

Volume 10 Nomor 4, November 2025, 929-944

PERCEIVED EASE OF USE AS AN INTERVENING FACTOR IN STUDENTS' PERCEPTIONS OF LEARNING OUTCOMES WHEN COMPLETING ASSIGNMENTS VIA AN AI CHATBOT

Rahmawati Erma Standsyah^{1*}, Raden Sulaiman², Dwi Nur Yunianti³, Farhan Halim Sentosa⁴, Nabila Agatha Parsa⁵

^{1,2,3,4,5} Department of Mathematics, Faculty of Mathematics and Natural Sciences, Universitas Negeri Surabaya, Indonesia

*Corresponding author: rahmawatistandsyah@unesa.ac.id

ABSTRACT

The use of AI-based technologies is increasingly widespread among students, particularly to facilitate assignments and understanding of course materials. Inappropriate use by students can have a negative impact on the future of the country. The objective of this research is therefore to examine the extent to which personal and environmental factors influence students' perceptions of learning outcomes when completing homework, considering the perceived ease of use of Chatbot AI as an intervening construct. In accordance with the TAM and UTAUT frameworks, perceived ease of use acts as an intervening variable that links the influence of personal and environmental factors on learning outcomes. A quantitative methodology, based on SEM-PLS, was used, involving 154 students from SMA/SMK in Surabaya and the surrounding areas. Based on gender, female respondents were 77.9% and male respondents were 22.1%. The validity and reliability of the research instrument were tested. The direct relationship between personal and environmental factors on students' perceived learning outcomes was found to be insignificant ($p = 0.277$). However, however, each factor is individually significant but the mediating effect is weak and insignificant. This means that students' personal and environmental factors alone do not improve their perception of their learning outcomes, as they feel that the results of AI chatbots do not reflect their own understanding. They consider learning successful only when it involves personal effort. However, when these factors influence perceived ease of use, this ease of use becomes the determining factor in how students evaluate their learning process.

Keywords: AI Chatbot, Perception of Learning Outcomes, Perception of Fluency, Digital Literacy, Academic Ethics, SEM.

How to Cite: Standsyah, R. E., Sulaiman, R., Yunianti, D. N., Sentosa, F. H., & Parsa, N. A. (2025). Perceived Ease Of Use As An Intervening Factor In Students' Perceptions Of Learning Outcomes When Completing Assignments Via An AI Chatbot. *Mathline: Jurnal Matematika dan Pendidikan Matematika*, 10(4), 929-944. <http://doi.org/10.31943/mathline.v10i4.1043>

PRELIMINARY

The digital era changes the order of human life, where, with the existence of Artificial Intelligence technology, or abbreviated as AI, human interaction becomes not only with fellow humans but also with machines (Hong, 2025). The development of this technology has affected various aspects of life, including in the world of education. One of the most popular forms of AI application in education today is an AI-based chatbot or dialogue with an AI technology bot, which is an artificial intelligence software designed to have an intellectual dialogue or resemble human conversation, according to the commands

or information given (Erlina et al., 2023). Easy access, fast response, and the ability to answer various academic questions are the main reasons why this technology is quickly adopted in daily learning activities (Wori Hana & Hamu Lie, 2024).

Based on a survey conducted by researchers, 93.5% of respondents stated that they had used an AI chatbot to do schoolwork. Likewise, the results showed that AI technology, especially ChatGPT and similar chatbots, has great potential to revolutionize the world of education through personalized learning, efficient access to information, and support for self-learning. However, its utilization must be accompanied by careful ethical and practical considerations, such as information accuracy, user responsibility, and data privacy (Adiguzel et al., 2023; Govender, 2024), but it is not entirely positive; unwise use can threaten students' critical thinking power (Hidayah et al., 2024). Critical thinking among high school students is becoming the foundation for their entry into university. A study by Reri Seprina Anggraini et al. (2025) (Anggraini et al., 2025) shows that critical thinking among today's students is still weak, or even moderate, for the majority of them. Many factors can affect student learning outcomes in the current era, especially, students tend to employ AI chatbots for assignments that are difficult to control by schools or parents.

Several previous studies have discussed the use of AI chatbots in education, for example, utilizing AI chatbots in the learning process (De Silva et al., 2023; Hoang et al., 2023; Stefano L, 2021), or analyzing their impact in the long term (Essel et al., 2022; Han, 2020). Many lecturers in Indonesia also do community service to schools to provide training and insight into the wise use of AI chatbots (Afrita, 2023; Alkhairi et al., 2024; Hidayat et al., 2024; Razali et al., 2023; Sahren et al., 2023). Many learning models with AI Chatbot have also been studied by researchers (Berse et al., 2024; Kleine et al., 2025; Setyaningrum et al., 2023).

The success of student learning at the high school/vocational school level is an important matter to study because this school period is the basic capital for the formation of superior human resources. Students' perception of learning outcomes, namely their views, assessments, or beliefs about learning achievements, especially in completing assignments, can be influenced by students' personal factors, such as digital literacy, attitudes in verifying answers, and understanding of academic ethics, or environmental factors such as school regulations regarding the utilization of AI and the level of supervision from the school (Ramli, 2023). The perceived usability of AI Chatbots can also capable of shaping students' perceptions of their learning outcomes (Mohd Rahim et al., 2022) and can act as a link between personal and environmental factors on the perception

of student learning outcomes. If students feel that the AI chatbot is easy to use, efficient, and useful, then they may have a positive perception of their learning outcomes. This perception of learning outcomes includes how easily AI answers are understood, easy to remember, and how much the chatbot helps improve technology usage skills. Therefore, the problem addressed in this research is how personal and environmental factors influence the perception of learning outcomes through the perceived usability of AI chatbots.

This research adopts a quantitative approach, specifically using structural equation modeling (SEM) to test and analyze the relationships between variables. SEM is a multivariate statistical analysis technique, which is a structural equation modeling combining factor analysis and multiple regression analysis, so that it is able to analyze the structural relationships between measured variables and latent constructs (Bollen, 1989). Many studies have applied SEM to the problem of AI Chatbots (Al-Emran et al., 2024; Chi, 2024; Ebadi & Amini, 2024; Pillai et al., 2024; Saihi et al., 2024). Exogenous variables include personal and environmental factors. The intervening variable in this research is the perceived ease of use of an AI chatbot, while the endogenous variable is the perception of student learning outcomes. Data was obtained through the distribution of questionnaires to high school/ vocational school (SMK/SMK) students in the Surabaya area and its surroundings who have used AI chatbots in completing school assignments.

This study is intended to analyze the influence of students' internal factors and school environmental factors on the perception of learning outcomes in utilizing AI chatbots and exploring the role of their perceived ease of use as an intervening variable in the relationship between these factors on the perception of learning outcomes. The perceived ease of use variable is based on the Technology Acceptance Model (TAM) developed by Davis (1989) and the Unified Theory of Technology Acceptance and Use (UTAUT) proposed by Venkatesh et al. (2003). Both theories emphasize that perceived ease of use is a psychological mechanism explaining how personal and environmental factors can influence the perception of learning outcomes obtained through AI chatbots. The benefits of this research are expected to provide input for schools in designing adaptive, educational, and ethical technology policies. It is also hoped to become a reference for teachers and parents in guiding students to use AI chatbots responsibly and to support the achievement of optimal learning outcomes.

METHODS

This quantitative study, using a survey approach, seeks to develop a causal model connecting hidden factors associated with students' reliance on AI chatbots. The selection of SEM-PLS for this analysis is due to the exploratory aspect of the research, which means it is not required to meet the normality assumptions associated with covariance-based SEM

The study population comprises all senior high school (SMA/MA) students or equivalent in Surabaya and the surrounding areas. Questionnaires were distributed proportionally to students in various public and private high schools, as well as vocational schools in Surabaya, to ensure balanced participation from grades 10, 11, and 12. A total of 154 responses were collected. During data selection, 10 respondents who indicated they had never used an AI chatbot were excluded, as the study focused solely on students with prior experience using this type of technology. After this selection, the final dataset comprised 144 respondents. While this number is slightly lower than the initial target, it remains within the acceptable range for a SEM-PLS analysis, which typically requires 5 to 10 observations per indicator (Hair, J.F. et al., 2019).

The research instrument is a questionnaire consisting of fixed-response items using a five-point Likert-type scale ranging from 1 (Strongly Disagree) to 5 (Strongly Agree). The instrument assessed several constructs: Personal and Environmental Factors, Perceived Ease of Use, and Perceptions of Learning Outcomes. Each construct was operationalized into several indicators derived from relevant literature and previous empirical studies. All items are written in clear Indonesian and reviewed for face validity by 3 experts in education or mathematics.

A pilot test is conducted with approximately 28 respondents to identify language issues, scale completeness, and preliminary reliability. The validity test was performed using the Pearson product-moment correlation, where items with a p-value of correlation coefficient greater than 0.05 were considered valid. The reliability test employed Cronbach's Alpha, with coefficients above 0.60 indicating acceptable reliability.

Data collection procedures include finalizing the questionnaire based on pilot results and expert feedback. Each construct was operationalized through a set of questionnaire items that correspond to its theoretical indicators. Specifically, the Personal and Environmental Factors (X1–X5) were represented by five items. The Perceived Ease of Use (Z1–Z3) construct was measured through three items. Meanwhile, the Perceptions of Learning Outcomes (Y1–Y3) were captured through three items. This mapping ensures that each latent variable is directly and consistently reflected by its corresponding

questionnaire items. Participants will receive a brief consent form describing the purpose of the study, guaranteeing data confidentiality, and confirming the right to unsubscribe from the research at any time.

Data analysis is performed using SEM-PLS software (e.g., SmartPLS or the PLS package in R). The SEM-PLS method was chosen because this research is predictive and involves latent variables, a relatively new concept in chatbot AI. The PLS-SEM method is more flexible with small sample sizes and does not require assumptions of multivariate normality. As for the next step, here are the steps to follow: (1) data preparation, including handling missing values and outliers; (2) evaluation of the outer (measurement) model to assess loadings, AVE, and reliability. The reliability and validity criteria used were: factor loading > 0.5 , AVE > 0.5 , and CR > 0.7 . The test results are presented in the "Results" section. (3) evaluation of the inner (structural) model to estimate path coefficients and R^2 values; (4) significance testing using bootstrapping with 5,000 resamples to obtain t-statistics and p-values; and (5) testing for mediating (indirect) effects of intervening variables such as satisfaction, learning outcomes, and learning experience.

Ethical considerations include the provision of informed consent, anonymization of respondent data, and use of data solely for research purposes. Study limitations to be acknowledged are the cross-sectional nature of the survey, which constrains long-term causal inference, and potential self-report bias; mitigation measures include neutral item wording, assurance of anonymity, and checks for response consistency.

RESULT AND DISCUSSION

This research uses primary data obtained through questionnaires filled out by high school equivalent students in the city of Surabaya and its surrounding areas. The data for this study were collected through the distribution of questionnaires to respondents, conducted both in person and online, with the questionnaire containing question items that represent each research variable. The data were collected in two separate stages; the first data collection was used for testing the validity and reliability of the questionnaire, and then the second data collection for the processed data. The questionnaire used in this research went through a validity and reliability testing process before being used for data collection. All statement items were declared valid based on the analysis results, and each of the constructs X, Z, and Y has a Cronbach's Alpha value above 0.761, 0.828, and 0.905, which indicates a good level of reliability. This means that the instrument used is feasible and consistent for measuring the variables in this research.

The variables used in this research consist of the exogenous latent constructs representing personal and environmental factors, the endogenous latent variable of perception of learning outcomes, and the intervening latent variable of perceived ease of use, each accompanied by indicators. The breakdown of each variable and its indicators can be seen in Table 1.

Table 1. Operational Definition of Variables

Variables	Definition of Variables	Indicator
Personal and Environmental Factors	Everything within the student and the surrounding environment that affects the use of AI Chatbot in learning (Saihi et al., 2024, 2025).	X1: Answer Verification Behavior X2: Digital Academic Ethics X3: Digital Literacy X4: Regulation X5: School Supervision
Perceived Ease Of Use	The extent to which students feel that the use of an AI Chatbot does not require special effort or skills, as well as the acceleration and ease in completing tasks (Saihi et al., 2024, 2025).	Z1: The AI Chatbot is easy to use without requiring special training. Z2: The AI Chatbot makes completing tasks faster. Z3: The AI Chatbot helps in completing school assignments.
Perceptions Of Learning Outcomes	The extent to which students acquire understanding, knowledge, skills, and academic values after using an AI Chatbot to complete tasks (Saihi et al., 2024, 2025).	Y1: The explanations from the AI Chatbot are easy to understand. Y2: It is easy to remember the explanations from the AI Chatbot, even after several days. Y3: AI Chatbot encourages being more proficient in using technology.

The study is based on the hypothesis that internal and external factors exert a significant and favorable impact, both directly and indirectly, on students' perception of learning outcomes when completing their homework using AI chatbots, through the perceived ease of use of AI chatbots. The conceptual framework of this research is presented in Figure 1.

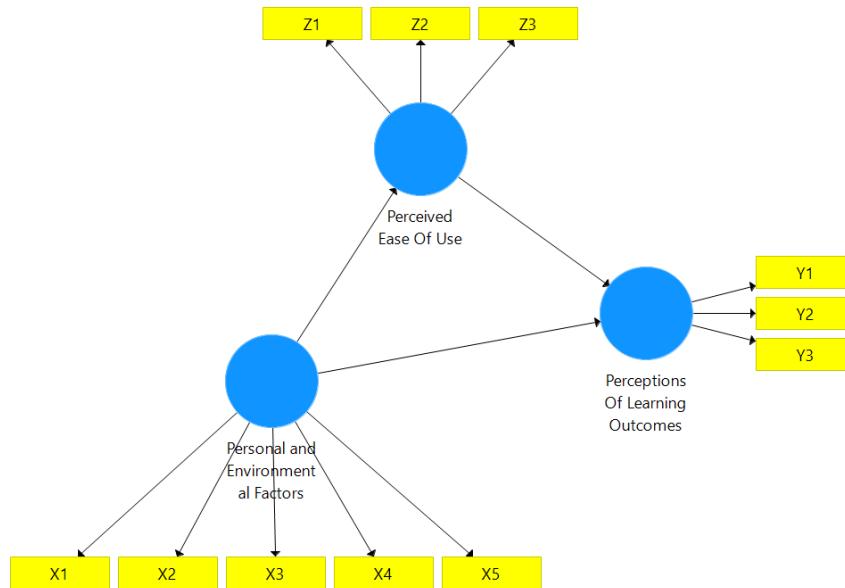


Figure 1. Preliminary SEM-PLS Model for Perceptions Of Learning Outcomes Using AI Chatbot

The method used in this research is the Partial Least Squares-based Structural Equation Modeling (SEM-PLS) method. The research steps are as follows (Tenenhaus & Esposito, 2005)

1. Outer Model Evaluation

This step aims to evaluate the validity and reliability of the indicators in reflecting the measured latent variables. The assessment is conducted through:

- Indicator reliability by examining the loading factor value (≥ 0.40).
- The degree to which a construct is captured by its corresponding indicators is reflected in its composite reliability, where it is considered reliable if the value is above 0.6.
- Convergent validity is assessed using the average variance extracted (AVE ≥ 0.50), which indicates a higher correlation among the indicators that make up a construct.
- Discriminant validity, to ensure that the measured constructs are empirically distinct from one another.

2. Inner Model Evaluation

After the outer model is declared valid and reliable, an evaluation of the structural model is conducted to see the strength of the correlations between latent variables. The indicator used is R-square (R^2), which measures the proportion of the dependent variable's variance explained by the independent variables.

3. Hypothesis Testing

Hypothesis testing is performed using the bootstrapping method, which is a resampling technique to test the significance of the dependencies among variables represented in the model. The test results are indicated by the p-value; if it is less than 0.05, then H_0 fails to be accepted, which means the hypothesis is supported.

Description Of Data

Description of respondents is an overview of the characteristics of respondents who have participated in filling out the questionnaire. A total of 154 students participated in this research, who came from SMA/SMK in Surabaya and the surrounding areas. Based on gender, female respondents were 120 students or equivalent to 77.9% of the total, while male respondents were only 34 students or equivalent to 22.1%. This imbalance shows that participation in filling out the questionnaire by female students is higher than male students. In addition, the respondents were also distributed in various grade levels, for class X as many as 44 students, class XI as many as 50 students, and class XII, as many as 60 students.

A total of 144 students, or around 93.5% of students, answered that they had used an AI chatbot in doing assignments, while the remaining 10 people had never used an AI chatbot in doing assignments, so the data modeled by SEM-PLS was 144. The mapping of the calculation of the number of respondents based on the perceived ease of use score in the relationship between personal and environmental factors with students' perceptions of learning outcomes when completing assignments through Chatbot AI, grouped by high school and vocational education levels, is explained in Figure 2 with representatives of each latent variable.

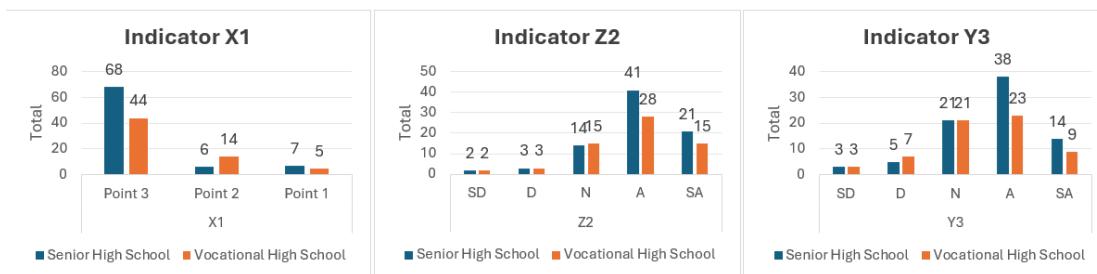


Figure 2. Mapping The Calculation Of The Number Of Respondent Response Indicators

SEM-PLS Modeling

Outer Model Evaluation

At the initial stage, the loading factor values of all indicators were analyzed. Based on Figure 3, it is shown that some indicators have a loading factor value of $\lambda \leq 0.4$ so they must be eliminated or excluded from the model in order to meet the convergent validity requirements.

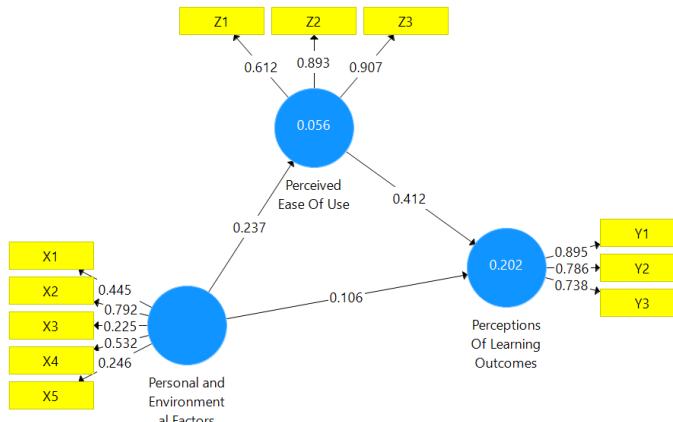


Figure 3. The first analysis of the reliability indicator by the value of the loading factor. The value on each arrow indicates the loading factor of each indicator on its construct.

Indicator reliability analysis was carried out again after the disposal of the indicators. In this second result, according to Figure 4, all indicators have a loading factor of $\lambda > 0.5$, most of them are even above 0.7, which means that the indicators are valid to measure their respective constructs.

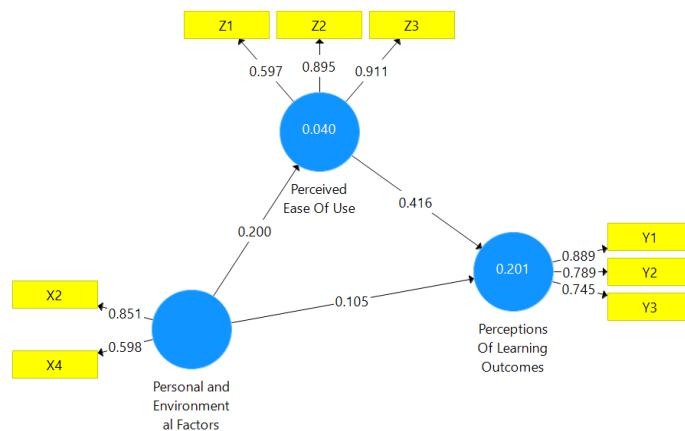


Figure 4. The second analysis of the reliability indicator by the value of the loading factor. The value on each arrow indicates the loading factor of each indicator on its construct.

These results are supported by the AVE (Average Variance Extracted) value, which meets the requirements, although for the Personal and Environmental Factors construct, and is still below the ideal threshold of 0.5. This indicates that this variable is less able to

adequately explain the variance of its indicators, although composite reliability is still acceptable.

TABLE 2. Construct Reliability and Validity

Variable	Composite Reliability	Average (AVE)	Variance	Extracted
Perceived Ease Of Use	0.851		0.663	
Perceptions Of Learning Outcomes	0.851		0.656	
Personal and Environmental Factors	0.696		0.541	

This states that the indicators measuring personal and environmental factors, namely the attitude of digital academic ethics, where students edit or adjust answers from AI Chatbots so that they do not look like direct copy results and school regulations regarding the use of AI Chatbots. In contrast to the Perceived Ease of Use variable and the perceived learning outcomes variable, all indicators measure their variables well.

Inner Model Evaluation

The structural model was evaluated using the coefficient of determination (R^2). The R^2 values for the variables "Perceived Ease of Use" and "Perceived Learning Outcomes" were relatively low, at 0.040 and 0.201, respectively. This indicates that the model's ability to explain variations in perceived learning outcomes remains limited. This is likely due to the omission of several important constructs that could influence student learning outcomes, such as motivation and attitudes toward AI use. Therefore, it is recommended that future research consider adding these constructs to strengthen the model's explanatory power regarding perceived learning outcomes.

Hypothesis Testing (Bootstrapping)

Hypothesis testing is done through the bootstrapping method, and the results:

Table 3. Bootstrapping Results

Influence Pathway	Original Sample (O)	P-Values	Significant ?
Perceived Ease of Use → Perceptions of Learning Outcomes	0.416	0.000	Yes
Personal and Environmental Factors → Perceived Ease of Use	0.200	0.025	Yes
Personal and Environmental Factors → Perceptions of Learning Outcomes	0.105	0.277	No
Indirect Effects: Personal and Environmental Factors → Perceptions of Learning Outcomes	0.083	0.062	No

X2 <- Personal and Environmental Factors	0.851	0.001	Yes
X4 <- Personal and Environmental Factors	0.598	0.069	No
Y1 <- Perceptions Of Learning Outcomes	0.889	0.000	Yes
Y2 <- Perceptions Of Learning Outcomes	0.789	0.000	Yes
Y3 <- Perceptions Of Learning Outcomes	0.745	0.000	Yes
Z1 <- Perceived Ease Of Use	0.597	0.000	Yes
Z2 <- Perceived Ease Of Use	0.895	0.000	Yes

Discussion

The direct relationship between personal and environmental factors on students' perceived learning outcomes was found to be insignificant ($p = 0.277$), meaning that neither students' personal background nor school environment directly influenced how students assessed learning outcomes when using the AI chatbot for assignments. The path between personal and environmental factors and perceived ease of use, as well as between perceived ease of use and perceived learning outcomes, was individually significant; however, the specific indirect effect of personal and environmental factors on perceived learning outcomes, via perceived ease of use, was not statistically significant. This result indicates that perceived ease of use does not play a mediating role in this relationship. In other words, when students feel their background is supportive and they also find the AI chatbot easy to use, then they are likely to rate their learning outcomes more positively.

This means that students' personal factors and a supportive school environment cannot improve their perceptions of learning outcomes. This is possible because students feel that the results of the AI chatbot do not show their own thinking ability or understanding. Students perceive the learning process as successful if there is personal involvement and effort during the task (Fredricks et al., 2004; Zimmerman, 2002). But when these personal and environmental factors influence perceived ease of use, then the ease of use of this technology becomes a major factor in shaping students' assessment of their learning process. Students find the AI chatbot easy to use, and then the perception of student learning outcomes increases, although it does not necessarily reflect a deep understanding of the material.

These results indicate that, although perceived ease of use is a key variable in the TAM and UTAUT models, where it is considered a primary predictor of users' attitudes, intentions, and evaluations of technology, its role in this research model does not produce a significant mediating effect. This suggests the need to incorporate other variables to strengthen the mediating relationship. The literature on technology acceptance shows that variables such as perceived usefulness, motivation to learn, engagement, and attitudes toward technology often play an important mediating role in explaining how individual and

environmental characteristics can influence perceived learning outcomes. In the absence of these variables, perceived ease of use appears to be too weak a psychological effect to explain this relationship.

This study's outcomes are something that needs to be critically examined, where the perceived ease of use of AI chatbots significantly improves the perception of learning outcomes of high school / vocational high school students in Surabaya and surrounding areas in doing school assignments. On the one hand, this shows that technology is able to provide a sense of comfort and confidence in completing tasks. But on the other hand, there is a potential danger when this convenience is interpreted as a measure of learning success. If the perception of learning outcomes is only based on technical convenience, without going through a process of critical thinking, analysis, and deep understanding, then what is formed is not quality learning, but the formality of academic achievement. Students become complacent and forget that learning outcomes in doing schoolwork require personal effort and thought, not because they successfully complete tasks with the help of an AI chatbot. This reliance on convenience, if not addressed early on, can have a negative impact on student academics. Therefore, the results of this study can serve as a warning to educators and school policy makers at the SMA / SMK level in Surabaya and surrounding areas to not only encourage students to adapt to technology, but also need to ensure that its use is directed to strengthen the learning process, not replace it.

CONCLUSION

Based on the results of data processing using SmartPLS Version 3, it was found that personal and environmental factors have a significant influence on the perception of ease of use, but the mediating effect of these concepts on the perception of learning outcomes of secondary/vocational school students in Surabaya and its surroundings is weak and insignificant. **The theoretical contribution** of these results lies in confirming that perceived ease of use, while an important variable in the TAM and UTAUT models, does not systematically mediate the relationship between individual characteristics, the learning context, and the assessment of learning outcomes when using AI-based technologies. **In practical terms**, simply providing user-friendly technology is insufficient to improve students' perceptions of learning outcomes; teachers and schools must ensure that the use of AI chatbots is accompanied by pedagogical strategies that promote conceptual understanding, self-regulation, and active engagement. **Future research** should explore other concepts such as perceived usefulness, learning motivation, engagement, and

attitudes toward technology, and consider longitudinal studies or mixed-methods approaches to better understand how the use of AI chatbots influences students' learning processes and their perceptions of learning outcomes.

While the results of this study offer theoretical and practical contributions, they have several limitations that warrant highlighting. The variables used remain restricted, and the approach is exclusively quantitative, which does not allow for a full description of all influencing factors or an in-depth exploration of the significance and empirical context. Therefore, further research is recommended to incorporate other relevant latent variables, increase the size and diversity of the samples, and combine quantitative and qualitative approaches to achieve a more comprehensive and contextualized analysis.

ACKNOWLEDGMENTS

This article is part of the results of research funded through the Policy Grant Program of the Faculty of Mathematics and Natural Sciences, Surabaya State University. The authors would like to express their deepest gratitude to FMIPA UNESA for the financial support and academic facilities that have been provided during this research process.

REFERENCES

Adiguzel, T., Kaya, M. H., & Cansu, F. K. (2023). Revolutionizing education with AI: Exploring the transformative potential of ChatGPT. *Contemporary Educational Technology*, 15(3). <https://doi.org/10.30935/cedtech/13152>

Afrita, J. (2023). Peran Artificial Intelligence dalam Meningkatkan Efisiensi dan Efektifitas Sistem Pendidikan. *COMSERVA : Jurnal Penelitian Dan Pengabdian Masyarakat*, 2(12), 3181–3187. <https://doi.org/10.59141/comserva.v2i12.731>

Al-Emran, M., Alqudah, A. A., Abbasi, G. A., Al-Sharafi, M. A., & Iranmanesh, M. (2024). Determinants of Using AI-Based Chatbots for Knowledge Sharing: Evidence From PLS-SEM and Fuzzy Sets (fsQCA). *IEEE Transactions on Engineering Management*, 71, 4985–4999. <https://doi.org/10.1109/TEM.2023.3237789>

Alkhairi, P., Perdana Windarto, A., Wanto, A., Tunas Bangsa, S., Studi Sistem Informasi, P., Utara, S., kunci, K., Buatan, K., Digital, L., & Siswa, K. (2024). Sosialisasi Pemanfaatan Tool AI dalam Literasi Digital Untuk Pengembangan Kompetensi Siswa. *Jurnal Warta Pengabdian Masyarakat Nusantara (JW-Abdinus)*, 2(1), 10–17.

Anggraini, R. S., Gunawan, R. G., & Rizki, H. (2025). Evaluation Of Students' Critical Thinking Ability In Solving Real Analysis Problems. *Mathline : Jurnal Matematika Dan Pendidikan Matematika*, 10(3), 689–702. <https://doi.org/10.31943/mathline.v10i3.852>

Berşe, S., Akça, K., Dirgar, E., & Kaplan Serin, E. (2024). The Role and Potential Contributions of the Artificial Intelligence Language Model ChatGPT. *Annals of Biomedical Engineering*, 52(2), 130–133. <https://doi.org/10.1007/s10439-023-03296-w>

Bollen, K. A. (1989). *Structural Equations with Latent Variables*. John Wiley & Sons, Inc.

Chi, N. T. K. (2024). The Effect of AI Chatbots on Pro-environment Attitude and Willingness to Pay for Environment Protection. *SAGE Open*, 14(1).

<https://doi.org/10.1177/21582440231226001>

De Silva, D., Mills, N., El-Ayoubi, M., Manic, M., & Alahakoon, D. (2023). ChatGPT and Generative AI Guidelines for Addressing Academic Integrity and Augmenting Pre-Existing Chatbots. *Proceedings of the IEEE International Conference on Industrial Technology, 2023-April*, 1–6. <https://doi.org/10.1109/ICIT58465.2023.10143123>

Ebadi, S., & Amini, A. (2024). Examining the roles of social presence and human-likeness on Iranian EFL learners' motivation using artificial intelligence technology: a case of CSIEC chatbot. *Interactive Learning Environments*, 32(2), 655–673. <https://doi.org/10.1080/10494820.2022.2096638>

Erlina, Juliyanto, Rusandi, J., Alexander, Francisco, L., Ma'muriyah, N., & Sabariman. (2023). Penerapan Artificial Intelligence pada Aplikasi Chatbot sebagai Sistem Pelayanan dan Informasi Online pada Sekolah. *Journal of Information System and Technology*, 04(03), 421–430.

Essel, H. B., Vlachopoulos, D., Tachie-Menson, A., Johnson, E. E., & Baah, P. K. (2022). The impact of a virtual teaching assistant (chatbot) on students' learning in Ghanaian higher education. In *International Journal of Educational Technology in Higher Education* (Vol. 19, Issue 1). Springer. <https://doi.org/10.1186/s41239-022-00362-6>

Fredricks, J. A., Blumenfeld, P. C., & Paris, A. H. (2004). School engagement: Potential of the concept, state of the evidence. In *Review of Educational Research* (Vol. 74, Issue 1, pp. 59–109). American Educational Research Association. <https://doi.org/10.3102/00346543074001059>

Govender, R. G. (2024). My AI students: Evaluating the proficiency of three AI chatbots in completeness and accuracy. *Contemporary Educational Technology*, 16(2). <https://doi.org/10.30935/cedtech/14564>

Hair, J.F., Black, W.C., Babin, B.J., & Anderson, R. E. (2019). Multivariate Data Analysis (Eighth Edition). In *Gedrag & Organisatie* (Vol. 19, Issue 3). Annabel Ainscow. <https://doi.org/10.5117/2006.019.003.007>

Han, D.-E. (2020). The Effects of Voice-based AI Chatbots on Korean EFL Middle School Students' Speaking Competence and Affective Domains. *Asia-Pacific Journal of Convergent Research Interchange*, 6(7), 71–80. <https://doi.org/10.47116/apjcri.2020.07.07>

Hidayah, N., Firmansyah, L. H., Rochman, F. Y. A. R., & Satvikadewi, A. A. I. P. (2024). ChatGPT dan Ancaman terhadap Kemampuan Berpikir Kritis Mahasiswa (AWK Foucault pada Podcast GCED Isola Edu ChatGPT: Ini Respon Terbaik Dunia Pendidikan). *Filosofi : Publikasi Ilmu Komunikasi, Desain, Seni Budaya*, 1(3), 254–261.

Hidayat, R., Rahayu, W. P., Hari, M., & Martha, J. A. (2024). Pelatihan Pengembangan Media Pembelajaran Berbasis Artificial Intelligence Dalam Meningkatkan Kompetensi Profesional Guru Anggota MGMP Bisnis Daring Pemasaran Kabupaten Malang. *Jurnal Pengabdian Masyarakat Bhinneka*, 3(2), 44–48. <https://doi.org/10.58266/jpmb.v3i2.107>

Hoang, N. T., Ngoc Han, D., & Le, D. H. (2023). Exploring Chatbot AI in improving vocational students' English pronunciation. *AsiaCALL Online Journal*, 14(2), 140–155. <https://doi.org/10.54855/acoj.231429>

Hong, S. J. (2025). What drives AI-based risk information-seeking intent? Insufficiency of risk information versus (Un)certainty of AI chatbots. *Computers in Human Behavior*, 162. <https://doi.org/10.1016/j.chb.2024.108460>

Kleine, A.-K., Schaffernak, I., & Lermer, E. (2025). Exploring predictors of AI chatbot usage intensity among students: Within- and between-person relationships based on the technology acceptance model. In *Computers in Human Behavior: Artificial*

Humans (Vol. 3, p. 100113). Elsevier. <https://doi.org/10.1016/j.chbah.2024.100113>

Mohd Rahim, N. I., A. Iahad, N., Yusof, A. F., & A. Al-Sharafi, M. (2022). AI-Based Chatbots Adoption Model for Higher-Education Institutions: A Hybrid PLS-SEM-Neural Network Modelling Approach. *Sustainability (Switzerland)*, 14(19). <https://doi.org/10.3390/su141912726>

Pillai, R., Ghangorkar, Y., Sivathanu, B., Algharabat, R., & Rana, N. P. (2024). Adoption of artificial intelligence (AI) based employee experience (EEX) chatbots. In *Information Technology and People* (Vol. 37, Issue 1, pp. 449–478). emerald.com. <https://doi.org/10.1108/ITP-04-2022-0287>

Ramli, M. (2023). Mengeksplorasi Tantangan Etika Dalam Penggunaan Chat GPT Sebagai Alat Bantu Penulisan Ilmiah: Pendekatan Terhadap Integritas Akademik. *TA 'DIBAN: Journal of Islamic Education*, 4(1), 1–10. <https://doi.org/10.61456/tjie.v4i1.129>

Razali, Armia, & Harun, M. (2023). Gerakan Literasi Sekolah : Sebuah Pengabdian Dosen dan Mahasiswa di SMP Negeri 2 Peukan Bada, Kabupaten Aceh Besar. *Kawanad : Jurnal Pengabdian Kepada Masyarakat*, 2(2), 128–133. <https://doi.org/10.56347/kjpkm.v2i2.160>

Sahren, S., Ruri Ashari Dalimunthe, Afrisawati, A., & Muhammad Wahi Butar-Butar. (2023). Pelatihan Penerapan Pembelajaran Berbasis Artificial Intelligence Di UPT SD Negeri 04 Sei Muka. *Journal Of Indonesian Social Society (JISS)*, 1(3), 132–139. <https://doi.org/10.59435/jiss.v1i3.205>

Saihi, A., Ben-Daya, M., & Hariga, M. (2025). The moderating role of technology proficiency and academic discipline in AI-chatbot adoption within higher education: Insights from a PLS-SEM analysis. *Education and Information Technologies*, 30(5), 5843–5881. <https://doi.org/10.1007/s10639-024-13023-0>

Saihi, A., Ben-Daya, M., Hariga, M., & As'ad, R. (2024). A Structural equation modeling analysis of generative AI chatbots adoption among students and educators in higher education. *Computers and Education: Artificial Intelligence*, 7, 100274. <https://doi.org/10.1016/J.CAEAI.2024.100274>

Setyaningrum, V., Erlina, E., & Thongsan, N. C. (2023). Developing a chatbot in quantities, denomination, and measurement: an artificial intelligence-based teaching materials. *Thabiea : Journal of Natural Science Teaching*, 6(2), 132. <https://doi.org/10.21043/thabiea.v6i2.23487>

Stefano L, H. (2021). 'Future Classroom', in *A Great Model for Future Learning*. books.google.com.

Tenenhaus, M., & Esposito, V. (2005). PLS path modeling. *Computational Statistics & Data Analysis*, 48, 159–205.

Wori Hana, A., & Hamu Lie, N. (2024). Artificial Intelligence Sebagai Mitra Pengajaran. *CONSCIENTIA: Jurnal Teologi Kristen*. <https://doi.org/10.60157/conscientia.v3i1.48>

Zimmerman, B. J. (2002). Becoming a self-regulated learner: An overview. In *Theory into Practice* (Vol. 41, Issue 2, pp. 64–70). https://doi.org/10.1207/s15430421tip4102_2

