RESEARCH ARTICLES

by SPHIX STORE

Landbot-Based Interactive Chatbot as a Tax Learning Medium for 11th-Grade Vocational High School Students in Accounting and Financial Institutions

ABSTRACT

Taxation learning in vocational high schools still faces various challenges, such as difficult material, limited use of interactive media, and low student motivation. This study aims to examine the effectiveness of an interactive chatbot based on Landbot as a learning medium for Income Tax material for 11th-grade Accounting and Financial Administration students at a private SMK in Malang regency. Using a Research and Development method at the implementation stage and a one-group pretest-posttest design, this study measured students' understanding before and after using the chatbot through learning outcome tests. The Wilcoxon Signed-Rank test results showed a significance value of 0.000 (< 0.05), indicating a significant improvement in learning outcomes. The average student score increased from 67.41 to 91.30 after the treatment. This proves that the interactive chatbot is effective enhancing comprehension of taxation material and provides a more engaging and flexible learning experience tailored to the needs of SMK students.

Keywords: Chatbot, Landbot, Learning Media, Taxation, Income Tax.

INTRODUCTION

Advances in digital technology have brought significant changes in various fields of life, including in education. One of the main challenges in today's education is to create learning experiences that are interesting, accessible, and in accordance with the characteristics of learners from the digital generation (Al-Abdullatif et al., 2023). In Indonesia, this challenge is also felt by vocational education units such as Vocational High Schools (SMK), especially in the Accounting and Financial Institutions department. Various obstacles are still found in the learning process, such as limited learning media, lack of variety of methods, and low student motivation (Ruan et al., 2021). One of the subjects that is very difficult for most students to understand is taxation (Sriyunianti et al., 2024). This is due to the taxation system in Indonesia which has a high level of complexity and is dynamic, characterized by the large number of regulations that must be studied and changes to the rules that are made periodically to adjust to national developments. The complexity of calculating Income Tax (PPh) and the frequent changes in regulations are the main factors causing students' low understanding of taxation material (Biettant et al., 2020).

One concrete evidence of the problem was found through an initial survey at a private vocational school in Malang Regency, which showed that the majority of grade XI students had difficulty understanding the material on Income Tax (PPh), especially due to the complexity of numbers, formulas, and regulatory provisions that often change. The teacher also said that the learning process is still dominated by the one-way lecture method and has not utilized interactive media. In fact, such conventional methods are less effective for complex and technical material

such as taxation (Putri & Widodo, 2020). This finding is reinforced by Mulyani & Marlina (2021), who stated that vocational students tend to experience confusion in understanding taxation concepts because of their theoretical and calculating nature.

The utilization of Artificial Intelligence technology in the form of an interactive chatbot can be one of the potential solutions to address complex tax learning challenges that require in-depth technical explanations. Chatbot is an AI technology that enables instant conversational interaction between students and the system. This technology supports flexible, personalize, and adaptive learning to students' needs (Gupta et al., 2019; Cano et al., 2021). From a theoretical perspective, chatbots can be understood through Skinner's (1954) behaviorism as a reinforcement tool that provides immediate feedback in the form of praise or scores when students answer correctly, thus increasing learning motivation (Binhammad et al., 2024). In addition, Bruner's (1960) and Gagné's (1985) cognitivism theories emphasize gradual and structured learning, which chatbots support through interactive dialogues that help students understand complex material systematically (Cano et al., 2021). Recent studies reinforce the relevance of both theories in AI learning, where chatbots provide both reinforcement and adaptive learning experiences according to students' style and pace (Gupta et al., 2019; Arias et al., 2020). This shows that behaviorism and cognitivism are important foundations in the development of chatbot learning media.

Some previous studies show the effectiveness of chatbots in various subjects such as Mathematics (Moral-Sánchez et al., 2023), English (Annamalai et al., 2023), and Computer Science (Kuhail et al., 2023). However, the application of chatbots in

learning Income Tax in SMK is still very limited. In fact, this material requires learning media that can explain technical concepts interactively (Khairunisa & Suyatmini, 2024). The development of tax learning media has been carried out, such as Android applications for inventory valuation (Ardianti & Susanti, 2022) and interactive e-modules for Income Tax Article 21 (Tunggawardhani & Susanti, 2022). However, the media is one-way without direct interaction with students. In fact, interactive media is proven to be more effective in increasing student learning engagement (Jacob & Centofanti, 2024).

Adaptive, personalized, and responsive learning tools are essential because each student has a different learning style, pace of understanding, and needs, so a one-size-fits-all approach is often ineffective (Pashler et al., 2008; El-Sabagh, 2021). AI-based chatbots have the potential to meet these needs by providing real-time customized learning experiences based on student responses (Cano et al., 2021; Binhammad et al., 2024). A personalized approach can also increase learning comfort and reduce student anxiety when learning difficult material such as taxation (Arias et al., 2020). However, there are not many AI-based adaptive and personalized media specifically for Income Tax (PPh) material, because the use of chatbots in accounting learning has been more on basic material (Khairunisa & Suyatmini, 2024). Therefore, this research develops an interactive chatbot based on Landbot as a medium for learning income tax in vocational schools that is easily accessible, adaptive to students' needs, and able to improve their learning outcomes and motivation (Yin et al., 2021).

LITERATURE REVIEW

Behaviorism and Cognitivism Theories

Behaviorism theory is a learning approach that emphasizes that learning occurs through the formation of stimulus and response relationships that are strengthened by reinforcement (Skinner, 1957). In this context, the learning process occurs when learners are able to respond appropriately to the stimulus given, and receive reinforcement in the form of feedback, both positive and negative (Ormrod, 2020). In technology-based learning, the principle of behaviorism is often applied through the presentation of material, practice questions, and the provision of immediate feedback that encourages repetition until the correct response is formed automatically (Ally, 2019). Chatbot-based learning media such as Landbot is in accordance with behavioristic principles because it provides stimulus in the form of taxation material, followed by quiz questions and student responses that are immediately responded to by the system through automatic feedback in the form of scores and evaluation of answers. This pattern provides direct reinforcement that plays a role in deepening students' understanding of the material that has been received. With a systematic and structured presentation, chatbots provide individualized learning experiences that are controlled and oriented towards achieving specific learning outcomes (Yilmaz, 2021).

In addition to the behavioristic approach, the theory of cognitivism is also an important basis for learning using chatbots. Cognitivism theory emphasizes that learning is an active process of processing information in the mind, which involves attention, memory, and understanding (Bruning et al., 2020). In learning through chatbots, information is

organized sequentially and logically so that it can be optimally processed by students. Landbot's chatbot presents the Article 21-29 taxation material in stages, from introduction, concept exposure, to quizzes, thus supporting the activation of working memory and the formation of a more organized knowledge scheme (Mayer, 2022). With its characteristics of presenting material automatically, interactively, and individually, the use of chatbots in taxation learning is more suitable based on behaviorism and cognitivism theories. Unlike constructivistic approaches that prioritize social interaction and collaboration, this chatbot is non-social and does not involve direct human facilitators. Therefore, behavioristic and cognitive principles provide a more relevant theoretical basis for the development and application of Landbot-based interactive chatbot media in taxation learning in vocational schools (Ally, 2019; Bruning et al., 2020; Yilmaz, 2021).

Chatbot

A chatbot is a computer-based application created to interact with humans automatically, both in the form of text and voice conversations. In the world of education, chatbots are used to deliver subject matter, provide responses or feedback, and support an independent and flexible learning process (Aji et al., 2021). According to Mulyani et al. (2021), educational chatbots equipped with artificial intelligence and natural language processing (NLP) can provide an interactive learning experience especially in online learning. Chatbot makes it easy for students to understand the material gradually without having to depend on the direct presence of the teacher. Chatbot in learning can be either rule-based or artificial intelligence-based system. Rule-based chatbots have limited responses as they only follow a predefined

script, whereas AI-based chatbots are more flexible and able to understand the context of students' questions better (Liu et al., 2023). Research by Dergaa et al. (2023) revealed that the utilization of chatbots can significantly increase student participation as well as the effectiveness of the learning process, especially when used to deliver material, provide interactive quizzes, and provide immediate feedback. These findings indicate that chatbots have great potential as an innovative learning medium in today's digital era.

Landbot

Landbot is a text-based chatbot development platform with an interactive visual interface that allows users to design conversation flows without advanced programming skills. In education, Landbot supports digital learning media through an intuitive and flexible drag-and-drop system. The platform is capable of combining various types of content, such as text, images, videos, links, along with interactive quizzes, thus creating a more engaging learning experience and motivating active student engagement. A key advantage is the branching conversation feature that allows students to learn at their own pace and path, aligning with differentiated and problem-based learning approaches.

The study by Natalia and Chandra (2024), shows that Landbot can be integrated with NLP such as Dialogflow to create dynamic interaction in the delivery of academic information. Although not directly focused on tax learning, the approach illustrates the potential of Landbot as an interactive medium capable of providing contextualized responses. In addition, Landbot can be utilized for formative assessment through quizzes and reflective questions, providing immediate feedback, and monitoring student learning progress.

With these features, Landbot is a promising alternative in learning complex subjects such as taxation, as it enables structured delivery of material through question and answer simulations, article exploration, and case study completion. Therefore, the development of a Landbot-based chatbot is considered potential to improve concept understanding and active student engagement.

Learning Media

Learning media includes various types of tools or means that are applied to convey subject matter as well as arouse students' attention and interest in learning (Arsyad, 2021). The media serves as a link between teachers and students to increase the effectiveness and attractiveness of the learning process. According to Sadiman et al. (2020), media can be in the form of visual aids to interactive technologies such as software, simulations, and chatbots. The right media can increase student motivation and understanding. In the digital era, technology supports flexible, collaborative, and problem-based learning (Pratama & Umam, 2021). Smaldino et al. (2019) emphasized that media selection needs to be adjusted to the needs of students and the learning objectives to be achieved. Especially in SMK, learning media plays an important role in explaining complex vocational material. Astuti et al. (2023) stated that vocational students need media that is applicable and in accordance with the world of work. Therefore, interactive media such as videos, digital modules, and chatbots are very suitable to strengthen students' understanding.

Taxation as a Learning Material in Vocational High Schools (SMK)

Taxation is one of the main materials in the SMK curriculum in the Accounting and Finance Expertise Program (AKL), especially in the Accounting Expertise Competency area. This material covers the taxation system, various types of taxes, skills in calculating and reporting tax obligations, including Income Tax and Value Added Tax. According to the Ministry of Education and Culture (2021), the purpose of learning taxation is to create graduates who are competent in tax administration. However, students often have difficulty understanding abstract concepts and complex calculations of taxation, especially with conventional methods (Maulida et al., 2022). The materials developed in this study include Income Tax Articles 21, 22, 23, 24, 25, 4 paragraph 2, 28, 29, Fiscal Corrections, and Filing Personal Tax Returns. These materials are relevant in learning accounting in SMK, especially in calculating income tax and filling out tax returns. Mustafa and Rakhman (2021) recommend the use of technology in learning to increase student motivation and understanding. The use of interactive media, such as videos and tax return simulations, has proven effective in improving students' competence in taxation, as shown by Yulianingsih and Wahyudi (2023), who noted the improvement of students' abilities through case study-based learning and online tax form filling.

Income Tax

Income Tax (PPh) is a direct tax imposed on income obtained during one tax year, both from domestic and foreign sources (Directorate General of Taxes, 2021). At SMK Accounting and Finance Institutions, Income Tax is an important material that provides an understanding of the types of income tax, calculation, deduction, and reporting of tax obligations. According to Amri & Fitriah (2020), mastery of income tax is an important provision for students in the world of work,

especially in the field of tax administration and financial reporting. Income tax learning also involves technical skills, such as filling out tax return forms and applying e-Filing. Setiawan (2021) argues that project-based learning can improve practical skills as well as concept understanding, while interactive media such as e-modules and digital simulations can enrich the learning process and support the development of digital literacy (Purwanto et al., 2022). Thus, Income Tax material is not only important in the curriculum of Accounting Vocational Schools, but also plays a role in preparing students for the world of work and further education.

RESEARCH METHOD

This research adopts the Research and Development (R&D) approach with a concentration on the implementation stage in developing interactive chatbot learning media based on landbot for taxation subjects. The main objective of this research is to determine the effectiveness of the learning media developed in order to improve the learning outcomes of students in class XI of Vocational Schools of Accounting and Finance Institutions. The development model applied refers to a modified version of the Borg and Gall model (2003). Researchers did not carry out all stages of development as a whole, but only included the implementation stage without involving a thorough product evaluation. The stages carried out in this study include:
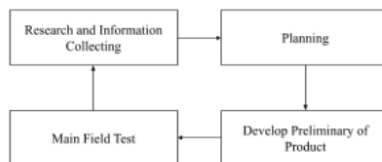
Figure 1. Product Development Stages

The explanation of some of the stages above, namely:

The initial phase carried out was research and data collection. In this phase, the researcher conducted an initial analysis of the condition of taxation learning in class XI of SMK Accounting and Finance Institution. The activities carried out include literature studies to identify appropriate theories and previous research, as well as surveys to student teachers to find out student needs, learning constraints, and the potential use of alternative media. The results of the initial analysis revealed that students face difficulties in understanding taxation material due to limited learning resources, lack of variety of learning media, and the assumption that taxation material is difficult. Seeing these conditions, it is considered important to develop learning media that is interactive and easily accessible, one of which is by utilizing the Landbot-based chatbot platform.

The second stage is the planning stage, where researchers design learning media development which includes mapping the material of Income Tax (PPh) Articles 21 to 29, determining the type of media to be used, and designing the chatbot interaction flow that will be made using the Landbot platform. Researchers also develop learning objectives that will be achieved through the use of chatbot media. In addition, the chatbot work system was also designed which includes the sequence of delivering material in stages, inserting examples of problem solving, and providing further learning recommendations for students. This planning serves as a foundation in making media prototypes that are accurate and in accordance with the characteristics of students at SMK Accounting and Finance Institutions.

The next stage is the initial product development stage. In this stage, researchers began to create an interactive chatbot using the Landbot platform based on the results of the previously compiled planning. This process includes the preparation of chatbot dialog scripts for each Income Tax Article 21 to 29 submaterial, integrating learning materials in the form of conceptual explanations and examples of problem solving, and setting up a systematic conversation flow that is easy for students to understand. The chatbot was developed with a friendly communication style and in accordance with the characteristics of vocational high school teenagers so that learning feels more interesting and interactive. After completion, the chatbot media was tested internally to ensure that the conversation flow went as designed.

The fourth stage is the implementation stage, where the interactive chatbot media that has been developed is used in the learning process in class XI SMK Accounting and Finance Institute. The teacher shares the chatbot link with students through an agreed learning platform (such as WhatsApp Group). Students are directed to learn the material between Income Tax Article 21 to 29 independently through the chatbot according to the teacher's instructions. This implementation is carried out in the context of online or offline learning, depending on the class schedule and conditions. After students complete the learning process through the chatbot, the researcher measures the effectiveness of the media by comparing student learning outcomes before and after the implementation of the media using a test as an instrument.

Type of Research

This type of research is quantitative research with a pre-experimental design using a one-group pretest-posttest approach. The research subjects consisted of 11th grade students of Accounting and Finance Institution Vocational Schools who participated in learning using interactive chatbot media.

Data Sources

The data source in this study is only one main type of data, namely student learning outcomes obtained from pretests and posttests. This measurement was conducted to evaluate the effectiveness of interactive chatbot learning media in improving students' understanding. A media validation questionnaire was designed, but it was not used in this stage because the focus of the research was only until the product implementation stage.

Data Collection Procedures

The data collection procedure was carried out in several stages:

1. Learning Media Design and Development: This stage involves the development of Landbot-based learning media, which focuses on taxation materials such as Income Tax Article 21, 22, 23, 24, 25, Final Income Tax (Article 4 paragraph 2), Income Tax 28, and 29, as well as Fiscal Correction and Filing Personal Tax Return.
2. Student Testing: After the media was developed, the chatbot was tested on students of class XI of the Vocational School of Accounting and Finance Institute. Students were given the opportunity to use the chatbot as an interactive learning media.
3. Collection of Learning Outcome Data: After students used the media, a posttest was conducted to measure the improvement in their

understanding. The collected learning outcome data was then analyzed.

Data Analysis

Data on student learning outcomes from pretests and posttests were analyzed through descriptive and inferential statistical methods. Descriptive statistics were used to describe the mean, median, and distribution of student scores before and after the application of learning media. Before hypothesis testing, researcher first conducted a normality test using the Shapiro-Wilk method. The results showed that the data did not meet the assumption of normal distribution, even after data transformation. Therefore, to test the significant difference between the pretest and posttest scores, the researcher chose the Wilcoxon Signed-Rank Test, which is a non-parametric method suitable for two paired samples. This Wilcoxon test is used to determine whether there is a significant difference in student learning outcomes before and after the use of interactive chatbot media based on Landbot.

RESULTS AND DISCUSSION

DATA DESCRIPTION

This study was conducted at a private vocational high school (SMK) in Malang Regency during the 2024/2025 academic year. The research subjects consisted of 27 students from the 11th grade Accounting and Financial Institution class, comprising 26 female students and 1 male student. The research process took place from the initial observation phase to the media trial, spanning from April to May 2025. Initial data sources were obtained from the students' recorded assignment scores in the even semester, serving as a baseline for assessing their initial learning

outcomes prior to the intervention. The learning process began with a pretest to measure students' prior understanding of Income Tax (PPh) material before the use of the interactive chatbot-based learning media developed using Landbot. Following the pretest, students participated in learning activities using the web-based interactive chatbot, which had been designed by the researcher. This learning covered topics on Income Tax Articles 21 through 29 and was delivered in the form of interactive chatbot dialogues. After the learning phase, students took a posttest to assess their learning outcomes following the intervention. Both pretest and posttest scores were obtained through multiple-choice questions administered via Google Forms, reflecting the students' level of understanding of the Income Tax material. The pretest scores represented students' initial competence using conventional learning methods, while the posttest scores reflected the learning achievements after the implementation of the interactive chatbot media.

Graph 4.1 List of Pretest Results
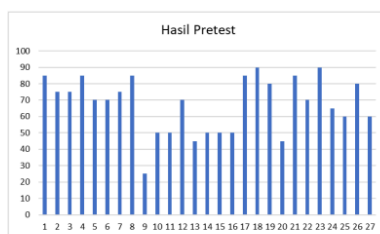
Based on the pretest results of the Income Tax material displayed in Graph 4.1, there are still some students in class XI AKL who get scores below the Criteria for Achieving Learning Objectives (KKTP). This shows that students' understanding of the material still needs to be improved. Therefore, an innovative learning solution is

needed so that students can understand the material more effectively, one of which is through the use of interactive chatbot learning media based on Landbot.

As a follow-up to learning activities using Landbot-based chatbot media, students were given a posttest in the form of multiple choice questions to measure their level of understanding after receiving treatment. This posttest was conducted to measure the effectiveness of learning media in improving student learning outcomes on Income Tax material. The collected data were then analyzed quantitatively using SPSS version 26 software.

Graph 4.2 List of Posttest Results
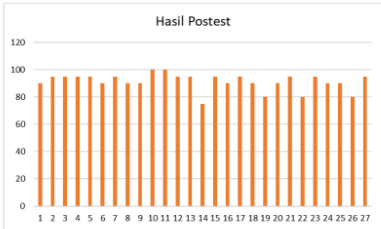
Based on the posttest data on Income Tax material displayed in Figure 4.2, it can be seen that there is an increase in student learning outcomes after participating in learning with interactive chatbot media based on Landbot. The average student score on the posttest reached 91.30, which showed an increase in understanding compared to before the treatment was given.

Table 4.1 Comparison of Pretest and Posttest Scores

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
Pretest Eksperimen	27	25.00	90.00	67.4074	17.00511
Postest Eksperimen	27	75.00	100.00	91.2963	6.13825
Valid N (listwise)	27				

Based on Table 4.1, we can see the comparison of pretest and posttest scores of Income Tax material obtained through Google Form from 27 students of class XI Accounting and Finance Institute at a private vocational school in Malang Regency. The highest student score on the pretest was 90, and increased to 100 on the posttest. While the lowest score on the pretest was 95, which rose to 75 on the posttest. The average pretest score was 67.41 with a standard deviation of 17.005, while the average posttest score reached 91.30 with a standard deviation of 6.138. From these data, it can be concluded that there was a significant increase in the average and highest scores after learning using interactive chatbot media based on Landbot.

DATA ANALYSIS

Normality Test Analysis

Normality testing on pretest and posttest data was carried out using SPSS version 26 software to support data analysis. The purpose of this normality test is to ascertain whether student learning outcomes data come from a normally distributed population. In this study, the Shapiro-Wilk test was used because the sample size was less than 30 students, so this method was considered more appropriate. The results of the normality test are presented in Table 4.2 through the Test of Normality output using the Shapiro-Wilk test.

Table 4.2 Normality Test Results

Test of Normality

		Kolmogorov-Smirnov			Shapiro-Wilk		
	Kelas	Statistic	df	Sig.	Statistic	df	Sig.
Hasil	Pretest Eksperimen	.153	27	.104	.925	27	.051
	Postest Eksperimen	.268	27	.000	.817	27	.000

a. *Lilliefors Significance Correction*

The normality test is carried out to determine whether the data student learning outcomes follow a normal distribution or not. The determination of normality is based on the significance value (Sig.) of the Shapiro-Wilk test analyzed using SPSS. If the significance value is more than 0.05 (p> 0.05), the data is considered normally distributed. Conversely, if the significance value is less than 0.05 (p < 0.05), the data is declared abnormal. Based on Table 4.2, the significance value for pretest data is 0.051, so the data meets the normality requirements because the value is greater than 0.05. However, the posttest data shows a significance value of 0.000, which indicates that the data is not normally distributed.
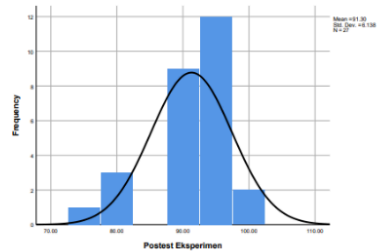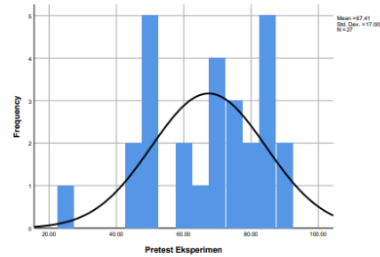
The assumption of normality in the posttest data was not met because the data distribution showed a right-skewed, which indicated that the majority of students obtained scores in the medium to high range after taking part in learning using an interactive chatbot based on Landbot. Given that the posttest data was not normally distributed, hypothesis testing was carried

out with the non-parametric Wilcoxon Signed Ranks Test. This method is used to test whether there is a significant difference between students' pretest and posttest scores.

Statistical Analysis Using Wilcoxon Signed Ranks Test

The normality test results showed that the posttest data did not follow a normal distribution. Therefore, further analysis uses the Wilcoxon test, which is a non-parametric statistical method that is appropriate for comparing two paired samples when the data does not meet the assumption of normality. The data processing was carried out with the help of SPSS version 26 software, and the results of the Wilcoxon test are presented in the following table:

Table 4.3 Results of Wilcoxon Signed Ranks Test

Wilcoxon Signed Ranks Test

Ranks

		N	Mean Rank	Sum of Ranks
Postest Eksperimen-PretestEksperimen	Negative Ranks	0a	.00	.00
	Positive Ranks	24b	12.50	300.00
	Ties	3c		
	Total	27		

a. Posttest Eksperimen < Pretest Eksperimen

b. Posttest Eksperimen > Pretest Eksperimen

c. Posttest Eksperimen = Pretest Eksperimen

Test Statistics a

Posttest Eksperimen - Pretest Eksperimen

Z	-4.288b
Asymp. Sig. (2-tailed)	.000

a. *Wilcoxon Signed Ranks Test*

b. *Based on negative ranks.*

Based on Table 4.3 of the Wilcoxon Signed Ranks Test results in the "Ranks" section, the following information is obtained:

No learners showed a decrease in scores (Negative Ranks = 0), which means that all students at least maintained or improved their learning outcomes between the pretest and posttest. This can be seen from the Mean Rank and Sum of Ranks which are 0.00 in this group. A total of 24 students experienced an increase in scores (Positive Ranks), with a Mean Rank of 12.50 and a total Sum of Ranks reaching 300.00, indicating progress after using the Landbot-based chatbot media. Meanwhile, 3 students had Ties, indicating that their pretest and posttest scores remained the same without change.

Based on the results in the "Test Statistics" section, the Asymp. Sig. (2-tailed) of 0.000, which is below the significance limit of 0.05 (0.000 < 0.05). This finding shows that there is a significant difference between the pretest and posttest scores. This means that the use of interactive chatbot learning media based on Landbot has a significant effect and shows effectiveness in improving the learning outcomes of students in class XI AKL, especially on the topic of Income Tax.

DISCUSSION

The results of this study indicate that the application of interactive chatbot learning media based on Landbot significantly has a positive impact on maximizing student understanding and learning outcomes in Income Tax material. This media proves to be quite effective in supporting the learning process in class XI Financial and Institutional Accounting. The use of chatbot not only facilitates a more interactive understanding of Income Tax material, but also creates an interesting and flexible learning atmosphere. Students can access the material independently, conduct questions and answers directly through the chatbot, and get instant feedback that helps them understand the material better.

Students' Understanding of Income Tax in Grade XI AKL at Private Vocational High Schools in Malang Regency Before Using the Landbot-Based Interactive Chatbot

Students' understanding of Income Tax material before the application of interactive chatbot media based on Landbot is still relatively poor. This is indicated by a number of students whose scores are still below the Criteria for Achieving Learning Objectives (KKTP). Grade XI students have difficulty in understanding various aspects of the material, such as types of income tax, rates, tax subjects and objects, withholding mechanisms, and tax calculation methods. The dominant conventional learning method in the form of lectures and assignments without the support of interactive media causes students to easily feel bored, lack concentration, tend to talk to themselves, and even often leave the class with the excuse of going to the toilet.

The low mastery of basic taxation concepts also causes students to experience confusion in understanding the sequence and interrelationship between materials. Prior to the use of interactive chatbot learning media, students' imaginative thinking skills in understanding the differences between each type of Income Tax were also not optimally developed. To measure initial learning outcomes before being given treatment, students of class XI AKL first took a pretest. From the pretest results, the average student score was 67.41 with the lowest score reaching 25. This figure shows that most students have not met the Learning Objective Achievement Criteria (KKTP) that has been set. Based on the normality test, the significance value of 0.051 (> 0.05) indicates that the pretest data is normally distributed. The low pretest scores were caused by students' lack of understanding of the material concepts, so many were not correct in answering questions, especially questions that required numeracy skills. In addition, low learning motivation due to monotonous learning methods also contributed to the achievement of less than optimal learning outcomes.

The findings in this study support the results obtained by Vitriani, et al. (2025), who proved that the utilization of AI chatbot as an interactive learning media is effective in improving programming logic skills in vocational students. The chatbot provides adaptive explanations, allows students to repeat difficult material, and provides instant feedback. This reinforces that chatbot media has similar potential in taxation learning, especially in helping students understand complex concepts such as Income Tax. This research is also supported by Noorriskya and Rizki (2025), who examined the ability of ChatGPT in presenting accurate and comprehensive information about Income Tax Article 21. The results show that AI-based chatbots are able to present information that is accurate, systematic, and in accordance with tax provisions, thus

greatly supporting the effectiveness of students' independent learning. In addition, Swastiko and Fauzi (2023) through their study on the implementation of chatbot technology in the Kring Pajak 1500200 service, stated that chatbots are able to increase the service capacity and effectiveness of tax information communication to the public. So, it can be concluded that the use of interactive chatbot media based on Landbot in learning Income Tax provides an alternative learning media that is relevant, efficient, and able to improve student understanding and learning outcomes.

Students' Understanding of Income Tax after the Implementation of the Interactive Chatbot-Based Learning Media Using Landbot

The application of interactive chatbot-based learning media through the Landbot platform shows a positive impact on improving student understanding of Income Tax material. After the learning process, the average posttest score reached 91.30, with the highest score of 100. This result reflects a significant increase compared to the previous pretest score, indicated by a 10-point difference in the maximum score. This is an indicator that mastery of the material increased after students used the chatbot media. This media facilitates students to learn independently and flexibly, anytime and anywhere, thus encouraging their learning engagement and interest. In addition, this media also provides opportunities for students who tend to be passive to be more actively involved, as well as being a productive means for using devices in learning activities. Based on the normality test of the posttest data, which resulted in a significance value of 0.000 (p < 0.05), it can be concluded that the data is not normally distributed. Therefore, the analysis was continued using the Wilcoxon Signed-Rank Test non-parametric statistical test to determine significant differences between pretest and posttest results, as well as to evaluate the effect of using chatbot media on student understanding of Income Tax material.

The results of this study are in line with the research conducted by Khairunisa and Suyatmini (2024), which found that the use of AI-based chatbots in accounting education at SMK Batik 1 Surakarta enhanced students' understanding as well as the skills of both teachers and learners in accessing and utilizing AI technology. The presence of AI chatbots encouraged active student engagement and broadened the range of learning materials in a more diverse and interactive manner. Additionally, this medium supported the development of critical thinking and problem-solving skills. However, the study also noted several challenges, such as limited understanding, lack of supporting facilities, and difficulties in fully integrating technology into the learning process. Therefore, continuous collaboration among educational institutions, foundations, and government agencies through strategic partnerships and sustained support is needed. Similar findings were also presented by Ramadhanti and Nugraha (2022), who showed that the use of instructional media had a positive and significant impact on improving the learning outcomes of Grade XII AKL students at SMK Palebon Semarang. Furthermore, students' learning interest was identified as a crucial factor influencing academic achievement, particularly in tax administration subjects. In fact, the combination of learning media and students' interest in learning was proven to have a simultaneously positive influence on enhancing students' academic performance.

Research by Sari and Listiadi (2019) also supports the relevance of the findings in

this study. They found that the application of interactive learning media based on Adobe Flash CS 6 in tax administration subjects for class XI Accounting students at SMK Negeri 2 Buduran had a positive impact on improving learning outcomes. The media is designed with an attractive visual approach and easy-to-understand material delivery, so as to increase student motivation and understanding of taxation material. The three studies previously described show a consistent pattern regarding the effectiveness of interactive media in supporting student academic achievement. In line with this, this study shows that the use of an interactive chatbot based on Landbot provides a more participatory and enjoyable learning experience, which in turn supports students' increased understanding of Income Tax concepts.

The Effect of Landbot Media on Income Tax Learning Outcomes of Grade XI AKL Students in Private Vocational Schools in Malang Regency

The impact of using Landbot-based interactive chatbot media on improving student learning outcomes was analyzed with a non-parametric statistical approach, namely through the Wilcoxon Signed-Rank Test. The data analysis process was carried out using SPSS version 26 software, which showed an Asymp. Sig. (2-tailed) value of 0.000, which is smaller than the significance limit of 0.05. These results indicate a significant difference between students' pretest and posttest scores. Thus, the use of Landbot chatbot media contributes positively to increasing students' understanding in learning Income Tax material. Before the Wilcoxon test was conducted, the data normality test was first applied using the Shapiro-Wilk method, considering the number of respondents was less than 50 people.

The normality test results show that the pretest data has a significance value of 0.051, which is above the significance threshold of 0.05. This indicates that the pretest data is normally distributed. In contrast, the posttest data showed a significance value of 0.000, which is below the significance limit, so it is not normally distributed. Given the difference in data distribution between the pretest and posttest, the hypothesis analysis was conducted using the Wilcoxon Signed-Rank test, which is a non-parametric statistical method suitable for these conditions.

Based on the Wilcoxon test results listed in Table 4.5, the Asymp. Sig. (2-tailed) of 0.000, which is below the 0.05 significance level. This finding indicates that the alternative hypothesis is accepted, which means that there is a significant difference between the pretest and posttest scores. Thus, the use of interactive chatbot media based on Landbot is proven to have a positive influence on improving student learning outcomes. This strengthens the evidence that the use of digital media that is interactive and in line with the characteristics of students can improve their understanding of taxation material, especially the topic of Income Tax, for class XI AKL students at one of the private vocational schools in Malang Regency in the 2024/2025 academic year.

This study is consistent with the findings of Maharani Zuroida et al. (2024), which demonstrated that the use of interactive learning media based on Denially significantly improved students' understanding of the PPh Article 21 material. The implementation of this media in the classroom showed an increase in learning outcomes of up to 30%, while also enhancing students' learning motivation through the use of visual, audio, and real case-based simulation elements. This

indicates that interactive learning media, including the Landbot-based chatbot used in this study, has strong potential to enhance student learning achievements. In addition, the research by Qory Eka Retta Sari and Agung Listiadi (2019) supports these findings, showing that the use of interactive media developed with Adobe Flash CS6 was effective in improving learning outcomes in the subject of Tax Administration. Students who used the media experienced better conceptual understanding of taxation and demonstrated active participation during the learning process. Furthermore, Ratna Ratna Sari and Suyatmini (2024) revealed that the integration of AI-based chatbots in accounting education at vocational schools enhanced classroom interaction, provided real-time feedback, and personalized learning content according to individual student needs. Although challenges such as limited AI knowledge and reduced personal interaction were noted, the study concluded that integrating chatbots into education could significantly improve the effectiveness and outcomes of student learning. Therefore, the results of this study are in line with previous research indicating that the use of interactive media, including Landbot-based chatbots, can improve students' understanding and academic performance. Leveraging technology in the learning process not only makes learning activities more engaging but also supports deeper comprehension and better retention of the material.

CONCLUSION

This study shows that the utilization of interactive chatbot learning media based on Landbot is proven to be effective in improving the learning outcomes of students in class XI Accounting and Finance Institute on Income Tax material. The average pretest score of 67.41 increased significantly to 91.30 during the posttest after students used the chatbot media. The results of the analysis using the Wilcoxon Signed-Rank Test resulted in a significance value of 0.000 (<0.05), which indicates a significant difference between learning outcomes before and after the application of the media. This chatbot not only supports students' understanding of complex concepts such as income tax rates, tax objects and subjects, and tax calculations, but can also generate motivation and active involvement of students during the learning process. The features in Landbot, such as flexible access to learning, user-friendly interface, and instant feedback, are in line with the principles of behavioristic and cognitive theories that underlie learning. Thus, this chatbot-based learning media can be seen as a relevant innovative solution in overcoming various taxation learning obstacles in the SMK environment.

REFERENCES

Al-Abdullatif, A. M., Al-Dokhny, A. A., & Drwish, A. M. (2023). Implementing the Bashayer chatbot in Saudi higher education: measuring the influence on students' motivation and learning strategies. Frontiers in Psychology, 14. https://doi.org/10.3389/fpsyg.2023.1129070

Annamalai, N., Rashid, R. A., Munir Hashmi, U., Mohamed, M., Harb Alqaryouti, M., & Eddin Sadeq, A. (2023). Using chatbots for English language learning in higher education. *Computers and Education: Artificial Intelligence*, *5*. https://doi.org/10.1016/j.caeai.2023.100153

Ardianti, T. R., & Susanti, S. (2022). Pengembangan Media Pembelajaran Interaktif Berbasis Android pada Mata Pelajaran Akuntansi Keuangan SMK. *EDUKATIF : JURNAL ILMU PENDIDIKAN*, *4*(2), 2879–2892. https://doi.org/10.31004/edukatif.v4i2.2618

Biettant, R., Bieattant, L., Sugondo, L. Y., Pujianthi, E., Andrian, P. D., & Charlie. (2020). *Meningkatkan kompetensi perpajakan bagi guru-guru akuntansi SMK di wilayah Jakarta Timur*. Jurnal Komunitas: Jurnal Pengabdian kepada Masyarakat, 2(2), 145–151. https://ojs.stiami.ac.id/index.php/jks/article/view/737

Binhammad, M. H. Y., Othman, A., Abuljadayel, L., Mheiri, H. A., Alkaabi, M., & Almarri, M. (2024). Investigating Advanced Generative Dialogue Systems for Educational Chatbots. Creative Education, 15(8), 1593. https://doi.org/10.4236/ce.2024.158096

Bruner, J. S. (1960). *The process of education.* Cambridge, MA: Harvard University Press. https://doi.org/10.1007/978-1-4419-1428-6_1859

Bruning, R. H., Schraw, G. J., Norby, M. M., & Ronning, R. R. (2004). *Cognitive psychology and instruction* (4th ed.). Pearson Education.

Cano, E. V., Andrés, S. M., & Menéses, E. L. (2021). Chatbot to improve learning punctuation in Spanish and to enhance open and flexible learning environments. International Journal of Educational Technology in Higher Education, 18(1). https://doi.org/10.1186/s41239-021-00269-8

Gagné, R. M. (1985). *The conditions of learning and theory of instruction* (4th ed.). New York: Holt, Rinehart and Winston. https://doi.org/10.1007/978-1-4419-1428-6_117

Gupta, S., Jagannath, K., Aggarwal, N., Sridar, R., Wilde, S., & Chen, Y. (2019). Artificially Intelligent (AI) Tutors in the Classroom: A Need Assessment Study of Designing Chatbots to Support Student Learning. Pacific Asia Conference on Information Systems, 213. http://dblp.uni-trier.de/db/conf/pacis/pacis2019.html#GuptaJASWC19

Jacob, T., & Centofanti, S. (2024). Effectiveness of H5P in improving student learning outcomes in an online tertiary education setting. *Journal of Computing in Higher Education*, *36*, 469–485. https://doi.org/10.1007/s12528-023-09361-6

Khairunisa, T., & Suyatmini, S. (2024). Implementation of AI Chatbot as an Interactive Learning Medium on Accounting Lessons in SMK. Ideguru: Jurnal Karya Ilmiah Guru, 9(3), 1414–1420. https://doi.org/10.51169/ideguru.v9i3.1059

Kuhail, M. A., Alturki, N., Alramlawi, S., & Alhejori, K. (2023). Interacting with educational chatbots: A systematic review. *Education and Information Technologies*, *28*(1), 973–1018. https://doi.org/10.1007/s10639-022-11177-3

Mayer, R. E. (2022). The past, present, and future of the cognitive theory of multimedia learning. *Educational Psychology Review, 36*(1), 8. https://doi.org/10.1007/s10648-023-09842-1

Merrill, M. D. (2002). First principles of instruction. Educational Technology Research and Development, 50(3), 43–59. https://doi.org/10.1007/BF02505024

Moral-Sánchez, S. N., Rey, F. J. R., & Cebrián-De-la-serna, M. (2023). Analysis of artificial intelligence chatbots and satisfaction for learning in mathematics education. *International Journal of Educational Research and Innovation*, *2023*(20). https://doi.org/10.46661/ijeri.8196

Ruan, S., Jiang, L., Xu, Q., Liu, Z., Davis, G. M., Brunskill, E., & Landay, J. A. (2021). EnglishBot: An AI-Powered Conversational System for Second Language Learning. 434. https://doi.org/10.1145/3397481.3450648

Sari, R. R., & Suyatmini, S. (2024). Evaluation of Chatbot AI Application in Accounting Learning in High Schools: Challenges and Impacts. *Ideguru: Jurnal Karya Ilmiah Guru*, 9(3), 1440-1445. https://doi.org/10.51169/ideguru.v9i3.1139

Sari, Q. E. R., & Listiadi, A. (2019). Pengembangan Media Pembelajaran Interaktif Menggunakan Adobe Flash CS 6 pada Mata Pelajaran Administrasi Perpajakan Kelas XI Akuntansi di SMK Negeri 2 Buduran. *Jurnal Pendidikan Akuntansi (JPAK)*, 7(3). Retrieved from https://ejournal.unesa.ac.id/index.php/jpak/article/view/31207

Skinner, B. F. (1953). Science and human behavior. New York: The Macmillan Company. https://doi.org/10.1002/sce.37303805120

Skinner, B. F. (1957). Verbal behavior. Appleton-Century-Crofts. https://doi.org/10.1126/science.129.3342.143

Sriyunianti, F., Ferdawati, F., Haslina, W., Handayani, D., Ananto, R. P., & Maghfira, I. (2024). Peningkatan kompetensi guru akuntansi dalam pemahaman akuntansi pajak melalui kegiatan pengabdian di SMKN 2 Bukittinggi. *Jurnal Pengabdian Kepada Masyarakat (Japepam)*, 3(2), 33–40. https://akuntansi.pnp.ac.id/japepam/index.php/japepam/article/view/54

Tunggawardhani, D., & Susanti, S. (2022). Pengembangan Bahan Ajar E-Modul Interaktif Berbasis Flipbook pada Materi Pajak Penghasilan (PPH) Pasal 21. *EDUKATIF : JURNAL ILMU PENDIDIKAN*, *4*(3), 4638–4650. https://doi.org/10.31004/edukatif.v4i3.2995

Wang, F., & Hannafin, M. J. (2005). Design-based research and technology-enhanced learning environments. Educational Technology Research and Development, 53(4), 5–23. https://doi.org/10.1007/BF02504682

Yılmaz, R. M., & Kılıç, E. (2021). Chatbot application in a 5th grade science course. Education and Information Technologies, 26(5), 5917–5935. https://doi.org/10.1007/s10639-021-10627-8

Yin, J., Goh, T. T., Yang, B., & Xiaobin, Y. (2021). Conversation Technology with Micro-Learning: The Impact of Chatbot-Based Learning on Students' Learning Motivation and Performance. *Journal of Educational Computing Research*, *59*(1), 154–177. https://doi.org/10.1177/0735633120952067

Zuroida, M., Kurnia, A. D., Ikhsaniyah, S. N., Arif, A., & Hakim, L. (2024). Genially sebagai Alternatif Belajar Pajak Jadi Seru: Pengembangan Bahan Ajar Pajak Penghasilan Pasal 21. *PEKA*, 12(2), 95–106. https://doi.org/10.25299/peka.2024.vol12(2).19918

RESEARCH ARTICLES

11 dergipark.org.tr
Internet Source
<1%

12 ejurnal.poltekkesjakarta3.ac.id
Internet Source
<1%

13 journals.smartinsight.id
Internet Source
<1%

14 digilib.uin-suka.ac.id
Internet Source
<1%

15 www.dataanalysishelp.net
Internet Source
<1%

16 journal.unilak.ac.id
Internet Source
<1%

17 www.researchgate.net
Internet Source
<1%

18 eprints.lancs.ac.uk
Internet Source
<1%

19 journal.unesa.ac.id
Internet Source
<1%

20 Mathias Adawurah. "Enhancing Early Numeracy through Play-Based Learning: A Case Study Using Counting Games and Visual Aids in a Ghanaian Kindergarten Classroom", Springer Science and Business Media LLC, 2025
Publication
<1%

21 Sabine Hoidn, Manja Klemenčič. "The Routledge International Handbook of Student-Centered Learning and Teaching in Higher Education", Routledge, 2020
Publication
<1%

22 Zane L. Berge, Lin Y. Muilenburg. "Handbook of Mobile Learning", Routledge, 2013
Publication
<1%

23   journal.um-surabaya.ac.id
Internet Source
   <1%

24   Puspita Ratna Susilawati. "Implementation of Web-Based Virtual Laboratory Media in Learning", TAMAN VOKASI, 2019
Publication
   <1%

25   journal.uir.ac.id
Internet Source
   <1%

26   open.metu.edu.tr
Internet Source
   <1%

27   Fathor Rozi, Muhammad Munif, Soviatul Widad. "Utilization of Artificial Intelligence to Improve Students' Understanding through ChatGPT", ISLAMIKA, 2025
Publication
   <1%

28   Purnaning Dhian Isnaeni, Mashitah Shikh Maidin, Muh. Amrullah Pagala, Widhi Kurniawan, Asma Bio Kimestri. "Technological Innovations in Tropical Livestock Development for Environmental Sustainability and Food Security", CRC Press, 2024
Publication
   <1%

29   ijor.co.uk
Internet Source
   <1%

30   journal.formosapublisher.org
Internet Source
   <1%

31   journal.multitechpublisher.com
Internet Source
   <1%

32   Submitted to British University in Egypt
Student Paper
   <1%

33   Syahrul Munir, Apink Hanestia Putri. "Increasing Learning Outcomes in Economics with "Eco Tax" Media for Digital Era Students

in Malang, Indonesia", KnE Social Sciences, 2024
Publication

34 www.iscientific.org
Internet Source
<1 %

35 ojs.bonviewpress.com
Internet Source
<1 %

36 www.frontiersin.org
Internet Source
<1 %

37 Mengmeng Zhang, Xiantong Yang. "Google or ChatGPT: Who is the better helper for university students", Education and Information Technologies, 2024
Publication
<1 %

38 Abdel-Karim Al-Tamimi, Richard Moore, Yasir Javed, Stany Babu, Elizabeth Freeman. "chapter 6 Chatbots in Education", IGI Global, 2024
Publication
<1 %

39 Submitted to Universitas Negeri Semarang
Student Paper
<1 %

40 edukatif.org
Internet Source
<1 %

41 ir.jkuat.ac.ke
Internet Source
<1 %

42 Wenwen Lyu, Zarina Abdul Salam. "AI-powered personalized learning: Enhancing self-efficacy, motivation, and digital literacy in adult education through expectancy-value theory", Learning and Motivation, 2025
Publication
<1 %

43 bajangjournal.com
Internet Source
<1 %

digilib.unimed.ac.id

44	Internet Source	<1%
45	ejournal.uluwiyah.ac.id Internet Source	<1%
46	etheses.uin-malang.ac.id Internet Source	<1%
47	garuda.kemdikbud.go.id Internet Source	<1%
48	123dok.com Internet Source	<1%
49	Nor Hasan, Heru Tjaraka. "Analysis Of Construction Services Income Tax Law", Syariah: Jurnal Hukum dan Pemikiran, 2019 Publication	<1%
50	aisel.aisnet.org Internet Source	<1%
51	jurnal.konselingindonesia.com Internet Source	<1%
52	mdpi-res.com Internet Source	<1%
53	"Development of Learning Tools Based on Problem Based Learning for Electrical Motorcycle Maintenance Course: Cognitive Ability", International Journal of Engineering and Advanced Technology, 2019 Publication	<1%
54	Heni Dwi Pratiwi, Rahmah Evita Putri, Fitria Yenira. "Upaya Meningkatkan Hasil Belajar Siswa melalui Penggunaan Model Pembelajaran Discovery Learning pada Mata Pelajaran IPA SMP", TSAQOFAH, 2025 Publication	<1%
55	Nils Knoth, Carolin Hahnel, Mirjam Ebersbach. "Promoting Online Evaluation Skills Through	<1%

Educational Chatbots", Computers in Human Behavior: Artificial Humans, 2025
Publication

56 Robert A. Reiser, Alison A. Carr-Chellman, John V. Dempsey. "Trends and Issues in Instructional Design and Technology", Routledge, 2024
Publication
<1%

57 Submitted to Sogang University
Student Paper
<1%

58 Submitted to UIN Raden Intan Lampung
Student Paper
<1%

59 digilib.unesa.ac.id
Internet Source
<1%

60 en.wikibooks.org
Internet Source
<1%

61 epdf.pub
Internet Source
<1%

62 lib.unnes.ac.id
Internet Source
<1%

63 media.neliti.com
Internet Source
<1%

64 pt.scribd.com
Internet Source
<1%

65 storage.googleapis.com
Internet Source
<1%

66 www.lacsb.com
Internet Source
<1%

67 Andreas Gegenfurtner, Ingo Kollar. "Designing Effective Digital Learning Environments", Routledge, 2024
Publication
<1%

68 Bambang Budi Wiyono, A. Supriyanto, Maisyaroh Maisyaroh, Henny Indreswari. "The Diagnostic Feedback Supervision Model based on Information Technology as The New Strategy to Improve The Professional Competence of Academic Personnel in School Organization", 2021 2nd International Conference on Intelligent Engineering and Management (ICIEM), 2021
Publication

<1%

69 Chaohua Ou. "Designing Socially Dynamic Digital Learning - Technologies and Strategies for Student Engagement", Routledge, 2024
Publication

<1%

70 Esther Argelagós, Consuelo Garcia, Jesús Privado, Iwan Wopereis. "Fostering information problem solving skills through online task-centred instruction in higher education", Computers & Education, 2022
Publication

<1%

71 Indayani, Nurul Furqan, Rizkika. "The Importance of Assets and Liabilities in Sustainability Disclosure: Evidence from Indonesia", 2023 International Conference on Decision Aid Sciences and Applications (DASA), 2023
Publication

<1%

72 Javier Guaña-Moya, Yamileth Arteaga-Alcívar, Santiago Criollo-C, Diego Cajamarca-Carrazco. "Use of Interactive Technologies to Increase Motivation in University Online Courses", Education Sciences, 2024
Publication

<1%

73 Mei Lestari, Wanti Rahayu, Ari Irawan. "Trial And Validation Of Etnobatic Applications As A Media Mathematics Learning Based On

<1%

Android", Jurnal Math Educator Nusantara: Wahana Publikasi Karya Tulis Ilmiah di Bidang Pendidikan Matematika, 2022
Publication

74 etd.uwc.ac.za
    Internet Source   <1%

75 fe.unj.ac.id
    Internet Source   <1%

76 garuda.ristekbrin.go.id
    Internet Source   <1%

77 ijmmu.com
    Internet Source   <1%

78 jurnal.fkip.unila.ac.id
    Internet Source   <1%

79 jurnal.harianregional.com
    Internet Source   <1%

80 perpustakaan.poltekkes-malang.ac.id
    Internet Source   <1%

81 slejournal.springeropen.com
    Internet Source   <1%

82 www.edukatif.org
    Internet Source   <1%

83 www.jp.feb.unsoed.ac.id
    Internet Source   <1%

84 www.langedutech.com
    Internet Source   <1%

85 www.scirp.org
    Internet Source   <1%

86 www.tmfv.com.ua
    Internet Source   <1%

87 Chuhan Xu. "A Systematic Review of the Potential Influencing Factors for ChatGPT-   <1%

Assisted Education", International Journal of Technology-Enhanced Education, 2024
Publication

88   J. Michael Spector, M. David Merrill, Jeroen van Merriënboer, Marcy P. Driscoll. "Handbook of Research on Educational Communications and Technology", Lawrence Erlbaum Associates, 2008
Publication

<1 %

89   Mellisa, Laili Rahmi, Yeyendra, Yandri Waltriandi, Anggun Puspita Sari. "Development of Research-Based Modules in Hydroponic Learning", Journal Of Biology Education Research (JBER), 2025
Publication

<1 %

90   Omar Chamorro-Atalaya, Madison Huarcaya-Godoy, Víctor Durán-Herrera, Constantino Nieves-Barreto et al. "Application of the Chatbot in University Education: A Systematic Review on the Acceptance and Impact on Learning", International Journal of Learning, Teaching and Educational Research, 2023
Publication

<1 %

91   Alisya Qotrunada, Syamsul Furqon. "Development of Interactive Game-Based Learning Media Using Realistic Approach to Improve Students' Mathematical Problem-Solvingin Social Arithmetic Materials for Grade VII", International Journal of Research in Mathematics Education, 2024
Publication

<1 %

Exclude quotes   On
Exclude bibliography On

Exclude matches   < 5 words