CR = 0.908, AVE = 0.664.		
	1. I feel that the physical facilities in this school support learning activities.	SCC.1	0.819
	2. I feel that there are adequate learning materials available at this school.	SCC.2	0.812
	3. The availability of technology and devices in the school to support the learning process.	SCC.3	0.795
	4. How well the school management supports extracurricular activities and student development outside the classroom.	SCC.4	0.821
Teacher Performance (TCP)	CA = 0.914, CR = 0.937, AVE = 0.749.		
	1. Teachers at this school present the subject matter in a way that is easy to understand.	TCP.1	0.954
	2. Teachers at this school provide constructive feedback on students' work or assignments.	TCP.2	0.845
	3. Teachers in this school are willing to help if students have difficulty in understanding the subject matter.	TCP.3	0.760
	4. The creativity of teachers in designing interesting and interactive learning methods.	TCP.4	0.856
Technology Effectiveness (TEE)	5. Teachers in this school encourage active participation and discussion in class.	TCP.5	0.899
	CA = 0.900, CR = 0.921, AVE = 0.627.		

Variable	Items	Code	Loading Factor
	1. I trust the use of technology in learning at this school.	TEE.1	0.728
	2. I feel technology is used to increase student engagement in the learning process.	TEE.2	0.846
	3. The use of technology in customizing learning suits students' learning styles.	TEE.3	0.834
	4. How effective is the online learning platform (LMS) in supporting the delivery of materials and assignments.	TEE.4	0.791
	5. I feel technology is used to improve student access to learning resources.	TEE.5	0.841
	6. Ease of access and use of technology tools in this school.	TEE.6	0.717
	7. I believe that teachers' use of technology supports the achievement of learning objectives.	TEE.7	0.776

Source: Data Processed (2023)

All latent variables exhibited strong internal consistency according to reliability analysis, with Cronbach's alpha values above the advised cutoff of 0.70 (Nunnally, 1978). This suggests that the technology effectiveness, teacher performance, school capacity, and student engagement measuring scales are valid and dependable. Convergent and discriminant validity for our measuring model were validated by the validity assessment. The fact that the factor loadings for each indicator in the latent variables are fairly high suggests that the items measure the corresponding constructs accurately. Convergent validity is confirmed by the Average Variance Extracted (AVE) value above the suggested threshold of 0.50 (Fornell & Larcker, 1981). Discriminant validity was supported by the fact that the cross-loadings were smaller than the matching factor loadings. Our measurement model's good validity suggests that the underlying constructs are well-represented by the chosen indicators and that they differ from one another.

c. Model Evaluation

The goodness-of-fit index (GoF), the standardised root mean square residual (SRMR), and the normed fit index (NFI) are global fit indices that quantify the degree of agreement between the model and the data. The indices GoF (0.77), SRMR (0.07), and NFI (0.85), all of which have high values, suggest that the model adequately represents the observed data.

The R^2 value signifies the ratio of the exogenous variables to the variance in each endogenous variable. Our model is robust, as evidenced by the comparatively high R^2 values for each of the constructs (student engagement, school capacity, teacher performance, and technology effectiveness). More specifically, the R^2 value of 0.63 for Technology Effectiveness indicates that our model can account for 63% of the variability observed in technology effectiveness. This illustrates the importance of a comprehensive approach that takes into account teacher performance, school capacity, and pupil engagement when attempting to enhance the efficacy of technology use in educational settings.

The Q^2 values offer valuable information regarding the predictive validity and dependability of our model. Given that the Q^2 values for each construct surpass zero, our model demonstrates strong predictive relevance. The Q^2 value of 0.58 for Technology Effectiveness signifies that the model's predictions regarding technology

effectiveness, which are derived from the exogenous variables included, are dependable. This further substantiates the pragmatic applicability of our model in forecasting the influence of teacher performance, school capacity, and student engagement on the efficacy of technology integration.

d. Hypothesis Test

In order to validate the model and assess the significance of the path coefficients, 5000 samples were utilized in a bootstrapping procedure. This procedure ensured that the estimated parameters, including path values and t statistics, were stable and reliable in accordance with the guidelines provided (Hair, 2019).

Table 2. Hypothesis Testing

Hypothesis	Original Sample (O)	Sample Mean (M)	Standard Deviation (STDEV)	T-statistic	p-Values
STE -> TEE	0.666	0.668	0.113	5.902	0.000
SCC -> TEE	0.401	0.398	0.098	3.213	0.000
TCP -> TEE	0.440	0.460	0.103	4.269	0.000

Source: Data Processed (2023)

The intensity and direction of the association between latent variables are indicated by the route coefficient. In compliance with Hair, 2019, all routes are positive and statistically significant, indicating that the hypothesis is supported by the significance of the t statistics value > 1.96. Keeping all other factors equal, there is a 0.666 unit increase in Technology Effectiveness for every unit increase in Student Engagement. Teacher Performance 0.440 and School Capacity 0.401 have similar meanings. As a result, all three of the presented hypotheses—H1, H2, and H3—are accepted, and none of them are denied. The evidence suggests that improved levels of student engagement, school capacity, and teacher performance significantly contribute to enhanced technology effectiveness in Indonesian secondary schools.

Discussion

In our structural model, the path coefficients specify the direction and strength of the relationships between the main constructs. Our hypotheses are empirically supported, in particular, by the positive and statistically significant coefficients of Teacher Performance, School Capacity, and Student Engagement on Technology Effectiveness. This discovery aligns with the Integrated Educational Technology Ecosystem theory, which posits that enhanced technology utilization in Indonesian secondary schools is positively influenced by increased levels of student engagement, school capacity, and teacher performance.

The correlation between Student Engagement and Technology Effectiveness, which is both positive and statistically significant, highlights the critical significance of student engagement in facilitating the effective integration of technology within secondary institutions in Indonesia. Consistent with the literature (Wang et al., 2018) that emphasizes the significance of student participation in order to maximize the benefits of educational technology, the findings of this study support this notion. Actively involved pupils are inclined to engage with digital materials, cooperate with their fellow students, and efficiently employ technology for educational purposes, thereby making a positive contribution to the efficacy of technology.

Likewise, the correlation between technology effectiveness and school capacity is underscored by the positive path coefficient, which indicates that institutional readiness significantly impacts the efficient application of technology. Educational

institutions that possess sufficient technological infrastructure, learning materials, and physical resources will foster an atmosphere that is favorable for the successful integration of technology (Ertmer, 1999). This discovery underscores the importance of making strategic investments in the capacity of educational institutions in order to maximize the advantages offered by educational technology.

The correlation between technology effectiveness and teacher performance indicates that educators have a significant impact on the outcomes of technology integration. An enormous amount of effort is invested in the overall efficacy of technology use by educators who employ constructive feedback, employ effective instructional strategies, and make use of technology to accommodate diverse learning styles (Ertmer, Ottenbreit-Leftwich, & Tondeur, 2015). By concentrating on enhancing the performance of teachers, professional development programs can be a pivotal lever in maximizing the impact of technology in secondary school classrooms.

By empirically validating the Integrated Educational Technology Ecosystem theory within the context of Indonesian secondary schools, our research makes a valuable contribution to the existing body of knowledge. An intricacy of the dynamics of technology integration can be discerned through the positive correlations that exist among student engagement, school capacity, instructor performance, and technology effectiveness. This not only corresponds with established theoretical frameworks but also broadens our comprehension of the interrelated functions performed by these variables.

a. Practical Implications

Educational policymakers and practitioners are profoundly affected by the practical ramifications of our findings. By promoting student engagement via interactive and participatory learning opportunities, allocating resources towards enhancing school infrastructure to facilitate greater capacity, and facilitating ongoing professional development for educators, the overall efficacy of technology in secondary schools can be reinforced. Given the interdependent nature of student engagement, technology effectiveness, school capacity, and teacher performance, our findings support the implementation of targeted interventions that address these variables holistically.

b. Limitations and Future Research

Although our research offers significant contributions, it is not devoid of constraints. Due to the cross-sectional design of this investigation, it is not possible to establish cause-and-effect relationships. It is recommended that future investigations employ a longitudinal design in order to delve into the temporal dynamics of the relationships that have been identified. Moreover, it is prudent to exercise caution when extrapolating our findings to different contexts, as our research was limited to a particular regional area. Additional research is advised to delve into the contextual elements that exert an influence on the model, as well as the enduring consequences of technology integration, in order to attain a more comprehensive comprehension.

CONCLUSION

In summary, this research investigated the multifaceted aspects of technology integration in secondary schools in Indonesia, with a particular emphasis on the significant contributions made by instructor performance, school capacity, and student engagement. The selected indicators' dependability and validity were validated by the robust measurement model, which laid the groundwork for subsequent structural

analysis. The significance and positivity of the path coefficients emphasize the criticality of enhancing teacher performance, increasing school capacity, and promoting student engagement in order to facilitate successful technology integration. The results of this study make a valuable contribution to the expanding domain of educational technology research by providing educators and policymakers with actionable advice on how to maximize the effectiveness of technology in secondary schools. With Indonesia increasingly transitioning to a digital education era, this study proposes a comprehensive strategy that underscores the interdependence of the education technology ecosystem. The research not only contributes to the advancement of theoretical knowledge but also furnishes stakeholders with practical suggestions for establishing a setting that is favorable for learning experiences augmented by technology. The appeal to utilize technology to bring about educational change aligns with the wider international dialogue concerning the future of learning, which underscores the importance of employing strategies grounded in empirical evidence to navigate the constantly changing realm of digital pedagogy.

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