

Optimizing Students' Communication Skills through Kahoot-Assisted Project Based Learning in Biology Learning

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Abstract

Background: Preliminary observations at SMAN 1 Wundulako Senior High School indicated that students had limited communication skills during biology learning because classroom instruction tended to be teacher-centered and provided insufficient opportunities for active interaction. Therefore, an innovative learning model such as Project-Based Learning supported by Kahoot is needed to enhance student engagement and optimally develop communication skills.

Methodology: This research adopted a quantitative approach through a quasi-experimental method employing a posttest-only control group design. The participants consisted of 60 tenth-grade students at SMAN 1 Wundulako, with one class assigned as the experimental group and the other as the control group. Data were collected using a communication skills observation sheet, content-validated by two experts, measuring four indicators expressing and responding to opinions, mastery of presentation material, presenting findings clearly and systematically, and language use. Data were analyzed using an independent-samples t-test at a significance level of 0.05. **Findings:** Kahoot was integrated into the Project-Based Learning process as an interactive formative assessment tool. The findings demonstrate that PjBL integrated with Kahoot produced a statistically significant improvement in students' communication skills ($p < 0.05$), with the experimental group achieving a higher mean score (89.37) than the control group (50.83).

Contribution: This learning model is capable of enhancing communication skills through collaborative activities, project presentations, and interactive quiz-based interactions. Thus, PjBL supported by Kahoot is effective as an innovative learning alternative for improving students' communication skills. This study contributes to biology education by providing empirical evidence that integrating Kahoot into Project-Based Learning offers an effective technology-supported strategy for enhancing communication skills in senior high school biology classrooms.

Keywords: Communication skills; Competence Assessment; Kahoot; Project Based Learning



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INTRODUCTION

In senior high school science education, particularly in biology learning, communication skills are recognized as one of the essential 21st-century competencies because students are expected not only to understand biological concepts but also to explain observational findings, express opinions, participate in discussions, and present scientific work systematically (Sudarisman, 2015; Fitriani et al., 2023). These skills support students' academic achievement, facilitate effective scientific interaction, and enable them to communicate ideas and interpret biological information clearly (Gomathi et al., 2023; Trilling & Fadel, 2009; Van Laar et al., 2020).

According to Sani (2019) that teacher-centered instruction provides limited opportunities for students to actively interact and express their opinions. Consistent with this perspective, preliminary observations at SMAN 1 Wundulako Senior High School indicated that biology learning was still predominantly teacher-centered, resulting in limited opportunities for students to participate in discussions and develop their communication skills. This situation results in students' communication skills remaining relatively low. Low communication skills can hinder the learning process, particularly in biology instruction, which requires discussion, presentations, and group work (Purnami & Widiadnya, 2024). This aligns with Greenstein (2012) view that communication skills need to be developed through active and collaborative learning so that students can effectively convey their ideas.

Innovative learning models are needed to address these issues (Putra, 2026). To foster active learning and improve students' competencies, this model has been widely implemented as a student-centered instructional model (Bell, 2010; Kokotsaki et al., 2016). This model encourages students to be active in planning, implementing, and presenting project results, thereby developing communication, collaboration, and problem-solving skills (Thomas, 2000; Kokotsaki et al., 2016). Furthermore, according to Bell (2010), PjBL promotes meaningful learning by involving students in the exploration, analysis, and resolution of authentic real-world challenges.

Previous studies have consistently reported that Project-Based Learning (PjBL) effectively enhances students' communication skills through collaborative learning activities, project presentations, and active participation. However, only a limited number of studies have examined the integration of interactive digital learning media into Project-Based Learning to further support communication skills. Consequently, empirical evidence regarding the integration of Kahoot into Project-Based Learning, particularly in senior high school biology learning, remains limited.

Previous studies consistently demonstrate that Project-Based Learning (PjBL) improves students' communication skills by promoting collaboration, active participation, and project presentations (Astri et al., 2022; Menggo et al., 2023). These findings suggest that communication skills develop more effectively when students are actively involved in meaningful learning activities rather than passively receiving information. Furthermore, the increased engagement fostered by PjBL enhances students' confidence in expressing ideas and participating in classroom discussions (Saad & Zainudin, 2022).

Besides the selection of instructional models, the effective integration of learning media is also essential for promoting students' active engagement in the learning process (Wang & Tahir, 2020). Interactive learning media such as Kahoot is a digital educational tool capable of boosting students' motivation and interaction (Licorish et al., 2018). The integration of the Kahoot platform into instructional practices allows students to actively engage through fun and competitive interactive quizzes, thereby creating a more active and communicative learning atmosphere (Wirani et al., 2022). This finding is consistent with previous research indicating that the use of interactive digital media can enhance students' self-confidence and communication skills (Purnami & Widiadnya, 2024).

Previous research has extensively examined the implementation of Project-Based Learning and the use of Kahoot in educational settings. However, limited research has investigated the integration of Kahoot into Project-Based Learning to enhance communication skills in senior high school biology learning. Moreover, previous studies have rarely examined communication skills comprehensively through indicators such as expressing and responding to opinions, mastery of presentation material, presenting findings clearly and systematically, and language use. Therefore, this study aimed to examine the effect of integrating Kahoot into Project-Based Learning on students' communication skills in biology based on these communication indicators.

METHOD

This investigation employed a quantitative quasi-experimental design to determine the extent to which the integration of Kahoot into Project-Based Learning contributes to the development of students' communication skills in biology. The study was conducted at SMAN 1 Wundulako Senior High School, involving an experimental class and a control class (30 experimental and 30 control sample). Research data were collected using observation sheets assessing students' communication skills and analyzed using independent sample t-test.

Sample or Participant

All tenth-grade students at SMAN 1 Wundulako Senior High School constituted the study population. The sample was determined using purposive sampling, whereby classes were selected based on characteristics considered appropriate for achieving the research objectives. Consequently, one class was designated as the experimental group whereas the other was assigned as the control group (Etikan et al., 2016). The selection criterion was that the experimental and control classes had relatively equivalent academic achievement, as reflected by their average class scores obtained from school records. This criterion was used to ensure comparable baseline academic ability between the two groups before the intervention.

Instrument

The research instrument consists of an observation sheet assessing students' communication skills. The indicators skills used in this study were adapted from Saroinsong (2024) research, which includes the ability to express one's own opinions

and listen to others' opinions, mastery of presentation material, the ability to communicate findings clearly and systematically, and the use of language in the communication process. Prior to implementation, the communication skills observation sheet was content-validated by two experts who evaluated the instrument in terms of clarity, content accuracy and validity, and language appropriateness. The validation results indicated that the instrument was suitable for use in this study. Students' communication skills were measured using a four-point Likert scale.

Data collection

Data for this study were collected using an observation sheet designed to assess students' communication skills. The observations focused on students' communication skills, covering both oral and written communication aspects, such as the ability to express opinions, participate in discussions, deliver presentations systematically, and write reports. These communication skill indicators were adapted from [Saroinsong \(2024\)](#) study. Each indicator was assessed using a predetermined rating scale adapted from [Purwanto \(2010\)](#) (Table 1). The data obtained were then analyzed to determine differences in communication skills between the class.

Table 1. Interpretation of Students' Communication Skills Scores

Score range	Category
$86\% \leq A \leq 100\%$	Excellent
$76\% \leq B \leq 85\%$	Good
$60\% \leq C \leq 75\%$	Fair
$55\% \leq D \leq 59\%$	Low
$E \leq 54\%$	Very low

Procedure

The research process consisted of several sequential stages. The study began with preparatory activities, which included developing instructional materials, class selection, and preparing for the research implementation. During the intervention, students in the experimental group completed learning activities through a Kahoot-assisted Project-Based Learning (PjBL) approach implemented according to its instructional phases, whereas students in the control group participated in teacher-centered conventional learning. The learning process followed six PjBL stages: (1) determining the project, (2) planning the project, (3) scheduling project activities, (4) carrying out the project, (5) presenting the project outcomes, and (6) evaluating the project. Kahoot was integrated during the evaluation stage, where students completed interactive quizzes to assess their understanding of the biological concepts learned through the project. The quizzes provided immediate feedback and encouraged students to discuss their responses, thereby supporting the development of communication skills. Throughout the learning process, the researcher observed the students' communication skills. The final stage involved collecting the observational data and analyzing it.

Data analysis

The data analysis techniques in this study were conducted quantitatively using parametric statistical tests. The observational data on students' communication skills were first processed to obtain the mean and standard deviation. Prior to conducting the independent samples t-test, the data were subjected to prerequisite tests, including the Shapiro–Wilk normality test and Levene's homogeneity test. Once the prerequisite tests were met, hypothesis testing was performed using the Independent Sample t-Test in accordance with the procedures for parametric statistical analysis according to [Sugiyono \(2018\)](#) using SPSS software at a significance level of 0.05.

RESULT AND DISCUSSION

The descriptive statistics of students' communication skills, obtained from the observation sheets, are summarized in Table 1.

Table 2. Descriptive Analysis of Communication Skills

Data	Communication skills of the control group	Communication skills of the experiment group
Number of students	30	30
Mean $\pm$ SD	50,83 $\pm$ 8.33	89,37 $\pm$ 6.01
Median	50	90,62
Highest score	68,75	100
Lowest score	37,5	68,76
Percentage	51%	89%
Percentage category	Very low	High

Note. The interpretation of score categories was adapted from [Purwanto \(2010\)](#)

The mean communication skills score of the control group was 50.83, whereas the experimental group obtained of 89.37. The control group achieved a percentage score of 51%, indicating a very low level of communication skills, while the experimental group attained a percentage score of 89%, which is classified as high. The analysis results for each communication skills indicator in the control and experimental groups are presented in Figure 1.

The descriptive analysis of students' communication skills, as illustrated in Figure 1, indicates that the group exposed to the Kahoot-assisted Project-Based Learning (PjBL) approach consistently outperformed its counterpart across all assessed indicators. For Indicator 1, which measured the ability to express and respond to opinions, the mean score reached 85.0, compared with 48.3 for the comparison group. Similarly, Indicator 2, assessing mastery of the presented material, yielded mean scores of 90.8 and 55.8, respectively. A comparable pattern was observed for Indicator 3, which evaluated the ability to present report findings systematically and clearly, with average scores of 90.8 and 53.3. The largest difference appeared in Indicator 4 (language use), where the mean score of the treatment group was 90.0, substantially exceeding the 45.8 recorded for the comparison group.

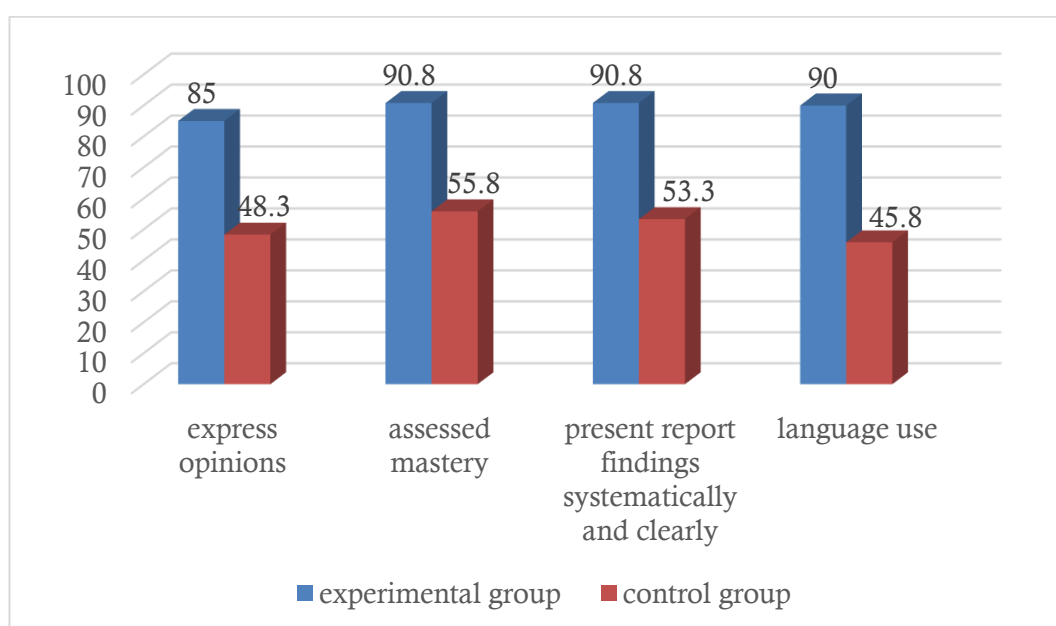


Figure 1. Analysis Results of Each Communication Skills Indicator

Table 3. Summary of The Normality test Communication Skills

Shapiro-Wilk			
	Statistic	df	Sig.
Communication skills (experimental group)	.963	30	.377
Communication skills (control group)	.964	30	.378

The analysis revealed that the highest mean scores were achieved for the indicators related to mastery of presentation material and the ability to communicate report findings clearly and systematically, both with a mean score of 90.8. The present findings provide evidence that integrating the PjBL model into classroom instruction enhanced students' communication skills, particularly during the project outcome presentation stage. [Rahayu et al., \(2021\)](#), at this stage, students were required to present the projects they had completed, enabling those in the experimental group to demonstrate a strong understanding of the presented material and to communicate their project reports in a systematic and coherent manner ([Nurhamudin et al., 2025](#)). Table 2 presents the results of the normality test.

The normality assumption was assessed using the Shapiro–Wilk test prior to hypothesis testing. As shown in Table 2, significance values of 0.377 and 0.378 were obtained, both of which exceeded the criterion of 0.05. These findings indicate that the communication skills data satisfied the assumption of normality. The homogeneity test results are summarized in Table 3.

Table 4. Homogeneity Test of Communication Skills

		Levene Statistic	df1	df2	sig.
Communication skill student	Based on Mean	34.047	5	58	.621
	Based on Median	32.362	5	58	.000
	Based on Median with adjusted df	32.362	5	55.937	.000
	Based on trimmed mean	33.662	5	174	.000

The assumption of homogeneity of variance was evaluated using Levene's test. As shown in Table 3, the obtained significance value was 0.621, which exceeded the 0.05 criterion, indicating that the communication skills scores exhibited homogeneous variances across the two groups. Since this assumption was satisfied, the hypothesis was subsequently examined using an Independent Samples *t*-test. The corresponding results are reported in Table 4.

Table 5. Results of the Independent Samples *t*-Test

Independent samples t-test								
							95% Confidence Interval Difference	
	F	sig	t	df	Sig (2- tailed)	Mean Difference	Lower	Upper
Commun ication skill	15.145	.621	10.03	58	.000	38.54	4.296	6.437
ability			2					
			10.03	36.31	.000	38.54	4.282	6.451
			2	8				

As reported in Table 4, the Independent Samples *t*-test demonstrated a statistically significant difference between the two groups (Sig. (2-tailed) = 0.000, $p < 0.05$). This result provides evidence that integrating Kahoot into the PjBL model positively influenced students' communication skills. Communication skills consist of four indicators, namely the ability to express opinions and listen to others' opinions, mastery of the material used for presentation, the ability to present report results systematically and clearly, and language use. For the indicator of expressing opinions and listening to others' opinions, the experimental group achieved a higher average score (85.0) than the control group (48.3).

These results indicate that the PjBL model enables students to express ideas or opinions regarding products to be produced from conventional biotechnology, listen to peers' opinions, and reflect on their ideas to others. For example, some students proposed ideas for making tempeh and tape using black glutinous rice, while others used a combination of black and white glutinous rice. [Jimenez-Gaona & Vivanco-Galvan \(2024\)](#) By engaging students in meaningful and authentic learning experiences, PjBL promotes a stronger conceptual grasp of biotechnology.

The implementation of the PjBL model also increased students' enthusiasm. The study conducted by [Niswara et al., \(2019\)](#) this model in which teachers and students collaboratively construct guiding questions that serve as the foundation for learning activities. Furthermore, [Purnami & Widiadnya \(2024\)](#) stated PjBL can foster students' self-confidence and communication skills. Kahoot can increase student engagement and enhance their enjoyment of the learning process ([Al Ghawail & Yahia, 2022](#)).

For the indicator of mastery of the material used as presentation content, A higher mean score was observed among students who participated in the PjBL intervention (90.8) than among those who experienced conventional learning (55.8). This result indicates that Project-Based Learning (PjBL) promoted active knowledge construction while facilitating the development of students' communication skills. According to [Anggraini & Wulandari \(2021\)](#), In addition, this model enables students to develop solutions to real-world problems by engaging them in the direct exploration and construction of concepts. Kahoot increases students' motivation to understand the material ([Kudubes, 2025](#)).

For the indicator of the ability to present report results systematically and clearly, The descriptive analysis revealed that the experimental group outperformed the control group, with mean scores of 90.8 and 53.3, respectively. Meanwhile, for the language use indicator, the experimental group obtained a mean score of 90.0, while the control group obtained a mean score of 44.2. These results show that the experimental group achieved higher scores than the control group.

This is consistent with the presentation activities conducted in the experimental class. Students demonstrated a better understanding of the project reports being presented and used clear and concise language. [Seo et al., \(2023\)](#), through the project presentation stage, students showed an increase in their self-confidence. As a result, during the question-and-answer session, the presenting groups were able to respond effectively to questions posed by their peers. These findings are in line with the study by [Saimon et al., \(2023\)](#), which reported that the implementation of PjBL can improve students' written communication skills through project report writing and presentations. [Aibar-Almazán et al., \(2024\)](#) prolonged use of Kahoot can enhance students' essential skills, including attention and self-regulated learning.

CONCLUSION

This study demonstrates that integrating Kahoot into Project-Based Learning (PjBL) effectively enhances senior high school students' communication skills in biology learning. The integration of an interactive digital platform within project-based activities encourages active participation, collaboration, and meaningful communication among students. These findings provide empirical evidence supporting the use of Kahoot-integrated PjBL as an effective instructional strategy for fostering communication skills in biology education.

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