DEVELOPMENT OF MOSADIG SCIENCE PRACTICUM MODULE TO SUPPORT SCIENTIFIC COMMUNICATION SKILLS

Liya Safitri[1], Muriani Nur Hayati[2], Fahmi Fatkhomi-[2]

[1,2] *Science Education Study Program, FKIP Universitas Pancasakti Tegal, Indonesia*

[*]*Corresponding author: safitriliya23@gmail.com*

Abstract

This study aims to determine the Mosadig science practicum module is interesting and feasible to support students' scientific communication skills. This research is a research and development (R&D) with the Bord and Gall development model. Data collection methods used questionnaires, interviews, and observations. The instruments in this study used product validation questionnaires, student response questionnaires and student scientific communication skills observation sheets. The feasibility assessment of the mosadig science practicum module product was validated by two material experts and two media experts. The material expert assessment showed 81.2% feasibility in the very feasible category, and the media expert assessment showed 93.7% feasibility in the very feasible category. The results of students' responses obtained 86.67% in the very interesting category. The results of observations of scientific communication skills skills at the first meeting amounted to 74.6% in the skillful category, and at the second meeting amounted to 82.7% in the skillful category. Based on the findings of this study, it can be concluded that Mosadig's science practicum module is very feasible and interesting to use to support scientific communication skills.

1 INTRODUCTION

Advances in information technology have led to the emergence of various challenges and paradigms of life in the 21st century. One of the challenges in the 21st century is the quality of education. This is an effort to achieve the goals and objectives of sustainable development set by SDGS (Sustainable Development Goals) 2030. Where education is part of the 4th goal, namely ensuring equal, inclusive and lifelong learning opportunities for all [1].

Education in Indonesia must prepare learners with skills such as critical thinking, creativity, collaboration, and communication [2]. Learners must develop skills, one of which is communication skills. An important aspect of technology and science education is the skill to communicate scientifically. This skill includes the skill to convey ideas or information verbally or nonverbally to others in a clear, logical, and scientific manner [3].

Sometimes in the communication process the teacher is successful in conveying information. Sometimes teachers are unsuccessful in conveying information. Failures in the communication process also vary, such as conceptual differences and learners' misinterpretation. A form of unsuccessful interpretation refers to the failure or inability to understand information that learners see, read, hear or observe. A failed form of communication can have an impact on not achieving goals in the learning process [4]. Therefore, effective communication between learners and teachers is very important and must be done correctly.

When associated with the science learning process in schools, the cause of the failure of the communication process is the characteristics of science subjects that are abstract. The same interpretation of science subjects also occurs among the general public. Problems that occur in the field. science subjects are considered difficult. Factors that cause difficulties in learning science are due to lack of interest and motivation, the way teachers deliver material, and unsupportive school facilities and infrastructure [5].

Based on preliminary studies, science learning activities rarely conduct practicum activities. Practicum that should be done at school is rarely carried out due to several obstacles, including insufficient learning hours, the unavailability of special practicum modules and the lack of availability of laboratory equipment and materials. During learning, teachers only use traditional teaching methods

with printed teaching materials that have been provided, thus not optimizing scientific communication and not encouraging students to utilize technology for learning as the urgency of 21st century education.

Science learning provides a unique learning experience to gain an understanding of science processes and concepts that are applied during the learning process. The ability to conduct research and communicate scientifically is a goal in the science learning process. These two abilities are very important for learners to participate in social life in the 21st century [6].

Science process skills are the basis for solving problems in natural science and the scientific approach. Scientific investigation skills need to be taught from an early age so that students feel more excited and challenged in discovering the concepts learned [7]. Therefore, science process skills can actually be said to be the basis for the learning process in students so that a foundation is formed for them to develop themselves.

Natural Science learning is not only limited to memorizing material but also involves practical activities. Through practicum activities, skills in conducting science processes and communicating in science can be sharpened. This is in line with Nurlaelah (2020) that the scientific investigation process experienced by students when participating in practicum activities can foster science process skills and scientific communication [6].

Based on the context of natural science learning, learners need to master scientific communication skills in order to actively participate in the learning process, conduct research, and present their findings and ideas effectively [8]. Increased learning success can be achieved when students can improve their understanding. This increase in learner understanding is also influenced by the way communication skills in a learning process [9].

Facts in the field, students have difficulty communicating. This is based on interviews with science teachers, lack of enthusiasm from students in expressing their ideas and opinions both orally and in writing. This is supported by scientific communication data which shows that around 20% of students are afraid to communicate. Verbal communication is usually minimal and only occurs when students are forced to communicate in front of the class [10]. The obstacles faced by students vary, one of which is caused by difficulties in choosing appropriate sentences, panic, not fully mastering concepts, lack of confidence, and lack of ability to express opinions in class.

Scientific communication skills in science subjects have a very important role. Science learning requires the use of a scientifically based approach. The process includes observation, asking questions, gathering information, analyzing data, and communicating findings (Kemdikbud, 2014). So, it is important to train communication during learning supported by appropriate learning resources, such as digital practicum modules.

A new approach is needed in learning science by using technological developments so that students are independent in learning topics related to Natural Science concepts through Mosadig digital practicum teaching materials. Mosadig is a digital science module that contains practicum guides accompanied by video tutorials packaged in the form of android applications so that students can learn and apply concepts independently at home. Using this electronic module, students can read as if they are opening a book because it has an animation that is used when turning pages like opening a physical book [11]. Furthermore, according to Astuti & Hayati (2019) the implementation of using e-modules in learning can improve students' thinking, skills, and active participation in science exploration [12].

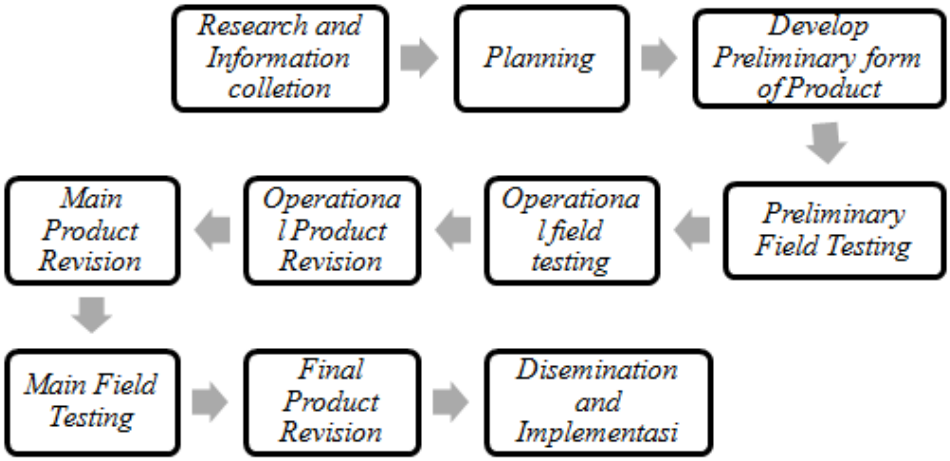
The application of appropriately developed practicum modules can help increase learners' interest in natural science. Learners will feel more confident in communicating scientifically and they will tend to be more enthusiastic in exploring more deeply and developing interest in the field of science. In addition, good scientific communication skills will also equip them with relevant expertise in various fields of work that require an understanding of science.

Digital science practicum teaching materials can be a solution because students are more interested in digital-based learning, and feel bored and bored with abstract and static things. This is in line with Fatkhomi (2020) that by using a digital learning approach, abstract material concepts are described more realistically in the teaching and learning process so that students can more easily understand them [13]. Students are also accustomed to using smartphones, with this digital teaching material, students not only use smartphones for social media activities but can also use their smartphones for learning activities.Therefore, research is needed to develop Mosadig science

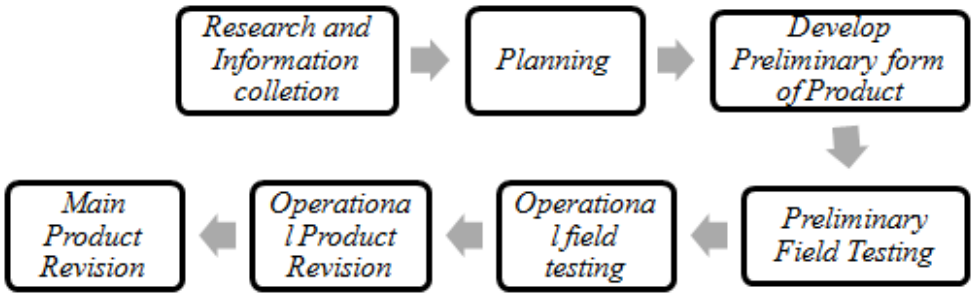
practicum modules to support students' scientific communication skills, so that the output of this learning can be more optimal.

2 METHODOLOGY

This development research uses the Borg and Gall development model, which consists of ten stages. The stages of development according to Borg and Gall are as follows [14] :



The research was limited to the main product revision stage because this study aims to determine the feasibility and attractiveness of the science practicum module made. Due to limited resources and time, researchers only used the seven stages of Borg & Gall development, which consisted of the following stages:



The data collection method in this study uses qualitative data in the form of questionnaire instruments, interviews and observations.

The data analysis carried out in this study included:

a. Product feasibility level

The analysis technique used is the percentage of answers from all question items can be calculated using the following formula [15]:

$$\text{Percentage (\%)} = \frac{\sum x}{\sum xi} \times 100\%$$

Description:

P: percentage number

∑x: the number of scores obtained

∑f: total score

b. Analysis of Scientific Communication Skills

Students' scientific communication skills are assessed by observers based on the indicators of scientific communication skills contained in the assessment sheet. The final assessment is then processed using the following formula to analyze it:

$$\text{Score} = \frac{\text{score received}}{\text{score maximum}} \times 100$$

c. Learner Response

Responses are measured through survey results to students to determine whether the product can be implemented based on observations and learning experiences. Questionnaire results based on learner responses will be analyzed using the following formula [16]:

$$P = \frac{R}{SM} \times 100$$

Description:

P : Percentage of learner response

R : Number of values obtained

SM : Maximum number of points

3 RESULTS

The development of mosadig science practicum teaching materials is based on Borg and Gall development research. The development stages include analyzing potential and problems, collecting information, product design, product validation, product improvement, limited scale product trials, limited scale product revision, broad scale trials, broad scale product revision (Sugiyono, 2021).

3.1 Research and Information Collection

The first stage of researchers looking for potential and problems in the field, namely the science learning process still looks monotonous. Students use textbooks provided by the government and worksheets purchased from distributors who visit schools. This worksheet contains material and practice questions, so that students learn science by rote. Since science is related to everyday life, its learning should have a greater impact. In class, teachers only deliver material in one direction and rarely conduct discussion activities. This causes students' scientific communication skills to not be optimal.

Based on interviews with science teachers in junior high schools, students' scientific communication skills are not optimal because students do not have confidence in communicating or asking questions in front of the class. Students are not confident when they want to ask questions or convey the results of the discussion (Nur Farida, interview January 6, 2023). Based on the needs analysis data, teaching materials that can train scientific communication skills are only 66.7%. So the need for teaching materials that can train students' scientific communication skills.

3.2 Planning

Once the preliminary study is complete, the developer can move on to the next stage, which is planning the research. Research and development planning involves identifying the purpose of the research, estimating the time required for the research, determining the qualifications of the researcher, and determining the desired mode of participation. The purpose of this development research is to produce a Mosadig science practicum module product (Digital Science Module). This research was conducted from April 13, 2023 to May 27, 2023. Participants in this research include validators who are experts in the field of media and experts in the field of learning materials, then ninth grade students totaling 10 people and following the small trial stage. In addition, there were also class VIII students totaling 30 people and participated in the large trial stage.

The main topic focused on in this research is about light and optical devices. The research focused on this topic, because based on the results of interviews with science teachers, it appears that students have a diverse understanding of optical devices. In addition, the material of light is very relevant to everyday life, and is also taught at all levels of education.

3.3 Develop Preliminary form of Product

3.3.1 Product Design

The mosadig design consists of the main menu, instructions for using mosadig, material summary, activity sheets, quizzes, and compiler information. The mosadig science practicum module was then measured based on aspects of content feasibility, presentation, language, font usage, visual appearance, audio and video quality, science process skills approach and user-friendliness. The cover and content of the mosadig science practicum module are shown in Figure 1.

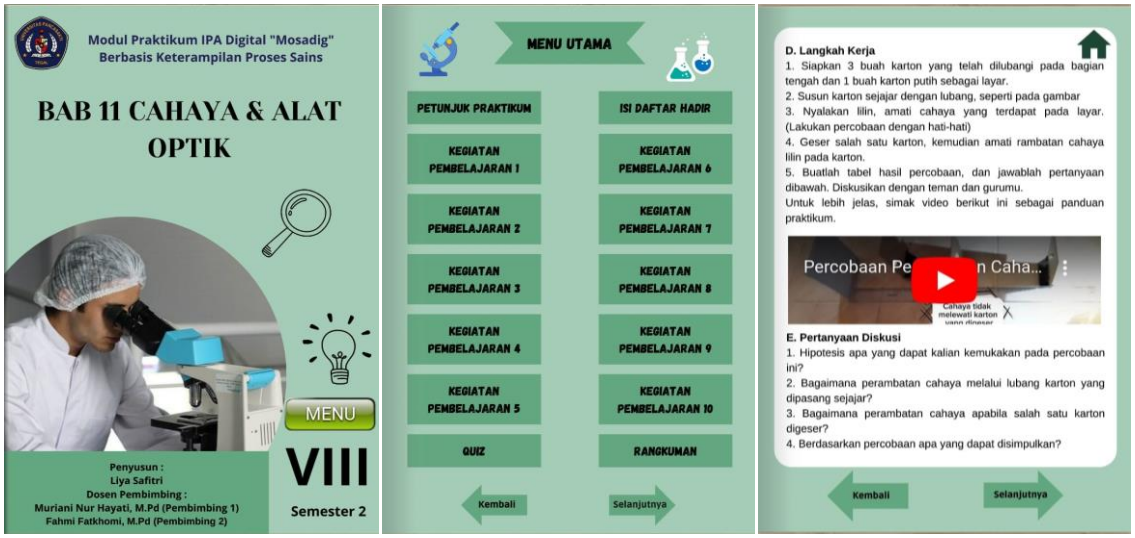


Figure 1. *Produk Design Mosadig*

3.3.2 Product validation

At this stage, the product is validated by media expert validators to assess the feasibility in terms of design and appearance and material expert validators to assess the feasibility of the material content.

Description of Product Validation Results by Material Experts

According to the data in Table 1, the percentage of assessments from material expert validators as a whole reached 81.2%. This assessment can be categorized as very feasible. Based on the results of this assessment, the Mosadig science practicum teaching materials are suitable for use and implementation in the learning process at school. Regarding the results of the material expert validation, it is explained in Table 1 below.

Table 1. Material Expert validation results

Validation Aspect	Skor	%	Categories
Suitability of Material Content	43	76,8	feasible
Presentation of material	28	87,5	very feasible
Linguistics	26	81,3	very feasible
Science process skills approach	38	79,2	feasible
Average	135	81,2	very feasible
Conclusions	Mosadig science practicum module can be used with minor revisions		

Description of Product Validation Results by Media Experts

Based on the results of the assessment by expert validators as a whole aspect of 93.7%, with very feasible qualifications. Therefore, Mosadig science practicum teaching materials based on science process skills are said to be suitable for science learning at school. Regarding the results of media expert validation, it is described in Table 2 below.

Table 2. Media Expert validation results

Validation Aspect	Skor	%	Categories
Visual appearance	26	92,9	very feasible
Font Usage	26	92,9	very feasible
Physical criteria of module	20	95,2	very feasible
Audio & Video	14	87,5	very feasible
User-friendliness	16	100	very feasible
Average	102	93,7	very feasible
Conclusions	Mosadig science practicum module can be used with minor revisions		

There are several suggestions related to Mosadig teaching materials that have been made by researchers, including a better explanation of the material if it is shorter and clearer and the use of color combinations that are less solid. These comments and suggestions are used as a basis for improving the Mosadig science practicum module that has been prepared by researchers. The following are suggestions and improvements from material and media expert validators:

Material Expert Validator I

"In the future, it needs to be improved in terms of material descriptions to be more interesting and concise. In general it is good".

Material Expert Validator II

"It needs to be improved in the practicum guide section so that the instructions are clearer and simpler so that they are easily understood by students. Overall it is good. Hopefully the e-module developed can be applied in the next KBM activities".

Media Expert Validator I

"Just improve the appearance, the layout is okay, just improve the color / color combination".

Media Expert Validator II

"It is necessary to add sources to the images and improve the quality of the images to be clearer and not blurry."

3.4 Preliminary Field Testing

The next stage is a limited scale trial which aims to find out an overview of the quality of the product that has been designed [17]. Limited testing has been carried out in class IX as many as 10 students. The following are the results of the limited scale product trial response in Table 3.

Table 3. Preliminary field testing result

Respondent	%	Categories
A	92	very good
B	88	very good
C	88	very good
D	96	very good
E	88	very good
F	92	very good
G	88	very good
H	92	very good
I	88	very good
J	72	good
Everage	88,4	very good

The results showed that the science practicum teaching materials were liked by students as a whole, with an average score of 88.4% and very good criteria. This is because the mosadig science practicum module is interesting and not boring, and gives them the ability to learn more independently.

3.5 Main Product Revision

Based on the results of students' responses, it was found that some had to be improved, namely images that were less clear and looked blurry, the description of the material presented was less clear, and the quality of the video presented was less clear. This response helped researchers make better products by improving image resolution, captions on images, presentation of material, and sound quality.

3.6 Main Field Testing

The next stage of large-scale trials involving class VIII as many as 30 students. Assessment of product attractiveness using a response questionnaire given to students. Regarding the results of students' responses to the broad-scale trial, it is described in Table 4.

Table 4. Main field testing result

Aspect	%	Categories
Module display	85,56	very good
Material content	81,33	very good
Presentation of material	88	very good
Linguistics	86,67	very good
Audio & Video	92,22	very good
User-friendliness	91,67	very good
Average	86,67	very good

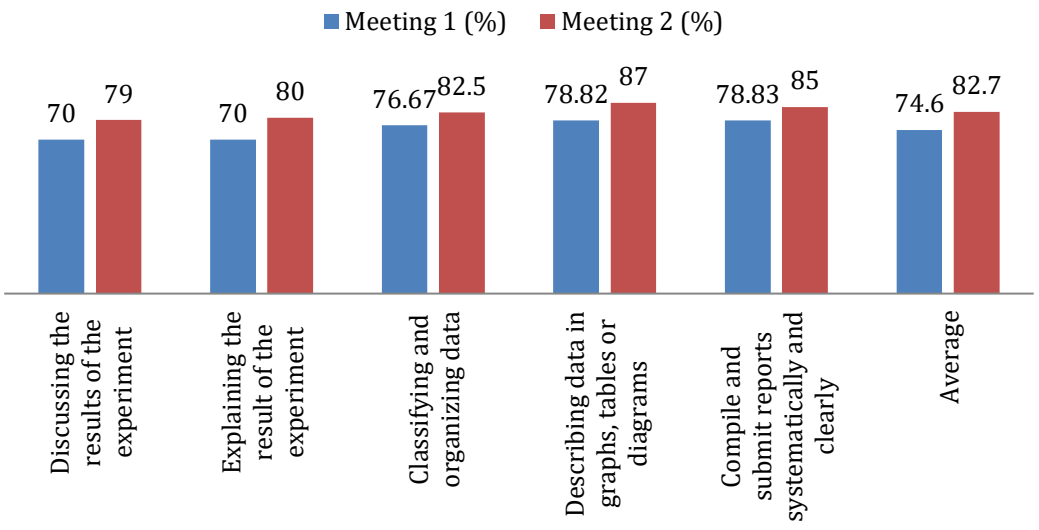
3.7 Operational Product Revision

At this stage, there were not many suggestions or criticisms from learners. Some learners said that the pictures presented were unclear and blurry. They also said that the description of the material presented was too dense. Some learners assessed the quality of the sound or the sound presented was not clear enough. These responses helped the researcher make a better product by improving the resolution of the images, the captions on the images, the presentation of the material, and the sound quality.

3.8 Observation Results of Students' Scientific Communication Skills

Scientific communication skills are assessed by observers directly during practicum activities. This assessment was carried out after the implementation of teaching material products to determine the effectiveness of the Mosadig science practicum module as a support for scientific communication skills. The average assessment of scientific communication skills of all students for each aspect is described in Graphic 1.

Graphic 1. Average Score of Scientific Communication Skills



The first indicator is discussing the results of the experiment. Based on the observers' observations, students were active in asking questions during learning and answering questions given by the teacher and classmates. The assessment results at the first meeting were 70% with the category "skillful", while at the second meeting it was 79% with the category "skillful". Based on this data, students have good speaking skills. Students who actively participate in questions and answer questions given show the success of the indicator [18].

The second indicator of communication skills is explaining the results of the experiment. The assessment results at the first and second meetings were 70% and 80% respectively with the skillful category, thus the teaching materials for science practicum were effective in training verbal communication. This is in line with the opinion of Yusuf & Adeoye (2012) to ensure the success of communication skills, activities such as oral presentations and discussions are needed. Presentation activities facilitate communication between fellow students and between students and teachers in discussions [19].

The third indicator is classifying and organizing data into tables, pictures, or diagrams. The average skill of classifying data at the first meeting with a percentage value of 76.67% with a skillful category, while at the second meeting it was 82.5% with a very skillful category. The increase in this indicator is lower than the increase in other indicators. Some students face difficulties in classifying and organizing data in tabular form. According to Shinta (2020) there are several reasons why students' ability to read data is low, one of which is their lack of habit of presenting experimental data using tables, graphs, or diagrams. The reason is that students usually receive assignment sheets that already consist of observation tables [20].

Assessment of the fourth indicator learners are trained to make data that must be presented in tabular form. The majority of learners make the table correctly. However, some of them made graphs by only making lines without information. Learners tend to skip parts that are considered less important, such as the reference section and the table or graph section. This was also seen in research, where almost 25% of sample students had difficulty understanding pictures and charts [6]. The average skill score on the indicator of describing data with graphs/tables at the first meeting was 78.82% with the skillful category. While at the second meeting 87% with a very highly skilled category, thus the teaching materials for science practicum can train the skills of communicating data. This is in line with research conducted Ika (2018) that certain laboratory activities can help students develop their writing skills, such as making tables of observation results, evaluating data, and formulating conclusions [21].

The fifth indicator in communication skills is compiling an experiment report. Based on the observer's assessment, students were skilled in compiling reports at the first meeting with an average value of 78.83% in the skilled category while at the second meeting 82.7% was in the highly skilled category. So, the science practicum module can help students learn to communicate scientifically. This is in line with the opinion Mufida (2018) that practicum activities that involve writing elements, such as making experimental reports, can be useful for improving students' communication skills [22].

The efficient use of Mosadig science practicum teaching materials based on science process skills can be an effective support for developing students' scientific communication skills. In each meeting, there was a significant improvement. Mastering knowledge and skills in the scientific process is very helpful for learners in developing their thinking, increasing their ability to understand science concepts, and can improve memory. Broadly speaking, learners have scientific communication skills in the "skillful" category. Then, the use of Mosadig science practicum teaching materials based on scientific process skills is very successful in helping the development of scientific communication skills.

4 CONCLUSIONS

The results showed that the mosadig science practicum teaching materials were suitable for use. This conclusion was obtained based on the assessment of the material expert of 81.2% while the media expert of 93.7%, which is included in the very feasible category. Students' response to the mosadig science practicum module was also very good with a percentage value of 86.67%. Meanwhile, the average evaluation results of students' scientific communication skills at the first meeting reached 74.6% in the skilled category. Meanwhile, at the next meeting the average score was 82.7% with a very skillful category. So that Mosadig's science practicum module is very interesting and very good for supporting scientific communication skills.

In order to obtain science practicum learning materials that have been tested for effectiveness, more in-depth research is needed in accordance with the stages of the research and development method. To test the effectiveness of the developed science practicum module, repeated testing is needed and carried out in several schools with diverse characteristics. This is done so that the module materials that have been developed are truly tested for effectiveness.

ACKNOWLEDGEMENTS

I would also like to thank all the contributors who have helped and supported me throughout this research journey. Guidance, insight and support were instrumental in making this research a success. Thank you for being an important part of this achievement.

REFERENCES

[1] A. O. Safitri, V. D. Yunianti, and D. Rostika, “Upaya Peningkatan Pendidikan Berkualitas di Indonesia: Analisis Pencapaian Sustainable Development Goals (SDGs),” *J. Basicedu*, vol. 6, no. 4, pp. 7096–7106, 2022, doi: 10.31004/basicedu.v6i4.3296.

[2] C. L. Scott, “Education Research and Foresight What Kind of Learning,” *Educ. Res. Foresight*, pp. 1–14, 2015.

[3] D. P. Y. Kurniati, “Modul Komunikasi verbal dan non verbal,” *Univ Udayana Fak Kedokt*, 2016.

[4] A. Daniyati, B. I. Saputri, R. Wijaya, and A. S. Septiyani, “Konsep Dasar Media Pembelajaran Ricken Wijaya STAI DR.KHEZ Muttaqien Purwakarta,” *J. Student Res.*, vol. 1, no. 1, pp. 282–294, 2023.

[5] A. K. Haqiqi, “Analisis Faktor Penyebab Kesulitan Belajar Ipa Siswa Smp Kota Semarang,” *Edu Sains J. Pendidik. Sains Mat.*, vol. 6, no. 1, p. 37, 2018, doi: 10.23971/eds.v6i1.838.

[6] I. Nurlaelah, A. Widodo, S. Redjeki, and T. Rahman, “Analisis Kemampuan Komunikasi Ilmiah Peserta Didik Pada Kegiatan Kelompok Ilmiah Remaja Berbasis Riset Terintegrasi Keterampilan Proses Sains,” *Quagga J. Pendidik. dan Biol.*, vol. 12, no. 2, p. 194, 2020, doi: 10.25134/quagga.v12i2.2899.

[7] M. N. Hayati, K. I. Supardi, and S. S. Miswadi, “Pengembangan Pembelajaran IPA SMK dengan Model Kontekstual Berbasis Proyek,” *Innov. J. Curric. Educ. Technol.*, vol. 2, no. 1, pp. 177–184, 2013.

[8] N. Fithriyyati and I. Maryani, “Evaluation of natural science learning implementation plans grade 7 junior high schools: A reflection of the learning process,” *Univ. Ahmad Dahlan. Jalan Ki Ageng Pemanahan 19 Yogyakarta*, vol. 1, no. 1, pp. 9–18, 2018, [Online]. Available: http://petier.org/index.php/PETIER/article/view/17

[9] F. E. Wulandari, J. Rohmah, and Y. Astutik, “Pengembangan Perangkat Pembelajaran Berbasis Proyek untuk Keterampilan Komunikasi Ilmiah Mahasiswa,” *Proc. ICECRS*, vol. 2, no. 1, pp. 261–264, 2019, doi: 10.21070/picecrs.v2i1.2438.

[10] A. A. Rosiah, N. S. A, D. T. Rahardjo, and B. Mulyono, “Peningkatan Komunikasi Ilmiah Siswa Kelas X MIA Melalui Model Pembelajaran SSCS (Search , Solve, Create, Share) pada Materi Alat-alat Optik,” *Perpust. UNS*, pp. 1–20, 2016.

[11] E. Wibowo and D. D. Pratiwi, “Pengembangan Bahan Ajar Menggunakan Aplikasi Kvisoft Flipbook Maker Materi Himpunan,” *Desimal J. Mat.*, vol. 1, no. 2, p. 147, 2018, doi: 10.24042/djm.v1i2.2279.

[12] R. K. Astuti and M. N. Hayati, “Development of Integrated Science Digital Module Based on Scientific Literacy,” *J. Pena Sains*, vol. 6, no. 1, p. 32, 2019, doi: 10.21107/jps.v6i1.5233.

[13] F. dan Y. Fatkhomi, “Pengembangan Multimedia Pembelajaran Interaktif berbasis Flash pada Pembelajaran Fisika,” *Pancasakti Sci. Educ. J.*, vol. 5, no. 9, pp. 4–11, 2020.

[14] Assyauqi, “Model Pengembangan Borg and Gall,” *https://www.researchgate.net/publication/347999352*, no. Institut Agama Islam, 2020.

[15] P. Oktaviani, H. Hartono, and P. Marwoto, “Pengembangan Multimedia Interaktif Bervisi SETS sebagai Alat Bantu Model Problem Based Learning (PBL) dalam Pembelajaran IPA di SMP untuk Meningkatkan Kemampuan Berpikir Kritis dan Keterampilan Sosial Peserta Didik,” *PSEJ (Pancasakti Sci. Educ. Journal)*, vol. 2, no. 2, p. 125, 2017, doi: 10.24905/psej.v2i2.746.

[16] K. M. Rozhana and M. F. Anwar, “Pengembangan Bahan Ajar Berbasis Multiple Intelligences untuk Meningkatkan Hasil Belalajar Siswa Sekolah Dasar,” *J. Bid. Pendidik. Dasar*, vol. 6, no. 1, pp. 95–103, 2022, doi: 10.21067/jbpd.v6i1.5957.

[17] A. K. P. Ani Widyawati, “Pengembangan Media Komik IPA untuk Meningkatkan Motivasi Belajar dan Karakter Peserta Didik SMP,” vol. 1, no. April, pp. 24–35, 2015.

[18] M. K. Ulfiatun, Novi Ratna Dewi, “Efektivitas Penggunaan LKS IPA Terpadu Bervisi Salingtemas (Sains-Lingkungan- Teknologi-Masyarakat) Berbasis Science Entrepreneurship terhadap Keterampilan Komunikasi Ilmiah dan Minat Berwirausaha Siswa,” *Pancasakti Sci. Educ. J.*, vol. 5, no. 9, pp. 4–11, 2020.

[19] F. Yusuf and E. Adeoye, “Developing Critical Thinking and Communication Skills in Students: Implications for Practice in Education,” *African Res. Rev.*, vol. 6, no. 1, pp. 311–324, 2012, doi: 10.4314/afrrev.v6i1.26.

[20] S. Purnamasari, “Pengembangan Praktikum IPA Terpadu TipeWebbed untukMeningkatkan Keterampilan Proses Sains,” *Pancasakti Sci. Educ. J.*, vol. 5, no. 2, pp. 8–15, 2020, doi: 10.24905/psej.v5i2.20.

[21] Y. E. Ika, “Pembelajaran Berbasis Laboratorium IPA untuk Melatih Keterampilan Komunikasi Ilmiah Siswa SMP Kelas VII,” *JIPFRI (Jurnal Inov. Pendidik. Fis. dan Ris. Ilmiah)*, vol. 2, no. 2, pp. 101–113, 2018, doi: 10.30599/jipfri.v2i2.338.

[22] E. Mufidah, “Pembelajaran Berbasis Praktikum IPA untuk Melatih Keterampilan Komunikasi Ilmiah Bagi Mahasiswa PGMI,” vol. 01, no. 02, pp. 120–140, 2019.