



Development of E-Module IPAS Based on Problem Based Learning Assisted with Articulate Applications to Improve Students Think Criticall

Adelweiss Saralee^{1*}, Yanti Fitria¹, Elfia Sukma¹, Abna Hidayati¹

¹ Elementary School Teacher Education Study Program, Universitas Negeri Padang, Padang, Indonesia.

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Corresponding Author:

Adelweiss Saralee

adelweissaralee27@gmail.com

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Abstract: Monotonous and boring learning using books and worksheets alone makes students less interested in learning and reduces students' critical thinking abilities. Teachers need to create open materials that are interesting and able to increase students' enthusiasm for learning and improve students' critical thinking skills. This research aims to develop an E-module based on the Problem Based Learning model with various steps in solving problems and containing video and image content that is interesting for students. The research location is SDN 015 Sungai Banyak City. The research subjects were fourth grade elementary school students. This research is R&D development research using the ADDIE model. There are 2 stages of data analysis technique, namely validation carried out by 3 experts. Media experts, language experts and material experts are drawn from expert lecturers and master's graduate teachers. The second stage is practicality taken from fourth grade elementary school students. The research results showed a validity figure of 92.82% in the very valid category and for practicality it was 97.5% for students and 92% for teachers. The obstacles faced are limited time and the need for introduction in creating e-modules using the articulate storyline 3 application.

Keywords: Articulate storyline 3; E-module; Interactive

Introduction

Currently, it is known as Society 5.0, namely the rapid development of artificial intelligence technology that reaches all aspects of human life, including in the field of education. Era 5.0 or what is commonly known as Super Smart Society was ratified by the Japanese government on January 21 2019. Through the 5.0 era, it changes the order of people's lives by transforming collections of millions of data into aspects of all the internet so that it can make it easier for people to live their lives by utilizing technology. The Society 5.0 era which is influencing the world of education can be seen from the use of digital technology in the learning process. Modules are teaching materials that are

designed systematically based on a certain curriculum and are packaged in the form of the smallest learning units and allow them to be studied independently in a certain amount of time so that students master the competencies being taught (Chani et al., 2019). The development of educational technology refers to the media that teachers will use in learning (Birgili et al., 2021). Arious technology-based applications have been found and can be used to support the learning process. Applying this technology-based media requires teacher abilities and skills from designing to implementing it in learning. Therefore, literacy is needed to increase teachers' understanding in the field of educational technology (Keshav et al., 2022). The solution that researchers can offer is to develop teaching materials

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based on 21st century learning models in the 40th industrial revolution that use technology in their application so that they can improve student learning outcomes (Fokam et al., 2014). Learning outcomes are the abilities a person has after going through the learning process (Akbar et al., 2020). Learning outcomes play an important role in the learning process because they provide information to teachers about students' progress in their efforts to achieve learning goals in the subsequent teaching and learning process. With regard to current developments in technology and information, to create more interesting learning activities, one way that a teacher can do in this day and age is to try to develop and utilize learning media that is adapted to advances in science and technology (IPTEK) (Shahali et al., 2017). Learning (PBL) is a learning model that uses a problem-based approach to students authentically, so that students can construct their own knowledge, develop higher skills and inquiry, make students independent and increase their sense of self-confidence in the learning process (Wang et al., 2022). Learning provided through technology can make students learn more enthusiastically, creatively, and create a more enjoyable learning atmosphere. One of them is that teachers can use technology-based learning modules, namely e-modules. With regard to current developments in technology and information, to create more interesting learning activities, one way that a teacher can do in this day and age is to try to develop and utilize learning media that is adapted to advances in science and technology (IPTEK) (Harefa et al., 2020). Learning provided through technology can make students learn more enthusiastically, creatively, and create a more enjoyable learning atmosphere. One of them is that teachers can use technology-based learning modules, namely e-modules. Modules can be used as an interesting learning medium, can foster students' interest in learning, and can provide students with direct experience in learning (Aulia et al., 2022).

Articulate Storyline 3 is a software that can be used by teachers to create interactive learning E-modules. According to Articulate Storyline 3 is a software that can be used to create easy and fun learning modules. Based on the results of observations and interviews conducted by researchers, the researchers concluded that the use of printed books that had been used by teachers was still not able to make students fully interested in learning. In line with research conducted. Using e-modules can help students learn in an independent context. Because with digital modules, learning is packaged as attractively as possible, and easy to understand using language that is simple and easy for students to understand. So using digital modules can help students in the learning process (Rushiana et al., 2023).

Literature Review

Understanding E-Modules

E-modules or electronic modules are teaching materials that are arranged systematically or sequentially using language that is easy to accept and understand. E-modules are modifications or new forms of conventional modules by combining the use of information technology, so that existing modules can be more attractive (Solé-Llussà et al., 2020). The design stage in preparing an electronic module is a phase where the module compiler carefully designs what he will develop so as not to deviate from the analysis stages that have previously been carried out. At this stage, the module developer begins by compiling a flowchart or storyboard to produce a continuous flow and display illustrations, as a reference in the development stage. This flowchart is intended so that the material in the storyboard is in accordance with the objectives of the learning process to be achieved (Sole et al., 2017). The basics used to design interactive multimedia in learning used for class IV students are that learning is carried out by combining several media components such as: Text; color; design graphics; animation; audio, video and quizzes (Tvenge et al., 2018). The application that can be applied to support the creation of interactive multimedia is Articulate Storyline 3, a combination of Google Form (Wicaksana et al., 2022).

Articulate storyline 3 in learning is a learning media animation software to assist teachers in delivering learning aimed at making students interested in the learning being carried out and increasing students' interest in learning. The definition of e-module is teaching materials that are designed systematically and designed using digital applications in which electronic modules or e-modules will be formed, in e-modules in the form of the smallest learning units and allow them to be studied independently in a certain amount of time (Chani et al., 2019). There are six components that must be present in an e-module according to, including: Instructions for using learning, (student/educator instructions, Competencies to be achieved, indicators, materials Exercises-exercise, Work instructions, Evaluation (Legina et al., 2022).

Problem Based Learning (PBL) Model

The Problem Based Learning (PBL) model is characterized by practical problems allowing students to learn critical thinking and problem solving skills. According to Aulia et al. (2022) PBL equips students with basic understanding and mastery of knowledge, problem solving skills, learning to manage their own learning, and group participation. The problem-based learning model is a learning model that discusses problems related to a child's lifetime. So that children can solve these problems according to educational

topics. To stimulate interesting learning, tasks are set and students are asked to solve or solve problems (Sukma et al., 2023). Material that has been prepared previously is combined with images, graphics, video or audio using an authoring tools program to produce a product. The product also needs to be validated before it is finally produced and disseminated. The suggestions and input presented by the validators then become material that helps the improvement process by using it as a reference for revising and finalizing the product. This validation activity itself includes validation of content/material and appearance by material and media experts (Mehmood et al., 2019).

E-modules can present complete, interactive material with attractive designs. Teaching materials using e-modules have their own advantages, namely that students can learn independently using communication tools such as computers or smartphones so that they are more practical and can be accessed whenever needed (Wekerle et al., 2022).

Articulate Storyline 3 Application

Articulate Storyline 3 is the third tool released by Articulate Company which prioritizes the areas of presentation, media, teaching materials/software modules Steps for Using the Articulate Storyline 3 Application According to the steps for using the Articulate Storyline 3 application are:

Download the Articulate Storyline 3 application from the official website, then right-click the installation file and select run as administrator, tick on the license agreement, click install now and wait until it's finished.



Figure 1. Application articulate storyline 3

Enter the Articulate Storyline 3 opening screen, then select new project to create a new project, or you can press the Ctrl+N button.



Figure 2. Ctrl+N button

If the project is already open, then there is blank slide that is ready to be used, and double click on the scene display to start working on the slide.

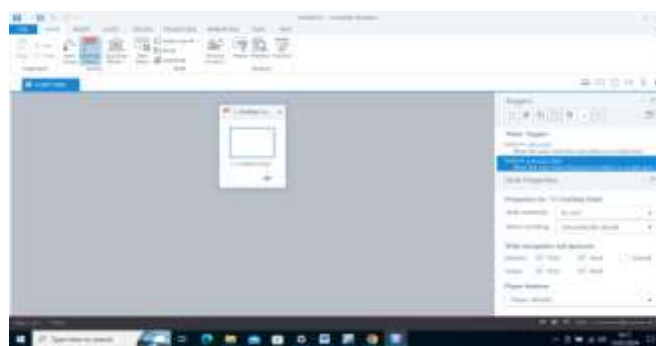


Figure 3. Blank slide

Change the title of the scene and slide by right clicking on the section. Enter the text or image you want to create, to add an image to the background select the insert menu then click picture, then select the image that was previously on the laptop, then enter text by clicking the insert menu and clicking the text box menu, and write the title you want to create.



Figure 4. Example cover

Select the insert menu, click button and select the desired button shape to create a display with buttons, and if you want to change the color of the button select the insert menu then click format select the desired color. Then add characters to the display by clicking the insert menu select character, and select the character you want

to add, besides that we can also change the character's expression and pose. Next add a new slide by clicking the home menu then click new slide and select the desired work view, after that we can create or copy the material to a new sheet that is already available. If everything is finished it can be published, click preview, click entire project to display the project as a whole.

IPAS Learning

IPA is a subject that studies nature, objects, natural phenomena and living things (Fitria et al., 2020). This subject is taught from elementary school to high school. Science learning at the elementary level has an important role in science learning at the next level. Science consists of a collection of theories applied to natural phenomena. In science learning, scientific methods such as observation and experimentation are used, and a scientific attitude is demanded. In general, science studies the universe. Natural Sciences (IPA) is a branch of science that studies the universe through careful observation, using procedures and reasoning to reach conclusions. For educators, especially those who teach science in elementary schools, it is important to understand the essence of science learning so they can plan and implement learning smoothly. This also helps students understand the concepts in science without experiencing difficulties. Science or natural science learning is expected to increase students' creativity. In this learning, students can develop creativity, problem-solving skills, and interest in science. The essence of science learning can be categorized into three aspects, namely: science as a result, process and attitude. Natural science (IPA) learning involves science learning concepts that emphasize students' natural and real-world situations, and encourages students to make connections between various branches of science and between the knowledge they have and everyday life. Science learning also focuses on students' direct experience (Lestarani et al., 2023).

This research is very important to carry out because to increase students' enthusiasm for learning, the results of observations made by researchers are that teachers use uninteresting learning media so that students feel bored and lazy when the learning process takes place. The main teaching materials used by teachers in learning are textbooks provided by schools, so students' knowledge is limited and they are not interested in reading them. Apart from that, teachers also need innovation in other learning media, so that they don't just use conventional methods in delivering material and use a memorization style by students. This causes students' low understanding of concepts. So in a short time it is lost and forgotten from memory. This causes students' ability to understand concepts to be still low. In addition, this method causes a lack of providing

development of understanding according to learning objectives. For example, the reality of narrative texts and how they work. So this research is intended to develop an E-module accompanied by video, audio, images, animation and HOTS questions which will stimulate students' enthusiasm for learning and improve critical thinking skills.

Method

The type of research that researchers use is development research (Research and Development) or usually abbreviated as R & D. Development research is a research method used to produce a particular product and test the effectiveness of the product that has been developed (Sugiyono, 2018). Products developed in research are not always in the form of objects or hardware (hardware) but can also be software (software). Preparing an instrument is a step that connects the definition stage with the design stage. The instrument preparation was carried out by compiling validation sheets for expert validators, student and teacher response questionnaires, as well as test instrument (Mufidah et al., 2021; Siregar et al., 2019). The validation sheet instrument is prepared to assess the feasibility (validity) of the e-module developed and assessed by experts or expert validators (lecturers). The validation sheet prepared includes: material validation sheet, language and media (e-module). Student and educator response questionnaire instruments were prepared to assess the practicality of the e-module developed based on student responses or assessments (Wibowo et al., 2018). Apart from that, a test instrument was also prepared which aims to obtain data about students' ability to understand and master the material after using and studying the e-module being developed (Yildiz et al., 2021).

Development research has several models, but in this research the researcher uses the ADDIE model which was developed by Dick and Carry in 1996. The ADDIE model consists of several steps, namely: analysis, design, development, implementation, and evaluation. Each stage in the ADDIE model is interrelated and interacts with each other because each stage can be used as a reference for the development of the next stage (Bulhayat et al., 2022).

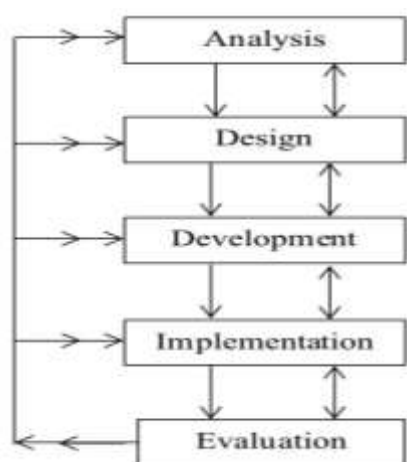


Figure 5. Development research phases ADDIE model

Result and Discussion

Research and development procedures starting from the initial stage to the product, researchers carry out the following steps:

Analysis Stage (Analysis)

At this stage, needs analysis, curriculum analysis and student characteristics analysis are carried out. This stage aims to identify problems and formulate goals. Apart from that, it can also be in the form of identifying whether it is necessary to develop learning methods based on feasibility indicators and conditions for development in general. The author identifies that the use of teaching materials in learning in schools has not been implemented optimally. Especially in the use of PBL-based teaching materials. Apart from that, it is also important to consider the characteristics of students, goals, experiences and how this can be useful in the learning process.

Design Stage (Designing)

Preparation of instruments and designing the e-module

Development Stage (Development)

At this stage the aim is to produce products that are ready to be implemented into classroom learning, such as lesson plans, material summaries and teaching materials.

Develop a Lesson Plan

Developing E-Module

In general, students in this class are quite active and also like to play after learning. However, when studying, they are not used to working in groups and are not used to being asked to think critically (Williamson et al., 2020).

Apart from that, many students also do not dare to express their opinions either individually or in groups. This was proven when the teacher asked students to appear in front of the class, many of them did not dare and appointed other friends to appear (Jojo et al., 2022). Most of the students do not seem to focus on what the students are explaining (Gede et al., 2022). This can be seen when the teacher explains the lesson, only a small number of students actually understand it. Based on the analysis of the student needs questionnaire that the researcher conducted, it was found that the researcher found that there was a large majority of students who did not understand the material being studied. , thus causing a feeling of boredom, less fun so that the learning process becomes less interesting (Marisa, 2021). Students are only focused on learning by using modules, LKS and LKPD as complements and the use of technology-based supporting teaching materials is also minimal (Sari et al., 2020).

Implementation Stage (Implementation)

This stage includes the application of e-modules that have been previously designed and have obtained good validity results. So from here all the plans prepared must be implemented well. This implementation was carried out to find out whether e-modules improve students' computational thinking skills in the learning process before and after using student modules that have been developed previously.

Evaluation Stage (Evaluation)

This stage includes whether the teaching materials that have been designed are successful, in accordance with initial expectations or not. This seeks to find out how successful the learning program that has been implemented has been. At this stage a practicality test is carried out by providing teacher response questionnaires, student response questionnaires and effectiveness tests are carried out.

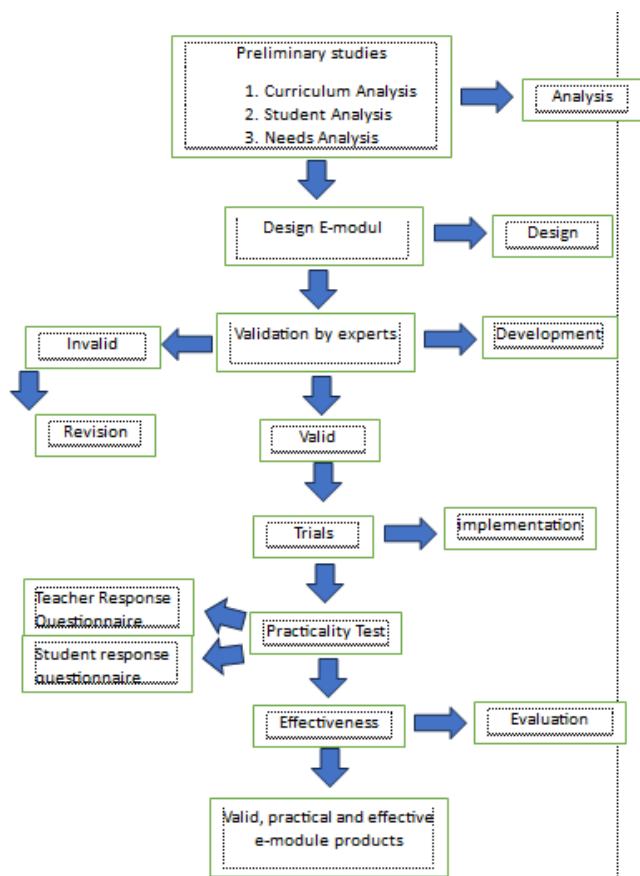


Figure 6. E-module development research procedure flow

Data Collection

Data collection techniques in this research were carried out by: a) Validate data by preparing a validation sheet. b) Practicality data by preparing questionnaire instruments.

Data Analysis

E-Module Validity Data Analysis

From the results of the e-module media analysis obtained, it was carried out on all aspects presented in table form using a Likert scale. Next, the score from the validity test questionnaire obtained from the expert validator will be analysed using the formula:

$$\bar{X} = \frac{\sum xi}{n} \tag{1}$$

Information:

\bar{X} = Average validation score

$\sum xi$ = Total score from validation results

n = Number of aspects assessed

Table 1. E-Module Validity Category (Sugiyono, 2018)

Interval	Sub-themes
86-100%	Very valid
76-85%	Valid
60-75%	Fairly valid
55-59%	Less valid
00-54%	Invalid

E-Module Practicality Data Analysis

Practicality analysis techniques are useful for analyzing data from teacher response questionnaires and student responses. In this study, a rating scale measurement scale was used. Data regarding teacher responses and student responses to the learning process are analyzed using the provisions confirmed in the rubric as in the following table.

Table 2. E-Module Practicality Category (Sugiyono, 2017)

Interval	Sub-themes
86-100%	Very practical
76-85%	Practical
60-75%	Quite practical
55-59%	Less practical
00-54%	Impractical

A questionnaire is a data collection technique that is carried out by giving respondents a set of questions or written statements to answer (Utariyani et al., 2018). This questionnaire sheet is to obtain information from respondents and to collect data regarding the accuracy of the digital module components, material accuracy and feasibility of this module. Response questionnaire or assessment of problem based learning modules to improve students' understanding of scientific concepts and attitudes by experts. In this study, validation data was obtained through a questionnaire containing expert responses regarding assessments of aspects of content quality, language quality and presentation quality.

The validation sheet contains items that state the validity of the content, the language in which the learning module is presented and indicators of concept understanding. The research instrument is a questionnaire based on the grid that was developed. The digital module practicality sheet filled in by educators contains aspects of practicality of use, effectiveness of learning time, suitability of illustrations and language used. The students' practicality sheet contains information about the students' ease in understanding the material, time and the attractiveness of the media. This practicality instrument is also structured using alternative answers: very good, good, poor and very poor. Teacher and student response questionnaires were used to obtain responses to the practicality of the digital learning modules being developed. This instrument is filled in by students after following the learning process and educators after carrying out the learning.

The test subjects in this research were class IV students at SDN SNP PLUS 015/XI Lawang Agung, Sungai Penuh City, Jambi Province, in Indonesian Language Literacy Learning. Meanwhile, the subjects of development research are as follows: instrument validator; expert validators (material experts, language

and graphics experts). Meanwhile, the author uses a Problem Based Learning E-Module Assisted by the Articulate Storyline Application as a research object.

Table 3. Validation Test Table

Content validation	Score	Score Criteria
Design validation	96.60%	Very valid
Material validation	97.17%	Very Valid
Language validation	84.70%	Valid

The validation results obtained in the general information aspect with an average value of 92.82% were very valid. In the material aspect, an average score of 97.17% was obtained in the very valid category, in the language aspect, the average score was 84.70% in the valid category, in design, an average score of 96.60% was obtained, including the very valid category. On the teaching module validation sheet there are several comments and suggestions as a reference in revising the teaching module that will be used.

Table 4. Practicality Test Table

Content Practicality	Score	Score Criteria
Teacher response	92%	Very Practical
Student response	97.5%	Very Practical

This e-module PBL with the Articulate Storyline 3 application which has been declared valid is then tested to determine its practicality. The trial was carried out on 25 Class IV students at SDN SNP PLUS 15/XI Lawang Agung and also with the class IV homeroom teacher. Based on practicality trials, it was found that the practicality value of the student response questionnaire was 97% and the teacher response questionnaire score was 97.50% with category (very practical). Modules were developed to provide learning facilities and create interesting learning that can be accessed anytime, anywhere, when needed.

Conclusion

The results of this e-module development research were found to be valid by design experts, material experts and language experts with an average score of 96.60%. Meanwhile, the results of the practicality test proved to be practical with teacher responses of 97.5% and students 97%. Presenting material that is interesting and appropriate to students' needs is the main key to creating a memorable learning experience. This teaching material not only meets these criteria, but also successfully applies everyday life concepts, providing high relevance in the learning process. In this way, enthusiastic students are stimulated, and they can more easily imagine and understand the concepts being taught with the reality around them. The use of

everyday life contexts provides a practical dimension to learning, enriching students' understanding and providing them with a more holistic learning experience. The development of teaching material products carried out in this research certainly experienced obstacles that were limitations in achieving a perfect product, so extra effort was needed so that the teaching material products that the researchers developed could be better in the future. One of the obstacles found in the field was the use of networks on cellphones and laptops used by teachers and students.

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Author Contributions

Conceptualization, S. M., & A. P. L.; methodology, S. M.; validation, A. P. L. and S. M.; formal analysis, A. P. L.; investigation, S. M and A. P. L.; resources, S. M and A. P. L.; data curation, S. M.: writing – original draft preparation, S. M and A. P. L.; writing – review and editing, S. M.: visualization, and A. P. L and S. M. All authors have read and agreed to the published version of the manuscript.

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Conflicts of Interest

The authors declare no conflict of interest.

References

Akbar, Y. F., Rizal, A., Tiara, Islami, N. N., & Hartanto, W. (2020). The urgency of using online-based learning media to enhance students' self-directed learning and result study on accounting chapter of economics subjects. *IOP Conference Series: Earth and Environmental Science*, 485(1), 012137. <https://doi.org/10.1088/1755-1315/485/1/012137>

Aulia, A., & Hardeli, H. (2022). Validity of E-Module Based on Problem Based Learning Integrated Demonstration Video and Science Literacy. *IJIS Edu: Indonesian Journal of Integrated Science Education*, 4(1), 45. <https://doi.org/10.29300/ijisedu.v4i1.5871>

Birgili, B., Seggie, F. N., & Oğuz, E. (2021). The trends and outcomes of flipped learning research between 2012 and 2018: A descriptive content analysis. *Journal of Computers in Education*, 8(3), 365–394. <https://doi.org/10.1007/s40692-021-00183-y>

Bulhayat, Sugito, Yumnah, S., Arifin, M. M., Sofa, M., Ahdiyati, M., Widayanti, R., Tullah, R., Sumarni, Soma, M., Fikriah, A., Nova, A., Suwandi, Imanuddin, M., Anam, C., Lestari, D. V., Soehardi, Prananta, A. W., Dharta, F. Y., & Adhim, F. (2022).

- Pengantar Ilmu Pendidikan Islam*. CV Literasi Nusantara Abadi.
- Chani, I., & Dwiyan, N. (2019). Rancang Bangun Media Pembelajaran Interaktif Komputer dan Jaringan Dasar Kelas X SMK. *Voteteknika (Vocational Teknik Elektronika dan Informatika)*, 7(1), 32. <https://doi.org/10.24036/voteteknika.v7i1.103640>
- Fitria, Y., & Indra, W. (2020). *Pengembangan model pembelajaran PBL berbasis digital untuk meningkatkan karakter peduli lingkungan dan literasi sains*. Deepublish.
- Fokam, J., & Espinosa, J. C. M. (2014). Development Du Secteur Informel Et Son Impact Sur L'Economic: Cas Du Niger. *International Journal of Progressive an Technologies*, 42(2). Retrieved from <https://ijpsat.org/index.php/ijpsat/article/view/5899/3709>.
- Gede, I., Septiana, Y., Made, I., Wibawa, C., Putu, G. A., & Trisna, S. (2022). Interactive Multimedia Based on Articulate Storylines in the Topic of Plant Anatomy and Physiology. *International Journal of Elementary Education*, 6(2), 182-194. <https://doi.org/10.23887/ijee.v6i2.46837>
- Harefa, D., Telaumbanua, T., Sarumaha, M., Ndururu, K., & Ndururu, M. (2020). Peningkatan Hasil Belajar IPA pada Model Pembelajaran Creative Problem Solving (CPS). *Musamus Journal of Primary Education*, 3(1), 1-18. <https://doi.org/10.35724/musjpe.v3i1.2875>
- Jojo, A., & Sihotang, H. (2022). Analisis Kurikulum Merdeka dalam Mengatasi Learning Loss di Masa Pandemi Covid-19 (Analisis Studi Kasus Kebijakan Pendidikan). *Edukatif: Jurnal Ilmu Pendidikan*, 4(4), 5150-5161. <https://doi.org/10.31004/edukatif.v4i4.3106>
- Keshav, M., Julien, L., & Miezal, J. (2022). The Role of Technology in Era 5.0 in the Development of Arabic Language in the World of Education. *Journal International of Lingua and Technology*, 1(2), 79-98. <https://doi.org/10.55849/jiltech.v1i2.85>
- Legina, N., & Sari, P. M. (2022). Pengembangan Media Pembelajaran Interaktif Articulate Storyline Berbasis Keterampilan Berpikir Kritis pada Pembelajaran IPA bagi Siswa Sekolah Dasar. *Jurnal Paedagogy*, 9(3), 375. <https://doi.org/10.33394/jp.v9i3.5285>
- Lestarani, D., Tanone, K. L. K., Parera, L. A. M., Lalang, A. C., & Naat, J. N. (2023). Development of Articulate Storyline 3-Based for Chemical Bonding Teaching Materials. *Hydrogen: Jurnal Kependidikan Kimia*, 11(2), 106. <https://doi.org/10.33394/hjkk.v11i2.7403>
- Marisa, M. (2021). Inovasi Kurikulum mbkm di era society 5.0. *Santhet: Jurnal Sejarah, Pendidikan dan Humaniora*, 5(1), 72. Retrieved from <https://ejournal.unibabwi.ac.id/index.php/santhe/article/view/1317https://ejournal.unibabwi.ac.id/index.php/santhe/article/download/1317/903>
- Mehmood, R., Hunjra, A., & Chani, M. (2019). The Impact of Corporate Diversification and Financial Structure on Firm Performance: Evidence from South Asian Countries. *Journal of Risk and Financial Management*, 12(1), 49. <https://doi.org/10.3390/jrfm12010049>
- Mufidah, N. L., & Surjanti, J. (2021). Efektivitas Model Pembelajaran Blended Learning dalam Meningkatkan Kemandirian dan Hasil Belajar Peserta Didik pada Masa Pandemi Covid-19. *Ekuitas: Jurnal Pendidikan Ekonomi*, 9(1), 187. <https://doi.org/10.23887/ekuitas.v9i1.34186>
- Rushiana, R. A., Sumarna, O., & Anwar, S. (2023). Efforts to Develop Students' Critical Thinking Skills in Chemistry Learning: Systematic Literature Review. *Jurnal Penelitian Pendidikan IPA*, 9(3), 1425-1435. <https://doi.org/10.29303/jppipa.v9i3.2632>
- Sari, R. I., & Wulandari, S. S. (2020). Pengembangan Lembar Kegiatan Peserta Didik (LKPD) Berbasis Pendekatan Saintifik Mata Pelajaran Humas dan Keprotokolan Semester Gasal Kelas XI OTKP Di SMK YPM 3 Taman. *Jurnal Pendidikan Administrasi Perkantoran (JPAP)*, 8(3), 440-448. <https://doi.org/10.26740/jpap.v8n3.p440-448>
- Shahali, E. H. M., Halim, L., Treagust, D. F., Won, M., & Chandrasegaran, A. L. (2017). Primary School Teachers' Understanding of Science Process Skills in Relation to Their Teaching Qualifications and Teaching Experience. *Research in Science Education*, 47(2), 257-281. <https://doi.org/10.1007/s11165-015-9500-z>
- Siregar, N. H. O., Adisaputera, A., & Saragih, A. (2019). Development of Interactive Multimedia in Learning to Read Genre Text with Local Wisdom for Students Junior High School Silangkitang. *Proceedings of the 4th Annual International Seminar on Transformative Education and Educational Leadership (AISTEEL 2019)*, 600-603. <https://doi.org/10.2991/aisteel-19.2019.136>
- Sole, F. B., & Anggraeni, D. M. (2017). Pengembangan Instrumen Penilaian Sikap Ilmiah Sains Siswa Sekolah Dasar (SD) Berbasis Pendidikan Karakter. *Jurnal Penelitian Pendidikan IPA*, 3(2). <https://doi.org/10.29303/jppipa.v3i2.111>
- Solé-Llussà, A., Aguilar, D., & Ibáñez, M. (2020). Video-worked examples to support the development of elementary students' science process skills: a case study in an inquiry activity on electrical circuits. *Research in Science and Technological Education*, 40(2), 1-21.

- <https://doi.org/10.1080/02635143.2020.1786361>
Sugiyono. (2018). *Metode Penelitian Kuantitatif, Kualitatif dan RD*. Bandung: CV Alfabeta.
- Sukma, E., Ramadhan, S., Aldiyah, M. P., & Sihes, A. J. (2023). Challenges in Implementing Indonesian Language Teaching Materials in Elementary Schools. *International Electronic Journal of Elementary Education*, 16(2).
<https://doi.org/10.26822/iejee.2024.327>
- Tvenge, N., & Martinsen, K. (2018). Integration of digital learning in industry 4.0. *Procedia Manufacturing*, 23(2017), 261–266.
<https://doi.org/10.1016/j.promfg.2018.04.027>
- Utariyani, N. nyoman T., Rizka, M. A., & Maskun, M. (2018). Pengaruh Pelatihan Tata Boga Terhadap Sikap Berwirausaha Warga Belajar di SKB (Sanggar Kegiatan Belajar) Gerung Kabupaten Lombok Barat Tahun 2016. *Transformasi: Jurnal Penelitian Dan Pengembangan Pendidikan Non Formal Informal*, 3(1).
<https://doi.org/10.33394/jtni.v3i1.657>
- Wang, A., Xiao, R., Zhang, C., Yuan, L., Lin, N., Yan, L., Wang, Y., Yu, J., Huang, Q., Gan, P., Xiong, C., Xu, Q., & Liao, H. (2022). Effectiveness of a combined problem-based learning and flipped classroom teaching method in ophthalmic clinical skill training. *BMC Medical Education*, 22(1), 487.
<https://doi.org/10.1186/s12909-022-03538-w>
- Wekerle, C., Daumiller, M., & Kollar, I. (2022). Using digital technology to promote higher education learning: The importance of different learning activities and their relations to learning outcomes. *Journal of Research on Technology in Education*, 54(1), 1–17.
<https://doi.org/10.1080/15391523.2020.1799455>
- Wibowo, E., & Pratiwi, D. D. (2018). Pengembangan Bahan Ajar Menggunakan Aplikasi Kvisoft Flipbook Maker Materi Himpunan. *Desimal: Jurnal Matematika*, 1(2), 147.
<https://doi.org/10.24042/djm.v1i2.2279>
- Wicaksana, T. I., Ambiyar, A., Maksum, H., & Irfan, D. (2022). Penerapan model (PJBL) untuk meningkatkan kreativitas dan hasil belajar dalam mata pelajaran pemrograman berorientasi objek. *JRTI (Jurnal Riset Tindakan Indonesia)*, 7(3), 470.
<https://doi.org/10.29210/30032058000>
- Williamson, B., Bayne, S., & Shay, S. (2020). The datafication of teaching in Higher Education: critical issues and perspectives. *Teaching in Higher Education*, 25(4), 351–365.
<https://doi.org/10.1080/13562517.2020.1748811>
- Yildiz, C., & Guler Yildiz, T. (2021). Exploring the relationship between creative thinking and scientific process skills of preschool children. *Thinking Skills and Creativity*, 39, 100795.
<https://doi.org/10.1016/j.tsc.2021.100795>