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APPLICATION OF *PROJECT-BASED LEARNING-BASED E-MODULE* TO STUDENT LEARNING OUTCOMES IN 21ST CENTURY BIOLOGY LEARNING

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ABSTRACT

The application of information and communication technology in the learning process must be modified to answer global demands as a response to the needs of the industrial revolution in the 21st century, where humans and technology are aligned to create new opportunities creatively and innovatively. One form of learning modification is by designing learning media that attracts students' interest in learning so that their learning outcomes are maximized. E-module is one of the teaching media which is a multimedia development solution to facilitate students' understanding in today's learning. The purpose of this study is to determine the effect of implementing e-modules based on project based learning on student learning outcomes. This type of research is quantitative research using pre-experimental design with one group pretest-posttest design. The sample in this study was a 3rd semester biology class consisting of 20 students. The types of research instruments used were questionnaires and essay tests. The data found were then analyzed using the normalized N Gain test to determine the effectiveness of the application of e-modules on student learning outcomes with the help of the SPSS version 23 application. The results of the study showed that the N-Gain value was 66.78, which means that the application of e-modules based on project based learning is quite effective on student learning outcomes.

Keyword: e-Module, PjBL, Learning Outcomes.

INTRODUCTION

Changes in the field of education in the 21st century are a new challenge for teachers in integrating increasingly advanced technology into learning, so there is a need for changes in the curriculum with technology-based learning methods. Teachers as educators must be able to utilize various media to convey information to students during the learning process (Widya et al., 2022). Educators can also incorporate teaching media into learning activities as long as they contain knowledge and information (Anjelina et al., 2021). Similarly In developing biology learning to students, it is inseparable from the support of interesting and quality learning media (Bagus Aditya Hutomo, 2021).

Quality teaching media will help students as students to achieve learning goals effectively and help students in learning independently. This was emphasized by Angin (2023) which states that media packaged with technology makes learning and learning activities more comfortable so that it can shift the learning orientation from *outside-guided* become *self-guided*. Electronic module (*e-module*) is one of the teaching media which is a multimedia development solution to facilitate student understanding in today's

learning. *E-module* It is a multimedia-based non-print learning media whose use is quite practical, effective and efficient. *E-module* It has the advantages of the print module, including being interactive, easy to navigate, can load images, videos, audio, animations, and others, and is attached with interactive quizzes (Romayanti et al., 2020). E-modules also Enable immediate automatic feedback in searching for learning materials if using the internet. Based on this opinion, we can assume that e-modules are digital educational materials that are systematically arranged and presented in electronic format. E-modules can also increase students' creativity in learning, this is supported by by research Fujiarti et al., (2024) which states that electronic modules can improve student learning outcomes and are suitable to support the learning process.

Type *Project-Based Learning* (PjBL) is one of the learning models that can be combined with e-modules to support students in exploring the material and enriching their knowledge. The implemented e-module is ideal when combined with the model *Project-Based Learning* Because with the e-module, MAPU students get concepts independently so that they can motivate students in learning. Type *Project-Based Learning* (PjBL) provides opportunities for students to study in groups as well as process information in each project learning activity as a way to develop student character. Project learning activities carried out by students are expected to inspire the surrounding environment (Nurhadiyati et al., 2020).

Selection of learning model *project based learning* be appropriate when combined with appropriate learning materials. According to Al-Tabany (2017) in Marshella et al., (2022) type *project based learning* is an innovative learning model centered on students while lecturers are facilitators and motivators. The application of projects in learning gives students the opportunity to build their own learning. This was also revealed by Faturrohman (2017) in Marshella et al., (2022) Which also explains that the Project Based Learning model is a learning model that involves a project in the learning process. This learning model can direct students to build their creativity based on real experiences so as to increase their learning activities (Cahyani, 2021; Hastuti et al., 2023). Activities in the model *project based learning* This consists of problem-solving activities, decision-making, investigative skills, and project-making skills. Thus, students can be actively involved in each learning process so as to build knowledge in the context of their own experience (Hikmawati, 2022).

Through the above background presentation, the reason why the researcher chose to research the effect of the implementation of *project-based learning-based* e-modules on student learning outcomes is to find out the influence of this PjBL-based e-module can facilitate students in a learning and see the extent to which students apply digital literacy, which with the implementation of this PjBL-based e-module means that students have taken advantage of progress existing technology. This study aims to determine the influence of PjBL-based e-module learning media on student learning outcomes in the 21st century.

METHODS

This research is a type of quantitative research. According to (Ardyan et al., 2023), quantitative approaches are a type of systematic empirical approach that collects and analyzes numerical data using statistical, mathematical, or computational techniques.

The researcher used a quantitative approach to organize the research data using *pre-experimental design* with the type of *one group pretest-posttest design*.

The design was carried out without a control group or comparator. One group was given a pretest question, then received an experimental intervention in the form of the use of interactive e-modules in the learning process. Posttest questions are given after students get learning experience. Respondents were also asked to fill out a questionnaire that aimed to find out their response to the use of interactive e-modules.

The sample in this study was determined using a random sampling technique whose sampling was based on class rather than individual. The sample in this study is 20 biology education students in the 4th semester of the 2023/2024 academic year. The independent variable in this study is the application of *project-based learning-based e-modules*, while the bound variable is the learning outcomes of students in the herbal botany course.

Research Instruments and Data Analysis Techniques

In this study, it measures the implementation of learning and student learning outcomes. The implementation of learning was measured using an instrument in the form of an observation sheet of the implementation of the learning model on learning outcomes and a hypothesis test based on the correlation of product moments to see the influence. Learning outcome data was obtained through the use of test questions to measure student scores taught before using PjBL-based e-modules and after using PjBL-based e-modules.

As for finding the implementation of the PjBL learning model on student learning outcomes, use a presentation formula by paying attention to the criteria in the following table:

Table 1. Criteria for the Implementation of the Learning Model

Score	Model Feasibility	Category
85-100	75-100%	Excellent
70-84.99	49,98-74,98%	Good
50-69,99	24,98-49,97%	Pretty Good
< 49.99	< 24.97%	Not Good

(Mirnawati & Yuwono, 2020)

The assessment data of the test results is calculated by the numbered gain score. This test was carried out on the students' pretest and posttest scores using the IBM SPSS version 23 application. The N-gain score test was carried out to determine the effectiveness or influence of the use of e-module media on student learning outcomes. The N-Gain score test can be done by calculating the difference between the scores before (pre-test) and after using the learning module media (post-test). In this section, the analysis also uses the mean value of the pre-test and post-test scores. The following is a formula to determine the mean adapted from Hake (1999).

$$N - \text{Gain} = \frac{\text{Skor Pretest} - \text{Skor Posttest}}{\text{Skor Maximal} - \text{Skor Pretest}}$$

After obtaining pre-test and post-test scores, this study conducted a parametric statistical prerequisite test, where the N-gain score obtained was converted into the following criteria:

Table 2. N-Gain Score Criteria

Range	Criterion
$0.00 < g \leq 0.30$	Low
$0.30 < g \leq 0.70$	Keep
$0.70 < g \leq 1.00$	Tall

While Arikunto (2009) *deep* (Ramadhani & Putra, 2021) provides an interpretation of the effectiveness of the use of devices such as *e-module* with the following criteria:

Table 3. Interpretation of Effectiveness

Interpretation of N-Gain Effectiveness	
Percentage	Category
$n < 40\%$	Ineffective
$40\% < n < 55\%$	Less Effective
$56\% < n < 75\%$	Quite Effective
$n > 76\%$	Highly Effective

Source: Arikunto (2009)

RESULTS AND DISCUSSION

This research was carried out on students of the 4th semester biology education study program of the University of Muhammadiyah Maluku in the herbal botany course totaling 20 people. The research was conducted by analyzing the learning outcomes and creative thinking abilities of students after applying the ethnoscience-based PjBL model. Integrated learning of ethnoscience in this study was carried out by lecturers to raise the potential of nutmeg as a typical plant endemic to Maluku into herbal medicine products that are packaged into student learning materials in the form of *online* modules. This teaching material is a source of ethnoscience for students to gain knowledge according to cultural values, local wisdom and problems that exist in society in real life. The student learning outcomes after the implementation of the ethnoscience-based *project-based learning* model can be seen in the following table:

Table 4. Student learning values

Acquisition value range	Total Value Acquisition	
	Pretest	Posttest
0-20	0	0
21-40	3	0
41-60	13	0
61-80	4	7
81-100	0	13
Sum	20	20

Source: Data Analysis Results (2024)

The table above shows that the learning outcomes of students before using *the project-based learning* model and after using the PjBL learning model are very different. The number of students who have a pretest score below 60 is 13 people, while after the lecturer implements learning with the PjBL learning model, the same number has a high score range, which is above 80 scores. These results indicate that the ethnoscience-based PjBL model is very effective in biology learning. The average results of the overall class grades can be seen in the table below:

Table 3. Average Class Grades

Component	Average Value (%)	Information
<i>Pre-test</i>	54,75	Lack of understanding
<i>Post-test</i>	87.87	Fully understand

Source: Data Analysis Results (2024)

Through table 3, it shows that the average student learning outcome after the application of the ethnoscience-based *project based learning* model in the Maluku endemic plant course has increased by 33.12%. The results show that students' mastery of the concept of the material can be understood after students learn using the PjBL model. This will certainly increase students' understanding of the concepts given because students will work on projects according to the material explained earlier. As for seeing the implementation of the learning model on the value of student learning outcomes, it can be compared in this table:

Table 4. Implementation of the Learning Model

Learning Outcome Score Range	Model Execution Presentation Range	Category
85-100	75-100%	Excellent
70-84,99	45-74,99%	Good
50-69,99	25-49,99%	Pretty Good
< 49.99	< 24.99%	Not Good

Source: Research Data Results (2024)

Based on table 4, it is known that there are 9 students who achieved the implementation of the learning model with a very good category (75-100%) because they have a learning outcome score of 85-100, while the other 6 students only have the implementation of the model with a good category (49.98-74.99) with a score range between 70-84.99. The rest are in the pretty good category. The high achievement of student learning outcomes is due to the activity of students directly in learning. Students can directly collaborate and discuss with other students to solve problems and complete projects as best as possible. This result proves that the implementation of the project-based learning model has received a positive response from students. For students who learn using project-based learning, this methodology is very interesting because it is a new way of learning biology in the 21st century, especially in herbal botany courses. In

addition, they feel challenged and do not feel bored with this treatment compared to learning using conventional models (Andini & Rusmini, 2022). The results of the student pretest and posttest are presented in the following table 5:

Table 5. Student Pretest and Posttest Results

Student Initials	Pretest	Posttest	N-Gain	Criterion
SL	60	85	.63	Keep
HS	60	85	.63	Keep
RN	70	80	.33	Keep
MSS	65	80	.43	Keep
ON	60	90	.75	Tall
NW	60	80	.50	Keep
Hes	65	90	.71	Tall
AW	80	100	1.00	Tall
UP	75	90	.60	Keep
AW	70	98	.93	Tall
IT	65	80	.33	Keep
Ht	75	80	.20	Low
Nsia	60	80	.50	Keep
I	70	100	1.00	Tall
SJL	70	100	1.00	Tall
SL	70	100	1.00	Tall
AS	65	98	.94	Tall
JAT	60	80	.50	Keep
RH	50	80	.60	Keep
AK	50	80	.60	Keep

Source: Research Results Data (2024)

The effectiveness or influence of the use of e-module media on student learning outcomes can be seen in the following table:

Table 6. Student Learning Outcomes

Uji N-Gain	Number of samples	Installment- installment Pretest	Posttest installment	N-Gain	Effectiveness
	20	54.75	87.87	66.76	Quite Effective

Based on the data in table 6, the n-gain value of the students was 66.78. based on the interpretation of n-gain from Arikunto (2009), the n-gain of 66.78 is included in the criteria for being quite effective. So it can be concluded that e-module is a fairly effective module in biology learning in the 21st century. In addition to the use of e-modules, the learning carried out also uses a project-based learning model (PJBL). This project-based learning focuses on questions or problems that encourage the implementation of concepts and principles that are expected to produce a product in the project work that has been carried out based on facts. Mayangsari, (2017) stated that project-based learning focuses on problems that encourage the need for concepts and principles to be solved. The project encourages students to gain a significant level of

learning experience. Projects prioritize autonomy, choice, uncomplicated work time, and student responsibility so that the project can be completed appropriately (Syukriah et al., 2020). In addition, in the learning project-based assessment process, it can be seen that students become more active, confident, and responsible in completing their projects (Fadillah et al., 2021). In addition, in the learning project-based assessment process, it can be seen that students become more active, confident, and responsible in completing their projects (Widiana et al., 2021). Therefore, through the ethnoscience-based project-based learning method, it can improve creative thinking skills and student learning outcomes in the 5.0 era.

CONCLUSION

Based on the results and discussion above, it can be concluded that the application of project-based learning-based e-modules is the best media and method used in the 21st century in biology learning at the university level because the results of this study show that most students achieve the implementation of the learning model with a very good category. Meanwhile, the implementation of *project-based* learning-based e-modules is quite effective on student learning outcomes, as evidenced by a gain value of 66.78.

REFERENCES

- Andini, S., & Rusmini, R. (2022). Project-based learning model to promote students critical and creative thinking skills. *Jurnal Pijar Mipa*, 17(4), 525–532. <https://doi.org/10.29303/jpm.v17i4.3717>
- Angin, C. K. B. P. (2023). Pengaruh Penerapan Model Pembelajaran PjBL Berbantuan Media Digital Flipbook Terhadap Minat dan Hasil Belajar Siswa. *Pediaqu: Jurnal Pendidikan Sosial dan Humaniora*, 2(1), 306–316.
- Anjelina, W., Silvia, N., & Gitituati, N. (2021). Program Merdeka Belajar, Gebrakan Baru Kebijakan Pendidikan. *Jurnal Pendidikan Tambusai*, 5(1), 1977–1982.
- Ardyan, E., Boari, Y., Akhmad, A., Yuliyani, L., Hildawati, H., Suarni, A., Anurogo, D., Ifadah, E., & Judijanto, L. (2023). *Metode Penelitian Kualitatif dan Kuantitatif: Pendekatan Metode Kualitatif dan Kuantitatif di Berbagai Bidang* (Nomor Desember).
- Bagus Aditya Hutomo, D. (2021). INOVASI PEMBELAJARAN PPKN PADA ERA 4.0 Bagus. *Jurnal pendidikan edutama*, 1–11.
- Cahyani, N. K. C. (2021). Effectiveness of Project-Based Learning Models in Improving Students' Creativity (A Literature Review). *The Art of Teaching English as a Foreign Language*, 2(1), 73–77. <https://doi.org/10.36663/tatefl.v2i1.107>
- Fadillah, R., Giatman, M., & Muskhair, M. (2021). *Meta Analysis : Efektivitas Penggunaan Metode Proyek Based Learning Dalam Pendidikan Vokasi*. 4(1), 138–146.
- Fujiarti, A., Meilania, D. K., Angraeni, M., & Umah, R. N. (2024). Literatur Review : Pengaruh Penggunaan E-Modul Terhadap Hasil Belajar Siswa Sekolah Dasar. *Jurnal Jendela Pendidikan*, 4(01), 83–89. <https://doi.org/10.57008/jjp.v4i01.694>
- Hastuti, B., Jalinus, N., & Syah, N. (2023). *Project-Based Learning to Enhance Creativity*. Atlantis Press SARL. <https://doi.org/10.2991/978-2-38476-050-3>
- Hikmawati, H. (2022). Application of Project Based Learning with Scientific Article Analysis Method to Improve Student Learning Outcomes in Education Profession Courses. *Journal of Science and Science Education*.

- Marshella, A. D., Reffiane, F., & Setianingsih, E. S. (2022). *DIKDAS MATAPPA : Jurnal Ilmu Pendidikan Dasar Pengaruh Model Project Based Learning Berbasis Etnosains Tema 9 Benda-Benda di Sekitar kita terhadap Hasil Belajar Kelas V*. 5(3), 576–583.
- Mayangsari, S. N. (Sizillia). (2017). Peningkatan Hasil Belajar Mahasiswa dengan Project Based Learning (Pjbl). *Likhitaprajna*, 19(2), 33–43.
- Mirnawati, M., & Yuwono, I. (2020). Efektifitas Model Pembelajaran CRV Ideal Dalam Meningkatkan Partisipasi Belajar Mahasiswa Tunarungu. *Jurnal ORTOPEDAGOGIA*, 6(1), 20. <https://doi.org/10.17977/um031v6i12020p20-24>
- Nurhadiyati, A., Rusdinal, R., & Fitria, Y. (2020). Pengaruh Model Project Based Learning (PjBL) Terhadap Hasil Belajar Siswa Di Sekolah Dasar. *Jurnal Basicedu*, 5(1), 327–333. <https://doi.org/0.31004/Basicedu.V5i1.684>
- Ramadhani, R., & Putra, D. B. P. (2021). Pengembangan Modul Elektronik Interaktif Berbasis Sigil pada Materi Pitagoras sebagai Penunjang Pembelajaran Jarak Jauh. *Koulutus*, 4(September 2021), 140–152.
- Romayanti, C., Sundaryono, A., & Handayani, D. (2020). Pengembangan E-Modul Kimia Berbasis Kemampuan Berpikir Kreatif Dengan Menggunakan Kvisoft Flipbook Maker. *Alotrop*, 4(1), 51–58. <https://doi.org/10.33369/atp.v4i1.13709>
- Syukriah, S., Nurmaliah, C., & Abdullah, A. (2020). The implementation of project-based learning model to improve students' learning outcomes. *Journal of Physics: Conference Series*, 1460(1). <https://doi.org/10.1088/1742-6596/1460/1/012064>
- Widiana, I. W., Tegeh, I. M., & Artanayasa, I. W. (2021). The project-based assessment learning model that impacts learning achievement and nationalism attitudes. *Cakrawala Pendidikan*, 40(2), 389–401. <https://doi.org/10.21831/cp.v40i2.38427>
- Widya, W., Yusmanila, Y., Zaturrahmi, Z., & Ikhwan, K. (2022). Praktikalitas E-Module Berbasis Model Creative Problem Solving (CPS) untuk Materi Fluida Dinamis Terintegrasi Keterampilan Abad 21. *Edukatif: Jurnal Ilmu Pendidikan*, 4(4), 5700–5707. <https://doi.org/10.31004/edukatif.v4i4.3313>