Educenter : Jurnal Ilmiah Pendidikan
Vol 4 No 1 2025
ISSN: 2827-8542 (Print) ISSN: 2827-7988 (Electronic)
Open Access: https://jurnal.arkainstitute.co.id/index.php/educenter/index

Development of an artificial intelligence based fine arts learning management system using the borg & gall model to enhance learning effectiveness

Hendra[1*], Zaitun[2], Dody Irawan[3], Abdul Malik[4], Tety Kumalasari [5]
[1,2,3,4,5] Raja Ali Haji Maritime University, Tanjungpinang 29411, Indonesia
[1]hndratua@gmail.com*, [2]zaitun@umrah.ac.id, [3]dodyirawan@umrah.ac.id , [4]abdulmalik@umrah.ac.id , [5]teti@umrah.ac.id

Article Info

Article history:
Received October 2nd 2025
Revised November 20th 2025
Accepted December 28th 2025

Keyword:
Artificial Intelligence, Learning Management System, Fine Arts, Learning Analytics, Intelligent Chatbot, Adaptive Recommendations, Learning Effectiveness

ABSTRACT

This study aims to develop an artificial intelligence (AI)-based Learning Management System (LMS) specifically designed for two-dimensional art learning. This system integrates three main AI-based features, namely learning analytics (TrackBoot), intelligent tutoring chatbot (ArtBoot), and adaptive recommendation engine. The research used the Research and Development (R&D) method with the Borg & Gall model, which includes the stages of needs analysis, planning, development, expert validation, limited and main field trials, and final product revision. Data were collected through pre-tests and post-tests, validation sheets, practicality questionnaires, and LMS activity logs. The results showed a significant increase in student learning outcomes with an average *N-Gain* score of 0.78 (high category). The validity of the material and media increased from the "Less Valid" category to "Very Valid," while the practicality level reached a score of 4.49 (very practical category). Regression analysis showed that interaction with ArtBoot had a significant effect on student learning outcomes ($p < 0.001$). These findings prove that AI integration through learning analytics, adaptive feedback, and personalized learning is effective in increasing student motivation, conceptual understanding, and learning independence. This research contributes to the development of adaptive, contextual AI-based digital learning innovations that are in line with the spirit of the Merdeka Curriculum.

INTRODUCTION

Art is a compulsory subject and plays a very crucial role. Art education helps develop students' creativity, critical thinking, and empathy. Furthermore, Awaliyatul et al. (2025) say that art is not only taught as a technical skill but also as a medium for developing students' creativity and imagination. The limitations of conventional learning methods, the scarcity of relevant contextual teaching materials, and the relatively limited duration of learning collectively hinder the development of students' creativity and have a negative impact on the results of arts and culture learning in Indonesia. Several empirical indicators show that around 60%–75% of students have low interest in learning arts and culture because learning is still centered on lecture methods without a variety of contextual teaching materials, so that only 10%–30% of students show active involvement in the arts and culture learning process before the application of innovative learning media or models such as digital applications or project-based learning methods. In the context of secondary schools, classroom action research shows that around 60% of students have a low interest in participating in arts and culture learning before the intervention of digital media, with only 10% of students having good learning engagement, indicating an urgent need for more effective and contextual teaching materials and learning strategies (Rais, 2022; Zidni, 2023).

This challenge points to the need for systemic transformation that integrates technology to address the needs of personalized learning, equitable access to learning resources, and the strengthening of attitudes in arts education, as stated by (Rahmat & Au, 2019), the integration of Information and Communication Technology (ICT) in Visual Arts Education (VAE) provides opportunities to transform and enrich this field of study. Puteri et al. (2025) further explain that the application of digital learning technology allows for broader and more flexible access to learning materials without space and time

`

limitations. This is in line with Wilfridus et al. (2025), who explain that the application of information technology allows the learning process to be more flexible, efficient, and adaptive to the individual needs of students, enabling students to access information outside the classroom, which can increase their motivation and engagement in the learning process. One of the technologies that can be used in learning is the Learning Management System (LMS). LMS is a software system that functions to design, deliver, and manage the online learning process in a structured manner (Khairi, 2024).

Conventional LMSs tend to be limited to content management and activity tracking functions without the adaptive capabilities to meet the individual needs of learners. In response, this study details the development of an independent Learning Management System (LMS) specifically designed to address these challenges through the integration of three core Artificial Intelligence (AI) features. According to Chen et al. (2020), artificial intelligence (AI) has great potential to transform the learning process and improve teaching effectiveness through data analysis capabilities, learning personalization, and continuous learning support. The practice of art education in schools still relies heavily on conventional approaches and general digital platforms. This condition has resulted in art education not being fully adaptive to the individual needs of students or local cultural characteristics. Therefore, a smart technology-based learning approach that can accommodate the uniqueness of art education is needed.

Previous studies have confirmed the potential of AI in education. For example, research by (Mayasari et al., 2023) shows a positive correlation between the use of AI technology and improved learning outcomes. Meanwhile, (Rahmadanti et al., 2023) has examined the integration of AI-LMS through a literature study. However, the gap filled by this study is practical implementation through a full R&D cycle. Research on digital-based Learning Management Systems (LMS) states that LMS contributes positively to learning efficiency and access to teaching materials (Luan et al., 2020). Another study found that the integration of AI in LMS, such as learning analytics and educational chatbots, can improve the monitoring of learning progress and provide more personalized academic support to students (Khairiniza & Rizki, 2025). Recent research also reports that AI-based adaptive learning systems can increase engagement and learning outcomes through material recommendations tailored to user needs (Kurniawan et al., 2024). However, most of these studies focus on general subjects and cognitive domains, with an emphasis on system efficiency rather than creativity development. The aspects of art learning that require visual exploration and creative expression are still relatively neglected.

In addition, recent studies reveal that most LMSs developed are generic and have not been specifically designed for the characteristics of arts learning (Luan et al., 2020). Educational chatbots used in LMS are generally cross-domain and rely on open knowledge bases, thus potentially presenting information that is less curated or not fully aligned with the curriculum (Saragih & Silalahi, 2024). These limitations indicate a research gap regarding the development of AI-based LMS that is contextual, academically controlled, and culturally relevant, especially in art education. Thus, there is a need for a learning system that is not only technologically intelligent but also sensitive to pedagogical and cultural contexts.

This research offers novelty by developing an integrated, multi-feature AI-based fine arts learning management system that goes beyond existing generic LMS approaches. This system integrates AI-based learning analytics to monitor student progress, a smart learning guidance chatbot designed specifically for the fine arts domain, and an adaptive recommendation engine that suggests learning materials based on student learning data. The uniqueness of this research lies in the chatbot design that fosters contextual learning through interactions based on local wisdom, namely the use of Malay rhymes as an opening to the learning dialogue. In addition, the system's knowledge base is strictly limited to the fine arts curriculum, thereby ensuring the validity of the material and minimizing the risk of disinformation or misinformation.

Based on the background, previous research findings, and identified gaps, this study aims to develop, validate, and test the effectiveness of an adaptive and culturally relevant artificial intelligence-based fine arts learning management system. The developed system is expected to increase student engagement, creativity, and learning outcomes through personalized and contextual learning. In

`

addition to providing practical contributions to the development of AI-based LMS for art education, this research is also expected to enrich theoretical studies related to the integration of AI, art pedagogy, and local wisdom in digital learning.

RESEARCH METHODS

This study uses the Research and Development (R&D) method by adapting the Borg and Gall model, which has been widely used in educational product development (Laugi, 2018). This model is selectively applied through the stages of needs analysis, planning, prototype development, limited testing, extensive testing, and product revision until a final product that is suitable for use is obtained. The standard *Borg and Gall* procedure was referenced from previous literature, so this study only describes contextual adjustments. The research focused on the development of an artificial intelligence-based *Learning Management System* (LMS) for two-dimensional art learning at the secondary school level.

The research population consisted of all 10th grade students at SMAN 1 Bintan Pesisir, with a research sample of 40 students selected purposively for the main field test and 10 students for limited testing. Product validation involved two experts, namely a fine arts expert and a learning media expert. The system development included the integration of AI-based learning analytics features (TrackBoot) and an AI-based chatbot tutor specifically for the domain of fine arts (ArtBoot). The novelty of the method lies in the limitation of the AI knowledge base to the fine arts curriculum and the integration of the local cultural context through interactions based on Malay pantun (poetry), which is not described in detail in conventional LMS procedures.

Product testing was conducted in two stages, namely preliminary field testing and main field testing. In the main field testing stage, students participated in a complete learning cycle that included a pre-test, learning activities using the LMS, interactive quizzes, art practice assignments, and a post-test. The learning design in the LMS refers to Gagné's *Nine Events of Instruction*, which has been tested theoretically and empirically in previous studies (Isnaini et al., 2021). Therefore, the implementation of this model is not described in depth procedurally but focuses on its integration into an AI-based system.

Data collection used a mixed-method approach, including expert validation sheets, practicality questionnaires, learning outcome tests (pre-test and post-test), observation sheets, and LMS usage logs. Validation and practicality data were analyzed descriptively using percentages and frequencies. Learning effectiveness was analyzed using N-Gain values to measure improvements in student learning outcomes. In addition, student engagement data recorded on *TrackBoot* was analyzed using multiple linear regression to determine the effect of learning duration and interaction intensity on post-test scores.

RESULTS AND DISCUSSION

RESULT

Learning Management System (LMS) Features

The initial prototype of the LMS developed has three main features that are integrated and support the adaptive learning process of fine arts. The main LMS dashboard serves as a navigation center that makes it easy for students to access all learning features, including teaching materials, the ArtBoot tutor chatbot, and the TrackBoot analytics dashboard. The ArtBoot feature is designed as an artificial intelligence-based chatbot tutor that provides conceptual guidance, learning directions, and motivation to students through a contextual approach based on Malay rhymes. Meanwhile, TrackBoot acts as a learning analytics dashboard that presents information about student learning progress, learning activity duration, quiz scores, and adaptive learning recommendations based on user interaction data. These three features are visualized in the system interface to provide an overview of the usage flow and functional integration between LMS components.

`

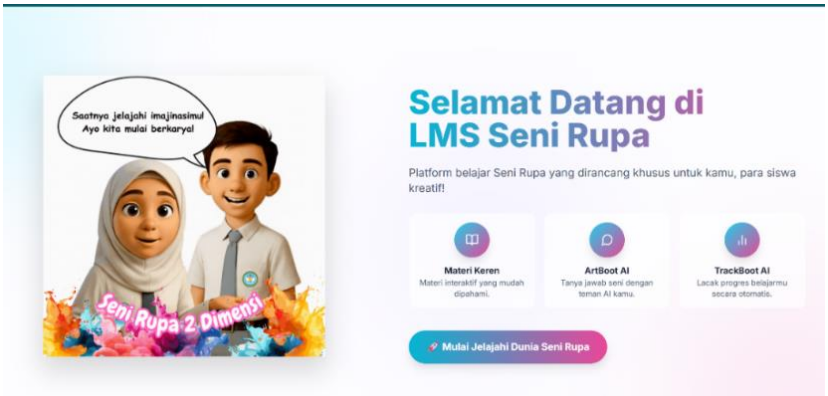

Figure 1. Home Dashboard

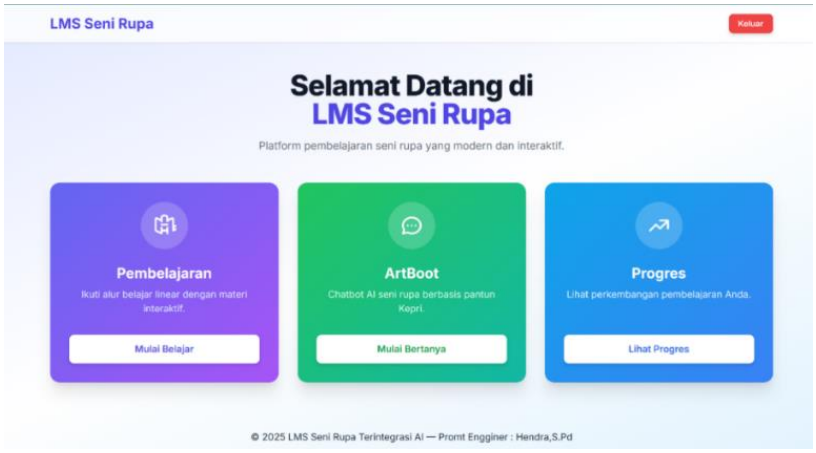

Figure 2. Student Dashboard

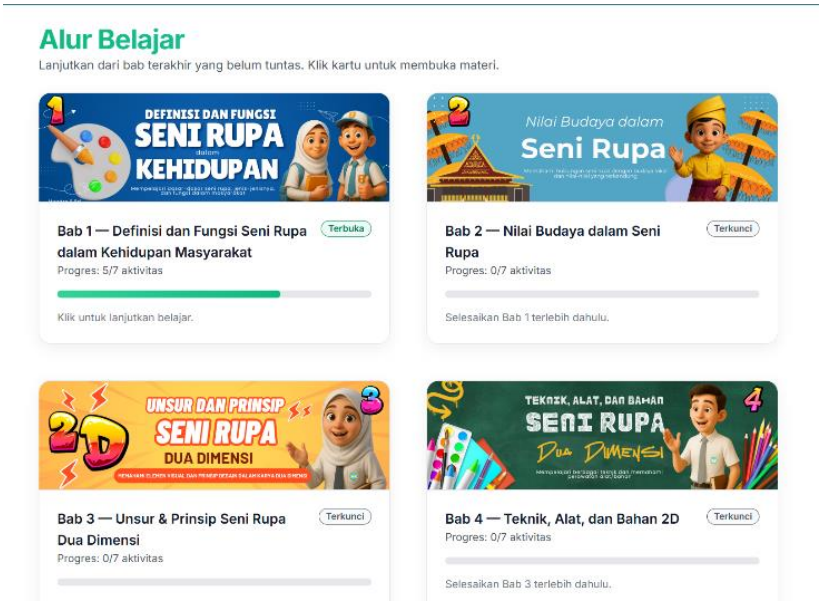

Figure 3. Learning Progress Dashboard

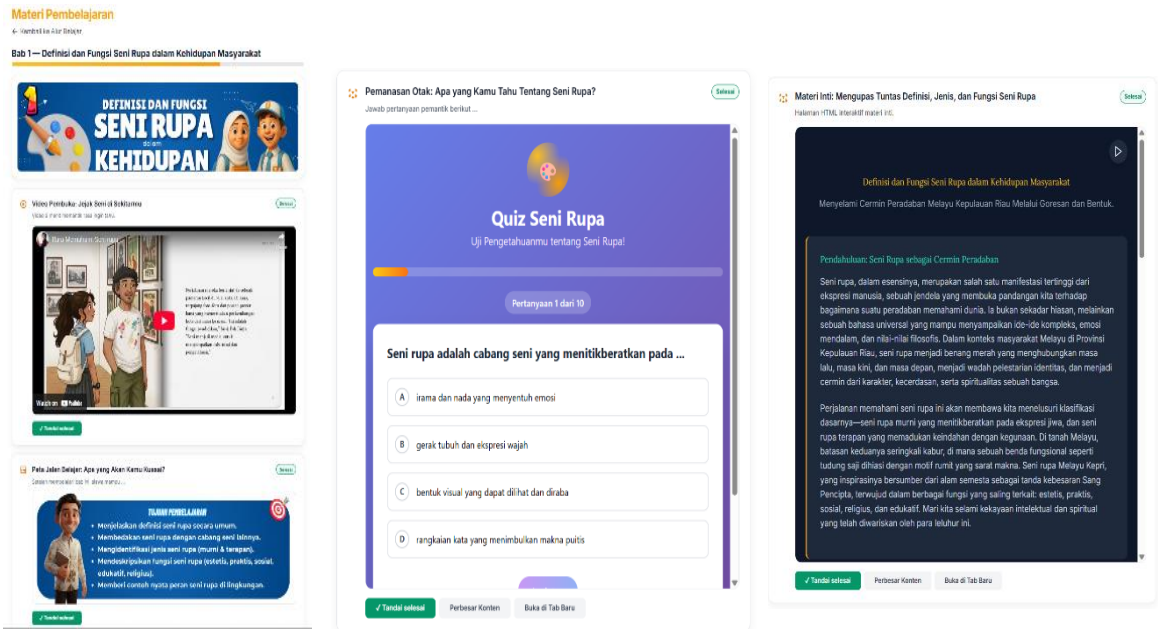

Figure 4. Learning Content Page

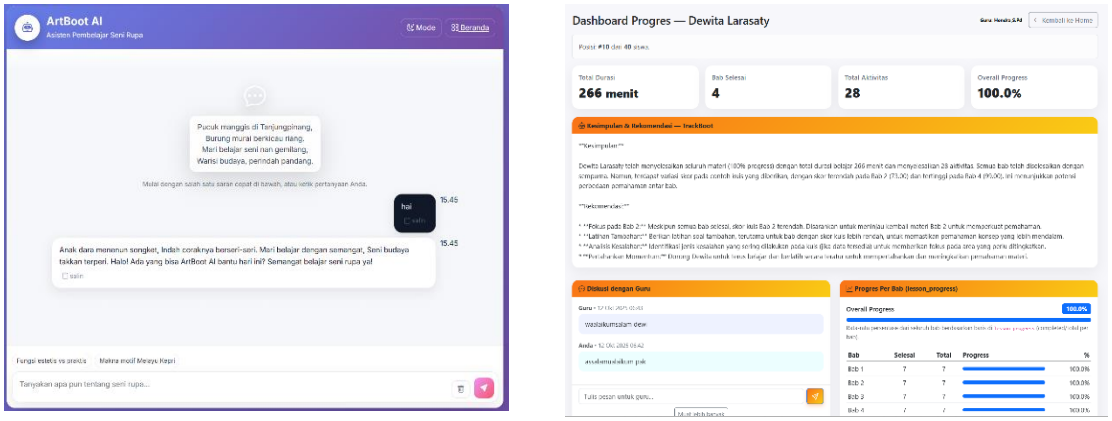

Figure 5. ArtBoot and TrackBoot Analytics Dashboard with AI-Based Recommendations

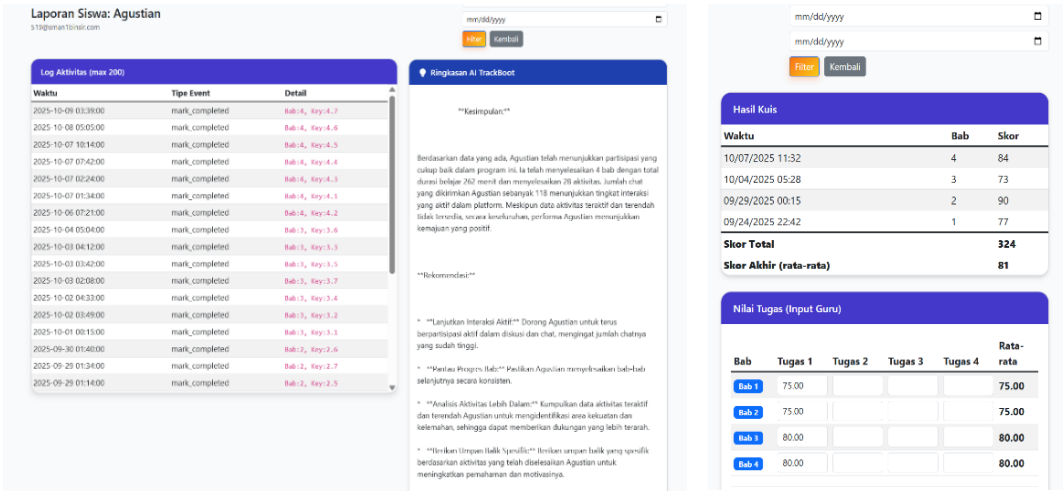

Figure 6. TrackBoot Dashboard for AI-Driven Learning Analytics and Student Performance Reports

`

Figures 1 to 6 illustrate the overall flow of usage and integration of key features in the developed artificial intelligence-based LMS. The *Home Dashboard* and *Student Dashboard* display the initial interface that serves as a learning navigation center, allowing students to access materials, activities, and supporting features in a structured manner. The Learning Progress Dashboard and Learning Content Page show how the system presents learning materials and continuously monitors student learning progress. The integration of ArtBoot and TrackBoot on the analytics dashboard demonstrates the use of AI in providing learning guidance, feedback, and adaptive learning recommendations based on user interaction data. Overall, the visualization of this system confirms that the LMS is designed not only as a medium for delivering material, but as an adaptive learning environment that supports learning personalization, student performance monitoring, and data-driven pedagogical decision-making.

The learning content in the LMS follows Gagné's Nine Events of Instruction to ensure a systematic and meaningful learning experience:

Table 1. ***Nine Events of Instruction*** **(Gagné)**

No	Instructional Events	Implementation on LMS
1	Attract attention	ArtBoot opens the session with relevant Malay rhymes
2	Communicate objectives	Learning objectives appear at the beginning of each module
3	Activate prior knowledge	Short quizzes/reflections before the main material
4	Present content	Multimedia material (text, images, videos)
5	Provide guidance	ArtBoot as a smart tutor provides explanations and examples
6	Elicit performance	Interactive exercises & practical assignments (upload work)
7	Provide feedback	Automatic feedback and AI-based ArtBoot responses
8	Assess performance	Post-test and final project evaluation (offline)
9	Enhance retention	Adaptive recommendations by TrackBoot based on log analysis

Table 1 shows that the learning design in the developed LMS is systematically aligned with Gagné's Nine Events of Instruction framework. Each instructional event is implemented concretely through LMS features, ranging from attracting students' attention through ArtBoot's opening interaction with Malay rhymes to providing adaptive learning recommendations by TrackBoot to improve retention. The integration of preliminary quizzes, multimedia materials, interactive exercises, and AI-based automatic feedback ensures that the learning process focuses not only on content delivery but also on strengthening students' understanding and performance. ArtBoot's role as an intelligent tutor is prominent in the guidance and feedback stage, while TrackBoot strengthens the evaluation and retention stage through learning data analysis. Thus, this table confirms that the LMS is designed based on proven instructional design principles, thereby supporting the creation of a structured, adaptive, and meaningful fine arts learning experience.

Validity and Practicality

Product quality is assessed based on two main criteria: validity from experts and practicality from users. Validity, as a key requirement for media development according to Nguyen et al. (2020), is assessed by subject matter experts and media experts through an iterative process. The material validation results increased dramatically from 32.00% (Less Valid) to 86.00% (Very Valid) after revision. Similarly, media validation also increased from 30.00% (Less Valid) to 85.00% (Very Valid). Practicality data collected from students also showed progressive improvement at each stage of the trial, reaching a final score of 4.49 on a scale of 5, which falls into the “Very Practical” category. These results indicate that the final product is not only accurate in content and well-designed, but also very easy for students to use.

`

This is in line with the view of Morrison et al. (2022), who emphasize that the validity of learning media depends not only on the accuracy of the content, but also on its ability to facilitate meaningful interaction between learners and the material. In addition, Lai et al. (2022) assert that the iterative design process in digital media development is an important element in ensuring content accuracy and usability consistency, so that the resulting media is not only academically valid but also easy for learners to use. Thus, the increase in validity scores in this study indicates that the product design has met the principles of instructional alignment between objectives, content, and evaluation.

Table 2. Summary of Expert Validation Results

Validation Aspect	Initial Score	Final Score	Category
Content Validity	32.00%	86.00%	Highly valid
Media Validity	30.00%	85.00%	Highly valid

From a practicality perspective, the results of the three-stage trial, initial field test, main test, and operational test, showed consistent improvement, with a final score of 4.49 out of 5, which is classified as "Very Practical." According to Gunawan et al. (2023), a high level of practicality indicates that the learning media can be easily used by the target users without requiring intensive assistance, as well as providing an efficient and enjoyable learning experience. This is also reinforced by Wathon (2025), who explains that practicality reflects the feasibility and acceptability of a research and development product.

Table 3. Summary of Practicality Test Results by Students

Testing Phase	Number of Students	Average Score	Category
Initial Field Testing	10	3.79	Practical
Main Field Testing	20	4.29	Very Practical
Operational Field Testing	40	4.49	Very Practical

Product Effectiveness

The effectiveness of LMS in improving learning outcomes was measured using a pre-test and post-test design with 40 students as subjects. The improvement in learning outcomes was analyzed using N-Gain scores. The results of the analysis (Table 3) showed a very significant improvement. The average student score jumped from 45.88 on the pre-test to 88.25 on the post-test. The average N-Gain score of 0.78 places the effectiveness of this product in the "High" category, indicating that the use of LMS has a significant positive impact on students' mastery of the material.

Table 4. Summary of Practicality Test Results by Students

Metric	Mean Score
Pre-test	45.88
Post-test	88.25
Skor N-Gain	0.78
Effectiveness Category	Tinggi

These findings are in line with the results of research by Mayasari et al. (2023) which shows that the integration of artificial intelligence in the learning process significantly improves the cognitive effectiveness and learning motivation of students in East Java. In addition, Kaluge (2024) emphasizes that AI-based learning systems can facilitate adaptive feedback and personalized learning, which have been proven to accelerate students' conceptual understanding. Furthermore, the effectiveness of this product can also be explained through the learning analytics approach. According to Gašević et (2023),

`

learning analytics integrated into LMS allows educators to understand learning patterns and provide adaptive interventions that strengthen learning outcomes. This is in line with the findings of this study, where the TrackBoot and ArtBoot features contribute to monitoring activities and duration, as well as providing personal guidance, thereby supporting continuous improvement in student achievement.

DISCUSSION

The findings of this study comprehensively show that the integrated artificial intelligence (AI) self-directed LMS that was developed has proven to be a valid, practical, and highly effective solution to overcome the challenges of learning fine arts at SMAN 1 Bintan Pesisir. This success is not only reflected in quantitative data, but also in profound pedagogical implications when linked to instructional design theory and previous research. The significant improvement in learning outcomes, reflected in an N-Gain score of 0.78 (high category), indicates more than just an increase in cognitive scores; it represents the successful implementation of an adaptive, interactive, and personalized learning environment. These findings are consistent with the results of research by Chen et al. (2020) and Mayasari et al. (2023) which confirm that the integration of AI in learning contributes directly to improving students' academic outcomes and learning motivation through adaptive feedback and content personalization.

To understand the mechanisms behind this success, a multiple linear regression analysis was performed on the log data collected by *TrackBoot*. This analysis aimed to identify the extent to which three forms of student engagement Total Activity (X_1), Learning Duration (minutes) (X_2), and Chat Interaction with ArtBoot (X_3) affected the Post-test Score (Y) as an indicator of learning outcomes.

Table 5. Multiple Linear Regression Analysis Results

Variable	Coefficient (b)	Std. Error	t-stat	p-value (Significance)
(Constant)	25.45	8.12	3.13	0.003
Total Activity (X_1)	0.15	0.25	0.60	0.552
Duration (minutes) (X_2)	0.08	0.06	1.33	0.191
Chat (ArtBoot) (X_3)	0.42	0.11	3.82	< 0.001
Model Summary				
Coefficient of Determination (R^2)	0.67			
F-Statistic	24.31			< 0.001

The regression results in Table 5 provide crucial insights. The model is significant overall ($p < 0.001$) and explains 67% of the variance in post-test scores ($R^2 = 0.67$). The most notable finding is that of the three independent variables, only interaction with “Artboot” showed a statistically significant effect ($p < 0.001$) on learning outcomes. Total Activity and Learning Duration on the platform did not turn out to be significant predictors. The interpretation of these findings is crucial: it is not the quantity of time or number of clicks that determines learning success, but rather the quality of guided interaction. This underscores the central role of Artboot as an implementation of the fifth (providing guidance) and seventh (providing feedback) instructional events of Gagné's model. Artboot functions as digital “scaffolding” that provides timely support, a concept that has been proven effective in many studies on intelligent learning guidance.

Artboot's success can be attributed to two aspects of its design. First, as a domain-specific chatbot, it provides relevant and focused answers, preventing misinformation that might occur if students searched the internet freely. Second, and equally important, is its contextual approach based on local wisdom. The use of Malay rhymes as an opening to interactions, as revealed by qualitative observations, successfully attracted students' attention (Gagné's first event) and created a more friendly and culturally relevant learning environment. This approach indirectly increased students' motivation and emotional engagement, which ultimately facilitated a deeper cognitive process.

Thus, this study not only confirms the effectiveness of AI in education, but also shows that the most successful learning technology designs are those that are able to combine artificial intelligence with pedagogical and cultural intelligence. The results of this study are closely related to instructional design theory and basic hypotheses regarding the role of quality engagement in technology-based learning.

`

The finding that interaction with ArtBoot was the only significant predictor of learning outcomes supports the theories of instructional scaffolding and guided learning, which emphasize that structured guidance and timely feedback are more influential than learning duration alone. This is in line with Gagné's *Nine Events of Instruction* framework, particularly the events of guidance and feedback, which serve to reinforce students' cognitive processes. Thus, the results of this study are theoretically acceptable because they show consistency between the system design, the initial research hypothesis, and proven learning principles. AI in this study does not function as a substitute for teachers, but rather as a cognitive facilitator that strengthens the learning process.

Compared to previous studies in the last five years, these findings show strong consistency while expanding existing understanding. Supriyatmoko et al. (2025) reported that AI is most effective when used for personalization and adaptive feedback, rather than merely as a content distribution tool. Similar findings were also shown by Rohana et al. (2024), who confirmed that active interaction with intelligent systems has a stronger correlation with learning outcomes than platform access frequency. However, this study differs from several conventional LMS studies that emphasize duration of use as an indicator of success (Sugiarto & Musyafa, 2024), as the results show that duration and total activity are not statistically significant. This difference emphasizes that the quality of domain-based and culturally contextual interactions are the main distinguishing factors in the effectiveness of AI-based learning.

CONCLUSION

Based on the results of the research and development that has been carried out, several conclusions can be drawn. First, the AI-integrated independent LMS product that has been developed has been proven to be valid and practical for use in two-dimensional art learning at SMAN 1 Bintan Pesisir. Second, the implementation of this LMS has proven to be very effective in improving student learning outcomes, as shown by a significant increase in average scores from the pre-test to the post-test with a “High” N-Gain category. Third, from the AI architecture developed, the smart tutor chatbot feature (*Artboot*) was identified as the most significant component in driving improved learning outcomes.

This study has several limitations that need to be considered. First, the research subjects were limited to one school, namely SMAN 1 Bintan Pesisir, so generalizing the results to other school contexts must be done with caution. Second, this study focused on two-dimensional art materials, so the effectiveness of the platform for three-dimensional materials or other art branches has not been tested. Third, the duration of the operational trial, which lasted for one semester, may not be sufficient to measure the long-term impact on students' knowledge and skill retention.

Based on these findings, several recommendations are proposed. For education practitioners and schools, especially in areas with limited resources, it is recommended to adopt and develop similar digital learning solutions that focus not only on content delivery but also on intelligent interaction and personalization based on local wisdom. For future researchers, it is recommended to explore the development of this system further, such as testing its effectiveness in the long term, developing it for three-dimensional art materials, or replicating this model in different subjects and cultural contexts.

Credit authorship contribution statement

Hendra, S.Pd: Conceptualization, Methodology, Software Development, Validation, Formal Analysis, Investigation, Data Curation, Initial Draft Writing, Review & Editing, Visualization, Project Administration.

Declaration of competing interest

The authors declare that there are no conflicts of interest, either financial or personal, that could influence the objectivity of the research and the results reported in this paper.

Ethical Declaration

All participants gave informed consent before participating in the study. They were informed of the purpose, procedures, and their right to withdraw at any time without any consequences. Research permission was also obtained from the school concerned.

`

Acknowledgment

The authors express their sincere gratitude to their thesis advisors, Dr. Zaitun, S.S., M.Ag and Dr. Dody Irawan, M.Pd., M.Hum, for their invaluable guidance, direction, and support during the research process, as well as Prof.dr.Drs.H.Abdul Malik, M.Pd, as the Research Proposal Examiner. Thanks also go to the Principal, teachers, and all students of SMAN 1 Bintan Pesisir who participated and gave their full support. Thanks also go to the expert validators, Riri Trinanda, S.Pd, M.Sn and Dwi Mutia Sari, S.Ds., M.Ds., for their valuable input and suggestions in improving the product.

REFERENCES

Awaliyatul, F., Wijayanto, W., & Wardani, K. (2025). Menggali Kreativitas Dan Imajinasi Anak Melalui Pembelajaran Seni Rupa Dengan Pendekatan Terintegrasi. *Elementary School: Jurnal Pendidikan Dan Pembelajaran Ke-SD-An*, *12*(1), 199–214. https://es.upy.ac.id/index.php/es/article/view/4389

Chen, L., Chen, P., & Lin, Z. (2020). Artificial Intelligence in Education: A Review. *IEEE Access*, *8*, 75264–75278. https://doi.org/10.1109/ACCESS.2020.2988510

Gašević, D., Siemens, G., & Sadiq, S. (2023). Empowering learners for the age of artificial intelligence. In *Computers and education: artificial intelligence* (Vol. 4, p. 100130). Elsevier. https://www.sciencedirect.com/science/article/pii/S2666920X23000097

Gunawan, G., Nur, W., & Mardianto, M. (2023). Analisis Tingkat Kepraktisan Pengembangan Media Pembelajaran Berbasis Welt Pada Politeknik Negeri Medan. *Edukasi Islami: Jurnal Pendidikan Islam*, *12*(04). https://doi.org/10.30868/ei.v12i04.5172

Isnaini, H. S., Arief, Z. A., & Waspodo, M. (2021). *Monograf Pengembangan Model Pembelajaran Online Dengan Nine Events Of Instruction: Bahasa Inggris Kelas 8*. https://repository.penerbitwidina.com/publications/352872/monograf-pengembangan-model-pembelajaran-online-dengan-nine-events-of-instructio

Kaluge, A. H. (2024). Pemanfaatan AI untuk Meningkatkan Pemahaman Konsep Matematika di Era Digital. *Mathematical Proceedings of The Widya Mandira Catholic University*, *2*(1), 191–205. http://journal.unwira.ac.id/index.php/SEMNAPTIKA/id/article/view/4187

Khairi, A. I. (2024). Enhancing Social Studies Learning Outcomes through Interactive Ice Breaking and Peer Teaching Strategies in Junior High School. *SOCIALE: International Journal of Social Studies*, *1*(2), 36–50. https://doi.org/10.19105/sociale.v1i2.15227

Khairiniza, N., & Rizki, C. A. (2025). Implementasi Pembelajaran Hybrid Berbasis Learning Management System (LMS) dalam Meningkatkan Kemandirian Belajar Siswa pada Mata Pelajaran Pendidikan Agama Islam. *Jurnal Pendidikan Agama Islam*, *1*(3), 65–73. https://doi.org/10.62712/jurpai.v1i2.12

Kurniawan, H., WU, A. S., & Tambunan, R. W. (2024). Potensi AI dalam meningkatkan kreativitas dan literasi dalam pembelajaran bahasa Indonesia. *JAMI: Jurnal Ahli Muda Indonesia*, *5*(1), 8–15. https://doi.org/10.46510/jami.v5i1.285

Lai, C., Wang, Q., & Huang, X. (2022). The differential interplay of TPACK, teacher beliefs, school culture and professional development with the nature of in-service EFL teachers' technology adoption. *British Journal of Educational Technology*, *53*(5), 1389–1411. https://doi.org/10.1111/bjet.13200

Laugi, S. (2018). Sistem Informasi berbasis Web dalam Penyelenggaran Lembaga Pendidikan. *Shautut Tarbiyah*, *24*(1), 109–126. https://doi.org/10.31332/str.v24i1.939

Luan, H., Geczy, P., Lai, H., Gobert, J., Yang, S. J. H., Ogata, H., Baltes, J., Guerra, R., Li, P., & Tsai, C. C. (2020). Challenges and Future Directions of Big Data and Artificial Intelligence in Education. *Frontiers in Psychology*, *October*, 1–11. https://doi.org/10.3389/fpsyg.2020.580820

`

Mayasari, N., Dewantara, R., & Yuanti, Y. (2023). Pengaruh Kecerdasan Buatan dan Teknologi Pendidikan terhadap Peningkatan Efektivitas Proses Pembelajaran Mahasiswa di Jawa Timur. *Jurnal Pendidikan West Science, 1*(12), 851–858. https://doi.org/10.58812/jpdws.v1i12.863

Morrison, G. R., Ross, S. M., Kalman, H. K., & Kemp, J. E. (2022). *Designing Effective Instruction* (8th ed.). Wiley.

Nguyen, T. D., Pham, L. D., Crouch, M., & Springer, M. G. (2020). The correlates of teacher turnover: An updated and expanded meta-analysis of the literature. *Educational Research Review*, *31*, 100355. https://www.sciencedirect.com/science/article/pii/S1747938X19305597

Puteri, A. R., Nasution, W. N., & Nasution, M. I. P. (2025). Integrasi teknologi informasi dan komunikasi dalam pendidikan: konsep, perkembangan, dan inovasi media pembelajaran. *Jurnal Pendidikan Indonesia: Teori, Penelitian, Dan Inovasi*, *5*(4). https://doi.org/10.59818/jpi.v5i4.1760

Rahmadanti, S. N., Wahyudanti, N. R., & Khimaya, N. (2023). *Pengintegrasian Learning Management System (LSM) dengan Artificial Intelligence untuk Memfasilitasi Ragam Kebutuhan Peserta Didik*. https://doi.org/https://doi.org/10.22515/literasi.v3i2.9770

Rahmat, M. K., & Au, W. K. (2019). Visual art education teacher's beliefs and attitudes toward incorporating ICT into art classrooms. *Asian Journal of University Education, 15*(3), 285–294. https://doi.org/10.24191/ajue.v15i3.02

Rais, R. (2022). *Upaya Pembinaan Karakter Religius Siswa Melalui Program Full Day School Di Sdit Al-Muslimin Kota Tasikmalaya*. https://dspace.uii.ac.id/handle/123456789/41288

Rohana, D. D. A., Ardhiansyah, A. N., & Widodo, D. P. (2024). Digital learning with Artificial Intelligence (AI): The correlation of AI to student learning motivation. *International Conference on Aplied Social Sciences in Education*, *1*(1), 198–209. https://doi.org/10.31316/icasse.v1i1.6913

Saragih, S. P., & Silalahi, M. (2024). Pengembangan Learning Management System berbasis Web menggunakan konsep MOOC. *Jurnal Desain Dan Analisis Teknologi*, *3*(1), 15–21. https://doi.org/10.58520/jddat.v3i1.42

Sugiarto, R., & Musyafa, A. (2024). Learning Management System (LMS) pada SMK 1 Barunawati Jakarta. *Jurnal Teknologi Informatika Dan Komputer*, *10*(2), 768–789. https://doi.org/10.37012/jtik.v10i2.2422

Supriyatmoko, S., Anam, K., & Kurniawan, W. (2025). Model Pembelajaran Adaptif Berbasis Kecerdasan Buatan: Peluang Dan Tantangan Dalam Mewujudkan Pendidikan Personalisasi. *STRATEGY: Jurnal Inovasi Strategi Dan Model Pembelajaran*, *5*(1), 36–45. https://doi.org/10.51878/strategi.v5i1.4944

Wathon, A. (2025). Pengembangan Pembelajaran Tingkat SD Berbasis Animasi Flash 8. *Mentari: Journal of Islamic Primary School*, *3*(3), 180–193. https://doi.org/10.59689/ment.v2i2.1709

Wilfridus, N., Wulan, M. P., Zulaikha, S., & Takdir, M. (2025). Peran Teknologi dalam Reformasi Manajemen Pendidikan di Era Digital: Penelitian. *Jurnal Pengabdian Masyarakat Dan Riset Pendidikan, 3*(4), 5381–5388. https://doi.org/10.31004/jerkin.v3i4.1429

Zidni, H. H. (2023). *Pengembangan Kreativitas Dan Inovasi Pembelajaran Guru Untuk Meningkatkan Hasil Belajar PAI Siswa Pada Masa Pandemi Covid-19 (Analisis Kualiatif Pada Siswa SMP Islam Terpadu Al-Irsyad Sukabumi Jawa Barat)*. Institut PTIQ Jakarta. https://repository.ptiq.ac.id/id/eprint/1534/