EFFECTIVENESS OF USING AI-BASED CHATBOT FOR LIBRARY INFORMATION SERVICES AT SMAN 9 BANDAR LAMPUNG

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Abstrak
This study aims to determine the effectiveness of an artificial intelligence (AI)-based chatbot compared to conventional methods in library information services at SMAN 9 Bandar Lampung. The research method uses an experimental quantitative approach with an Intact-Group Comparison design. The study population consisted of 1,102 students, with a sample of 92 respondents selected using the Slovin formula. The experimental group used a WhatsApp Business-based AI chatbot, while the control group used conventional services. Data were collected through a 1–5 Likert scale questionnaire that was valid and reliable (Cronbach's Alpha = 0.786). Prerequisite tests using Shapiro-Wilk and Levene's Test showed that the data were normally distributed and homogeneous. The results of the independent sample T-test showed t = 7.285 with a significance of 0.000 (p < 0.05), so H_1 was accepted. Descriptive analysis showed that the experimental group (M = 48.30) achieved the "effective" category for all indicators, while the control group (M = 38.65) was in the "neutral" category for the indicators of information speed and service availability without time constraints. In conclusion, the use of AI-based chatbots through WhatsApp Business has proven to be more effective than conventional services in improving the quality of library information services.
Keyword: *Artificial Intelligence, Information Services, Libraries, Chatbots*

INTRODUCTION

In the current era of the Fourth Industrial Revolution, the way people access and utilize information has undergone significant transformation. Artificial Intelligence (AI) has become one of the main drivers of digital transformation in various sectors, including libraries. Librarians are now faced with increasingly complex challenges, such as the demand to provide faster access to information, more accessible services, and more responsive interactions with library users. In response to these conditions, libraries need to develop various innovations to adapt to technological advancement, improve service quality, and strengthen the relationship between librarians and users (Aboelmaged, Bani-Melhem, Al-Hawari, & Ahmad, 2023).

Conventional librarian-based services, which are limited by working hours and human resource capacity, are no longer sufficient to meet the needs of students who are growing up in the digital era (Wankhede, 2025).

Hernon and Altman (2015) define service effectiveness as the extent to which a library fulfills users' information needs efficiently and satisfactorily. Furthermore, the effectiveness of digital libraries is associated with four main dimensions: speed of information delivery, user satisfaction, availability of services without time limitations, and operational efficiency (Hernon & Altman, 2015). The Technology Acceptance Model (TAM), introduced by Davis (1989), provides a theoretical framework for understanding how students adopt new technologies such as AI-based chatbots (Davis, 1989). TAM states that perceived usefulness and perceived ease of use are the main determinants of technology acceptance. Previous studies indicate that when students perceive a library technology as both useful and easy to use, they are more likely to engage with it regularly (Venkatesh, 2008; Shelley, 2008). This theoretical foundation underlies the hypothesis of this study that AI-based chatbot services, due to their 24/7 availability, instant responsiveness, and accessibility through smartphones, will be perceived as more effective than conventional library services.

A chatbot is known as a technology capable of supporting two-way interaction, allowing library users to ask various questions according to their needs (Shiddiq, 2021). AI-based chatbots have become one of the potential innovations for addressing various challenges in library information services. This technology enables services to remain active 24 hours a day without being limited by time or place and is capable of providing rapid responses to user inquiries. In addition, chatbots can handle multiple requests efficiently. The system can be trained to answer various frequently asked questions related to library services, assist users in searching library collections, provide information on book availability, facilitate borrowing and returning processes, and direct users to digital resources relevant to their needs (Alkatrin, 2023). Chatbot systems can also be trained to answer general questions about library services, help users search collections, provide information on book availability, and guide users to relevant digital resources (Rubin, Chen, & Thorimbert, 2020).

The library of SMAN 9 Bandar Lampung has demonstrated progressive adaptation to developments in the digital era. Based on preliminary observations and interviews, the library already has adequate technological infrastructure, including high-speed internet access, a digital catalog, and sufficient librarian staff. Students at this school are also allowed to use mobile phones during learning hours, which facilitates mobile access to information. The implementation of an AI-based chatbot is expected to become a disruptive innovation that complements these existing advancements. Through the WhatsApp Business platform, which can be accessed via students' mobile phones anytime and anywhere, the chatbot enables users to ask questions about book collections, requirements for library card registration, and guidance on library facilities without having to visit the library physically. This innovation not only improves service efficiency but also strengthens students' digital literacy amid the Fourth Industrial Revolution. If proven effective, its implementation at SMAN 9 Bandar Lampung has the potential to serve as a pilot model for other senior high school libraries in Indonesia in adopting similar technology to optimize information services.

Considering the number of previous studies that have discussed library users' information-seeking behavior, including those by Guntoro, Costaner, and Lisnawita (2020), Prasojo et al. (2024), Amrullah, Anas, and Primajati (2022), Qaulan, Wahyuni, and Adytia (2025), and Sentiana, Mustofa, and Wuryan (2024), this study is similar to previous research in that it

examines AI-based chatbots. However, this study does not only discuss chatbot implementation; it also compares its effectiveness with conventional services in the context of a school library. Based on the importance of the problems described above, the researcher is interested in investigating this issue under the title "The Effectiveness of Using AI-Based Chatbots for Library Information Services at SMAN 9 Bandar Lampung."

The problem addressed in this study is whether AI-based chatbots are more effective than conventional methods in providing information services at the library of SMAN 9 Bandar Lampung. The objective of this study is to determine whether the use of AI-based chatbots is more effective than conventional methods in delivering library information services. The benefit of this study lies in its potential contribution to the development of more responsive library services through the use of AI-based chatbots. It is also expected to provide benefits for practitioners, academics, users, and library institutions. In addition, this study may serve as a comparative reference for further development.

RESEARCH METHOD

This study employed a quantitative experimental research method. The experimental method used in this study adopted an intact-group comparison design, a type of quasi-experimental design in which existing groups are assigned as the experimental group and the control group without full randomization (Sugiyono, 2019). Quantitative research, in essence, is a scientific approach that focuses on collecting numerical data or measurable data. This approach provides a systematic analytical framework, enabling researchers to conduct accurate measurements, observe phenomena carefully, and analyze data using planned and structured quantitative procedures (Zulfikar et al., 2020).

The research was conducted at the library of SMAN 9 Bandar Lampung. To address the potential limitations of the non-randomized design, the comparability of the two groups was assessed based on their academic background profiles. Both groups consisted of students from Grades X, XI, and XII with similar academic achievement records and comparable previous experience in using library services. This was confirmed through a brief demographic questionnaire administered before the treatment. This initial equivalence check strengthened the internal validity of the study.

The population of this study consisted of all students of SMAN 9 Bandar Lampung, totaling 1,102 students (Kita, n.d.). According to Sarwono, a population refers to the entire set of objects or individuals targeted in a study, while a sample is a subset of the population selected to represent the whole in the research process (Sarwono, 2022). In this study, the Slovin formula was also used to determine the required sample size. The Slovin formula is presented as follows:

$$n = \frac{N}{1 + N\,e^2}$$

Note:

n = sample size or number of respondents
N = population size
e^2 = allowable margin of error, with e = 0.1 (10%)

In this study, the sample size was determined using the Slovin formula because the population size was relatively large, consisting of 1,102 users. By setting a margin of error of 10%, the sample size obtained from the calculation was rounded accordingly to ensure

consistency and to account for possible variations among respondents. Therefore, the sample size used in this study was determined based on the calculation using the following formula:

$$n = \frac{1.102}{1 + 1.102\ (0{,}1)^2}$$
$$n = \frac{1.102}{12{,}02}$$
$$n = 92$$

Thus, the sample consisted of 92 respondents, who were then equally divided into the experimental group (n = 46) and the control group (n = 46).

The experimental group used an AI-based chatbot implemented through WhatsApp Business during a two-week treatment period. During this period, students in the experimental group were encouraged to use the chatbot for all library information needs, including inquiries about book availability, library membership procedures, collection searches, and information on library facilities. Meanwhile, the control group continued to use conventional face-to-face library services as usual, without access to the chatbot.

An interval scale enables the measurement of the extent to which an individual characteristic is related to a particular variable. By using consistent units, this scale can indicate numerical differences with equal distances. In this measurement, objects are systematically assigned numerical values so that the distance between numbers reflects fixed and comparable differences in attributes (Maskhuliah et al., 2025). The interval scale is determined by dividing the difference between the lowest and highest scores by the number of scale categories. The formula for the scale range is presented as follows:

$$Rs = \frac{m - n}{b}$$

Note:
Rs = scale range
m = highest score
n = lowest score
b = number of assessment scale categories to be formed

If the assessment scale applied consists of five categories, where the lowest score is 1 and the highest score is 5, the interval scale range can be calculated as follows:

$$Rs = \frac{m - n}{b} = \frac{5 - 1}{5} = \frac{4}{5} = 0{,}8$$

Based on the calculation above, the scale range (Rs) is 0.8, which means that each interval on the 1–5 scale has a width of 0.8 units.

kategori Efektifitas	**rentang skor**
Very Effective	4.4 – 5,2
Effective	3,5 – 4,3
Neutral	2,6 – 3,4
Ineffective	1,7 – 2,5

Very Ineffective	0,8 – 1,6

(Maskhuliah et al. 2025)

The hypotheses in this study are formulated as follows:

1. Null Hypothesis (H_0): The use of an AI-based chatbot is not effective in improving library information services at SMAN 9 Bandar Lampung, particularly in reducing librarians' workload and increasing students' unrestricted access to information.
2. Alternative Hypothesis (H_1): The use of an AI-based chatbot is effective in improving library information services at SMAN 9 Bandar Lampung, particularly in reducing librarians' workload and increasing students' unrestricted access to information.

Validity and Reliability Tests

Validity measures the extent to which a research instrument accurately measures what it is intended to measure. The most commonly used validity test employs the Pearson Product-Moment Correlation formula, which examines the relationship between each item score and the total score. Meanwhile, reliability refers to the consistency and stability of an instrument when used repeatedly. The reliability test most frequently uses Cronbach's Alpha coefficient. In this study, validity and reliability testing were conducted using a sample of 31 respondents, in accordance with the minimum sample size requirement for instrument testing. The instrument is considered reliable if the Cronbach's Alpha value is greater than 0.60 or 0.70, indicating that the measurement results are consistent and trustworthy (Wahyuni, 2014).

Correlations

		P09	P10	P11	P12	**TOTAL**
P01	Pearson Correlation	.495**	.202	.132	.321	**.663****
	Sig. (2-tailed)	.005	.275	.480	.078	**.000**
	N	31	31	31	31	**31**
P02	Pearson Correlation	.320	.332	-.068	.262	**.550****
	Sig. (2-tailed)	.079	.068	.715	.154	**.001**
	N	31	31	31	31	**31**
P03	Pearson Correlation	.448*	.164	.095	.324	**.651****
	Sig. (2-tailed)	.011	.378	.613	.076	**.000**
	N	31	31	31	31	**31**
P04	Pearson Correlation	-.059	.186	.049	.386*	**.479****
	Sig. (2-tailed)	.751	.316	.796	.032	**.006**
	N	31	31	31	31	**31**
P05	Pearson Correlation	.030	.497**	.150	-.007	**.352**
	Sig. (2-tailed)	.873	.004	.420	.971	**.052**
	N	31	31	31	31	**31**
P06	Pearson Correlation	.631**	.158	.217	.430*	**.545****
	Sig. (2-tailed)	.000	.396	.241	.016	**.002**
	N	31	31	31	31	**31**
P07	Pearson Correlation	.235	.051	.381*	.376*	**.646****
	Sig. (2-tailed)	.203	.785	.034	.037	**.000**
	N	31	31	31	31	**31**
P08	Pearson Correlation	.068	.259	.199	.382*	**.503****
	Sig. (2-tailed)	.718	.160	.283	.034	**.004**
	N	31	31	31	31	**31**
P09	Pearson Correlation	1	.298	.205	.363*	**.606****
	Sig. (2-tailed)		.103	.269	.045	**.000**
	N	31	31	31	31	**31**
P10	Pearson Correlation	.298	1	.044	-.152	**.436***

	Sig. (2-tailed)	.103		.816	.416	**.014**
	N	31	31	31	31	**31**
P11	Pearson Correlation	.205	.044	1	.526**	**.478****
	Sig. (2-tailed)	.269	.816		.002	**.007**
	N	31	31	31	31	**31**
P12	Pearson Correlation	.363*	-.152	.526**	1	**.658****
	Sig. (2-tailed)	.045	.416	.002		**.000**
	N	31	31	31	31	**31**
TOTAL	Pearson Correlation	.606**	.436*	.478**	.658**	**1**
	Sig. (2-tailed)	.000	.014	.007	.000	
	N	31	31	31	31	**31**

Reliability Statistics	
Cronbach's Alpha	**N of Items**
.786	**12**

RESULT AND DISCUSSION

Before conducting the comparative test, a normality test was first performed to determine whether the data obtained from the two groups were normally distributed. The normality test was conducted using the Shapiro–Wilk test because the sample size in each group in this study was classified as small to moderate (n ≤ 50). The results of the normality test are presented below:

Table 1. Results of the Normality Test (Tests of Normality)

Tests of Normality[a,c,e,f,g]							
	Eksperimen	Kolmogorov-Smirnov[b]			**Shapiro-Wilk**		
		Statistic	df	Sig.	Statistic	df	**Sig.**
Kontrol	37	.238	4	.	.938	4	**.643**
	40	.260	2	.			
	44	.260	2	.			
	45	.165	4	.	.997	4	**.989**
	47	.260	2	.			
	48	.227	6	.200*	.901	6	**.382**
	49	.260	2	.			
	50	.213	7	.200*	.898	7	**.321**
	51	.260	2	.			
	52	.260	2	.			
	53	.310	3	.	.900	3	**.384**
	54	.260	2	.			
	57	.304	3	.	.907	3	**.407**

Source: SPSS output, data processed by researchers (2026)

Based on Table 1, the Shapiro–Wilk normality test showed varying significance values, all of which were above 0.05 (p > 0.05), indicating that the data were normally distributed. Therefore, the data met the requirements for conducting a parametric statistical test.

After the data were confirmed to be normally distributed, a homogeneity of variance test was conducted using Levene's Test to determine whether the variances between the

experimental group and the control group were homogeneous. The results of the homogeneity test are presented below:

Table 2. Results of the Homogeneity Test (Tests of Homogeneity of Variance)

Test of Homogeneity of Variance					
		Levene Statistic	df1	df2	**Sig.**
Hasil	Based on Mean	2.630	1	90	**.108**
	Based on Median	2.179	1	90	**.143**
	Based on Median and with adjusted df	2.179	1	89.422	**.143**
	Based on trimmed mean	2.495	1	90	**.118**

Source: SPSS output, data processed by researchers (2026)

Based on Table 2, the results of the homogeneity of variance test showed significance values of 0.108 based on the mean, 0.143 based on the median, 0.143 based on the median with adjusted degrees of freedom, and 0.118 based on the trimmed mean. All significance values were greater than 0.05, indicating that the variances of the two groups were homogeneous. Since the assumption of homogeneity of variance was met, the analysis could proceed to hypothesis testing.

After the prerequisite tests were conducted, hypothesis testing was performed to determine the effectiveness of the AI-based chatbot in library information services. An Independent Samples t-test was used to compare the mean effectiveness scores between the experimental group, which used the chatbot, and the control group, which used conventional services. The descriptive statistics for each group are presented below:

Table 3. Group Descriptive Statistics (Group Statistics)

Group Statistics					
	Kelas	N	Mean	Std. Deviation	**Std. Error Mean**
Hasil	Eksperimen	46	48.30	5.830	**.860**
	Kontrol	46	38.65	6.839	**1.008**

Source: SPSS output, data processed by researchers (2026)

Based on Table 3, the test results showed that the experimental group obtained a mean score of 48.30, while the control group obtained a mean score of 38.65. This indicates a significant difference between the two groups, in which students who used the AI-based chatbot achieved a higher mean score than those who used the conventional method. Therefore, H_0 was rejected and H_1 was accepted.

In addition, the t-test results showed a calculated t-value of 7.285 with a significance value (Sig. 2-tailed) of 0.000. Since the significance value was less than 0.05, the null hypothesis (H_0) was rejected and the alternative hypothesis (H_1) was accepted. Thus, it can be concluded that the use of an AI-based chatbot was proven to be more effective than the conventional method in improving library information services.

Table 3. Results of the Independent Samples Test

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means	
		F	Sig.	t	df
Hasil	Equal variances assumed	2.630	.108	7.285	90
	Equal variances not assumed			7.285	87.804

Independent Samples Test

		t-test for Equality of Means			
		Sig. (2-tailed)	Mean Difference	Std. Error Difference	**95% Confidence Interval of the Difference Lower**
Hasil	Equal variances assumed	.000	9.65217	1.32501	**7.01982**
	Equal variances not assumed	.000	9.65217	1.32501	**7.01892**

Independent Samples Test

		t-test for Equality of Means 95% Confidence Interval of the Difference Upper
Hasil	Equal variances assumed	**12.28453**
	Equal variances not assumed	**12.28543**

Source: SPSS output, data processed by researchers (2026)

In addition, a descriptive analysis was also conducted on the effectiveness scores based on the questionnaire distributed to the respondents. The scores were measured using a 1–5 Likert scale, then averaged and categorized according to the effectiveness assessment scale used in this study. The following presents the recapitulation of scores for each indicator in the experimental group:

Table 4. Recapitulation of Indicators of Speed and Information Delivery to Users

No	Question	Total Answer	Score (average)
1.	The library service provides information quickly when I need it.	188	**4,08**
2.	The information provided by the library is always timely and without delay.	176	**3,82**
3.	I find the library's information delivery process very fast.	184	**4,00**
			11,9/3 = 3,96

Source: Primary Data, research questionnaire (2026)

Based on Table 4, the total score for the indicators of speed and information delivery to users in the experimental group was 11.9/3 = 3.96. This score places the chatbot service in the effective category on the effectiveness assessment scale, within the range of 3.5–4.3.

Table 5. Recapitulation of Indicators of User Satisfaction with Library Services

No	Question	Total Answer	Score (average)
1.	I am satisfied with the quality of service provided by the library.	187	**4,06**
2.	The library's information services meet my expectations as a user.	186	**4,04**
3.	Overall, I found the information services very satisfactory.	188	**4,08**
			12,18/3 = 4,06

Source: Primary Data, research questionnaire (2026)

Based on Table 5, the total score for the User Satisfaction Level Indicator for Library Services in the experimental group was 12.18/3 = 4.06. This score places the chatbot service in the effective category on an effectiveness assessment scale ranging from 3.5 to 4.3.

Table 6. Summary of indicators for comprehensive and seamless information service availability.

No	Question	Total Answer	Score (average)
1.	Library information services are available whenever I need them, without time constraints.	179	**3,89**
2.	The library provides comprehensive information for my various needs.	187	**4,06**
3.	I don't experience time constraints when accessing library information services.	189	**4,10**
			12,05/3 = 4,01

Source: Primary Data, research questionnaire (2026)

Based on Table 6, the total score for the comprehensive and seamless availability of information services in the experimental group was 12.05/3 = 4.01. This score places the chatbot service in the effective category on an effectiveness assessment scale ranging from 3.5 to 4.3.

Table 7. Summary of library service operational efficiency indicators (Time, Cost, and Resources Used)

No	Question	Total Answer	Score (average)
1.	The library service uses time efficiently to provide information.	180	**3,91**
2.	The cost of accessing library information services is very affordable.	188	**4,08**
3.	The library serves me quickly without wasting time, money, or energy.	190	**4,13**
			12,12/3 = 4,04

Source: Primary Data, research questionnaire (2026)

Based on Table 7, the total score for the library service operational efficiency indicator (time, cost, and resources used) in the experimental group was 12.12/3 = 4.04. This score places the chatbot service in the effective category on an effectiveness assessment scale ranging from 3.5 to 4.3. The following is a summary of the scores per indicator in the control group:

Table 8. Summary of indicators for speed and information delivery to users

No	Question	Total Answer	Score (average)
1.	The library service provides information quickly when I need it.	164	**3,56**
2.	The information provided by the library is always timely and without delay.	153	**3,32**
3.	I find the library's information delivery process very fast.	148	**3,21**
			10,09/3 = 3,36

Source: Primary Data, research questionnaire (2026)

Based on Table 8, the total score for the speed and delivery of information to users in the control group was 10.09/3 = 3.36. This score places the chatbot service in the neutral category on the effectiveness assessment scale, which ranges from 2.6 to 3.4.

Table 9. Summary of User Satisfaction Indicators for Library Services

No	Question	Total Answer	Score (average)
1.	I am satisfied with the quality of service provided by the library.	171	**3,71**
2.	The library's information services meet my expectations as a user.	169	**3,67**
3.	Overall, I found the information services very satisfactory.	171	**3,71**
			11,09/3 = 3,69

Source: Primary Data, research questionnaire (2026)

Based on Table 9, the total score for the User Satisfaction Level with Library Services indicator in the control group was 11.09/3 = 3.69. This score places the chatbot service in the effective category on the effectiveness assessment scale ranging from 3.5 to 4.3.

Table 10. Summary of indicators for comprehensive and seamless information service availability.

No	Question	Total Answer	Score (average)
1.	Library information services are available whenever I need them, without time constraints.	159	**3,45**
2.	The library provides comprehensive information for my various needs.	164	**3,56**
3.	I don't experience time constraints when accessing library information services.	152	**3,30**
			10,31/3 = 3,43

Source: Primary Data, research questionnaire (2026)

Based on Table 10, the total indicator score for the availability of information services comprehensively and without time constraints in the control group is 10.31/3 = 3.4. This score places the chatbot service in the neutral category on an effectiveness assessment scale ranging from 2.6-3.4.

Table 11. Recapitulation of operational efficiency indicators for library services (time, costs and resources used)

No	Question	Total Answer	Score (average)
1.	The library service uses time efficiently to provide information.	157	**3,41**
2.	The cost of accessing library information services is very affordable.	170	**3,69**
3.	The library serves me quickly without wasting time, money, or energy.	164	**3,56**
			10,66/3 = 3,55

Source: Primary Data, research questionnaire (2026)

Based on Table 11, the total score for the library service operational efficiency indicator (time, cost, and resources used) in the control group was 10.66/3 = 3.55. This score places the chatbot service in the effective category on the effectiveness assessment scale ranging from 3.5 to 4.3.

Table 12. Comparison of Average Scores per Indicator

Indicator	Eksperiment	Control	Difference	Ket.Exp	Ket.Ctrl
Speed and Information Delivery	3,96	3,36	+0,60	Effective	**Neutral**
User Satisfaction Level	4,06	3,69	+0,37	Effective	**Effective**
Uninterrupted Service Availability	4,01	3,43	+0,57	Effective	**Neutral**
Operational Efficiency (Time, Cost, Resources)	4,04	3,55	+0,49	Effective	**Effective**

Based on Table 12, the comparison between the two groups was examined through the mean scores categorized according to the effectiveness scale. The comparison results showed that the experimental group was categorized as effective across all indicators, whereas the control group had two indicators categorized as neutral, namely information speed and service availability. This difference was statistically proven to be significant through the Independent Samples t-test.

Theoretically, this finding is consistent with the intrinsic capability of chatbot technology. While conventional library services are limited by staff working hours, generally from 07:00 to 14:00 WIB, the chatbot implemented through WhatsApp Business is available 24 hours a day, seven days a week. This structural advantage directly addresses the time-related limitation identified by Hernon and Altman (2015) as a critical dimension of library service effectiveness. Students who need confirmation of book availability or access to library procedural information outside school hours, such as during evening study sessions or on weekends, are naturally more likely to give higher scores for service availability when using the chatbot system.

The speed indicator, which includes timeliness and users' perceived speed of information delivery, also showed a significant gap. This can be attributed to the near-instant response capability of the retrieval-based chatbot system compared to queuing at the service desk or waiting for librarians to search for information manually. In line with the findings of Guntoro et al. (2020) and Rubin et al. (2020), chatbots can substantially reduce the latency between users' information requests and the fulfillment of those requests. In the context of the Technology Acceptance Model (TAM), this characteristic is directly translated into a higher perception of usefulness, as students perceive the chatbot as beneficial because it delivers information more quickly.

The control group's effective rating on the operational efficiency indicator, with a score of 3.55, indicates that students perceived conventional services as relatively efficient in terms of cost. However, the higher score obtained by the chatbot group, namely 4.04, reflects additional time savings and reduced physical effort associated with mobile-based remote access. This finding has practical significance for library managers, as chatbot implementation not only benefits users but also reduces librarians' operational workload, allowing them to focus on more complex and value-added tasks.

CONCLUSION

Based on the results of the study, it can be concluded that the AI-based chatbot service implemented through WhatsApp Business is a more effective alternative than conventional library services at SMAN 9 Bandar Lampung across the four indicators of service effectiveness: speed and timeliness of information delivery, user satisfaction, availability of services without time constraints, and operational efficiency.

The descriptive analysis using a 1–5 Likert scale also showed that the experimental group was categorized as effective across all indicators, whereas the control group had two indicators categorized as neutral, namely information speed and service availability. This difference was statistically proven to be significant through the Independent Samples t-test. Thus, the implementation of an AI-based chatbot through the WhatsApp Business platform at the library of SMAN 9 Bandar Lampung was proven to significantly improve the quality and effectiveness of library information services.

The main advantage of the chatbot lies in its ability to eliminate temporal barriers in accessing library information. By enabling 24/7 information availability through students' smartphones, the chatbot addresses the fundamental limitation of conventional library service models, which are bound by staff operating hours. This positions AI-based chatbot technology not merely as a tool for improving convenience, but as an instrument that structurally transforms the delivery of school library services.

Future research should expand the scope to various types and levels of schools to improve generalizability, as well as integrate qualitative methods to capture the nuances of user experiences that cannot be fully represented by quantitative metrics. Longitudinal studies measuring chatbot effectiveness continuously over one academic year or longer would also provide valuable insights into habituation effects and long-term user behavior.

SUGGESTION

Based on the findings of this study, several recommendations may be considered by various stakeholders. For the library of SMAN 9 Bandar Lampung, it is recommended that the

AI-based chatbot that has been implemented continue to be developed and improved so that it can answer more diverse and complex questions according to users' needs. In addition, the chatbot database should be updated regularly to ensure that the information provided remains accurate and relevant. The library should also provide a user feedback channel as a basis for continuous evaluation.

For future researchers, it is recommended that the scope of the study be expanded by involving more schools or other types of libraries so that the findings can be generalized more broadly. Further research may also examine other aspects of chatbot implementation, such as user satisfaction from a qualitative perspective, its influence on students' digital literacy, and the factors affecting technology acceptance among library users. In addition, the development of similar studies by integrating more advanced technologies may serve as an innovative step toward improving the quality of chatbot interactions with users.

For educational institutions and policymakers, the findings of this study may serve as a reference in formulating policies for the development of technology-based school libraries. The implementation of an AI-based chatbot at SMAN 9 Bandar Lampung has the potential to become a pilot model for other schools in Indonesia in adopting similar innovations, thereby encouraging a more comprehensive and equitable digital transformation of school libraries.

THANK YOU NOTE

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