




Research Article

The Influence of the Utilization of Artificial Intelligence (AI) on Islamic Religious Education and Character Education Learning at State Senior High School 14 Bandar Lampung

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The Influence of the Utilization of Artificial Intelligence (AI) on Islamic Religious Education and Character Education Learning at State Senior High School 14 Bandar Lampung

Abstract. The rapid development of digital technology has driven the transformation of educational practices through the integration of Artificial Intelligence (AI) as an adaptive, interactive, and data-driven learning innovation. In the context of formal education, including Islamic Religious Education (PAI), the utilization of AI has the potential to measurably enhance instructional effectiveness while simultaneously strengthening students' cognitive and affective domains. However, its implementation must be balanced with ethical foundations and moral responsibility to minimize the risks of technological misuse. This study aims to analyze the effect of AI utilization on students' PAI learning outcomes and character development at SMA Negeri 14 Bandar Lampung. A quantitative approach was employed using a cluster sampling technique. Data were analyzed using SPSS through the Tests of Between-Subjects Effects. The findings indicate that AI utilization has a significant effect on improving PAI learning outcomes ($F = 15.528$; $p < 0.05$), with an R^2 value of 0.250, suggesting that 25% of the variance in learning outcomes is explained by AI usage. Furthermore, the effect of AI on character development demonstrates a stronger influence ($F = 123.594$; $p < 0.05$) with an R^2 value of 0.726, indicating a substantial contribution to students' character formation. These findings confirm that AI integration impacts not only academic achievement but also the reinforcement of values and attitudes. Future research is recommended to expand the sample scope, develop more comprehensive experimental designs, and incorporate mediating and moderating variables to gain a deeper understanding of the mechanisms through which AI influences PAI and character education learning.

Keywords: Artificial Intelligence, Islamic Religious Education, Character Education

INTRODUCTION

The rapid development of digital technology in the era of the Industrial Revolution 4.0 has generated various significant innovations in the field of education, one of which is the implementation of Artificial Intelligence (AI).¹ AI has now become an integral part of modern educational strategies that demand efficiency, adaptability, and personalized learning. In a global context, the utilization of AI has proven capable of transforming the way teachers teach and students learn by providing more dynamic, interactive, and data-driven learning experiences.² This phenomenon marks a paradigm shift in education from conventional approaches toward intelligent technology-based learning systems, particularly those based on artificial intelligence.

Conceptually, Artificial Intelligence is one of the branches of technology that has developed very rapidly over the past few decades. AI refers to the ability of computer systems to perform tasks that generally require human intelligence, such as natural language processing, facial recognition, and data-based decision-making.³ This development indicates a shift from traditional computational systems to adaptive intelligent systems that are capable of learning from data (machine learning) and continuously evolving over time. Such transformation opens broad opportunities

¹ Nurdianita Fonna, *Pengembangan Revolusi Industri 4.0 Dalam Berbagai Bidang* (Guepedia, 2019).

² Ruiqi Deng and et al., "Does ChatGPT Enhance Student Learning? A Systematic Review and Meta-Analysis of Experimental Studies," *Computers & Education* 227 (2025): 105224.

³ D Nurdiansyah, *Kecerdasan Buatan Dalam Pendidikan* (Yogyakarta: Deepublis, 2024).

for improving service quality, work effectiveness, and decision-making accuracy in various sectors, including education.⁴

In the educational context, AI does not merely function as a learning aid but as an intelligent system capable of analyzing students' learning behaviors and adjusting instructional materials according to individual needs.⁵ Several international studies show that the use of AI in learning can increase learning effectiveness by up to 32% compared to traditional methods, particularly due to its ability to provide real-time feedback and automatically adapt content.⁶ Thus, AI contributes to the creation of a more responsive and student-centered learning process.

The utilization of AI in education encompasses several main aspects.⁷ First, personalized learning, namely AI's ability to design individual learning pathways so that students can learn according to their respective styles and pace. Second, automated formative assessment, where AI systems can analyze students' responses to quizzes, assignments, and essays quickly, objectively, and in a data-driven manner. Third, increasing student engagement through the use of chatbots or virtual tutors that provide real-time interaction, thereby enhancing learning motivation. Fourth, administrative efficiency, as AI assists teachers in managing grades, attendance, and student progress reports. Fifth, the development of 21st-century skills, such as critical thinking, digital literacy, creativity, and technology-based problem-solving skills.

One form of AI implementation in education can be found in Islamic Religious Education (PAI). The integration of AI in PAI may include the use of chatbot-based memorization applications, such as ChatGPT, digital quiz platforms to answer questions related to Islamic jurisprudence, and digital analysis of hadith texts.⁸ Nevertheless, content generated by AI systems still requires validation by religious authorities or experts in order to avoid potential misunderstandings and to maintain the accuracy of Islamic scholarly substance.⁹

Several previous studies have examined the utilization of AI in Islamic Religious Education. Research conducted by Aprianti et al (2024). Shows that the use of AI encourages increased student participation in classroom discussions and strengthens

⁴ Apriadi et al., *KECERDASAN BUATAN Teori, Implementasi, Dan Aplikasi Di Era Digital* (jawa tengah: Lakeisha, 2025).

⁵ Richa Sucianingtyas et al., "Telaah Ragam Artificial Inteligence (AI) Dalam Pendidikan" 3, no. 2 (2025): 232-43.

⁶ Gwo-Jen Hwang and et al., "Artificial Intelligence in Education: Trends, Challenges, and Future Research Directions," *Educational Technology Research and Development* 72, no. 3 (2025): 555-73.

⁷ Almira Ulimaz and et al., "Analisis Dampak Kolaborasi Pemanfaatan Artificial Intelligences (AI) Dan Kecerdasan Manusia Terhadap Dunia Pendidikan Di Indonesia," *Innovative: Journal Of Social Science Research* 4, no. 3 (2024): 9312-19.

⁸ Mohammad Fahrur Rozi, Suhaimi Suhaimi, and Sapto Wahyono, "Tantangan Dan Peluang Dosen Pendidikan Agama Islam Dalam Mengintegrasikan Kecerdasan Buatan Di Universitas Madura," *Dirosat: Journal of Islamic Studies* 9, no. 1 (2024): 59-70.

⁹ Siti Nurul Munjiyat et al., "Ijtihad Fikih Dalam Regulasi Konten Kecerdasan Artifisial: Analisis Maqāṣid Al-Syarī'ah Terhadap Kebenaran, Amanah, Dan Otoritas Keagamaan Digital" 2, no. 1 (2026): 77-93.

their understanding of the material.¹⁰ Similar findings were presented by Muhammad Ardiansyah et al. (2024), who reported significant improvements in students' cognitive and affective aspects following the implementation of AI-based learning systems.¹¹ These findings indicate that AI integration has a positive impact on the quality of PAI learning.

However, a study published in *Attractive Journal* warns that without strong digital ethics, the implementation of AI risks reducing the quality of students' social and moral interactions, including their character.¹² Character education refers to a set of moral values that guide individuals to act in accordance with norms of goodness, social ethics, and humanitarian principles.¹³ This issue is highly relevant, considering the increasing number of cases involving the misuse of technology, including AI. To avoid ambiguity, this research specifies the indicators of character to be examined, namely honesty, responsibility, discipline, politeness, empathy, tolerance, cooperation, religiosity, and moral consistency.

Based on these findings, the utilization of AI in education demonstrates a constructive contribution, particularly in Islamic Religious Education. This research is planned to be conducted at SMA Negeri 14 Bandar Lampung. As a formal educational institution, SMA Negeri 14 Bandar Lampung is committed to developing students who are high-achieving, possess strong character, and demonstrate noble moral conduct through structured learning processes and diverse extracurricular activities. Academic activities at this school are supported by professional educators as well as adequate facilities and infrastructure, making it a relevant context for examining the implementation of AI-based learning in strengthening educational quality.

METHOD

This study employs a quantitative approach. A quantitative approach is a research method that emphasizes objective data measurement through the use of numerical data, statistical analysis, and standardized instruments to test hypotheses or address research problems. This approach is theory-testing oriented; therefore, the data obtained are analyzed using statistical techniques to examine relationships, differences, and effects among variables.¹⁴

¹⁰ A Aprianti and et al., "Penggunaan Teknologi Artificial Intelligence (AI) Dalam Pembelajaran Pendidikan Agama Islam (PAI) Di SMA," *Jurnal Arjuna: Publikasi Ilmu Pendidikan, Bahasa Dan Matematika* 2, no. 4 (2024): 150-60.

¹¹ Muhammad Ardiansyah and et al., "Strategi Pengembangan Lembaga Pendidikan Islam Pada Era Digital Di Madrasah Tsanawiyah PAB 1 Helvetia," *Jurnal Ilmu Pendidikan Muhammadiyah Kramat Jati* 5, no. 2 (2024): 1-7.

¹² *Attractive Journal*, "AI Integration and Ethical Literacy in Society 5.0 Education," *Bulletin of Social Education* 7, no. 2 (2024): 1416-30.

¹³ N Rahmawati, *Foundations of Moral Education in Contemporary Schools* (Jakarta: Prenadamedia, 2021).

¹⁴ Dela Fahiran Pandiangan and Meyniar Albina, "Model Dan Tahapan Penelitian Kuantitatif: Pendekatan Teoretis Dan Praktis Dalam Kajian Pendidikan," *Jurnal IHSAN: Jurnal Pendidikan Islam* 3, no. 3 (2025): 724-30, <https://doi.org/10.61104/ihsan.v3i3.1494>.

The type of research used in this study is a quasi-experimental design, is a research method used to measure the effect of a particular treatment on a variable without using full subject randomization.¹⁵ which aims to determine cause-and-effect relationships or the influence among variables but does not fully implement the controls of a true experimental design. In a quasi-experimental study, the researcher administers a treatment to a particular group.

However the selection of samples and the control of extraneous variables are not conducted through full randomization.¹⁶ The design applied in this quasi-experimental study is the nonequivalent control group design. This design was chosen because the researcher was unable to randomly assign subjects to the experimental and control groups. Nevertheless, both groups were administered a pretest and a posttest to determine their initial conditions and to measure changes after the treatment was implemented.¹⁷

Table 1. Research Design or Experimental Design

Kelompok	Pretest	Perlakuan	Posttest
Eksperimen	O ₁	X	O ₂
Kontrol	O ₃	-	O ₄

Description:

O₁ / O₃ = Pretest administered before the treatment

O₂ / O₄ = Posttest administered after the treatment

X = Treatment (the utilization of AI in the learning process)

The population in this study consists of all Grade XI.F students at SMA Negeri 14 Bandar Lampung. The following table presents the detailed distribution of the research population.

Table 2. Research Population

No	Kelas	Jumlah
1	XI F. 1	36
2	XI F. 2	36
3	XI F. 3	35
4	XI F. 4	36
5	XI F. 5	35
6	XI F. 6	38
7	XI F. 7	38
8	XI F. 8	37
9	XI F. 9	36
10	XI F.1 0	33

¹⁵ Gisela Anantasia and Sulastrri Rini Rindrayani, "METODOLOGI PENELITIAN QUASI EKSPERIMEN" 5, no. 2 (2025): 183-92.

¹⁶ Bambang Sri Anggoro, Eli Puspita Sari, and Novian Riskiana Dewi, "Pengaruh Model SIMAS ERIC Terhadap Kemampuan Komunikasi Matematis Dan Literasi Matematis," *LAPLACE: Jurnal Pendidikan Matematika* 5, no. 2 (2024): 200-210, <https://doi.org/10.31537/laplace.v5i2.759>.

¹⁷ Ida Fiteriani, Rahma Diani, and Chairul Anwar, "Project-Based Learning through STEM Approach: Is It Effective to Improve Students' Creative Problem-Solving Ability and Metacognitive Skills in Physics Learning?," in *Journal of Physics: Conference Series*, vol. 1796 (IOP Publishing, 2021).

No	Kelas	Jumlah
Jumlah Keseluruhan		360

The research sample was selected using the Cluster Sampling technique. Cluster Sampling is a sampling method in which the researcher selects samples not based on individual participants, but on naturally formed groups (clusters).¹⁸ In this study, the researcher selected two Grade XI.F classes to serve as the research samples: Class XI F.1 as the experimental group and Class XI F.2 as the control group, each consisting of 36 students.

To measure the effect of AI utilization on Islamic Religious Education (PAI) learning outcomes, a test instrument was employed. Meanwhile, to measure the effect of AI utilization on students' character (budi pekerti), a questionnaire instrument was used. Data analysis in this study was conducted quantitatively with the assistance of SPSS software. The hypotheses in this study aim to determine whether variable X (AI Utilization) has a partial or simultaneous effect on PAI learning outcomes (Y_1) and students' character (Y_2). The statistical hypotheses to be tested are as follows:

Hypothesis 1 (H_{01} and H_{11}): The Effect of Artificial Intelligence Utilization on PAI

- $H_{01}: \beta_1 = 0$
There is no significant effect of Artificial Intelligence utilization on students' PAI learning outcomes.
- $H_{11}: \beta_1 \neq 0$
There is a significant effect of Artificial Intelligence utilization on students' PAI learning outcomes.

Hypothesis 2 (H_{02} and H_{12}): The Effect of Artificial Intelligence Utilization on Students' Character

- $H_{02}: \beta_2 = 0$
There is no significant effect of Artificial Intelligence utilization on students' character.
- $H_{12}: \beta_2 \neq 0$
There is a significant effect of Artificial Intelligence utilization on students' character.

RESULTS AND DISCUSSION

The researchers first conducted a trial of the instrument, which consisted of Islamic Religious Education (PAI) questions and a character education questionnaire. After the instruments were tested on experts, the PAI questions and character education questionnaire were then tested on 28 12th-grade students at SMA Negeri 14 Bandar Lampung. The results of the instrument trial are as follows:

¹⁸ B S Anggoro and A Fadila, "Komunikasi Matematis Melalui Model Pembelajaran CMP Berbantuan Google Site Ditinjau Dari Adversity Quotient," in *NCOINS: National Conference Of Islamic Natural Science*, vol. 4 ((Proceedings): NCOINS, 2024), 247-62.

Analysis of the Test Instrument Trial

1. Validity test

Validity testing is a procedure used to determine the extent to which a research instrument (such as a questionnaire, test, or survey) is capable of accurately measuring what it is intended to measure.¹⁹ This study employed instruments in the form of PAI test items and a student character questionnaire.

a. Content Validity

The test and questionnaire instruments used in this study underwent content validity testing. The validation process involved several lecturers from the Master's Program in Islamic Religious Education at the Graduate School of UIN Raden Intan Lampung. The validators for the test and questionnaire were Prof. Dr. Hj. Umi Hijriyah, M.Pd., and Dr. Sunarto, M.Pd.I.

b. Construct Validity of the Test Instrument

The construct validity test of the instruments was conducted on both the PAI test items and the Character Questionnaire using the Product Moment correlation technique. The results of the item validity analysis for the PAI test and the Character Questionnaire are presented in the table below:

Tabel 3. Validity Results of the PAI Test Instrument Trial

Butir Soal	r_{xy}	r_{tabel}	Kriteria
1	0,484	0,374	Valid
2	0,179	0,374	Tidak Valid
3	0,578	0,374	Valid
4	0,405	0,374	Valid
5	0,418	0,374	Valid
6	0,269	0,374	Tidak Valid
7	0,426	0,374	Valid
8	0,304	0,374	Tidak Valid
9	0,461	0,374	Valid
10	0,447	0,374	Valid
11	0,418	0,374	Valid
12	0,407	0,374	Valid
13	0,248	0,374	Tidak Valid
14	0,380	0,374	Valid
15	0,621	0,374	Valid
16	0,452	0,374	Valid
17	0,318	0,374	Tidak Valid
18	0,460	0,374	Valid
19	0,405	0,374	Valid
20	0,538	0,374	Valid
21	0,101	0,374	Tidak Valid
22	0,434	0,374	Valid
23	0,111	0,374	Tidak Valid
24	0,527	0,374	Valid
25	0,336	0,374	Tidak Valid

¹⁹ Febrianawati Yusup et al., "UJI VALIDITAS DAN RELIABILITAS" 7, no. 1 (2018): 17-23.

Butir Soal	r_{xy}	r_{tabel}	Kriteria
26	0,478	0,374	Valid
27	0,274	0,374	Tidak Valid
28	0,439	0,374	Valid
29	0,466	0,374	Valid
30	0,179	0,374	Tidak Valid

Source: Data Processing in the Appendix

Based on Table 4.2, the analysis of the 30 multiple-choice items that were piloted indicates that the items fall into valid and invalid categories. An item is considered invalid if the calculated correlation coefficient r_{hitung} is less than the critical value in the r_{tabel} ($r_{x(y-1)} < 0,374$) The items that were found to be invalid are numbers 2, 6, 8, 13, 17, 21, 23, 25, 27, and 30. Therefore, these 10 items were excluded from the PAI test instrument. Conversely, an item is considered valid if the r_{hitung} value is greater than or equal to r_{tabel} ($r_{x(y-1)} \geq 0,374$) The valid items include numbers 1, 3, 4, 5, 7, 9, 10, 11, 12, 14, 15, 16, 18, 19, 20, 22, 24, 26, 28, and 29. Thus, 20 valid items were retained and used as the PAI test instrument, as their $r_{hitung} \geq r_{tabel}$, indicating that they are statistically valid for use.

2. Item Difficulty Index Test

The purpose of the item difficulty test for the PAI test instrument in this study was to examine each test item based on its level of difficulty in order to determine whether it falls into the categories of easy, moderate, or difficult. The results of the item difficulty analysis for the PAI test are presented in the following table:

Tabel 4. Item Difficulty Level of the PAI Test Questions

Butir Soal	Skor Tingkat Kesukaran	Kategori
1	0,36	Sedang
2	0,36	Sedang
3	0,54	Sedang
4	0,50	Sedang
5	0,54	Sedang
6	0,39	Sedang
7	0,68	Sedang
8	0,64	Sedang
9	0,46	Sedang
10	0,46	Sedang
11	0,54	Sedang
12	0,46	Sedang
13	0,46	Sedang
14	0,71	Mudah
15	0,57	Sedang
16	0,43	Sedang
17	0,43	Sedang
18	0,39	Sedang

Butir Soal	Skor Tingkat Kesukaran	Kategori
19	0,39	Sedang
20	0,54	Sedang
21	0,46	Sedang
22	0,46	Sedang
23	0,57	Sedang
24	0,46	Sedang
25	0,71	Mudah
26	0,61	Sedang
27	0,61	Sedang
28	0,43	Sedang
29	0,43	Sedang
30	0,50	Sedang

Source: Data Processing in the Appendix

Based on Table 4. the difficulty level of the PAI test items shows that there are 2 items categorized as easy ($0,70 < TK \leq 1,00$), namely items number 14 and 25. Furthermore, 28 items are categorized as moderate ($0,30 < TK \leq 0,70$), namely items number 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 26, 27, 28, 29, and 30. There are no items categorized as difficult ($0,00 \leq TK \leq 0,30$). The classification of items as easy, moderate, or difficult does not determine whether an item should be eliminated or not, since items at all levels of difficulty easy, moderate, and difficult are considered feasible.

3. Discrimination Index Test

The discrimination index test was conducted on each PAI test item to distinguish between students who understand the material and those who have less understanding of the given questions. The results of the discrimination index analysis for the PAI Test items and the Numeracy Skills Test items can be seen in the following table:

Tabel 5. Discrimination Index of the PAI Test Items

No	Daya Beda	Kriteria
1	0,50	Baik
2	0,25	Cukup
3	0,75	Sangat Baik
4	0,38	Cukup
5	0,50	Baik
6	0,38	Cukup
7	0,50	Baik
8	-0,25	Sangat Jelek
9	0,50	Baik
10	0,75	Sangat Baik
11	0,50	Baik
12	0,75	Sangat Baik

No	Daya Beda	Kriteria
13	0,38	Cukup
14	0,38	Cukup
15	0,88	Sangat Baik
16	0,50	Baik
17	0,38	Cukup
18	0,50	Baik
19	0,38	Cukup
20	0,63	Baik
21	0,13	Jelek
22	0,50	Baik
23	0,13	Jelek
24	0,63	Baik
25	0,50	Baik
26	0,50	Baik
27	0,25	Cukup
28	0,38	Cukup
29	0,50	Baik
30	0,25	Cukup

Source: Data Processing in the Appendix

Based on Table 5 which presents the results of the discrimination index test, the distribution of item quality shows variation in the ability of the test items to distinguish between high- and low-ability students.

There are 5 items categorized as Very Good ($0,70 \leq DB < 1,00$), namely items number 3, 10, 12, and 15. These items have a very high discrimination index and are highly effective in identifying differences in students' abilities.

Furthermore, there are 13 items categorized as Good ($0,40 \leq DB < 0,70$), namely items number 1, 5, 7, 9, 11, 16, 18, 20, 22, 24, 25, 26, and 29. These items meet adequate discrimination criteria and are suitable for use in the research instrument.

In addition, 8 items fall into the Fair category ($0,20 \leq DB < 0,40$), namely items number 2, 4, 6, 13, 14, 17, 19, 27, 28, and 30. Items in this category may still be used; however, it is recommended that they undergo editorial revision or structural improvement to enhance their discriminatory quality.

Moreover, there are 2 items categorized as Poor ($0,00 \leq DB < 0,20$), namely items number 21 and 23. These items demonstrate low discriminatory power and therefore require substantial revision before being reused.

Additionally, there is 1 item with a negative discrimination index ($DB < 0,00$), namely item number 8. A negative value indicates that the item does not function properly, as low-ability students answered it correctly more frequently than high-ability students. Therefore, this item should be eliminated or thoroughly reconstructed.

Overall, the majority of the test items fall within the good to very good categories, indicating that the instrument generally possesses adequate

discriminatory power. Nevertheless, several items in the poor and negative categories require revision to further optimize the instrument's quality, reliability, and validity in accurately measuring students' mastery of the material.

4. Reability Test

Reliability testing is a procedure used to determine the extent to which a research instrument has consistency and stability in its measurement results when used repeatedly under the same conditions.²⁰ Based on the calculation results of the 30 essay test items that were piloted, the reliability coefficient of the PAI test was 0,777. Thus, the instrument can be considered reliable since the score $\geq 0,700$. Therefore, the PAI test instrument is deemed reliable and consistent, making it suitable for measuring the sample and collecting PAI data.

5. Conclusion of the Instrument Try-Out Results

Based on the analysis of the validity test, item difficulty test, discrimination index test, and reliability test of the PAI items, the conclusions can be summarized in the following table:

Tabel 6. Conclusion of the PAI Test Instrument Try-Out Results

No	Validitas	Tingkat Kesukaran	Daya Pembeda	Reliabilitas	Keterangan
1	Valid	Sedang	Baik	Reliabel	Digunakan
2	Tidak Valid	Sedang	Cukup		Tidak Digunakan
3	Valid	Sedang	Sangat Baik		Digunakan
4	Valid	Sedang	Cukup		Digunakan
5	Valid	Sedang	Baik		Digunakan
6	Tidak Valid	Sedang	Cukup		Tidak Digunakan
7	Valid	Sedang	Baik		Digunakan
8	Tidak Valid	Sedang	Sangat Jelek		Tidak Digunakan
9	Valid	Sedang	Baik		Digunakan
10	Valid	Sedang	Sangat Baik		Digunakan
11	Valid	Sedang	Baik		Digunakan
12	Valid	Sedang	Sangat Baik		Digunakan
13	Tidak Valid	Sedang	Cukup		Tidak Digunakan
14	Valid	Mudah	Cukup		Digunakan
15	Valid	Sedang	Sangat Baik		Digunakan
16	Valid	Sedang	Baik		Digunakan
17	Tidak Valid	Sedang	Cukup		Tidak Digunakan
18	Valid	Sedang	Baik		Digunakan
19	Valid	Sedang	Cukup		Digunakan
20	Valid	Sedang	Baik		Digunakan
21	Tidak Valid	Sedang	Jelek		Tidak Digunakan
22	Valid	Sedang	Baik		Digunakan
23	Tidak Valid	Sedang	Jelek		Tidak Digunakan
24	Valid	Sedang	Baik		Digunakan
25	Tidak Valid	Mudah	Baik		Tidak Digunakan

²⁰ Afifah Aulia Zayrin et al., "Analisis Instrumen Penelitian Pendidikan (Uji Validitas Dan Relibilitas Instrumen Penelitian)," 2025, 780-89.

No	Validitas	Tingkat Kesukaran	Daya Pembeda	Reliabilitas	Keterangan
26	Valid	Sedang	Baik		Digunakan
27	Tidak Valid	Sedang	Cukup		Tidak Digunakan
28	Valid	Sedang	Cukup		Digunakan
29	Valid	Sedang	Baik		Digunakan
30	Tidak Valid	Sedang	Cukup		Tidak Digunakan

Source: Data Processing in the Appendix

Based on Table 6 regarding the conclusion of the PAI test instrument try-out results, it is known that out of the 30 items administered, 20 items were declared valid and 10 items were declared invalid. The valid items include numbers 1, 3, 4, 5, 7, 9, 10, 11, 12, 14, 15, 16, 18, 19, 20, 22, 24, 26, 28, and 29. Meanwhile, the invalid items are numbers 2, 6, 8, 13, 17, 21, 23, 25, 27, and 30.

In terms of difficulty level, most of the items fall into the moderate category, and only two items are categorized as easy, namely numbers 14 and 25. This indicates that, in general, the level of difficulty of the instrument is proportional and appropriate for measuring students' abilities evenly.

From the discrimination index perspective, the majority of items fall into the very good, good, and fair categories, meaning they effectively distinguish between high- and low-ability students. However, several items fall into the poor and very poor categories, and there is even an item that is invalid despite having a high discrimination index; therefore, overall, such items were not used in the study.

Based on the results of the validity test, difficulty level test, discrimination index test, and the reliability test which indicates that the instrument is reliable 20 items were deemed appropriate for use in the research, namely numbers 1, 3, 4, 5, 7, 9, 10, 11, 12, 14, 15, 16, 18, 19, 20, 22, 24, 26, 28, and 29. These items meet the criteria of a good-quality instrument and represent the measured PAI material indicators.

Thus, the PAI test instrument used in both the experimental class and the control class has undergone a quantitative selection process and meets the required standards of feasibility, making it suitable for objectively and accurately measuring students' learning outcomes.

Analysis of the Questionnaire Instrument Try-Out Results

The students' Character Education questionnaire, consisting of 27 items, was piloted on 28 twelfth-grade students at SMA Negeri 14 Bandar Lampung. The following are the results of the try-out of the Character Education questionnaire instrument that has been conducted:

1. Validity test

Construct validity was used to calculate the validity of the questionnaire. The questionnaire validity test employed the Product Moment correlation. The following are the results of the item validation test for the Students' Character Education (*Budi Pekerti*) Questionnaire:

Table 7. Validity of the Character Education Questionnaire Try-Out Results

Butir Soal	r_{xy}	r_{tabel}	Kriteria
1	0,569	0,374	Valid

Butir Soal	r_{xy}	r_{tabel}	Kriteria
2	0,315	0,374	Tidak Valid
3	0,654	0,374	Valid
4	0,589	0,374	Valid
5	0,635	0,374	Valid
6	0,501	0,374	Valid
7	0,285	0,374	Tidak Valid
8	0,582	0,374	Valid
9	0,413	0,374	Valid
10	0,642	0,374	Valid
11	0,651	0,374	Valid
12	0,085	0,374	Tidak Valid
13	0,397	0,374	Valid
14	0,411	0,374	Valid
15	0,595	0,374	Valid
16	0,546	0,374	Valid
17	0,567	0,374	Valid
18	0,039	0,374	Tidak Valid
19	0,465	0,374	Valid
20	0,552	0,374	Valid
21	0,436	0,374	Valid
22	0,432	0,374	Valid
23	0,599	0,374	Valid
24	0,473	0,374	Valid
25	0,538	0,374	Valid
26	0,334	0,374	Tidak Valid
27	0,576	0,374	Valid

Based on Table 7, the analysis of the 27 essay items that were piloted indicates that the items fall into valid and invalid criteria. An item is considered invalid if $r_{hitung} < r_{tabel}$ ($r_{x(y-1)} < 0,374$) The invalid items are numbers 2, 7, 14, 18, and 26; therefore, these 5 items were not used in the Character Education questionnaire. Meanwhile, an item is considered valid if $r_{hitung} \geq r_{tabel}$ ($r_{x(y-1)} \geq 0,374$) namely items number 1, 3, 4, 5, 6, 8, 9, 10, 11, 13, 14, 15, 16, 17, 19, 20, 21, 22, 23, 24, 25, and 27. Thus, 22 items were used in the Character Education questionnaire.

2. Reliability Test

Based on the calculation results of the 27 questionnaire items that were piloted, the reliability test of the Character Education instrument obtained a value of $r_{11} = 0,866$, which is considered reliable because the score $\geq 0,700$. Therefore, the Character Education questionnaire instrument is deemed reliable and consistent, making it suitable for measuring or collecting data on students' Character Education.

3. Conclusion of the Character Education Questionnaire Try-Out Results

Based on the results of the validity and reliability testing of the Character Education Questionnaire, the following conclusions can be drawn:

Table 8. Conclusion of the Character Education Questionnaire Try-Out Results

No	Validitas	Reliabilitas	Keterangan
1	Valid	Reliabel	Valid

No	Validitas	Reliabilitas	Keterangan
2	Tidak Valid		Tidak Valid
3	Valid		Valid
4	Valid		Valid
5	Valid		Valid
6	Valid		Valid
7	Tidak Valid		Tidak Valid
8	Valid		Valid
9	Valid		Valid
10	Valid		Valid
11	Valid		Valid
12	Tidak Valid		Tidak Valid
13	Valid		Valid
14	Valid		Valid
15	Valid		Valid
16	Valid		Valid
17	Valid		Valid
18	Tidak Valid		Tidak Valid
19	Valid		Valid
20	Valid		Valid
21	Valid		Valid
22	Valid		Valid
23	Valid		Valid
24	Valid		Valid
25	Valid		Valid
26	Tidak Valid		Tidak Valid
27	Valid		Valid

Sumber: Pengolahan Data Pada Lampiran

Based on the results of the validity and reliability tests of the Character Education questionnaire, it can be concluded that out of the 27 items tested, 22 items were declared valid and 5 items were declared invalid. The invalid items are numbers 2, 7, 12, 18, and 26, while the remaining items meet the validity criteria based on the item correlation calculations.

The reliability test results indicate that the instrument falls into the reliable category, meaning that it has a good level of consistency in measuring students' Character Education aspects. Thus, overall, the instrument has met the quality requirements of a measurement tool in terms of validity and reliability.

Based on the analysis results, the 22 valid items are deemed appropriate for use in the study, namely items number 1, 3, 4, 5, 6, 8, 9, 10, 11, 13, 14, 15, 16, 17, 19, 20, 21, 22, 23, 24, 25, and 27. These items represent the measured Character Education indicators and meet the feasibility criteria of a research instrument.

Thus, the Character Education instrument used in both the experimental and control classes has undergone quantitative testing procedures and has been declared suitable for research data collection. Therefore, the results obtained can objectively,

accurately, and scientifically account for the development of students' attitudes and character.

Data Analysis of Research Findings

1. Description of Observed Data

a. Description of Students' PAI Observed Data

The collection of PAI data was conducted before (pretest) and after (posttest) the completion of the learning process or instructional material. Both pretest and posttest were administered to the experimental class and the control class. The observed data can be seen in the appendix. The obtained posttest scores were then analyzed to determine the highest score (X_{max}) and the lowest score (X_{rendah}) in both the experimental and control classes. Subsequently, measures of central tendency were calculated, including the mean (\bar{X}) as well as measures of data variation, including the range (R), and standard deviation (S_d). The results are presented in the following table.

Table 9. Description of PAI Test Data Results

Kelompok	Tes	N	Minim	Maximum	Range	Mean	Std. Deviation
Eksperimen	Pretest	36	30	90	60	59,86	17,95
	Posttest	36	55	100	45	81,39	13,22
Kontrol	Pretest	36	30	85	55	56,39	18,08
	Posttest	36	35	95	60	66,81	18,33

Table 9 shows that the average pretest score in the experimental class was 59.86, while in the control class it was 56.39. This indicates that the initial abilities of both classes were relatively similar.

After the instructional treatment was administered, the posttest mean score in the experimental class increased to 81.39, whereas in the control class it increased to 66.81. The improvement in the experimental class was higher compared to the control class. In terms of data dispersion, the posttest standard deviation of the experimental class (13.22) was smaller than that of the control class (18.33), indicating that the learning outcomes in the experimental class were more homogeneous.

Thus, based on the descriptive statistical analysis, it can be concluded that the instructional treatment applied in the experimental class resulted in a greater improvement in PAI learning outcomes compared to the control class.

b. Description of Character Education (Budi Pekerti) Observed Data

The description of the research data and the results of the Character Education data collection can be seen in the following table:

Table 10. Description of Observed Data of the Character Education Questionnaire Results

Kelompok	Tes	N	Minimum	Maximum	Range	Mean	Std. Deviation
Eksperimen	Pretest	36	63	75	12	68,78	3,66
	Posttest	36	76	89	13	82,61	3,66
Kontrol	Pretest	36	63	75	12	69,06	3,45
	Posttest	36	67	80	13	73,61	3,66

The description of the research data and the collection of Character Education (Budi Pekerti) data can be seen in the following table. Table 10 shows that, based on the descriptive statistical data above, the number of students in each class was 36.

In the experimental class, the pretest scores had a minimum of 63 and a maximum of 75, with a range of 12, a mean of 68.78, and a standard deviation of 3.66. After the instructional treatment was administered, the posttest scores in the experimental class increased, with a minimum score of 76 and a maximum of 89, a range of 13, a mean of 82.61, and a standard deviation of 3.66.

Meanwhile, in the control class, the pretest scores showed a minimum of 63 and a maximum of 75, with a range of 12, a mean of 69.06, and a standard deviation of 3.45. In the posttest results, the minimum score was 67 and the maximum was 80, with a range of 13, a mean of 73.61, and a standard deviation of 3.66.

Based on this comparison, it can be observed that both classes experienced improvement from pretest to posttest. However, the increase in the mean score of the experimental class was higher than that of the control class. This indicates that the instructional treatment implemented in the experimental class had a more optimal effect on improving students' Character Education (*Budi Pekerti*) compared to the learning process in the control class.

2. Assumption Testing for Data Analysis

a. Data Normality Test

The normality test was conducted to determine whether the sample data in this study were normally distributed. In this research, the Shapiro-Wilk normality test was applied to both the experimental class, which received the AI utilization treatment, and the control class. The following are the results of the normality test calculations for the PAI and Character Education (*Budi Pekerti*) data:

Tabel 11. Normality Test PAI

Tests of Normality							
	KELAS (PRETEST/ POSTTEST)	Kolmogorov-Smirnov ^a			Shapiro-Wilk		
		Statistic	df	Sig.	Statistic	df	Sig.
PAI	PRETEST EKSPERIMEN	.094	36	.200 [*]	.954	36	.142
	POSTTEST EKSPERIMEN	.111	36	.200 [*]	.941	36	.056
	PRETEST KONTROL	.098	36	.200 [*]	.942	36	.060
	POSTTEST KONTROL	.094	36	.200 [*]	.954	36	.142
* . This is a lower bound of the true significance.							
a. Lilliefors Significance Correction							

Based on the results of the normality test in Table 4.10, the Shapiro-Wilk analysis at a significance level of $\alpha = 0.05$ indicates that all data groups have significance values (Sig.) greater than 0.05. Specifically, the Sig. value for the experimental class pretest is 0.142 and for the posttest is 0.056. Meanwhile, in the control class, the Sig. value for the pretest is 0.060 and for the posttest is 0.142.

Referring to the normality testing criteria, if the p-value ≥ 0.05 , the data are considered normally distributed, whereas if the p-value < 0.05 , the data are not normally distributed. Since all significance values in each group are greater than 0.05, it can be concluded that the PAI data in both the experimental and control classes, for both pretest and posttest, originate from a normally distributed population.

Thus, the assumption of normality as a prerequisite for parametric statistical analysis has been fulfilled, and the data are appropriate to proceed to the next stage of hypothesis testing.

Selanjutnya uji normalitas pada Budi Pekerti adalah sebagai berikut:

Tabel 12. Normality Test Character Education

Tests of Normality							
	KELAS (PRETEST/ POSTTEST)	Kolmogorov-Smirnov ^a			Shapiro-Wilk		
		Statistic	df	Sig.	Statistic	df	Sig.
BUDI_ PEKERTI	PRETEST EKSPERIMEN	.119	36	.200*	.960	36	.212
	POSTTEST EKSPERIMEN	.073	36	.200*	.970	36	.430
	PRETEST KONTROL	.117	36	.200*	.964	36	.277
	POSTTEST KONTROL	.089	36	.200*	.969	36	.391

*. This is a lower bound of the true significance.
a. Lilliefors Significance Correction

Based on the normality test results for the Character Education (Budi Pekerti) data, the Shapiro–Wilk analysis at a significance level of $\alpha = 0.05$ also shows that all data groups have significance values (Sig.) greater than 0.05. The Sig. value for the experimental class pretest is 0.212 and for the posttest is 0.430. In the control class, the Sig. value for the pretest is 0.277 and for the posttest is 0.391.

In accordance with the normality testing criteria, if the p-value ≥ 0.05 , the data are considered normally distributed, whereas if the p-value < 0.05 , the data are not normally distributed. Since all significance values in each group exceed 0.05, it can be concluded that the Character Education data in both the experimental and control classes, for both pretest and posttest, are normally distributed.

Therefore, the assumption of normality as a prerequisite for parametric statistical analysis has been satisfied, and the data are suitable to proceed to the subsequent hypothesis testing stage.

In conclusion, overall, both datasets PAI and Character Education (*Budi Pekerti*) are declared to be normally distributed.

b. Homogeneity Data Test

The homogeneity test was conducted as the second prerequisite for determining the appropriate hypothesis test to be used. The homogeneity test aims to examine whether the population variances of the data are equal. In this study, the homogeneity test was performed using SPSS 25 software with a significance level of $\alpha = 0.05$. The calculation results are presented as follows.

Tabel 13. Homogeneity Test PAI

Test of Homogeneity of Variance					
		Levene Statistic	df1	df2	Sig.
PAI	Based on Mean	1.486	3	140	.221
	Based on Median	1.436	3	140	.235
	Based on Median and with adjusted df	1.436	3	136.704	.235
	Based on trimmed mean	1.465	3	140	.227

Based on the results shown in the homogeneity test table, the PAI data have equal or homogeneous variances. This is evidenced by the significance value (p-value) based on the Mean of 0.221, which is greater than 0.05 ($0.221 > 0.05$). Therefore, it can be concluded that the variances between groups are homogeneous and meet one of the prerequisites for parametric statistical analysis.

Table 14. Homogeneity Test Character Education

Test of Homogeneity of Variance					
		Levene Statistic	df1	df2	Sig.
BUDI_	Based on Mean	.018	3	140	.997
PEKERTI	Based on Median	.021	3	140	.996
	Based on Median and with adjusted df	.021	3	138.406	.996
	Based on trimmed mean	.018	3	140	.997

Similarly, the results of the homogeneity test indicate that the Character Education (*Budi Pekerti*) data also originate from equal or homogeneous variances. This is proven by the significance value (p-value) based on the Mean of 0.997, which is greater than 0.05 ($0.997 > 0.05$). Since all significance values across each approach (mean, median, adjusted df, and trimmed mean) are also above 0.05, it can be concluded that the variances between groups are homogeneous and have fulfilled the prerequisite for proceeding with parametric statistical analysis.

Table 15. Output Box'M

Box's Test of Equality of Covariance Matrices ^a	
Box's M	3.769
F	.408
df1	9
df2	224612.219
Sig.	.932
Tests the null hypothesis that the observed covariance matrices of the dependent variables are equal across groups.	
a. Design: Intercept + MODEL_PEMBELAJARAN	

Furthermore, regarding the homogeneity test based on the Box's M value, the following results were obtained. Based on the results of the Box's Test of Equality of Covariance Matrices, the significance value (Sig.) was 0.932. This test aims to examine the null hypothesis that the covariance matrices of the dependent variables are equal (homogeneous) across groups based on the instructional model.

Referring to the testing criteria, if the $p\text{-value} \geq 0.05$, the null hypothesis is accepted, meaning that the covariance matrices between groups are equal. Conversely, if the $p\text{-value} < 0.05$, the covariance matrices are considered unequal.

Since the significance value of 0.932 is greater than 0.05 ($0.932 > 0.05$), it can be concluded that the covariance matrices of the dependent variables across instructional model groups are homogeneous. Therefore, the assumption of equality of covariance matrices has been satisfied, allowing further analysis such as MANOVA to be conducted.

Results of Hypothesis Testing

After confirming that the data in this study were normally distributed and homogeneous, hypothesis testing was conducted using MANOVA (Multivariate Analysis of Variance). The presentation of the hypothesis testing results is aligned with the research questions or hypotheses. For the partial test in MANOVA, the results can be seen in the *Tests of Between-Subjects Effects*. The results are as follows:

Table 16. *Tests of Between-Subjects Effects Result*

Tests of Between-Subjects Effects						
Source	Dependent Variable	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	PAI	13026.389 ^a	3	4342.130	15.528	.000
	BUDI PEKERTI	4491.917 ^b	3	1497.306	123.594	.000
Intercept	PAI	616225.000	1	616225.000	2203.692	.000
	BUDI PEKERTI	777630.028	1	777630.028	64189.055	.000
PEMANFAATAN_AI	PAI	13026.389	3	4342.130	15.528	.000
	BUDI PEKERTI	4491.917	3	1497.306	123.594	.000
Error	PAI	39148.611	140	279.633		
	BUDI PEKERTI	1696.056	140	12.115		
Total	PAI	668400.000	144			
	BUDI PEKERTI	783818.000	144			
Corrected Total	PAI	52175.000	143			
	BUDI PEKERTI	6187.972	143			
a. R Squared = .250 (Adjusted R Squared = .234)						
b. R Squared = .726 (Adjusted R Squared = .720)						

Based on the *Tests of Between-Subjects Effects*, information was obtained regarding the effect of the AI Utilization variable on two dependent variables, namely PAI and Character Education (Budi Pekerti).

For the PAI variable, the F value is 15.528 with a significance value of 0.000 ($p < 0.05$). This indicates that AI utilization has a significant effect on PAI learning outcomes. In addition, the R Squared value of 0.250 (Adjusted R Squared = 0.234) indicates that 25% of the variance in PAI outcomes can be explained by the model used, while the remaining variance is influenced by other factors outside the research model.

For the Character Education (Budi Pekerti) variable, the F value obtained is 123.594 with a significance value of 0.000 ($p < 0.05$). This result shows that AI utilization also has a significant effect on Character Education outcomes. The R

Squared value of 0.726 (Adjusted R Squared = 0.720) indicates that 72.6% of the variance in Character Education outcomes can be explained by the model, meaning that the contribution of the effect is strong.

Since all significance values are smaller than 0.05, it can be concluded that AI utilization has a significant effect on both PAI learning outcomes and Character Education (Budi Pekerti). Therefore, the research hypothesis stating that there is an effect of AI utilization on both dependent variables is accepted.

Table 17. Multivariate Tests Result

Multivariate Tests ^a						
Effect		Value	F	Hypothesis df	Error df	Sig.
Intercept	Pillai's Trace	.998	32697.669 ^b	2.000	139.000	.000
	Wilks' Lambda	.002	32697.669 ^b	2.000	139.000	.000
	Hotelling's Trace	470.470	32697.669 ^b	2.000	139.000	.000
	Roy's Largest Root	470.470	32697.669 ^b	2.000	139.000	.000
PEMANFAATAN_AI	Pillai's Trace	.751	28.036	6.000	280.000	.000
	Wilks' Lambda	.253	45.786 ^b	6.000	278.000	.000
	Hotelling's Trace	2.939	67.590	6.000	276.000	.000
	Roy's Largest Root	2.934	136.913 ^c	3.000	140.000	.000
a. Design: Intercept + PEMANFAATAN_AI						
b. Exact statistic						
c. The statistic is an upper bound on F that yields a lower bound on the significance level.						

Furthermore, for the simultaneous test in MANOVA, the results can be seen in the *Multivariate Tests*. Based on the *Multivariate Tests*, the effect of the AI Utilization variable on the two dependent variables (PAI and Character Education) can be analyzed through several multivariate statistical criteria, namely Pillai's Trace, Wilks' Lambda, Hotelling's Trace, and Roy's Largest Root.

For the effect of AI_UTILIZATION, the significance value across all criteria is 0.000 ($p < 0.05$). Under Pillai's Trace, the value obtained is 0.751 with $F = 28.036$; under Wilks' Lambda, 0.253 with $F = 45.786$; under Hotelling's Trace, 2.939 with $F = 67.590$; and under Roy's Largest Root, 2.934 with $F = 136.913$.

Since all significance values are less than 0.05, it can be concluded that simultaneously there is a significant effect of AI utilization on the PAI and Character Education variables. This means that the AI-based instructional model provides a meaningful impact on both dependent variables collectively. Therefore, the hypothesis stating that there is a simultaneous effect of AI utilization on PAI and Character Education (Budi Pekerti) is accepted.

Result Discussion of Research

This research was conducted at SMA Negeri 14 Bandar Lampung and implemented in Grade XI. The stages undertaken in this study included a validation phase by expert lecturers serving as postgraduate faculty members at UIN Raden Intan Lampung. Subsequently, a pilot test of the test items and questionnaire was conducted with Grade XII students, and the results of the pilot test are presented in the appendix.

This study consisted of two independent variables and two dependent variables. The independent variable was AI Utilization, while the dependent variables were PAI and Character Education (*Budi Pekerti*). The population of this research comprised all Grade XI students at SMA Negeri 14 Bandar Lampung. The research sample consisted of class XI F.1 as the experimental class, which received the AI utilization treatment, and class XI F.2 as the control class, with each class consisting of 36 students. The instructional material implemented in this study was “Applying al-Kulliyat al-Khamsah in Daily Life.”

The research was conducted over five meetings, consisting of one meeting for the pretest, three meetings for the AI utilization treatment, and one meeting for the posttest data collection. The pretest and posttest instruments met the criteria for PAI and Character Education after undergoing validity, discrimination index, difficulty level, and reliability testing.

The prerequisite test results indicated that the data were normally distributed, the variances between groups were homogeneous, and the covariance matrices were equal. With the MANOVA assumptions fulfilled, the interpretation of the hypothesis testing results could be conducted validly.

The explanation of the research findings using AI Utilization is as follows:

1. The Effect of AI Utilization on PAI

The Tests of Between-Subjects Effects results indicate that AI utilization has a significant effect on PAI, with $F = 15.528$ and a significance value of 0.000 ($p < 0.05$).

This means that the use of AI in learning significantly improves students' PAI outcomes compared to conventional instruction. The increase in the average PAI scores from pretest to posttest in the experimental class was higher than in the control class, demonstrating the effectiveness of AI in supporting students' understanding and mastery of the material, particularly complex religious concepts.

Theoretically, AI enables adaptive learning through personalized content, instant feedback, and data-driven learning analytics. This is consistent with the systematic review conducted by Wayne Holmes et al. (2021), which states that AI in education supports personalized learning and enhances students' academic achievement.²¹

These findings are further supported by recent systematic reviews showing that AI implementation positively impacts learning outcomes and student engagement across various educational contexts.²² Additionally, an empirical study by Vieriu (2025) found that the integration of AI in the learning process significantly contributes to improving academic outcomes and student engagement.²³

Thus, the first hypothesis stating that AI utilization has a significant effect on PAI is accepted.

²¹ W Holmes, R Luckin, and A Shaikh, *Artificial Intelligence in Education: Promise, Pedagogy, and Policy* (London: UCL Press, 2022).

²² Olaf Zawacki-Richter et al., “Systematic Review of Research on Artificial Intelligence Applications in Higher Education,” *International Journal of Educational Technology in Higher Education* 16, no. 39 (2019): 1–27.

²³ Adrian M Vieriu, “The Impact of Artificial Intelligence (AI) on Students' Academic Outcomes and Engagement,” *Education Sciences* 15, no. 3 (2025): 343.

2. The Effect of AI Utilization on Character Education (*Budi Pekerti*)

The analysis results indicate that AI utilization has a significant effect on Character Education ($p < 0.05$). This demonstrates that AI has a strong impact on students' character development.

Conceptually, the use of AI in learning enables the presentation of ethical simulations, interactive case studies, and scenario-based moral reflections. Rose Luckin (2022) emphasizes that AI has the potential to support social and emotional skill development when designed pedagogically and ethically.²⁴

Furthermore, UNESCO (2023) highlights that AI integration in education should focus not only on cognitive improvement but also on strengthening values, social responsibility, and students' digital literacy.²⁵

In the national context, research by Ambarita and Nurrahmatullah (2024) shows that AI utilization in learning positively affects both conceptual understanding and students' learning attitudes.²⁶ This reinforces the findings of the present study that AI can serve as an instrument for character education when applied purposefully and contextually within Islamic education.

CONCLUSION

Based on the results of data analysis and discussion regarding the effect of Artificial Intelligence (AI) utilization on the learning outcomes of Islamic Religious Education (PAI) and Character Education among eleventh-grade students at SMA Negeri 14 Bandar Lampung, it can be concluded that the utilization of AI has a significant effect on improving learning outcomes. This is evidenced by the results of the Tests of Between-Subjects Effects, which show an F value of 15.528 with a significance level of $p < 0.05$; therefore, statistically, the research hypothesis is accepted. These findings indicate that the use of AI in the learning process is demonstrably more effective than conventional learning in improving PAI learning achievement.

Furthermore, the R Squared value of 0.250 indicates that 25% of the variance in PAI learning outcomes is influenced by the utilization of AI, while the remaining 75% is affected by other variables outside the research model. Thus, the use of AI can be positioned as one of the determinant factors that moderately contributes to the improvement of learning outcomes.

Meanwhile, the results of the analysis on the effect of AI on character education show an F value of 123.594 with a significance level of $p < 0.05$ and an R Squared value of 0.726. This indicates that the utilization of AI provides a very strong contribution to the development and strengthening of students' character, particularly in aspects related to attitudes and the internalization of values.

Based on these findings, future research is recommended to expand the sample scope, employ more complex experimental designs, and integrate additional variables

²⁴ Holmes, Luckin, and Shaikh, *Artificial Intelligence in Education: Promise, Pedagogy, and Policy*.

²⁵ UNESCO, "Guidance for Generative AI in Education and Research" (Paris: UNESCO, 2023).

²⁶ Nita Ambarita and Muh. Fiqri Nurrahmatullah, "Impacts of Artificial Intelligence on Student Learning: A Systematic Literature Review," *Varidika* 36, no. 1 (2024): 1–20.

such as learning motivation, digital literacy, and self-regulated learning in order to obtain a more comprehensive analytical model. These efforts are expected to strengthen the empirical foundation for the use of AI in religious education as a strategic innovation that supports the improvement of adaptive, relevant, and character-oriented educational quality for future generations.

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