

A Development of Flipped Classroom Based an Electronic Module on Circulation System Material to Increase Student' Learning Motivation

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Received: April 16, 2024

Revised: June 19, 2024

Accepted: July 25, 2024

Published: July 31, 2024

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DOI: [10.29303/jppipa.v10i7.7411](https://doi.org/10.29303/jppipa.v10i7.7411)

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Abstract: The using of teaching materials has an important role to increase student learning motivation. This research and development aims to produce the Flipped Classroom based E-module that is appropriate, practical, and effective to increase students learning motivation on eleventh grade at senior high school. The research used a research and development methodology (R & D) with ADDIE development model through the phase of Analysis, design, development, implementation and evaluation. The data resources are material scholar, biology teacher, and the eleventh grade student at senior high school. The research instrument used a questionnaire. The data analysis used likert scale then the result of the research indicated that the product is appropriate based on the material scholar's assessment is 97,91%, (very appropriate), and the media scholar' assessment is 91,25% (very appropriate) the product is practically used based on biology teacher is 100% (very practical) and the result of small scale test obtained 89,66% (very practical). An E-module is effective to increase students motivation learning based N-gain score result 0,49.

Keywords: E-module; Circulation System; Flipped Classroom; Learning Motivation

Introduction

Education has an important role in society progression because it purposes to increase and develop human resources quality. In 21st century, the technology in the world develop quickly because of that, All of the sector should adjust about this case such as in educational sector. As we know that the education has an important role to increase the human quality. To actualize the human quality, the government should form the educational program well such as from the students, teacher and availability of teaching material. Curriculum, facilitate and so on (Wijaya et al., 2022). In 21st century, the educators should create a lesson plan that is organized, distinctive and interesting (Hamidi et

al., 2024). To increase the students learning motivation is one of the way how to increase the education quality. The students learning motivation has the significant role to actualize the direction of learning goal. Harahap & Siregar, (2020) stated that students learning motivation is very important to encourage as well as in internal and external of the students. The internal and external encouragemnet is able to undertake the learning goal to become successful. Djarwo, (2020) stated that the internal factor which meant likes physical, intellegent, behaviour, interest and emotional however external factor which meant likes family, school and society.

Warti, (2016) stated that learning motivation is a desire and willingness which encourage to do something. Learning motivation is closely related to the

How to Cite:

Samsi, I. F., & Djukri. (2024). A Development of Flipped Classroom Based an Electronic Module on Circulation System Material to Increase Student' Learning Motivation. *Jurnal Penelitian Pendidikan IPA*, 10(7), 4319–4326. <https://doi.org/10.29303/jppipa.v10i7.7411>

students behaviour because it can increase and guide the students in learning new things. The students who have a high learning motivation, certainly they have better learning ability, so they can obtain learning outcomes. Learning motivation depends on the students learning, students learning needs are influenced from students background such as determining the appropriate teaching material, through the appropriate teaching material with the students learning need can encourage students learning motivation highly. The existence of the appropriate teaching material encourage students learning motivation and interest to learn in the learning activity. A learning motivation is often influenced by several factors such as students' characteristics itself. Therefore it needs an observation highly for the teachers and parents, so it can develop students' characteristics (Wardani, 2019). In the biology learning. Learning motivation plays an important role in encouraging the students to participate actively in learning activity because of learning biology in the classroom is different from studying other scientific discipline. Biology learning has its own charm which can be found biological objects. As well as both of those have a life and do not, so that it can strengthen students interest to explore deeper their knowledge. In fact until now the learning biology process has not carried out yet well. Basically. In the biology classroom helps the students to prepare dealing with the technology era helps them to obtain more ideas and they can understand about the biology world.

Based on the interview results with biology teacher at senior high school of Bumi Raya in Morowali regency, Central Sulawesi province. The information acquired that the low of students learning motivation. It indicates that the role of the teachers are still dominantly (Teacher centered. The learning method used by the teacher is lecture method and the learning model that used, still less varied so that the students are less chance to develop their creativity in learning process. When the learning activity is going on, certainly the teachers as the facilitator to organize and facilitate a learning activity (Antony, 2022). One of the other factor that make the students learning motivation to become less because of the teaching material is not varied, the teachers are only using book to teach the students in order to less student learning motivation.

Based on the analysis of students need indicate that the students obtain a low motivation result when learning circulation system due to less interesting learning method and limited supporting teaching material. That things is indicated 100% students stated that during the learning activities using the lecture method, and the teaching material that focuses on the book, it makes the learning activity become boring. 98.2% when the learning activity is carrying out, the

students are allowed to bring their smartphone or laptop device. 100% students stated that they desire to the teaching material in electronic form which can be accessed through smartphone and laptop devices. The biology learning activity at the school never has used E-module. The questionnaire result that shared, indicate that the students are interested to learn the circulation material through e-module. To attempt the development of this era, particularly in educational scope the teaching material also should be relevant with this era through creating the E-module so that the learning activity become efficiently (Anggraeni et al., 2022).

Based on the research scientific studies revealed that in a middle school in China, It was indicated that the Flipped classroom in learning model could increase the learning outcomes and learning motivation for the students (Hung et al., 2019). It is similar to the research that was conducted by Bhagat et al. (2016) argued that the learning through flipped classroom for the students in Taiwan can increase their learning motivation and students achievement.

The teaching material is a set of learning facilitates or devices that contain learning material, method, limitation and way of evaluating which are designed systematically and interesting so that they can achieve the expected goal (Taqiyah et al., 2017). The role of teaching material in learning process for the students is simplified the time by giving an assignment that learned by the students about the topics that will be explained in the classroom first (Aprilia et al., 2023). Based on the interview result and the analysis of students need, it is necessary to prepare more innovative teaching material. The importance of Innovative learning is carried out to make the learning process in the classroom to become more meaningful (Miranda, 2020). The innovative learning also provides the learning experience for the students (Lestari et al., 2020). One of the teaching material that make the students become good experiential learning is flipped classroom based electronic module. It can make the students to increase the students motivation learning on circulation system.

An E-module is one of the digital teaching material effectively and efficiently which prioritize the independent learning for the students (Kustini et al., 2022). An electronic module presents an information in a structured, interesting, and have a high level of interactivity. The teaching material of electronic module is an interactive for the learning process which displayed through audio visual, sound, movies, based on the contain material so that the digital teaching material by the term of electronic module can help the teachers and students to carry out teaching and learning process in the classroom then the electronic module, and it can be implemented as the learning sources to increase the

students competence (Florentina Turnip & Karyono, 2021). The teaching material of electronic module is able to optimize achieving learning objective (Hidayati et al., 2020). An E-module is made in electronic form to adjust the development of era so that it is able to use (Kimianti & Prasetyo, 2019). practically and efficiently. The advantages of electronic module is compared to printed module is more interactive, possibly to reply the video, animation, and the test can be done and acquired a direct feedback (Rokhmania & Kustijono, 2017). The minister of national education (2008) stated that the characteristic of electronic module adapted from the characteristic of module as follows *self Instructional, Self Contained, Stand Alone, Adaptive, User Friendly*.

A flipped classroom based E-module is a learning that minimize a direct teaching, but maximize indirect teaching with the support of material that can be accessed anywhere and anytime for the students. Flipped classroom is defined a flipped learning method (Wijaya et al., 2022). Flipped classroom is defined as a learning model that flips or exchange learning that is usually carried out in the classroom with the different learning style (Rokhmania & Kustijono, 2017). Flipped classroom is a learning oriented to the students so that the learning become easier to implement it (Andrini et al., 2019). Ru et al. (2018), stated that there are some characteristics on Flipped classroom as follows. The role of the teachers has changed, to increase students motivation, and time allocation is more efficient. The learning strategies on flipped classroom utilizes the technology to acquire the knowledge and information that can be accessed by the students as well as both online and offline. There are several advantages in using flipped classroom are (1) increasing the students motivation, (2) students engagement, (3) academic performance and independent learning form the students (Zainuddin et al., 2019). Based on the problem that happened, so th researcher needs to develop flipped classroom based an E-module that is able to increase students learning motivation.

Method

The research design used research and development which purposes to create a product have a practicality score (Desyandri et al., 2019) and useful value (Oktarina et al., 2023). The assessment was done at senior high school of Bumi Raya on July to September. The research population are the students on eleventh grade. *Analysis, Design, Development, Implementation, and Evaluation* (ADDIE) is one of the model that used by the researcher. Sugiyono, (2014) stated that this product will obtain a recent product including the product effectiveness test.

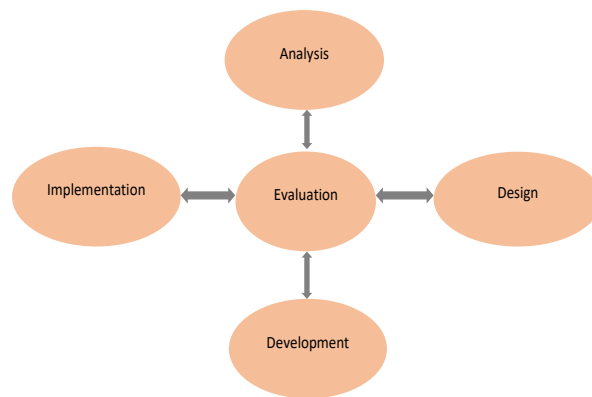


Figure 1. The research flow

The data results are obtained by using, an observation, technique, interview, questionnaire, validation share, and documentation the validation subject consist of the scholars (material and media scholars) and biology teacher assessment. The stage of developing a flipped classroom based an electronic module on circulation system material as follows:

The analysis stage aims to identify an urgent problem that should be completed before developing an electronic module. This stage includes an analysis of needs product, material and students. The design state aims to design research product and instruments. The development stage aims to produce a product that is feasible that is practical for the student to use it.

The research instrument were evaluated by the material scholar and media scholar used a likert scale score. The acquiring was changed to become a percentages and the categorize based on the product of feasibility scale range. Initial range based on score data to the formula 1.

$$M = \frac{\sum fx}{N} \tag{1}$$

Information

- M =average per aspect
- $\sum fx$ =The number of score per aspect
- N =The number of component

Table 1. Criteria scale and Likert Scale assessment

Scale	Assessment criteria
1	Very lack/ Very disagree
2	Lack/Disagree
3	Good / Agree
4	Very good /Very agree

Source : (Sugiyono, 2017)

Then the interpreted of the product feasibility and practicality categories as follows :

Table 2. The assessment categories of feasibility and the practicality product

Score	Category
81-100	Very appropriate
61-80	Feasibility
41-60	Enough
21-40	Lack of feasibility
≤ 20	Very lack of feasibility

Source : (Riduwan, 2010)

The implementation stage aims to create the result of the product development which can increase students learning motivation. On analysis stage of students learning motivation which undergo an improvement for the students. Analyzed based on n-gain score average which normalized with the formulation (Hake, 1998) (Formula 2).

$$g = \frac{Sf - Si}{Smax - Si} \tag{2}$$

- g = gain normalize score
- Sf = post test score
- Si = pre test score
- Smax = maximum score

Table 3. Interpretation criteria in n-gain

Value	Criteria
$g > 0.70$	High
$0.30 < g \leq 0.70$	Middle
$g \leq 0.30$	Low

Source : (Hake, 1998)

The evaluation stage aims to know the lack of the product which developed then it is done a revision based on the evaluation

Result and Discussion

This research has the initial phase is need analysis, and technique to collect data with interview, and distributing questionnaire to the educator, students, class observation and literature study to determine the problem in the classroom. Interview with the biology teacher is acquired the information that in 2013 curriculum particularly on the biology lesson has not been suitable expectation, after the researcher observes and the teaching material which is used actually still has not been fulfilled the purpose in 2013 curriculum KD. 3.6 (Analyze the relationship between the structure of the tissues that make up the organs t]in the circulatory system in relation to bioprocesses and functional disorders that can occur in the human circulatory system) and 4.6 (Presenting written work on abnormalities in the structure and function of blood, heart, blood vessels which cause disorders of the human

circulatory system and their relationship to technology through literature studies) Then basic competence is carried out indicator achievement of the competence which is used as fundamental development of e-module based *Flipped Classroom*. During a learning process takes place that the students still lack of engagement because of the method that used such as lecture, and the students feel a difficulty on circulation system material, so it requires the guidance.

In *designing* stage is carried out by teaching design material is an E-module based flipped classroom and the project that required in the form of circulation system material, the resource which used based on the book and journal. a design of research instrument as follows designing the paper assessment in material scholars and media scholars, and biology teacher’s assessment and students’ readability sheet in the test phase, then the test is conducted to determine critical thinking skill and students’ response sheet on wide scale trial. Designing E-module based *Flipped Classroom* used Canva application, google form, and live worksheet. The design of this an electronic module product is designed clearly and appropriately, so the electronic module is interesting and easy understood. The example of the product designing in flipped classroom based an electronic module on circulation system' material.

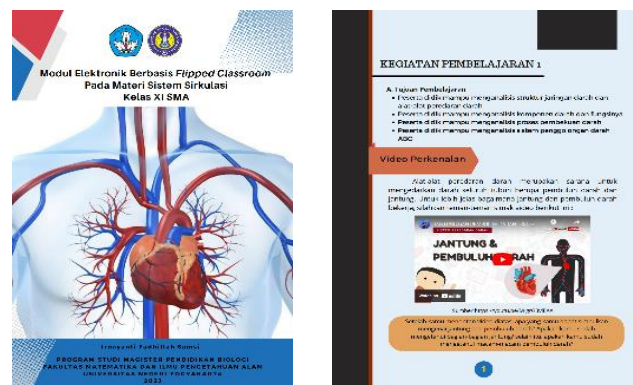


Figure 2. The example of content design an E-module based flipped classroom

Development stage is the realization from the previous activity. The product design has ben arranged, developed, based on the stages. In the development of flipped classroom based an electronic module is required data validation result, from material feasibility are done by material scholar and validation scholar which is presented in the Table 4.

Table 4. The validation result of material scholar

Aspect	Score	Category
Appropriateness	93.75	Very appropriate
Material presentation	100	Very appropriate
Language	100	Very appropriate
Average	97.91	Very appropriate

The table 4 indicates that the analysis result from flipped classroom based an electronic module on circulation material system from the validation of material scholar is obtained with the average 97.91 score with a very feasible category through several suggestions which is validated from material scholar in the form of material in the electronic module with narrative elated to explanation of pictures and adding images / videos. These suggestions have been increased. Furthermore, the results of feasibility from media scholar is presented in the table 5 as follows:

Table 5. the validation results from media scholars

Aspect	Score	Category
Visual communication	100	Very appropriate
Quality display	100	Very appropriate
Operation	81.25	Very appropriate
Reliability application	87.50	Very appropriate
Illustration quality (picture and video)	87.50	Very appropriate
Average	91.25	Very appropriate

The feasibility result from the media side in the flipped classroom based an electronic module on circulation system material that validated by the media scholar and acquired 91.25 score with ‘very feasibility’ categories with a several suggestions from the media scholar likes the researcher is suggested to attach the sources of concept mapping then those suggestions have been revised from the aspect media because an electronic module provides the video and picture to support the students understanding (Kamila *et al.*, 2018). The biology teacher’ assessment aims to know the practicality of flipped classroom based an electronic module on circulation system material that provided in Table 6.

Table 6. The validation result from biology teacher assessment

Aspect	Score	Categories
Material / content	100	Very practical
Language	100	Very practical
Media	100	Very practical
Learning activity	100	Very practical
Average	100	Very practical

The analysis practicality analysis result indicates that 100 average score with very practical criteria. This case indicate that the product that developed “very practical” with the several suggestions is to revise the sentence written mistake on the product then the

suggestion has been revised. The readable product assessment was done by ten students. All students give the responds that provide in Table 7.

Table 7. The result of readable product assessment

Aspect	Score	Categories
Structure	89.50	Very practical
Language	89	Very practical
Content	90.50	Very practical
Average	89.66	Very practical

The readability analysis result indicates with 89,66 average score “very practical” so the product that is developed such as flipped classroom based an electronic module which can be tested on large scale with same as researched by Irmawati *et al.*, (2021). The creating of an electronic module requires good responds from the students, and interested to the students as the guidance for learning in the classroom.

The implementation stage aims to obtain the result of learning process. The large-scale assessment product result by the students with the number of 26 students provided in Table 8.

Table 8. The assessment result of test

Aspect	Score	Categories
Easy to understand material	89.25	Very practical
Easy to use	87.25	Very practical
Interesting display	89.25	Very practical
Average	88.58	Very practical

Table 9. The comparison variable data of learning motivation

Analysis	Class Experiment		Class control	
	Pre test	Post Test	Pre test	Post test
A number of sample	26	26	26	26
A number of average score	1994	2297	2139	2208
The assessment of Standard deviation	6.61	4.92	7.01	6.77
Low score	58	78	67	70
High score	88	96	93	99

Based on the figure 3 indicates that 88.56 average score with very practical criteria. On the other hand the using of the flipped classroom based an electronic module as the guidance for the teacher and the students in teaching learning on circulation system material are able to increase the students learning motivation on eleventh grade students. The students learning motivation analyzed by statistic descriptive. The data are provided in Table 9 as follows :

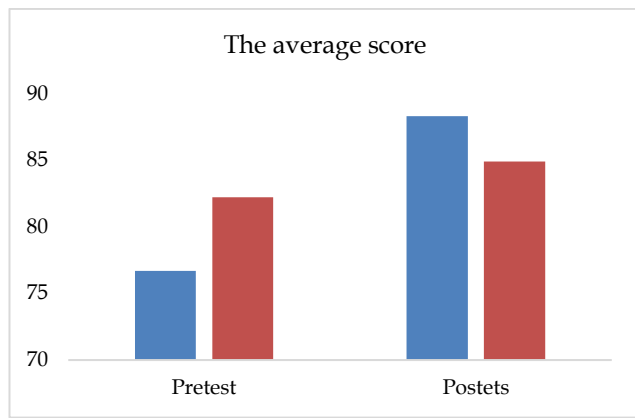


Figure 3. The comparison graph

Table 10. N-gain-score Analysis

Class	Average value		n-gain score	Criteria
	Pre test	Post test		
Experiment	76.69	88.34	0.49	Middle
Control	82.26	84.92	0.11	Low

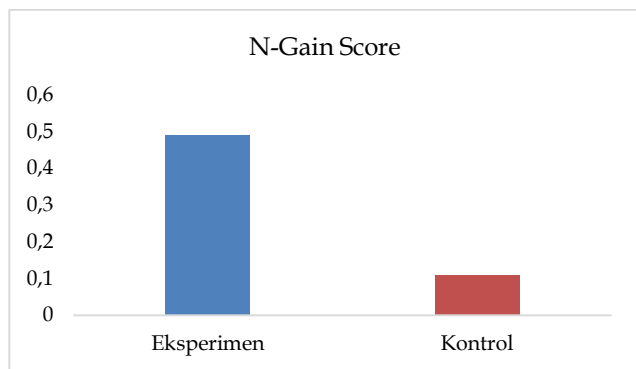


Figure 4. n-gain score graph

Based on the figure 4 obtained an information that occur the increasing of students learning motivation in class experiment looked at n-gain score 0.49% (middle) however in the class control is 0.11% (low). The analysis data indicate that the using of flipped classroom based an electronic module influence toward the students learning motivation. It is similar to the research that was conducted by Erniwati, (2022) the module is said to be effective based on increasing learning motivation, obtained an N-Gain value of 0.57 (medium). Hidayati et al., (2020) the *flipped classroom* strategy-oriented e-module was considered effective for increasing learning motivation. Increased student learning motivation due to using *flipped classroom*-based electronic modules.

Conclusion

Based on the assessment result of flipped classroom based an electronic module development is categorized very practical because it has been through the feasibility

test with the material scholar and media scholar then the product that has been developed “very practical”. This case was obtained from the assessment result of biology teacher and the students’ responds. The using of flipped classroom based an electronic module on circulation system material is abale to increase the students learning motivation looked at n-gain score 0.49%

Acknowledgments

That you for all of the respondent who engaged in this research, the lecturer of Yogyakarta state university, the principle, the students, and the teacher at senior high school of Bumi Raya

Author Contribution

All authors contributed to writing this article.

Funding

No external funding.

Conflicts of Interest

The author declares no conflict of interest.

References

- Andrini, V. S., Pratama, H., & Maduretno, T. W. (2019). The effect of flipped classroom and project based learning model on student’s critical thinking ability. *Journal of Physics: Conference Series*, 1171(1). <https://doi.org/10.1088/1742-6596/1171/1/012010>
- Anggraeni, N., Rahardjo, S. B., & Harlita, H. (2022). Validity of Problem Based Learning (PBL)-Based Global Warming E-Module. *Jurnal Penelitian Pendidikan IPA*, 8(5), 2335-2340. <https://doi.org/10.29303/jppipa.v8i5.1934>
- Antony, R. (2022). Peran Komunikasi Dialogis Guru dan Mitra Didik dalam Pembelajaran di Sekolah Dasar Eksperimental Mangunan. *Pedagogi: Jurnal Ilmu Pendidikan*, 2, 42-50. <https://doi.org/10.24036/pedagogi.v22i2.1404>
- Aprilia, S. D., Panjaitan, R. G. P., & Afandi, A. (2023). Pengembangan Modul pada Submateri Kelainan Sistem Peredaran Darah untuk SMA. *Jurnal Biologi Dan Pembelajaran Biologi*, 103-118. <https://doi.org/10.32528/bioma.v8i1.181>
- Bhagat, K. K., Chang, C. N., & Chang, C. Y. (2016). The impact of the flipped classroom on mathematics concept learning in high school. *Educational Technology and Society*, 19(3), 134-142. Retrieved from <https://www.jstor.org/stable/jeductechsoci.19.3.134>
- Desyandri, D., Muhammadi, M., Mansurdin, M., & Fahmi, R. (2019). Development of integrated thematic teaching material used discovery learning

- model in grade V elementary school. *Jurnal Konseling Dan Pendidikan*, 7(1), 16–22. <https://doi.org/10.29210/129400>
- Djarwo, C. F. (2020). Analisis Faktor Internal dan Eksternal Terhadap Motivasi Belajar Kimia Siswa SMA Kota Jayapura. *Jurnal Ilmiah IKIP Mataram*, 7(1), 1–7. Retrieved from <https://e-journal.undikma.ac.id/index.php/jiim/article/view/2790>
- Erniwati, E. (2022). Pengembangan E-Modul Berbasis Flipbook dalam Model Discovery Learning untuk Meningkatkan Motivasi dan Hasil Belajar Peserta didik (Studi pada Materi Pokok Laju Reaksi). *Chemistry Education Review (CER)*, 6(1), 58–71. <https://doi.org/10.26858/cer.v5i2.32722>
- Florentina Turnip, R., & Karyono, H. (2021). Pengembangan E-modul Matematika Dalam Meningkatkan Keterampilan Berpikir Kritis. *Jurnal Edukasi Matematika Dan Sains*, 9(2), 485–498. <https://doi.org/10.25273/jems.v9i2.11057>
- Hake, R. R. (1998). Interactive-engagement versus traditional methods: A six-thousand-student survey of mechanics test data for introductory physics courses. *American Journal of Physics*, 66(1), 64–74. <https://doi.org/10.1119/1.18809>
- Hamidi, A., Akmalia, R., Suyanta, S., & Wilujeng, I. (2024). Development of PBL Based E-Modules to Boost Students' Science Process Skills. *Jurnal Penelitian Pendidikan IPA*, 10(1), 820–827. <https://doi.org/10.29303/jppipa.v10i2.5939>
- Harahap, L. K., & Siregar, A. D. (2020). Pengembangan Media Pembelajaran Interaktif Berbasis Adobe Flash Cs6 Untuk Meningkatkan Motivasi Dan Hasil Belajar Pada Materi Keseimbangan Kimia. *JPPS (Jurnal Penelitian Pendidikan Sains)*, 10(1), 1910. <https://doi.org/10.26740/jpps.v10n1.p1910-1924>
- Hidayati, A., Saputra, A., & Efendi, R. (2020). Pengembangan E-Modul Berorientasi Strategi Flipped Classroom pada Pembelajaran Jaringan Komputer. *Jurnal Resti (Rekayasa Sistem Dan Teknologi Informasi)*, 4(3), 429–437. <https://doi.org/10.29207/resti.v4i3.1641>
- Hung, C. Y., Sun, J. C. Y., & Liu, J. Y. (2019). Effects of flipped classrooms integrated with MOOCs and game-based learning on the learning motivation and outcomes of students from different backgrounds. *Interactive Learning Environments*, 27(8), 1028–1046. <https://doi.org/10.1080/10494820.2018.1481103>
- Irmawati, I., Syahmani, S., & Yulinda, R. (2021). Pengembangan Modul IPA Pada Materi Sistem Organ Dan Organisme Berbasis STEM-Inkuiri untuk Meningkatkan Literasi Sains. *Journal of Mathematics Science and Computer Education*, 1(2), 64. <https://doi.org/10.20527/jmscedu.v1i2.4048>
- Kamila, A., Fadiawati, N., & Tania, L. (2018). Efektivitas Buku Siswa Larutan Penyangga Berbasis Representasi Kimia dalam Meningkatkan Pemahaman Konsep. *Jurnal Pendidikan Dan Pembelajaran Kimia*, 7(2), 211–222. Retrieved from <https://jurnal.fkip.unila.ac.id/index.php/JPK/article/view/14610>
- Kimianti, F., & Prasetyo, Z. K. (2019). Pengembangan E-Modul IPA Berbasis Problem Based Learning untuk Meningkatkan Literasi Sains Siswa. *Kwangsan Jurnal Teknologi Pendidikan*, 7(2), 84–96. <https://doi.org/10.36706/jc.v11i1.16047>
- Kustini, S., Syutaridho, S., & Zahra, A. (2022). Pengembangan Modul Elektronik Menggunakan Pendekatan Pembelajaran Kontekstual Untuk Siswa Kelas X Madrasah Aliyah Negeri 1 Pangkalpinang. *Jurnal Of Education in Mathematics, Science, and Technology*, 5(2), 56–65.
- Lestari, N., Basri, K. I., Yusuf, S. M., Suciati, S., & Masykuri, M. (2020). Life skill integrated science-PBL module to improve critical thinking skills of secondary school students. *Universal Journal of Educational Research*, 8(7), 3085–3096. <https://doi.org/10.13189/ujer.2020.080737>
- Miranda, Y. (2020). Inovasi Pembelajaran Biologi Materi Morfologi Tumbuhan Berbasis Etnobiologi Bagi Peserta Didik. *Wahana-Bio: Jurnal Biologi Dan Pembelajarannya*, 12(1), 21–30. <https://doi.org/10.20527/wb.v12i1.9557>
- Oktarina, R., Fitria, Y., Ahmad, S., & Zen, Z. (2023). Development of STEM-Oriented E-Modules to Improve Science Literacy Ability of Elementary School Students. *Jurnal Penelitian Pendidikan IPA*, 9(7), 5460–5465. <https://doi.org/10.29303/jppipa.v9i7.4503>
- Riduwan, R. (2010). *Skala Pengukuran Variabel-Variabel Penelitian*. Alfabeta.
- Rokhmania, F. T., & Kustijono, R. (2017). Efektivitas penggunaan E-Modul berbasis flipped classroom untuk melatih keterampilan berpikir kritis. *Seminar Nasional Fisika UNESA, November*, 91–96. Retrieved from <https://fisika.fmipa.unesa.ac.id/proceedings/index.php/snf/article/view/46>
- Ru, Z., Yachao, J., & Xianfang, T. (2018). Improve the Quality of College Mathematics Teaching by Flipping the Classroom. *IOP Conference Series: Materials Science and Engineering*, 439(3). <https://doi.org/10.1088/1757-899X/439/3/032025>
- Sugiyono. (2014). *Metode penelitian pendidikan dan pengembangan*.
- Sugiyono. (2017). *Metode Penelitian Pengembangan*.

Alfabeta.

- Taqiyyah, S. A., Subali, B., & Handayani, L. (2017). Implementasi Bahan Ajar Sains Berbahasa Inggris Berbasis Metakognitif untuk Meningkatkan Kemampuan Pemecahan Masalah Siswa SMP. *Jurnal Inovasi Pendidikan IPA*, 3(2), 224. <https://doi.org/10.21831/jipi.v3i2.14859>
- Wardani, W. (2019). Pengaruh kecerdasan adversitas dan kecerdasan emosional melalui model inkuiri sosial terhadap keterampilan sosial siswa. *Jurnal Teori Dan Praksis Pembelajaran IPS*, 4(2), 66–73. <https://doi.org/10.17977/um022v4i22019p066>
- Warti, E. (2016). Pengaruh Motivasi Belajar Siswa terhadap Hasil Belajar Matematika Siswa di SD Angkasa 10 Halim Perdana Kusuma Jakarta Timur. *Mosharafa: Jurnal Pendidikan Matematika*, 5(2), 177–185. <https://doi.org/10.31980/mosharafa.v5i2.273>
- Wijaya, I. G. H., Santyasa, I. W., & Sudatha, I. G. W. (2022). Pengembangan E-Modul Dengan Model Problem-Based Flipped Classroom Pada Mata Pelajaran Simulasi Dan Komunikasi Digital. *Jurnal Teknologi Pembelajaran Indonesia*, 12(2). Retrieved from <http://repo.undiksha.ac.id/id/eprint/12722>
- Zainuddin, Z., Haruna, H., Li, X., Zhang, Y., & Chu, S. K. W. (2019). A systematic review of flipped classroom empirical evidence from different fields: what are the gaps and future trends? *On the Horizon*, 27(2), 72–86. <https://doi.org/10.1108/OTH-09-2018-0027>