Bio Ed Kit: An Experiential Learning Approach in Teaching Biodiversity Education for Students and Teachers

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ABSTRACT

This research aimed to develop a valid BioEd Kit learning material with a scientific approach to biodiversity, enhancing students' academic performance, and to evaluate the effectiveness and students' perception of the learning material. The method used is a descriptive-quantitative approach and a quasi-experimental research design. Developed material contains tables, easy-to-follow procedures, activities, and guide questions. The material has been validated in content and design, with results "very appropriate" in quality. It was found that a significantly better learning outcome was achieved by participants after the utilization of learning material. Students' perceptions highlight a high level of engagement and satisfaction with the BioEd Kit, indicating its efficacy in making biodiversity tangible and relatable. The study's findings emphasize the potential of experiential learning tools, like the BioEd Kit, to enhance science education and foster a deeper connection between students and the environment recommended for students in learning biodiversity topics with a scientific approach to foster critical thinking ability.

Keywords: Biodiversity, Science Teaching, BioEd Kit, Experiential Learning

INTRODUCTION

Biodiversity, the variety of life on Earth, is crucial for the health of our planet and its ecosystem. However, the alarming decline in biodiversity due to human activities has raised concerns about the future of our environment. Educating the younger generation about biodiversity is vital to fostering a sense of responsibility and stewardship for the environment. However, biodiversity is a complex and abstract concept that can be challenging for young learners to grasp through traditional teaching methods. Lectures and textbooks often fail to engage learners fully and may not capture their interests (Lee J. et al., 2019). These limit their exposure to the natural world, hinder their ability to appreciate biodiversity's importance and struggle to connect theoretical knowledge with real-world application. Hence, leading to low engagement levels and poor academic performance of the students.

Experiential learning approaches, such as hands-on activities field trips, and interactive experiments, are highly effective in engaging students and enhancing their understanding of complex topics. These methods can bring the abstract concept of biodiversity to life, making the subject matter more relatable and memorable for grade 8 learners. Experiential learning also helps students see the direct connections between biodiversity and real-world problems like climate change, habitat destruction, and food security.

In the ever-evolving landscape of education, the need to effectively convey complex concepts and foster a deep understanding of biodiversity has become increasingly vital. Recognizing this urgency, the research embarks on an exploration of a groundbreaking educational instrument: the BioEd Kit. This innovative approach to biodiversity education is centered around experiential learning, offering a Do-It-Yourself Activity tailored for students and teachers alike.

This study aimed to assess how the BioEd Kit contributes to an enriching biodiversity education experience, benefiting both educators and their students.

Statement of the Problem

Due to the sudden change in educational systems and learning modes caused by the pandemic, there has been a noticeable change in the motivation and learning performance of the students, especially in science education. The implementation of printed modular distance learning for the past few years has caused a shift in the motivation of the students and affected their learning performance inside the classroom. Further, typical teaching resources such as printed activity sheets and textbooks do not address this pressing issue. Different teaching styles are used in the classroom by various science teachers; however, there has been no local research on the utilization of an experiential learning approach in teaching biodiversity using the BioEd Kit for students and teachers to improve students' learning performance.

Objectives

The study aimed to develop and test the BioEd Kit in teaching biodiversity through a DIY activity for grade 10 learners.

Specifically, this study sought to:

1. Develop a BioEd Box specifically for teaching biodiversity to high school learners;
2. Test the effectiveness of BioEd Box material in terms of students' academic performance;
3. Determine the students' perceptions of their experience during the utilization of BioEd Box in a class.

Methods

Research Design

This study utilized a descriptive-quantitative research design—specifically, the quasi-experimental to one group of Grade 10 learners using the pretest-posttest method. The data were gathered using the achievement test before and after utilizing the learning material, and a feedback questionnaire after the class.

Sampling Method

The research respondents for this study were the 38 grade 10 high school learners. Since the research only involved one section, a complete enumeration sampling technique was utilized.

Research Instruments

The study utilized different research instruments: An expert validation test, an achievement test, student insights, and a Feedback Questionnaire.

The Expert Validation Test, adapted from Suyanto et al. (2018), composed of a design expert test and a material expert test, is used to validate the developed BioEd box, especially the teacher's guide and students' material. The achievement test, composed of a 30-item multiple-choice test adapted from the ADM module in Science 10, was used in determining the pre-test and post-test scores of the respondents. Moreover, the Students' Insights and Feedback Questionnaire was used to gather the students' perception of the utilization of BioEd box, the BioEd box questionnaire, and a 4-point Likert scale adapted from Hsiao et al. (2016)

Table 1. Expert Validation Score for Design and Material Test

Score	Quality
4	Very Appropriate
3	Appropriate
2	Less Appropriate
1	Not Appropriate

Data Analysis

After gathering, the researchers will personally tally the gathered data and the results of the scoring table.

Descriptives. Calculate the means and standard deviation of the pre- and post-test scores on the engagement scale level and achievement test.

Wilcoxon signed-rank test. compare the means of the pre- and post-test scores of the students to determine if there is a significant difference in performance. Also, a comparison was made on the engagement level of the students towards the topic before and after the implementation of the BioEd box simulation.

Interpretation. The results of the analysis will be used to determine the effectiveness of the BioEd box in teaching biodiversity. Statistical analysis will be used to determine if there is a significant difference in the pre-test and post-test scores of the learners while controlling for any pre-existing differences. The data will be analyzed using the JAMOVI Version 26 by the official district statistician, and the interpretation will be done by the researcher.

RESULT AND DISCUSSION

The Learner's material and teacher's guide developed are still hypothetical, so the expert validation tests are carried out, namely the design test and martial test. Design expert tests are carried out to determine whether the design used is appropriate, such as selection in color combinations, fonts, clarity of tables and graphs, and clarity of images, as outlined in the materials to foster critical thinking skills. Based on the results listed in Table 2, of the average score obtained in the expert test, it can be concluded that the developed learning material is feasible and very well designed. It shows that the components in the energy resources interactive e-book design test are clear, can be understood, have no ambiguous meaning, can be explored independently, foster critical thinking in learning, and have clear instructions.

Table 2. Result of Design Expert Test

Design	**Mean**	**Quality**
Layout design of material	3.67	Very appropriate
Typography of material	3.60	Very appropriate
Illustration of material	3.60	Very appropriate
Material fosters critical thinking ability	3.84	Very appropriate
Instruction for using the material	3.90	Very appropriate
Average	**3.72**	**Very appropriate**

Expert test in material examines several indicators listed on BioEd Kit learning materials, which are completeness, immensity, and depth of material, accuracy of material, accuracy of interactive tests, material updates, and suitability of the material with the scientific approach. The expert test was also carried out by the same validator in the product design validation test. Based on the results of the material expert test in Table 3, it gets an average score of 3.72, so it can be concluded that the material contained in this learning material is feasible and highly accurate with the existing provisions that are adjusted to the competencies in the k-12 curriculum. This is anchored to one of the design principles of Inguva P. et al. (2021), wherein learning material should be accessible with user-friendly features that make it easier for students to use.

Table 3. Result of Material Expert Test

Material	**Mean**	**Quality**
Completeness, immensity, and depth of material	3.65	Very appropriate
Accuracy of material	3.77	Very appropriate

Accuracy of tests	3.80	Very appropriate
Material update	3.70	Very appropriate
Suitability of the material with a scientific approach	3.70	Very appropriate
Average	**3.72**	**Very appropriate**

Table 5 shows that before employing the BioEd Kit learning material, the average of science performance rating of the students was 9.37 (sd=1.81), which can be described as "did not meet expectation". Moreover, after the implementation of the said intervention, the average science performance rating of the students' mean increases to 17.45 (sd=1.52), which can be described as "very satisfactory". The result implies that there was an increase in the science assessment before and after the implementation of the intervention. It is evident that the science performance classification of the pupils moved to "very satisfactory" from "did not meet expectations". As discussed by Heinrich & Green (2020), A transition to new approaches in experiential education stands to benefit both educators and students. This shift involves a holistic focus on design, instruction, assessment, and learning, all while keeping the context in mind. By blending familiar components of established theories, we aim to emphasize a distinctive experiential teaching and learning mindset.

Table 5. Pretest and Posttest Results

	N	**Mean**	**SD**	**Percent Equivalent**	**Description**
Pretest	38	9.37	1.81	46.84	Did Not Meet Expectation
Posttest	38	17.45	1.52	87.24	Very Satisfactory

Table 6 shows the test of differences in the students' pretest and Posttest results. Utilizing the Wilcoxon Signed Rank Test, the p-value of .001 reflects the significant difference in the respondents' achievement tests before and after the implementation BioEd Kit learning material. Hence, there is a statistically significant increase in the academic performance of the respondents. This implies that the BioEd Kit material, as an experiential learning approach in teaching biodiversity education, is effective. According to Jose et al. (2017), outdoor field experiences play a crucial role in education. This emphasizes the significance of fostering collaboration between informal and formal educators. Adopting an experiential learning approach could serve as a compelling model for designing both informal programs and formal classroom activities centered around field experiences. This integration has the potential to enhance the overall learning experience for students, bridging the gap between theoretical knowledge and practical application.

Table 6. Result of Test of Significance Difference

	N	**df**	**W**	**p**	**Interpretation**
Pretest	38	37.0	0.00	.001	Significant
Posttest	38				

A five-point Likert scale questionnaire was used to gather data on students' attitudes toward the implementation of BioEd Kit learning materials. Mean scores for all Likert scale questions are listed in Table 4. Across five statement indicators, the respondents exhibit uniform perceptions, with all item statements consistently receiving a 'high' rating. This uniformity in high ratings signifies a persistent and elevated level of students' perception of their experience during the implementation of BioEd Kit Learning Materials. Therefore, it can be reasonably inferred that the respondents consistently demonstrate a high degree of engagement in learning through the BioEd Kit materials. This is in line with the result Askren J. (2020) wherein students expressed enthusiasm when recounting their hands-on activities with professionals, highlighting the experiential learning curriculum as more engaging than traditional methods. Their narratives

Table 7. Result of Students' Perception

No.	Item statement	Mean	SD	Implication
1	I want to have more learning material like this in my class	3.45	±0.50	High
2	I enjoyed studying with the learning activity	3.45	±0.50	High
3	I think the learning method of delivery helped my core skills	3.47	±0.51	High
4	I found this learning intuitive and user-friendly	3.47	±0.51	High
5	I feel confident in the knowledge gained from the activity	3.45	±0.50	High

emphasized that dynamic activities enhanced the memorability and relevance of the learned material to the real industry. Additionally, students felt that the challenging group work fostered the development of diverse insights for problem-solving.

CONCLUSION

This research concludes that the development of BioEd Kit learning material has been validated as teaching material on biodiversity topics using a scientific approach to enhance students' critical thinking skills. The BioEd Kit contains materials such as learner's material and teacher's guide in the form of texts, tables, graphs, guide questions, and achievement tests. It was found that a significantly better learning outcome was achieved by participants after the utilization of learning material. These higher scores also point to a high-level acceptance of BioEd Kit for Grdae 10 students. With such strong evidence in this study that the Experiential learning approach through BioEd Kit greatly increased learning effectiveness and scores of participants, other curriculums may also benefit from the inclusion of appropriate BioEd Kit experiential approach learning material.

RECOMMENDATIONS

1. Encourage educators to incorporate experiential learning methods, such as hands-on activities and field trips, into their biodiversity lessons. This can enhance student engagement and understanding.
2. Advocate for the adoption of innovative educational tools like the BioEd Kit. Schools and educational institutions could consider investing in such kits to make biodiversity education more interactive and impactful.
3. Provide training and professional development opportunities for teachers to effectively use experiential learning tools. This can empower them to deliver more engaging and effective lessons on biodiversity.

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