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DEVELOPMENT OF INTERACTIVE SCIENCE LEARNING E-MODULES BASED ON PROJECT BASED LEARNING TO IMPROVE SCIENCE PROCESS SKILLS AT ISLAMIC ELEMENTARY SCHOOL

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Abstract: *Interactive Science Learning E-Module teaching materials are developed with science process skills. The interactive science learning e-module has the form of software that can be used with the help of a laptop, computer and cellphone. Interactive e-Modules are presented in PDF form, making them easier for educators and students to use, and can be used offline, but there are several menus such as quizzes, learning videos and evaluations that cannot be accessed if you are not connected to the internet. This research is Research and Development (R&D), by applying five ADDIE model stages (analyze, design, develop, implement, and evaluate). Stage analyze includes analysis of educators and students. The design stage includes preparing the e-module outline in the form of selecting media and e-module formats as well as designing the learning content in the e-module. The development stage includes the development of data collection instruments. The data collection instruments in this research are eligibility sheets for validators and science learning practitioners, as well as pretest and posttest questions for science process skills. This instrument was developed based on review by supervisors, assessments by validator lecturers, science teacher learning practitioners, and trials on students. The implementation stage includes the application of the e-module that has been developed for class IV students at MI Tarbiyatussibyan Banyuwangi. The experimental design used at this stage is one group pretest-posttest. The evaluation stage includes the form of evaluation carried out at each ADDIE stage. The data analysis technique used is the normality test and t test.The research results show that the interactive science learning e-module based on project based learning that was developed is very effective and interesting to use in science learning. The science e-module is effective in improving science process skills because the results of field trials show students' enthusiasm in learning science and students who easily understand science material with the stages of science process skills. Science process skills can also provide innovation to educators in creating enjoyable science learning.*

Keywords: Interactive E-Modules; Project Based Learning; Science Process Skills

PENGEMBANGAN E-MODUL INTERAKTIF PEMBELAJARAN IPA BERBASIS *PROJECT BASED LEARNING* UNTUK MENINGKATKAN KETERAMPILAN PROSES SAINS DI MADRASAH IBTIDAIYAH

Abstrak: Penelitian ini bertujuan untuk Mendeskripsikan proses pengembangan e-modul interaktif, Mendeskripsikan penggunaan e-modul interaktif, dan Mendeskripsikan efektivitas dan kemenarikan e-modul interaktif pembelajaran IPA berbasis *project based learning* untuk meningkatkan keterampilan proses sains pada materi tumbuhan semester 1kelas IV di MI Tarbiyatussibyan Banyuwangi. Penelitian ini adalah Research and Development (R&D), dengan menerapkan lima tahap model ADDIE (analyze, design, development, implement, dan evaluate). Tahap analyze meliputi analisis pendidik dan peserta didik. Tahap design meliputi penyusunan outline e-modul berupa pemilihan media dan format e-modul serta mendisain isi pembelajaran dalam e-modul. Tahap development meliputi pengembangan instrumen pengumpulan data. Instrumen pengumpulan data dalam penelitian ini ialah lembar kelayakan untuk validator, dan praktisi pembelajaran IPA, serta soal pretest dan posttest untuk keterampilan proses sains. Instrumen ini dikembangkan berdasarkan peninjauan dosen pembimbing, penilaian dosen validator, praktisi pembelajaran guru IPA, dan uji coba pada siswa. Tahap implement meliputi penerapan e-modul yang telah dikembangkan pada peserta didik kelas IV MI Tarbiyatussibyan Banyuwangi. Desain eksperimen yang digunakan pada tahap ini adalah pretest-postest one group. Tahap evaluate meliputi bentuk evaluasi yang dilakukan pada setiap tahap ADDIE. Teknik analisis data yang digunakan merupakan uji normalitas dan uji t. Hasil penelitian menunjukkan bahwa e-modul interaktif pembelajaran IPA berbasis project based learning yang dikembangkan sangat efektif dan menarik untuk digunakan dalam pembelajaran IPA. E-modul IPA tersebut efektif untuk meningkatkan keterampilan proses sains karena hasil uji coba lapangan menunjukkan antusias peserta didik dalam pembelajaran IPA serta peserta didik yang mudah memahami materi IPA dengan tahap-tahap keterampilan proses sains. Keterampilan proses sains juga dapat memberikan inovasi kepada pendidik dalam menciptakan pembelajaran IPA yang menyenangkan.

Kata Kunci: E-Modul interaktif; Project based learning; Keterampilan proses

INTRODUCTION

Education is an effort that deliberately and systematically builds hope, guides and helps develop the mental and physical potential conveyed by educators to their students to reach the adult stage and find solutions to their life problems well (M. Ardiansyah & Nugraha, 2022). The importance of education is stated in Law no. 20 of 2003 concerning the national education system, it is stated in chapter 1 article 1 that education is a form of structured and systematic effort in an effort to realize learning conditions and teaching and learning activities with the hope that students will be able to reach the optimal stage in developing talents and skills, and can uphold the values religious values, self-control, character, ethical intelligence so that it can benefit the wider community (Kemendikbud & Tohir, 2020). The independent curriculum is a learning guide with a variety of extra-curricular activities and more optimal learning so that students can better understand learning concepts and strengthen students' competencies. Teachers also have the freedom to choose teaching devices or materials so that learning can be adjusted to the learning needs and interests of students. With curriculum changes, it is hoped that learning can improve and restore learning (Latifah, 2023).

Primary School Education Institutions or Madrasah Ibtidaiyah have implemented the Merdeka curriculum at the beginning of 2022 (Ikmal, Tobroni, n.d.), the implementation is carried out in grades I and IV. In the Merdeka curriculum, learning must be technology-based (Nurdiana Sari et al., 2023). Teaching materials that can make learning more effective, efficient and relevant and are technology-based are e-modules, because e-modules are teaching materials that can be easily accessed by both educators and students online. The role of educators in learning is as a facilitator and then the e-module can make it easier for educators to carry out learning. E-learning modules make students more independent, responsible in learning, and respect differences between individuals because with e-modules students will learn according to their respective abilities (Hayati et al., 2019). E-modules in science learning are used as a tool to achieve learning objectives and make it easier for students to understand the material delivered by educators (Najamuddin et al., 2021). With the e-module, science learning becomes more fun, students can carry out independent learning, make observations and understand concepts through the material in the e-module.

The subject of Natural Sciences is science that is systematic and regularly structured, generally applicable (universal), and is a collection of data resulting from observations and experiments (Amalia et al., 2021). The science learning process emphasizes direct experience so that it can develop students' competencies and understand the natural surroundings scientifically, not just theoreticall (Ghaniem et al., 2021). In implementing science learning, you should not only emphasize learning theory, but also the existence of projects in the learning process. Project-based learning is a Project Based Learning method, this method can be collaborated with science process skills. From the interview results, it is also known that students prefer learning that is not only carried out in class, but also involves experiments or projects after the presentation of the material. Therefore, the application of the project based learning (PjBL) learning model will be able to help students understand difficult concepts in science learning (Setiawan et al., 2022).

A learning model is a design that describes the detailed process and creation of situations that allow students to interact so that changes or developments can occur in the students (Sutiah, 2018). The project-based learning model can help students develop creativity through project-based problem solving activities. In carrying out problem-solving-based learning activities, students also need abilities such as observing, inferring, experimenting or referred to as science process skills (Dewi et al., 2018). Science process skills are scientists' thinking skills that are useful for solving problems and formulating results. According to Wahono, science process skills themselves are skills that in the learning process are not only theoretical but students carry out direct or observation, observation, classification, measurement and prediction (Trisnawati, 2019). Science process skills in science learning in elementary schools or Madrasah Ibtidaiyah make it easier for students to understand the material.

At the Elementary School or Madrasah Ibtidaiyah education level, Natural Sciences or Natural Sciences are subjects in which, in the learning process, students are invited to recognize the natural surroundings and understand the natural environment. Science is a human effort to understand the universe through targeted observations, and using procedures that can be explained by reasoning to obtain conclusions (Fatimah, 2016). Science learning in elementary schools emphasizes providing direct learning experiences through the use and development of process skills (Nuryani & Pratama, D,

2022). These process skills enable students to acquire and build knowledge in a more real and meaningful way.

Science process skills have been applied in science learning in elementary schools or Madrasah Ibtidiayah to increase students' knowledge and make it easier for students to learn natural sciences (Astutik, 2023), as evidenced by the approach used in the educator and student handbooks used in learning. science process skills approach, in science process skills students will learn to use skills including the skills of observing, measuring, classifying, predicting, concluding and communicating (Astutik, 2023). Based on several previous studies, it shows that science process skills have different levels of difficulty for each process, observing indicators which are relatively easy for students to do, this was proven by Indah Sulastri, Stepans Sahala, Syukran Mursyid with the research title "Analysis of science process skills" (Sulastri et al., 2021), the same research was also conducted by Lepiyanti with the title "analysis of science process skills in practicum-based learning" (Lepiyanto, 2017) in her research stated that science process skills with the highest score of 80% were on the observing indicator, for indicators measure and classify only 60%, predict, conclude, and communicate only 50%. This proves that it is necessary to improve science process skills in science learning so that students can also meet sufficient scores on each indicator of science process skills, not only stop there but can solve problems they encounter when conducting scientific research.

The results of previous research show that improving science process skills can be done using the project based learning learning model, as in the research "Development of Project Based Learning (PjBL) Model Learning Tools to Improve Science Process Skills and Creativity" (Kusumaningrum & Djukri, 2016) research results This shows that there is an increase in science process skills with the project based learning model, where project based learning requires students to think creatively and critically so that it is in line with science process skills. The book with the title "Project based Learning as an Effort to improve science process skills" (Rahman, 2016) in the book states that students' science process skills can be improved by implementing the project based learning learning model. This is supported by the implementation of an independent curriculum where students are required to be able to implement and develop their creativity. There is research "Application of the Project Based Learning Model to Improve the Process Skills and Science Learning Outcomes of Elementary School Students" (Yuniasih et al., 2022) from several studies showing that science process skills can be improved with the project based learning learning model which is collaborated with the process skills approach science.

Research with the title "Application of the Project Based Learning Model to Improve Students' Learning Outcomes and Science Process Skills"(Amsikan, 2022) in this research states that students' science process skills increase by implementing the project based learning learning model. Then there is research with the research title "The Effect of Implementing the Project Based Learning Model on the Science Process Skills of Class IV Students at SDK Wairpelit" (Baho et al., 2021). The results of previous research show that the project based learning model is very influential in improving science process skills, because The project based learning model in its output produces work, while science process skills can be carried out through experiments, so that you can create an experimental project consisting of observing, measuring, classifying and communicating skills.

Based on the results of observations in the field, researchers created the latest innovation regarding technology-based teaching materials so that they can help educators

and students to easily learn and carry out learning anywhere. Apart from that, the e-module teaching materials are designed using the Project Based Learning (PJBL) learning model so that in the learning process students not only listen to the teacher's presentation of the material but also produce a product or carry out a project. With the discovery of the science process skills approach in students' learning manuals, which in the learning process is not applied by educators. So researchers will develop science process skills in the science e-module based on the learning guidebook for students and educators. The aim of developing this e-module is to describe the development process, how to use it, and the effectiveness and attractiveness of interactive e-modules in science learning based on project based learning to improve the science skills process for class IV MI Tarbiyatussibyan Banyuwangi.

METHOD

The research method used is Research and Development. The ADDIE development model is a development model used to develop products in the form of learning media or technology-based teaching materials in Research and Development research (Sugiyono, 2020). The ADDIE development model consists of five stages as the name suggests, which stands for Analysis, Design, Development, Implementation and Evaluation (Rayanto, 2020). The first stage is analysis, which includes curriculum analysis regarding CP and TP contained in the independent curriculum, situation analysis and analysis of student characteristics so that the resulting teaching materials can be in accordance with school conditions and students. The final analysis, namely analysis of teaching materials, aims to examine references. which discusses aspects that need to be considered in developing teaching materials so that they can be classified as appropriate and good teaching materials. Next is the design, at the design stage the science e-module based on project based learning is designed to improve science process skills. The components in the e-module are designed according to student needs. After that, the development stage. At this stage, an initial science learning e-module product based on project based learning will be obtained to improve science process skills by collecting references used in e-module development, test question development, assessment questions, product validation, and revision. . Then, the Implementation stage is the stage of applying teaching materials that have been validated and then tested on students by conducting field tests (field evaluation). The next stage, namely evaluation, is a process carried out to provide value to the product. In the previous stage, researchers have carried out evaluations at each stage, but at this stage evaluation activities will be carried out regarding the quality of the products resulting from the development of teaching materials based on the results of questionnaire responses from educators and students as well as opinions from experts in order to get better results.

In this research, researchers validated the E-module developed with three validators, namely material expert validators, media expert validators, and language expert validators, as well as science learning practitioners. After validating the E-module, researchers will test it on class IV MI students. Researchers will see the effectiveness and attractiveness of the E-module by giving questionnaires to students. Questionnaires were given before treatment (pre-test) with the E-module and after treatment (post-test) with the E-module.

RESULT AND DISCUSSION

RESULT

This development product is e-module teaching materials based on project based learning to improve science process skills which were developed using the Canva application which is an application for designing e-modules and Heyzine for flip book applications. This product development is based on stages: (1) media concept, which is the process of selecting or developing media based on the context, resources and conditions of the school. In this case, the concept used is a link that students can easily access at any time, they can log in and log out on the e-module server. This aims to facilitate science learning. This is done to facilitate the learning process and in developing products that will be used; (2) Media building system; (3) Visualization, is a developed element based on a display that is easy for users to understand. The visualization in this development uses the Canva application which organizes the design in the e-module, while the interactive features use the Heyzine application so that the e-module can become an attractive interactive flipbook. E-Modules are created using Canva software which is then flipped book with the Heyzine application, which is operated online consisting of 1) main cover, 2) table of contents, 3) learning outcomes, 4) learning objectives, 5) concept of scope of material content, 6) learning process skills strategy, 7) e-module components in science process skills learning, 8) instructions for use, 9) study tips, 10) learning objectives for each topic, 12) concept map, 13) let's think, 14) let's observe , 15) let's try, 16) quiz, 17) summary of each learning topic, 18) comprehension test, 19) answer key, 20) assessment, 21) bibliography, 22) glossary, and 23) compiler profile information.

Data on the validity of the interactive E-Module for science learning was carried out by three expert validators chosen by researchers to validate this e-module are material expert validators, media expert validators, language expert validators, and learning practitioners. PjBL-based e-module teaching materials to improve science process skills must be validated before the e-module is tested on students. The assessment uses a Likert Scale which uses a score range of 1-4. With the following categories:

Table 1. Description of Validation Scores

Information	Score
Very appropriate, clear, interesting, precise, consistent, easy	4
Appropriate, clear, interesting, precise, consistent, easy	3
Not appropriate, clear, interesting, precise, consistent, easy	2
Inappropriate, clear, interesting, precise, consistent, easy	1

Material Expert Validation Results

The expert validator of the science learning interactive e-module material in this research is Dr. Amirul Mukminin Al-Anwary, M.Pd. Comments and suggestions from material expert validators and questionnaire results data from material experts were analyzed using descriptive analysis with the average scoring technique for each item. Based on the results of the material validator expert's assessment of the interactive science learning e-module teaching materials, the percentage level of achievement of the interactive science learning e-module teaching materials can be calculated as follows.

$$P = \frac{\Sigma xi}{\Sigma x} x\ 100\ \%$$
$$P = \frac{74}{80} x\ 100\ \%$$
$$P = 92\%$$

The calculation results above show that the achievement level of 92% is at a very good qualification level so that the interactive e-module teaching materials for science learning do not need to be revised.

Media Expert Validation Results

The expert validator of the science learning interactive e-module media in this research is Dr. Hj. Samsul Susilawati, M.Pd. Comments, suggestions and questionnaire data from design experts were analyzed using descriptive analysis with the average score technique for each item. Based on the results of the media validator expert's assessment of the interactive science learning e-module teaching materials, the percentage level of achievement of the interactive science learning e-module teaching materials can be calculated as follows.

$$P = \frac{\Sigma xi}{\Sigma x} x\ 100\ \%$$
$$P = \frac{91}{100} x\ 100\ \%$$
$$P = 91\%$$

The calculation results above show that the achievement level of 91% is at a very good qualification level so that the interactive e-module teaching materials for science learning do not need to be revised.

Linguist Validation Results

The linguistic expert validator of the science learning interactive e-module in this research is Dr. Susilo Mansurdin, M.Pd. Comments, suggestions and questionnaire data from language experts were analyzed using descriptive analysis with the average score technique for each item. Based on the results of the language validator expert's assessment of the interactive e-module teaching materials for science learning, the percentage level of achievement of the interactive e-module teaching materials for science learning can be calculated as follows.

$$P = \frac{\Sigma xi}{\Sigma x} x\ 100\ \%$$
$$P = \frac{65}{68} x\ 100\ \%$$
$$P = 95\ \%$$

The calculation results above show that the achievement level of 95% is at a very good qualification level so that the interactive e-module teaching materials for science learning do not need to be revised.

Learning Practitioner Expert Validation Results

The validator of interactive science learning e-module learning practitioners in this research is Mr. Sairofi, S.Pd. Comments and suggestions as well as questionnaire data from learning practitioners were analyzed using descriptive analysis with the average score technique for each item. Based on the results of expert learning practitioners' assessments of interactive science learning e-module teaching materials, the percentage

level of achievement of interactive science learning e-module teaching materials can be calculated as follows.

$$P = \frac{\Sigma xi}{\Sigma x} x\ 100\ \%$$

$$P = \frac{116}{120} x\ 100\ \%$$

$$P = 96\ \%$$

The calculation results above show that the achievement level of 96% is at a very good qualification level so that the interactive science learning e-module teaching materials do not need to be revised.

Effectiveness of Interactive E-Module Teaching Materials

Based on the results of the pre-test ≥ 70 reached 66.7% while the score ≤ 70 reached 83%. Meanwhile, the results of the post-test showed that the completion level ≥ 70 reached 100% and the score ≤ 70 reached 0%. The results of the pre-test and post-test for class IV will then be analyzed for the level of effectiveness of the interactive e-module teaching materials for science learning to see whether the interactive e-module teaching materials for science learning really influence students' science process skills. The results of the normality test state that the data is said to be normal if the significant value is greater than 0.05 (P>0.05). Conversely, if the significance is less than 0.05 then the data is said to be abnormal. After analysis using SPSS, the pre-test and post-test data were declared to be normally distributed. A description of the normality test results is presented in the following table.

Table 2. Pre-test and Post-test Normality Test

One-Sample Kolmogorov-Smirnov Test

		Unstandardized Residual
N		21
Normal Parameters[a,b]	Mean	.0000000
	Std. Deviation	20.10590814
Most Extreme Differences	Absolute	.158
	Positive	.158
	Negative	-.089
Kolmogorov-Smirnov Z		.723
Asymp. Sig. (2-tailed)		.673

a. Test distribution is Normal.

b. Calculated from data.

It is known that the average pre-test and post-test score for the interactive science learning e-module, namely the pre-test, was 53.3, while the post-test reached 87.5. The average post-test score obtained by students was greater than the average pre-test score, with a difference of 34.2. This shows that students experience an increase in science process values or skills after using interactive science learning e-module teaching materials. The pre-test and post-test data were analyzed using a two-sample t-test (Paired T Test) by comparing the Sig. (2-tailed) with a significance level of 0.05. And a comparison between the results of the t-count calculation and the t-table. This analysis technique is used by researchers using SPSS to determine whether or not a treatment has been applied to the research object.

Ho: there is no significant difference in the science process skills of class IV students after using interactive e-module teaching materials for science learning (post-test) and before using interactive e-module teaching materials for science learning (pre-test).
Ha: there is a significant difference in the science process skills of class IV students after using interactive e-module teaching materials for science learning (post-test) and before using interactive e-module teaching materials for science learning (pre-test).

Statistical results on the pre-test and post-test with the two-sample T test (Paired T Test) using SPSS.

Table 3. Uji-T (Paired T Test)

Paired Samples Statistics

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	PRE TEST	45.7143	21	25.21338	5.50201
	POST TEST	75.0000	21	33.20392	7.24569

Paired Samples Correlations

		N	Correlation	Sig.
Pair 1	PRE TEST & POST TEST	21	.796	.000

Paired Samples Test

		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
					Lower	Upper			
Pair 1	PRE TEST - POST TEST	-29.28571	20.14235	4.39542	-38.45440	-20.11703	-6.663	20	.000

The results of SPSS 22 data processing carried out by researchers using the T-Test (Paired T Test), it can be concluded that the descriptive statistical summary of the two samples studied, namely the pre-test and post-test scores, obtained a mean of 45.7143 in the pre-test. and 75.0000 on the post-test. The number of students used as research samples was 21 students. The Std.Deviation (standard deviation) value in the pre-test was 25.21338 and the post-test was 33.20392. Lastly is the Std value. The mean error for the pre-test was 5.50201 and the post-test was 7.24569. Based on the table above in the Paired Samples Test table, it is known that the Sig (2-tailed) value is 0.000 < 0.05, so Ho is rejected and Ha is accepted.

Data on the Attractiveness of E-Module Teaching Materials

Results of the trial of the attractiveness of interactive e-module teaching materials for 21 class IV students. The results of observations in field trials were found to be more varied. Many students enjoy learning using interactive e-module teaching materials. Based on these data, the results of the student response questionnaire in the field trial obtained a percentage of 96% with very interesting criteria.



Figure 1. Implementation of E-Module Learning Media

Students' science process skills include observing, measuring, classifying, communicating, predicting and inferring. Of the six stages contained in science process skills, only 4 (four) skills are successfully applied and can be understood by students. So that all stages of science process skills can be effective and successfully applied in science learning, at least one semester or 6 (six) are needed. meeting times. The application of science process skills can be said to be successful, students can observe the process of water capillarity in celery stems, can measure the growth of green bean plants, can classify leaf shapes, and can communicate the results of their research projects in front of the class.



Figure 2. Students Doing Experimental Projects

DISCUSSIONS

The process of developing interactive e-modules for science learning is designed by adjusting learning outcomes and learning objectives, also based on an analysis of teacher needs and student needs in science learning in Class IV SD/MI. The e-Module was designed using the Canva application which was then flipped into a flipbook using the Heyzine application. In the process, it went through a validation stage by expert validators and was previously revised by the supervisor. In its development, the e-module was designed based on project based learning to improve science process skills, the project based learning learning model trains students to create and produce work, this can improve science process skills through experimental project activities, students not only read and listening, but also carrying out activities and making products that can measure students' science process skills. Using e-modules requires an internet network because the electronic modules are designed in soft file form and can be operated with the help of laptops, cellphones and computers connected to the internet.

The pretest and post-test are carried out to measure students' abilities from e-module learning and can see the extent to which students' science process skills are obtained from the pretest scores given before the treatment and the posttest scores given after the treatment. The interactive science learning e-module based on Project Based Learning has been tested in learning. Researchers determined the level of effectiveness of e-modules in improving science process skills using a one-group pretest posttest design with a sample of 21 class IV students. students' science process skills not only through pre-test and post-test scores but also by looking at students' abilities when carrying out experiments and presenting in front of the class regarding the results of their experiments, from the results of the experimental project students can carry out science process skills only up to The component of inference skills alone in prediction skills is that students cannot do it because there is still a lack of treatment for science learning with interactive e-modules. The average pre-test result reached a score of 53.3 and the average post-test score was 87.5. Meanwhile, the t test calculation obtained a mean of 45.7143 in the pre-test and 75.0000 in the post-test. The number of students used as research samples was 21 students.

The Std. Deviation (standard deviation) value in the pre-test was 25.21338 and the post-test was 33.20392. Lastly is the Std value. The mean error for the pre-test was 5.50201 and the post-test was 7.24569. Based on the table above in the Paired Samples Test table, it is known that the Sig (2-tailed) value is 0.000 < 0.05, so Ho is rejected and Ha is accepted. Results of the trial of the attractiveness of interactive e-module teaching materials for 21 class IV students. The results of observations in field trials were found to be more varied. Many students enjoy learning using interactive e-module teaching materials. Based on these data, it can be concluded that students are enthusiastic about taking part in learning if there is learning media that can attract their attention to science subjects regarding plants that are the source of life on earth. When used, it can increase students' interest in learning, if students are interested in learning, they can improve science process skills (Lumbantoruan et al., 2022).

CONSLUSIONS

Based on the results of the development of an interactive e-module for science learning, plant material is the source of life on earth and the results of trials on teaching materials in class IV at MI Tarbiyatussibyan Banyuwangi were developed using a project based learning model to improve science process skills. Interactive science learning e-modules in the form of software that can be used with the help of laptops, computers and mobile phones are presented in the form of flipbooks. The E-Module was developed by adapting the Merdeka curriculum. Apart from that, the learning material in the E-Module is adapted to the learning outcomes and learning objectives in class IV SD/MI. Using e-modules, students will watch learning videos, so that students don't get bored while studying. Apart from that, quizzes are provided that hone students' abilities. The final activity in learning is in the form of a final evaluation provided for each learning activity. For each learning activity, an answer key is provided along with an independent assessment so that students can measure their own abilities. To be able to find out science process skills in students, after studying the e-module students will be invited to

experiment with experimental projects. Effectiveness and attractiveness of e-module teaching materials. Based on the results of the application of teaching materials, it can be seen from the average pre-test result reaching a score of 53.3 and the average post-test score of 87.5. Meanwhile, the t test calculation obtained a mean of 45.7143 in the pre-test and 75.0000 in the post-test. The number of students used as research samples was 21 students. The Std.Deviation value (standard deviation) in the pre-test was 25.21338 and the post-test was 33.20392. Lastly is the Std value. The mean error value for the pre-test was 5.50201 and the post-test was 7.24569. Based on the table above in the Paired Samples Test table, it is known that the Sig (2-tailed) value is 0.000 < 0.05, so Ho is rejected and Ha is accepted. This shows that the product developed has a high level of effectiveness in improving science process skills, so that e-module teaching materials are suitable for use in science learning, especially plant material which is the source of life on earth.

BIBLIOGRAPHY

Amalia, F., Anggayudha, R. A., & Aldilla, K. (2021). Ilmu Pengetahuan Alam dan Sosial. In *Ilmu Pengetahuan Alam dan Sosial Buku Siswa*.

Amsikan, A. (2022). Application of Project Based Learning Model to Increase Students Physics Learning Outcomes and Science Process Skills. *Paedagogia*, *25*(1), 1. https://doi.org/10.20961/paedagogia.v25i1.58989

Astutik, F. I. (2023). *Analisis Keterampilan Proses Sains Mahasiswa Program Studi PGMI Fakultas Tarbiyah IAI Al-Khairat Pamekasan Pada Mata Kuliah Kajian IPA MI / SD*. *5*(1), 1–7.

Baho, A. G., Maria, D., Puang, E., Timba, F. N. S., Studi, P., Guru, P., & Dasar, S. (2021). *diterima dan H*. *3*(1), 16–23.

Dewi, E. M., Annisa, M., & Kunadi, D. (2018). Pengembangan Modul IPA Berbasis Keterampilan Proses Sains dalam Mengembangkan Karakter Pada Siswa Kelas V a Sdn 007 Tarakan. *Lensa (Lentera Sains): Jurnal Pendidikan IPA*, *8*(2), 54–66. https://doi.org/10.24929/lensa.v8i2.36

Fatimah, S. (2016). Analisis Keterampilan Proses Sains Siswa Kelas V. *Seminar Nasional KSDP Prodi S1 PGSD "Konstelasi Pendidikan Dan Kebudayaan Di Era Globalisasi," 1*(1), 181–190.

Ghaniem, A. F., Rasa, A. A., Oktora, A. H., & Yasella, M. (2021). *Ilmu Pengetahuan Alam dan Sosial untuk SD Kelas V*.

Hayati, I. A., Rosana, D., & Sukardiyono, S. (2019). Pengembangan Modul Potensi Lokal Berbasis SETS. *Jurnal Inovasi Pendidikan IPA*, *5*(2), 248–257. https://doi.org/10.21831/jipi.v5i2.27519

Ikmal, Tobroni, S. (n.d.). Implementasi Pengembangan Kurikulum Integratif di UIN Maulana Malik Ibrahim Malang. *Al-Hidayah*, 399–416.

Kemendikbud, & Tohir, M. (2020). Merdeka Belajar: Kampus Merdeka. *Kemendikbud*, 1–19. https://osf.io/sv8wq/

Kusumaningrum, S., & Djukri, D. (2016). Pengembangan Perangkat Pembelajaran Model Project Based Learning (PJBL) untuk Meningkatkan Keterampilan Proses Sains dan kreativitas. *Jurnal Inovasi Pendidikan IPA*, *2*(2), 241. https://doi.org/10.21831/jipi.v2i2.5557

LATIFAH, D. N. (2023). Analisis Gaya Belajar Siswa untuk Pembelajaran Berdiferensiasi di Sekolah Dasar. *LEARNING : Jurnal Inovasi Penelitian Pendidikan dan Pembelajaran*, *3*(1), 68–75.

https://doi.org/10.51878/learning.v3i1.2067

Lepiyanto, A. (2017). Analisis Keterampilan Proses Sains Pada Pembelajaran Berbasis Praktikum. *Bioedukasi (Jurnal Pendidikan Biologi)*, *5*(2), 156. https://doi.org/10.24127/bioedukasi.v5i2.795

Lumbantoruan, A., Purwaningsih, S., Magister, S., Ilmu, P., Alam, P., Pascasarjana, F., Jambi, U., Farmasi, P. S., Farmasi, F., Padjajaran, U., Artikel, I., Melingkar, G., Sains, K. P., Lumbantoruan, A., Studi, P., Pendidikan, M., Pengetahuan, I., Pascasarjana, F., & Jambi, U. (2022). *Pengembangan E-Modul Berbasis Pemecahan Masalah*. *8*(2), 99–111. https://doi.org/10.32699/spektra.v8i2.223

M. Ardiansyah, M. A., & Nugraha, M. L. (2022). Analisis Pemanfaatan Media Pembelajaran Youtube dalam Meningkatkan Pemahaman Konsep Matematika Peserta Didik. *Semnas Ristek (Seminar Nasional Riset Dan Inovasi Teknologi)*, *6*(1), 912–918. https://doi.org/10.30998/semnasristek.v6i1.5828

Najamuddin, F., Wahrini, R., & Arwadi, F. (2021). Pengembangan Elektronik Modul (E-Modul) Interaktif Sebagai Sumber Belajar Elektronika Dasar Program Studi Pendidikan Vokasional Mekatronika FT-UNM. *Seminar Nasional LP2M UNM*, 100–108.

Nurdiana Sari, W., Faizin, A., Muria Kudus, U., & Hidayatul Mubtadiin, M. (2023). Pendidikan Karakter dalam Pembelajaran IPS di Sekolah Dasar pada Kurikulum Merdeka. *Jurnal Ilmiah Multidisiplin*, *2*(3), 2023.

Nuryani, S., & Pratama, D, F. (2022). Analisis pembelajaran IPA melalui Pendekatan Keterampilan Proses Sains pada Siswa Kelas VI Sekolah Dasar. *Journal of Elementary Education*, *5*(6), 1162–1169.

Rahman, A. (2016). *Project Based Learning Sebagai Upaya Meningkatkan Hasil Belajar dan Keterampilan Proses Sains* (Gramedia (ed.); 1st ed.).

Rayanto, yudi hari dan sugianti. (2020). *Penelitian Pengembangan Model ADDIE*. Lembaga Academic and Research Institute.

Setiawan, T., Sumilat, J. M., Paruntu, N. M., & Monigir, N. N. (2022). Analisis Penerapan Model Pembelajaran Project Based Learning dan Problem Based Learning pada Peserta Didik Sekolah Dasar. *Jurnal Basicedu*, *6*(6), 9736–9744. https://doi.org/10.31004/basicedu.v6i6.4161

Sugiyono. (2020). *Metode Penelitian Kuantitatif Kualitatif dan R&D, ed. Sutopo, cetakan ke*. Alfbeta.

Sulastri, I., Sahala, S., & Mursyid, S. (2021). Analisis Keterampilan Proses Sains Tentang Gerak Harmonis Peserta Didik Kelas X SMA. *Jurnal Pendidikan Dan Pembelajaran Khatulistiwa*, *10*(9), 1–8. http://dx.doi.org/10.26418/jppk.v10i9.49127

Sutiah, S. (2018). *Pengembangan model pembelajaran PAI* (1st ed.).

Trisnawati, O. R. (2019). *Analisis Keterampilan Proses Sains Siswa Kelas V Sdn 2 Kaleng Tahun Ajaran 2017/2018*. *3*(2), 10–21.

Yuniasih, E., Hadiyanti, A. H. D., Hadiyanti, A. H. D., Hadiyanti, A. H. D., Zaini, E., Zaini, E., & Zaini, E. (2022). Penerapan Model Project Based Learning untuk Meningkatkan Keterampilan Proses dan Hasil Belajar IPA Siswa Sekolah Dasar. *Edukatif : Jurnal Ilmu Pendidikan*, *4*(5), 6670–6677. https://doi.org/10.31004/edukatif.v4i5.3380