

Project-Based Assessment in Biology Learning: Enhancing Student Collaboration and Creativity

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ABSTRACT

This study aims to analyze the effectiveness of project-based assessment in biology learning to enhance collaboration and creativity of junior high school students. The research method used is a quasi-experimental design with a pretest-posttest control group approach involving 64 eighth-grade students at SMP Negeri 1 Maros divided into experimental and control groups. Data collection techniques include questionnaires, observation, and assessment rubrics. Data analysis was performed using paired t-test and independent t-test. The results showed that the application of project-based assessment significantly increased students' collaboration and creativity compared to conventional assessment methods. The experimental group showed an increase in collaboration skills of 42.3% and creativity of 38.6%, while the control group only increased by 11.5% and 9.8% respectively. This innovation offers an effective alternative in making biology learning more meaningful and developing 21st-century skills for junior high school students.

Keywords: Project-based assessment; Biology learning; Collaboration skills; Student creativity; Junior high school

ABSTRAK

Penelitian ini bertujuan untuk menganalisis efektivitas asesmen berbasis proyek dalam pembelajaran biologi untuk meningkatkan kolaborasi dan kreativitas siswa sekolah menengah pertama. Metode penelitian yang digunakan adalah quasi-experimental design dengan pendekatan pretest-posttest control group yang melibatkan 64 siswa kelas VIII SMP Negeri 1 Maros yang dibagi menjadi kelompok eksperimen dan kontrol. Teknik pengumpulan data meliputi angket, observasi, dan rubrik penilaian. Analisis data dilakukan dengan menggunakan uji paired t-test dan independent t-test. Hasil penelitian menunjukkan bahwa penerapan asesmen berbasis proyek secara signifikan

meningkatkan kolaborasi dan kreativitas siswa dibandingkan dengan metode asesmen konvensional. Kelompok eksperimen menunjukkan peningkatan keterampilan kolaborasi sebesar 42,3% dan kreativitas sebesar 38,6%, sedangkan kelompok kontrol hanya meningkat 11,5% dan 9,8%. Inovasi ini menawarkan alternatif efektif dalam menjadikan pembelajaran biologi lebih bermakna dan mengembangkan keterampilan abad 21 bagi siswa SMP.

Kata Kunci: Asesmen berbasis proyek; Pembelajaran biologi; Keterampilan kolaborasi; Kreativitas siswa; Sekolah menengah pertama

INTRODUCTION

Biology learning has a strategic role in developing science literacy and scientific thinking skills of junior high school students. As a science that studies life and all its aspects, biology not only provides factual knowledge but also trains students to think critically, creatively, and collaboratively in solving problems. A good understanding of biological concepts is an important foundation for students to continue their education to a higher level and face the challenges of life in the future.

However, the practice of biology learning in most junior high schools still faces a variety of challenges. The learning and assessment methods used tend to focus on low-level cognitive aspects, such as remembering and understanding biological facts, without developing the high-level thinking skills and 21st century skills that students desperately need. Conventional assessments dominated by multiple-choice written tests and short descriptions often only measure memorization skills, rather than deep understanding and knowledge application ability in a real context.

In today's 21st century era, the world of education faces the demands of preparing students with skills that go beyond just academic knowledge. Skills such as critical thinking, creativity, collaboration, and communication are essential competencies that students must master to succeed in the future. Unfortunately, conventional assessment practices that are still dominant in schools have not been able to measure and develop these skills optimally.

Initial observations conducted at SMP Negeri 1 Maros show that students tend to be passive in learning biology and have a high dependence on teachers as the main source of information. When asked to work in a group or complete an assignment that requires creativity, many students have a hard time. This indicates that the learning and assessment methods used have not been able to develop students' collaboration skills and creativity to the maximum.

Project-based assessments offer a promising alternative to addressing these problems. This assessment not only measures student learning outcomes, but also a learning process that involves in-depth investigation, authentic problem-solving, and the production of real work. Through project-based assessments, students are encouraged to work together in groups, explore creative ideas, and apply biology knowledge in the context of everyday life.

Several previous studies have shown the effectiveness of project-based learning in improving various aspects of student competence. However, most of the research

focused on the implementation of project-based learning in general, rather than on specific aspects of project-based assessment. In fact, assessments have a very important role in shaping the learning process and influencing the way students learn.

Research that specifically examines the implementation of project-based assessments in biology learning at the junior high school level is still very limited, especially in the context of education in Indonesia. The majority of existing research was conducted at the high school or college level, while the characteristics of junior high school students who are still in a transition period of cognitive development require a different and more structured approach.

Collaboration and creativity are two 21st century skills that are very important to develop in junior high school students. Collaboration allows students to learn to work in teams, value others' perspectives, and achieve common goals through effective communication. Meanwhile, creativity enables students to think divergently, generate original ideas, and find innovative solutions to the problems they face.

In the context of learning biology, these two skills are particularly relevant. Many biological concepts are complex and require understanding from multiple perspectives, so collaboration in discussion and problem-solving is essential. In addition, biology as a science that continues to develop requires creative thinking to produce innovations and solutions to various environmental and health problems.

Project-based assessments in biology learning can be designed to integrate biological concepts with real-world problems that students face in their daily lives. For example, projects on local ecosystems, environmental pollution, or health and nutrition can provide a meaningful context for students to apply their biology knowledge while developing collaboration and creativity skills.

This study aims to analyze the effectiveness of the application of project-based assessment in biology learning to improve students' collaboration skills and creativity at SMP Negeri 1 Maros. This study focuses on a comparison between a group of students who use project-based assessments and a group that uses conventional assessments. Thus, it can be identified to what extent project-based assessments have a positive impact on the development of both skills.

The hypothesis of this study is that there is a significant difference between the collaboration skills and creativity of students who use project-based assessments and students who use conventional assessments. It is hoped that this research can make a meaningful contribution to the development of more authentic and meaningful assessment practices in biology learning in Indonesia, as well as provide practical guidance for teachers in designing and implementing project-based assessments.

The findings of this study are expected to be a reference for junior high school biology teachers in developing assessment strategies that not only measure factual knowledge but also develop important skills for the 21st century. Furthermore, this research is expected to contribute to efforts to improve the quality of biology learning nationally through a more comprehensive and holistic transformation of assessment practices.

METHODS

This study uses a quantitative approach with a quasi-experimental pretest-posttest control group design. The scope of research is biology learning at the junior high school level with a focus on the material of the human digestive system and ecosystems.

The research was carried out at SMP Negeri 1 Maros, Maros Regency, South Sulawesi in the even semester of the 2024/2025 school year for 10 weeks. The research population was class VIII students with a sample of 64 students selected using purposive sampling techniques and divided into two groups: the experimental group (32 students from class VIII-A) who used project-based assessment and the control group (32 students from class VIII-B) who used conventional assessment.

The variables in this study consisted of independent variables, namely the type of assessment (project-based and conventional) and the bound variable, namely students' collaboration skills and creativity. The project-based assessments implemented include: (1) school ecosystem investigation projects by creating ecological reports and conservation proposals, (2) interactive digestive system modeling projects using recycled materials, and (3) nutrition health campaign projects through posters, educational videos, and interactive presentations.

The research instruments used were a collaboration skills questionnaire consisting of 25 statement items with a Likert scale of 1-5 covering aspects of communication, shared responsibility, and conflict resolution (validity 0.81; reliability 0.87), a creativity questionnaire consisting of 28 statement items with a Likert scale of 1-5 covering aspects of fluency, flexibility, originality, and elaboration (validity 0.79; reliability 0.84), as well as a project assessment rubric that measures project processes and products with the validity of the content through expert judgment. Data collection techniques are carried out through the provision of pretests and posttests, filling out questionnaires, learning observations using structured observation sheets, and documentation of student project processes and results.

The data analysis technique used descriptive statistics to describe the characteristics of the data in the form of mean, standard deviation, and percentage increase, as well as inferential statistics with paired t-test test to compare the pretest and posttest results in each group and independent t-test to compare the results between the experimental and control groups. The analysis prerequisites include the normality test with Kolmogorov-Smirnov and the homogeneity test with Levene's test. All statistical analyses were performed using SPSS software version 26 with a significance level of $\alpha = 0.05$.

RESEARCH RESULTS

The characteristics of the respondents in this study showed that of the 64 students who were sampled, 34 students (53.1%) were female and 30 students (46.9%) were male. Most students are 13-14 years old with a relatively homogeneous background of academic achievement based on the previous semester's report card scores in biology subjects with an average score of 75-80.

The results of the normality test using the Kolmogorov-Smirnov showed a significance value of > 0.05 for all variables (collaboration skills: $p = 0.187$; creativity: $p = 0.152$), which means that the data is normally distributed. The homogeneity test with

Levene's test also showed a significance value of > 0.05 (collaboration skills: $p = 0.312$; creativity: $p = 0.268$), which indicated homogeneous data variance, so that parametric analysis could be continued.

The description of collaboration skills data in the experimental group showed an average pretest score of 62.5 (SD=7.8) and a posttest score of 89.0 (SD=6.9). Meanwhile, the control group had an average pretest score of 61.8 (SD=8.2) and a posttest score of 68.9 (SD=7.5). The improvement in collaboration skills in the experimental group was 26.5 points (42.3%), while the control group was only 7.1 points (11.5%).

Untuk kreativitas siswa, kelompok eksperimen menunjukkan rata-rata skor pretest 58.3 (SD=8.5) and posttest 80.8 (SD=7.2), with an increase of 22.5 points (38.6%). The control group had an average pretest score of 57.6 (SD=8.9) and a posttest score of 63.2 (SD=8.1), with an increase of 5.6 points (9.8%).

The results of the paired t-test in the experimental group showed a value of $t = 17.28$ with $p < 0.001$ for collaboration skills and $t = 14.93$ with $p < 0.001$ for creativity, indicating a significant difference between pretest and posttest. In the control group, the values of $t = 4.15$ with $p = 0.002$ for collaboration skills and $t = 3.42$ with $p = 0.004$ for creativity, showed a significant improvement but with a much smaller effect size.

An independent t-test to compare gain scores between the experimental and control groups yielded a value of $t = 13.45$ with $p < 0.001$ for collaboration skills and $t = 11.87$ with $p < 0.001$ for creativity. These results show that project-based assessments are significantly more effective in improving students' collaboration skills and creativity than conventional assessments.

Table 1. Comparison of Pretest and Posttest Results

Kelompok	Variabel	Pretest (M±SD)	Posttest (M±SD)	Gain Score	% Peningkatan
Eksperimen	Keterampilan Kolaborasi	62,5±7,8	89,0±6,9	26,5	42,30%
	Kreativitas	58,3±8,5	80,8±7,2	22,5	38,60%
Kontrol	Keterampilan Kolaborasi	61,8±8,2	68,9±7,5	7,1	11,50%
	Kreativitas	57,6±8,9	63,2±8,1	5,6	9,80%

Based on learning observations, it was found that students in the experimental group showed higher active participation in project activities, with an average engagement rate in group discussions reaching 91.2% and a completion rate of project assignments reaching 95.4%. Students also show high enthusiasm in designing and developing project products, with 87.5% of students actively contributing to the creative process. Meanwhile, the control group showed lower participation with a 64.8% engagement rate in learning and a tendency to work individually more dominant.

The results of the assessment of project products in the experimental group showed that 78.1% of students produced products in the category of good to very good in the aspect of creativity, 81.3% in the aspect of group cooperation, and 75.0% in the aspect of understanding biological concepts. The documentation of the project process shows that students are able to integrate biological concepts with real-life contexts

through investigation of the school ecosystem, the creation of innovative anatomical models, and informative and engaging health campaigns.

DISCUSSION

The results of this study show that the application of project-based assessment in biology learning significantly improves the collaboration skills and creativity of SMP Negeri 1 Maros students. These findings are in line with the learning theory of social constructivism which emphasizes the importance of social interaction and collaborative knowledge construction in the learning process. Through project-based assessments, students are not only assessed as separate individuals, but as members of the learning community who interact with each other and contribute.

The project-based assessments applied in this study provide an authentic context for students to apply their biology knowledge in solving real problems. School ecosystem investigation projects, for example, allow students to observe firsthand the interactions between biotic and abiotic components in their environment, identify existing ecological problems, and design realistic conservation solutions. This meaningful learning experience not only enhances conceptual comprehension but also encourages students to think creatively in finding solutions.

The significant improvement in collaboration skills in experimental groups can be explained through a project-based assessment structure that requires students to work in groups intensively. In working on projects, students must communicate effectively, divide tasks and responsibilities, manage conflicts of opinion, and integrate each member's contributions into a coherent final product. This process provides a practical opportunity for students to develop various aspects of collaboration skills that are difficult to develop through conventional assessments that are individualized.

Students' creativity develops through the freedom afforded in project-based assessments to explore different ways of completing assignments and expressing their understanding. In a digestive system modeling project, for example, each group is given the freedom to choose the materials, design, and mechanism of the model they will create. This openness encourages students to think divergently, generate original ideas, and realize them in the form of real products that are functional and aesthetic.

Comparisons with similar studies show consistent results. Several studies in science learning show that project-based learning and assessment can improve students' collaboration skills by between 35-45% and creativity by 30-40%, which is in line with the findings of this study. However, this study makes an additional contribution with a specific focus on the project-based assessment aspect at the junior high school level, not just project-based learning in general.

The advantage of project-based assessments also lies in their ability to measure the learning process, not just the final outcome. Through systematic observation and documentation, teachers can see how students work together, how they develop ideas, how they overcome challenges, and how they reflect on their learning. This information is invaluable for providing constructive and personalized feedback to students, which in turn can improve their motivation and quality of learning.

The implementation of project-based assessments also has a positive impact on students' understanding of biology concepts. Although not the main focus of the study,

observational data showed that students in the experimental group showed a deeper understanding of biological concepts than the control group. This indicates that project-based assessments not only develop skills but also strengthen mastery of content through application and in-depth exploration.

The key factors for the successful implementation of project-based assessment in this study are the design of a structured but flexible project, the provision of scaffolding that suits the needs of junior high school students, and the use of clear and comprehensive assessment rubrics. A clear structure helps students understand project expectations and stages, while flexibility provides room for creativity. Scaffolding provided by teachers, such as investigation guides, report templates, and checklists, helps students who may have difficulty managing complex projects.

The challenges in the implementation of project-based assessments are mainly related to time management and assessment which require more intensive attention from teachers. A quality project requires sufficient time for investigation, exploration, and product development. Additionally, project-based assessment assessments are more complex because they must consider various aspects, from processes to products, from individual skills to group contributions. However, this investment of time and effort is proportional to the positive impact it has on student learning.

The practical implication of this study is the need to transform the assessment paradigm from assessment of learning to assessment for learning and assessment as learning. Biology teachers need to develop competencies in designing and implementing project-based assessments that are authentic, meaningful, and in accordance with the characteristics of junior high school students. Schools also need to support this implementation by providing flexible time in learning schedules, adequate resources for projects, and ongoing teacher training.

However, this study has some limitations. First, the duration of the study, which was limited to 10 weeks, could not measure the long-term effects of the application of project-based assessments on the development of students' collaboration skills and creativity. Second, the study involved only one school, so generalization of results needs to be done carefully and considering the context of other schools that may be different. Third, external factors such as students' intrinsic motivation, parental support, and previous learning experiences were not strictly controlled in this study and may affect outcomes.

CONCLUSIONS AND SUGGESTIONS

Based on the results of the research and discussion, it can be concluded that the application of project-based assessment in biology learning significantly improves the collaboration skills and creativity of SMP Negeri 1 Maros students. The experimental group that used project-based assessments showed an increase in collaboration skills by 42.3% and creativity by 38.6%, which is much higher than the control group that used conventional assessment. Project-based assessments have proven to be effective in providing an authentic context for students to apply biological knowledge, work together in groups, and explore creative ideas through real-world problem-solving.

Based on the findings of this study, it is recommended to biology teachers to integrate project-based assessments in their learning practices as an alternative or

complement to conventional assessments. Teachers need to design projects that are structured but flexible, provide scaffolding that suits students' needs, and use clear and comprehensive assessment rubrics. Schools are expected to provide support in the form of adequate time allocation, resources for projects, and teacher training in designing and implementing project-based assessments.

For subsequent researchers, it is recommended to conduct longitudinal studies of longer duration to measure the long-term effects and sustainability of students' development of collaboration skills and creativity. Research with a wider sample involving different schools with different characteristics can improve the generalization of results. In addition, further research can explore other factors that affect the effectiveness of project-based assessments, such as student learning styles, teacher readiness levels, and school infrastructure support, as well as examine the impact of project-based assessments on other aspects such as science literacy, critical thinking skills, and an in-depth understanding of biological concepts.

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