

## THE EFFECTIVENESS OF DEVELOPING SCIENCE E-MODULES BASED PROJECT-BASED LEARNING TO IMPROVE THE COMMUNICATION SKILLS OF GRADE 5<sup>th</sup> STUDENTS

Asriani<sup>1\*</sup>, Retno Triwoelandari<sup>2</sup>, Hambari<sup>3</sup>

<sup>1,2,3</sup>Ibn Khaldun University

<sup>1</sup>asriani7494@gmail.com

### Abstract

21st century teachers are required to be able to integrate information and communication technology (ICT) in the learning process. In addition, teachers must be able to equip students with skills needed in the 21st century, one of which is communication skills. Science as a subject studied since elementary school is related to communication skills. Therefore, this study aims to develop a project-based learning science learning e-module to improve the communication skills of grade 5 elementary school/ MI students. In addition, this study is focused on knowing the development process, feasibility and effectiveness in improving students' communication skills. The development of the e-module is carried out using the Research and Development (R&D) 4D model and data collection was carried out through interviews, observations and questionnaires. Meanwhile, data analysis was carried out by measuring the validity of the e-module by material experts, linguists and media experts while to determine the effectiveness of normality, homogeneity and hypothesis tests of independent samples t-test. Based on the overall feasibility test results, a score of 81.9% was obtained, which means that the e-modules that have been developed are very valid and suitable for use in science learning. In addition, the effectiveness test was carried out using the SPSS FOR Windows 26 application from posttest and pretest data in the control class and experimental class, obtained Sig. (2-Tailed) results of 0.001 or less than 0.05 which means there is a significant difference. Thus, it can be concluded that the project-based learning e-module of science learning is declared effective for improving students' communication skills. **Keywords:** Effectiveness, Development, E-module, Communication Skills

**Keywords:** Development; E-module; Communication Skill

### Abstrak

Guru abad 21 didituntut untuk mampu mengintegrasikan teknologi informasi dan komunikasi (TIK) dalam proses pembelajaran. Selain itu, guru harus mampu membekali siswa dengan keterampilan yang dibutuhkan di abad 21, salah satunya keterampilan komunikasi. IPA sebagai mata pelajaran yang dipelajari sejak SD berkaitan dengan keterampilan komunikasi. Oleh karena itu, penelitian ini bertujuan untuk mengembangkan e-modul pembelajaran IPA berbasis *project based learning* untuk meningkatkan keterampilan komunikasi siswa kelas 5 SD/MI. Selain itu, penelitian ini difokuskan untuk mengetahui proses pengembangan, kelayakan dan keefektifannya dalam meningkatkan keterampilan komunikasi siswa. Pengembangan e-modul dilakukan menggunakan metode *Research and Development (R&D)* model 4D dan pengumpulan data dilakukan melalui wawancara, observasi serta angket. Adapun, analisis data dilakukan dengan mengukur validitas e-modul oleh ahli materi, ahli bahasa dan ahli media sedangkan untuk mengetahui efektivitas dilakukan uji normalitas, homogenitas dan uji hipotesis independent samples t-test. Berdasarkan hasil uji kelayakan secara keseluruhan diperoleh skor 81,9% yang berarti e-modul yang telah dikembangkan sangat valid dan layak digunakan dalam pembelajaran IPA. Selain itu, uji efektivitas dilakukan dengan menggunakan aplikasi *SPSS FOR Windows 26* dari data *posttest* dan *pretest* di kelas kontrol dan kelas eksperimen, didapatkan hasil *Sig.(2-Tailed)* 0,001 atau kurang dari 0,05 yang berarti terdapat perbedaan yang signifikan. Dengan demikian, dapat disimpulkan bahwa e-modul pembelajaran IPA berbasis *project based learning* dinyatakan efektif untuk meningkatkan keterampilan komunikasi siswa.

**Kata Kunci:** Pengembangan; E-modul; Keterampilan Komunikasi

Received : 2023-08-17

Approved : 2023-10-30

Revised : 2023-10-28

Published : 2023-10-31



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## Introduction

The 21st century is marked by the industrial revolution 4.0 which causes massive developments in science and information and communication technology (ICT). This has an impact on the world of education, especially the role of teachers and the skills that students must have. 21st century education aims to create the next generation of the nation who are independent, resilient, and able to compete according to the demands of an increasingly competitive era and increasingly advanced technology (Anggreni & Yohandri, 2022: 117). In addition, this century also has very high demands to create quality human resources (Hasibuan & Prastowo, 2019: 29). Various competencies needed by students today are often referred to as 21st century skills, while the concept of education is better known as 21st century learning (Andrian & Rusman, 2019: 15). Therefore, teachers in the 21st century are required to be able to integrate information and communication technology (ICT) in the learning process, master the use of ICT well, design innovative student-centered learning methods, and make students more active in asking questions and opinions with their own original ideas and ideas (Hapudin 2022: 177). In addition, as a central figure in the world of education, teachers must also be able to equip students with 21st century skills through the learning process. The development of skills in the 21st century in the learning process can help students become aware of information, knowledge and technology, and grow into people who have skilled thinking skills (Salma Monika et al., 2022: 885).

In line with this, Permendikbudristek Number 16 of 2022 Article 6 No. 4 states that one of the objectives of education is to make students have life skills that are in accordance with their conditions and needs. In 21st century education, the skills students need to be able to compete globally are critical thinking skills, the ability to communicate effectively, innovate, solve problems through negotiation and collaboration as well as an entrepreneurial spirit and the ability to access and analyze information (I. Rahayu & Sukardi, 2021: 398). Furthermore, the Partnership for 21st Century Skills (P21) formulates skills that students need to master, including learning and innovating skills ((Nesri & Kristanto, 2020: 481; P21: 2019). These skills are critical thinking, collaboration, creativity, and communication known as 4C skills (Ermawati et al., 2022: 377).

Communication skills are one of the essential skills needed in the 21st century (Hidayat & Puspitasari, 2022: 182). In addition, Zubaidah argues that communication is a skill that includes the ability to read, listen and speak so it is important for students to have (Khoerunnisa et al., 2022: 238). Therefore, the development of students' communication skills needs to be carried out in the learning process. According to Inah, good communication between teachers and students is needed in the learning process so that the material provided by teachers can be digested optimally (I. Y. Rizki et al., 2021). Meanwhile, the benefits of other communication skills for students are helping students in the learning process to achieve learning goals effectively (Indriyani et al., 2020: 86). Student communication skills can be developed through activities in providing responses, expressing ideas and opinions, and asking questions when students experience difficulties in the learning process (Fitriah, Yulianto & Asmarani, 2020: 547). Meanwhile, communication consists of two forms, namely verbal and nonverbal. According to Asiyah (2018: 154), verbal communication is a form of communication carried out orally and in writing, while nonverbal communication is communication carried out in addition to using oral, such as gestures, gestures, mimics, intonation and language style. Indicators of verbal communication skills, including conducting discussions, presenting the results of discussions, expressing opinions, answering questions, writing down the final results

of discussions, using good grammar, short, clear and easy to understand and sounds clear. Nonverbal communication skills, including seeing the interlocutor, friendly facial expressions, and hand gestures in accordance with the words spoken (Arsyad, 2011: 100-101).

Science is a subject that is able to represent the implementation of 21st century learning. This is because the characteristics of the content in IPA consist of products, processes, and procedures (Endaryati et al., 2021: 301). In addition, according to Rahayu and Anggraeni, the science learning process includes three elements, including science as a product, namely the accumulation of the results of the efforts of previous science inventors which have been compiled completely and systematically in textbooks, science as a process, which is a method to obtain knowledge and science as a method to cultivate attitudes and skills (Awalia & Witarasa, 2021: 3905). In line with this, Rizki and Sari (2021: 1158) argue that science is one of the subjects at the elementary school level that seeks to develop students' communication skills to live together as individuals and groups and interact with their environment physically and socially.

However, the fact that science learning in Indonesia has a relatively low quality. This can be seen from the results of the PISA (Program for International Student Assessment) international study in 2018, the average results of students' science literacy scores in Indonesia showed a score of 396 points from the average standard of 489 points (OECD, 2019: 1). Then, the results of the 2015 TIMSS study showed that Indonesia was in 46th place out of 51 countries with an average of 397. This is far below the international average of 500. When referring to the international standards set by TIMSS for the advanced category it is 625, high is 550, medium 475, and low 400. In addition, based on observations and interviews that researchers have conducted on 2 grade 5 teachers at SD Insan Kamil Bogor in March 2023, researchers found problems where science learning still uses a teacher-centered learning model, students answer in low voices when asked and no students ask questions when teachers provide opportunities. In addition, teachers have not used e-modules so books are the only learning resource. Thus, students' communication skills will be difficult to develop properly.

According to Garcia and Morrel, the main feature of 21st century learning is the digitization of the teaching and learning process because technology remains an important component in the classroom for teachers to create extraordinary learning (Yuliana & Atmojo, 2021: 6036). Thus, one of the efforts that teachers can make in overcoming problems in the science learning process is to use e-modules. E-module is teaching material in the form of modules displayed in electronic format which is expected to increase student interest and motivation (Siregar & Harahap, 2020: 1926). Another opinion states that e-modules are media with limitations, methods and tools to evaluate which are made systematically and attractively according to the level of complexity electronically to achieve the desired 21st century competence (Putri et al., 2022: 27). According to Wulansari, the qualities of a good e-module are (1) self instruction means the instructions are clear, (2) self contained means it does not rely on other teaching materials, (3) stand alone which denotes that the subject matter may be researched alone, (4) User-friendly and adaptable means simple to use (Aji et al., 2023: 22). Meanwhile, the use of e-modules can reduce the use of paper and also facilitate students' access to learning anytime and anywhere through computers, laptops or mobile phones (Sa'diah et al., 2022: 22). According to Naval, the benefit of learning modules is that will be provided to improve student competencies in schools with multiple shifts to extend hours (Berlianda, 2022: 27). In addition, the advantages of e-modules, namely (1) clarifying and facilitating teaching material so that it is not too verbal, (2) increasing student's learning motivation, (3) students can learn according to their wishes, needs, and abilities and (4) students can measure their abilities

through the evaluation contained in the e-module (Gistituati & Atikah, 2022: 108). However, infrastructure must support e-module access through a consistent internet network (Widya et al., 2023: 49).

Learning model innovation in e-modules can be done by integrating the project based learning (PjBL). The PjBL model is defined as a learning model that involves active students in solving problems and creating a product independently or in groups through scientific stages with a certain time limit to be presented to others (Kemendikbud, 2020: 10). In line with this opinion, Zubaedah stated that PjBL is an ideal learning model to fulfill skills in the 21st century which include critical thinking, collaboration, creativity, and communication (Kelana & Wardani, 2021: 39). According to Rusman, the advantages of the project-based learning model are as follows (1) Increase student's motivation to learn, encourage their ability to do important work, and they need to be appreciated, (2) Improve problem-solving skills, (3) Make students become more active and successfully solve complex problems, (4) Improve collaboration, (5) Encourage learners to develop and practice communication skills, (6) Improve the ability of students to manage resources, (7) Provide experience to learners learning and practice in organizing projects, and make allocations of time and other resources such as equipment to complete tasks, (8) Provide learning experiences that engage students in complex ways and are designed to evolve according to the real world, (9) Involving students to learn to take information and show the knowledge they have, then implemented with the real world and (10) Make the learning atmosphere fun, so that students and educators enjoy the learning process (Mayuni et al., 2019: 186). In addition, project-based learning can provide opportunities for students to actively exchange opinions, collaborate with friends, interact with teachers, and respond to other students' thoughts, so that learning becomes more meaningful. Thus, the novelty of this research are e-modules of project-based learning science can help teachers train and improve students' communication skills and prepare students for success in the 21st century.

Therefore, researchers are interested in developing a project-based learning science learning e-module to improve the communication skills of grade 5 elementary school/ MI students as a solution to the problems described above. In addition, this study aims to test the effectiveness of the e-module that has been developed.

### Research Methods

The approach used in this research is research and development (R & D) or development research with a 4D model proposed by Thiagarajan. Based on the 4D model, the development stages in this study include the define, design, develop and disseminate stages (Thiagarajan et al., 1974: 5). The purpose of this study is to develop products and find out their effectiveness.



Figure 1. Stages of 4D Model development

The place of data collection in this study was carried out at SD Insan Kamil which is located at Jalan Dramaga Km. 6, Margajaya, Kec. West Bogor City, Bogor City. Meanwhile, this study was conducted from May 25 to June 1, 2023. The research subjects consisted of 3 expert lecturers and 5 class 5B students in individual tests, 10 class 5D students in small group trials, 25 grade 5F students in large group trials and 42 students in grades 5A and 5C as experimental classes and control classes. The data collection was carried out by (1) interviews with 2 grade 5A and 5F teachers of SD Insan Kamil Bogor, (2) expert validation questionnaires

and student responses to test feasibility, (3) observation sheets to assess the effectiveness of students' communication skills. Data analysis was carried out qualitatively and quantitatively. Data from interviews and observations were analyzed qualitatively, while data from expert validation and pretest-posttest results were analyzed quantitatively. Furthermore, data analysis was carried out to determine the feasibility and effectiveness of e-modules on students' communication skills using data from validation results and development trials as well as *pretest* and *posttest* observation sheets of student communication skills. Communication skill indicators that will be used in this study include verbal and nonverbal communication skills. Indicators of verbal communication skills include conducting discussions, presenting discussion results, expressing opinions, answering questions, writing down the final results of discussions, using good grammar, short, clear and easy to understand and sounds clear. Meanwhile, indicators of nonverbal communication skills consist of looking at the interlocutor, friendly facial expressions, and hand gestures that correspond to the words spoken. The following is the interpretation of the validation data according to Sugiyono (2022: 172).

Table 1  
Validity Interpretation Criteria

Presentation (%)	Validity Level	Interpretation
81-100	Very High	Very valid
61-80	Tall	Valid
41-60	Enough	Quite valid
21-40	Low	Invalid
0-20	Very Low	Very invalid

Meanwhile, the effectiveness test is calculated using SPSS 26 For Windows with interpretation of independent samples t-test result data, as follows:

Sig.(2-Tailed)<0.05 then there is a significant difference

Sig.(2-Tailed)>0.05 then the data there is no significant difference

Significant differences show that the e-modules developed are effective in improving the communication skills of grade 5 elementary school students.

## Results and Discussion

The product developed in this study is a project-based learning science e-module to improve the communication skills of grade 5 elementary school students and then tested for feasibility and effectiveness. Meanwhile, the research was conducted using a 4D model consisting of 4 stages of development which are define, design, develop and disseminate (Thiagarajan et al., 1974: 5). The define stage is carried out through front end analysis, student analysis, task analysis, concept analysis and formulation of learning objectives. The results of the data found in the analysis of the future through observation and interviews of 2 grade 5 teachers of SD Insan Kamil, namely Mrs. Rani, the homeroom teacher of grade 5a and Mr. Indra, the homeroom teacher of grade 5F, show that the curriculum used, namely the 2013 curriculum, the project-based learning model is still rarely used, the 2013 revised edition of the 2018 curriculum science science book is the only source of science learning, and communication skills have not been maximized. In addition, in the analysis of students through observation and interviews, information was obtained that students are more receptive to material when learning is carried out by direct practice and in groups. The task analysis is carried out by analyzing core competencies, basic competencies and indicators. Furthermore, in the concept analysis, researchers determine the material to be loaded, namely science material theme 9 subtheme 2 about single substances and mixed substances with a project-based learning

model. Finally, learning objectives are formulated based on the results of task analysis and concept analysis.

The design stage is carried out by researchers by compiling test reference standards, selecting media, choosing formats and making initial designs. At this stage, researchers compile test reference standards that produce validation questionnaires (material experts, media experts, linguists), student response questionnaires and observation sheets on student communication skills. Meanwhile, the media to be developed in this study is an e-module created using the Canva application. Based on the previously selected media, the format to be presented in this study is web-based in the form of links or links. In addition, e-modules are designed according to BSNP 2006 and contain covers, forewords, competency standards, instructions for use, learning materials, learning steps based on project-based learning, quizzes, evaluation and reflection, glossary and bibliography. Here are some components of the e-module that researchers have designed:



Figure 2. Front cover and Back cover



Figure 3. Learning Materials



Figure 4. Project based learning steps

At the *development stage*, researchers develop e-modules in accordance with validator revisions and suggestions so as to obtain effective e-modules. In addition, researchers conducted expert validation and e-module trials to determine the feasibility of the effectiveness of the developed e-module. In this study, validation was carried out by lecturers from Ibn Khaldun University. Material experts are Mrs. Ir. Retno Triwoelandari, M.Pd. who is a lecturer in PGMI study program, media experts namely Mrs. Maimunah, M.Pd. lecturer at the Faculty of Teacher Training and Education, linguists namely Mrs. Dr. Salati Asmahasanah, M.Pd. lecturer at the Faculty of Islamic Religion. Meanwhile, the e-module trial involving grade 5 students of SD

Insan kami is an individual trial with 5 students, a small group trial with 10 students, and a large group trial with 25 students. Here are the results of expert validation and trials that researchers have done:

Table 2  
E-Module Development Feasibility Assessment Data

No	Assessment	Assessment Results (%)	Interpretation
1	Material Expert	77,5%	Valid
2	Media Expert	81%	Highly Valid
3	Linguist	83,3%	Highly Valid
4	Individual Trials	83,7%	Highly Valid
5	Small Group Trials	80,2%	Valid
6	Large Group Trials	86%	Highly Valid
	<b>Total Average</b>	<b>81,95%</b>	<b>Highly Valid</b>

Based on the data in Table 2, the expert validation test and e-module trial were 81.95% with a "Very Valid" interpretation. Thus, the e-module developed in this study is feasible to be used as a project-based learning science learning e-module to improve the communication skills of grade 5 elementary school students. However, some suggestions were given as enriched with examples and references from material experts and fonts and layouts were made more symmetrical based on the advice of media experts and linguists.

After the e-module is declared feasible, disseminate or disseminate is carried out. In this study, dissemination was carried out on a limited basis to teachers of SD Insan Kamil by sharing the e-module link via Whatsapp Group. In addition, to determine the effectiveness of the e-module, researchers conducted observation tests of communication skills before (pretest) and after (posttest) in the experimental class and control class using observation sheets. The data obtained are then analyzed through normality tests, homogeneity tests, and independent samples t-tests. The results of the analysis showed that the data were normally distributed and homogeneous. The following are the results of the average assessment of students' pretest and posttest communication skills.

Table 3  
Average Pretest and Posttest

Class	Pretest	Post
Experiment	27,4	34
Control	24,5	32,1

The data in Table 3 shows an increase in communication skills, because there are differences in pretest and posttest scores. The value of the experimental class is greater because it is given treatment using the e-module that the researcher developed. Furthermore, independent samples t-test was conducted using SPSS 26 For Windows to determine the average difference in post-test results of students' communication skills between the experimental class and the control class.



Table 4  
Test Results Independent Samples T-Test

	Levene's Test for Equality of Variances	T-Test for Equality of Means					95% Confidence Interval of the Difference			
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Keterampilan Komunikasi	Equal variances assumed	1.640	.208	3.576	40	.001	1.810	.506	.787	2.832
	Equal variances not assumed			3.576	37.179	.001	1.810	.506	.784	2.835

The data in table 4 shows that the result of Sig. (2-Tailed) value is 0.001 or less than 0.05, meaning that there is a significant difference in students' communication skills between the experimental class and the control class. Thus the e-module is declared effective for improving students' communication skills.

The effectiveness of project based learning based science learning e-modules can also be seen from the results of e-module trials. Here are the effectiveness results based on individual trials, small group trials and large group trials.

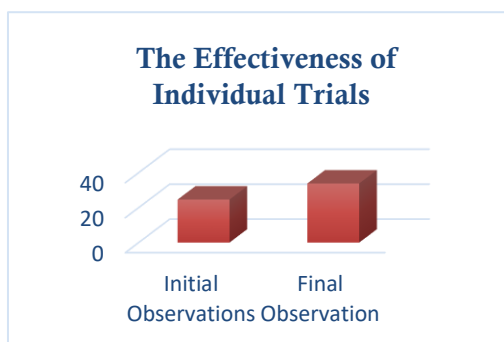


Figure 5. Individual Trials Effectiveness Graph

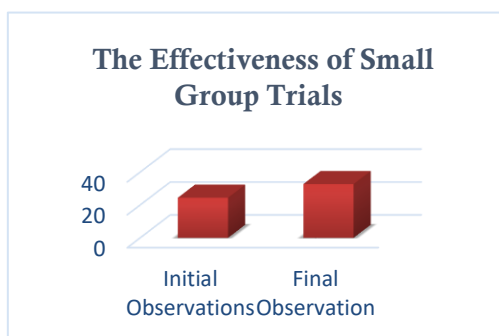
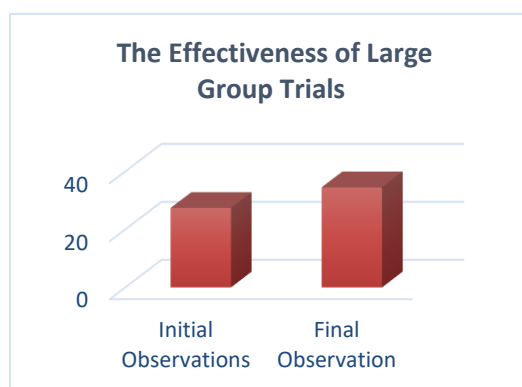


Figure 6. Small Group Trials effectiveness graph





**Figure 7.** Large Group Trials effectiveness graph

Based on Figure 5, Figure 6. And Figure 7 can be seen the individual effectiveness test pretest result of 24.6 and posttest of 33.8. In the small group effectiveness test, the pretest result was 24.4 and the posttest was 32.7. In the large group effectiveness test, the pretest result was 27.4 and the posttest was 34.5. Based on the effectiveness tests that have been carried out, the overall pretest score is 76.4 and the posttest score is 101 or a difference of 24.6, which shows a significant improvement. Thus, there is an increase between pretest and posttest which shows that the development of project-based learning e-modules is effectively used to improve the communication skills of grade 5 elementary school / MI students.

The results showed that the project-based learning e-module of science learning was effective in improving the communication skills of grade 5 elementary school students. These results are relevant to research that has been conducted by (Riskayanti, 2021) which states that learning with a project-based learning model is worthy of being used as learning that can increase student activeness and can improve students' 4C skills, namely critical thinking skills, communication, collaboration and creativity. In addition, e-module science learning based on project based learning can be a solution in creating active and innovative learning. This is relevant to the results of research conducted (Padwa & Erdi, 2021) which states that project-based learning e-modules make learning more effective and easy for students to understand.

### **Conclusion**

Based on the results of the research that has been done, it can be concluded that the project-based learning science e-module that has been developed using the 4D model is declared effective for improving the communication skills of grade 5 elementary school /MI students. This is shown by the results of the independent samples t-test, namely the value of Sig. (2-Tailed) 0.001 or less than 0.05 which means there is a significant difference between posttest in control class and experimental class. In addition, the effectiveness of e-modules is shown by increasing pretest and posttest results in individual trials, small group trials and large group trials. Thus, science learning e-modules based on project based learning are effective and can be used by teachers in improving the communication skills of grade 5 elementary school students.

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