



Development Of STEM-Based PjBL E-Student Worksheet to Foster Character Building

Retni S Budiarti^{1*}, Harlis¹, Jodion Siburian¹

¹Department of Biology Education, Faculty of Teacher Training and Education, University of Jambi, Jambi, Indonesia

Received: September 2, 2023

Revised: October 18, 2023

Accepted: November 25, 2023

Published: November 30, 2023

Corresponding Author:

Retni S Budiarti

retni.sulistiyoning@unja.ac.id

DOI: [10.29303/jppipa.v9i11.6169](https://doi.org/10.29303/jppipa.v9i11.6169)

© 2023 The Authors. This open access article is distributed under a (CC-BY License)



Abstract: This research aims to determine whether E-Student Worksheet for Project-Based Learning (PjBL) based on STEM (Science, Technology, Engineering, and Mathematics) can cultivate valid and practical Character Building for microbiology learning. This type of research falls under Research and Development (R&D). The study employs the 4D research model (Four D models), adapted from Thiagarajan (as cited in Kurniawan et al., 2017). The 4D development consists of four stages: Define, Design, Development, and Disseminate. Instruments used include media expert validation sheets, content expert validation sheets, and practicality sheets for students. The data obtained are analyzed descriptively, both quantitatively and qualitatively. The feasibility of the STEM-based PjBL e-Worksheet for Character Building development is validated with a media validity of 91.67% and content validity of 88.89%, meeting the criteria for being highly valid. Therefore, it can be tested on students of Biology Education at the Faculty of Teacher Training and Education, University of Jambi. Practicality, as assessed by student responses using STEM-based PjBL learning media, is 90.83%, meeting the criteria for being highly practical. In conclusion, the development of STEM-based PjBL e-Worksheet demonstrates tremendous potential in shaping students' character while enhancing their academic abilities. The integration of technology and project-based learning approaches creates interactive and contextual learning experiences, preparing students for the technological challenges of the workforce.

Keywords: Character Building; Development; E-Student Worksheets; PjBL; STEM

Introduction

The Independent Curriculum implemented in Indonesia since 2022 has transformed the role of educators from uniform approach instructors to educators capable of assisting students in becoming lifelong independent learners (Kurniatullaila & Albahri, 2022; Irawan & Masyitoh, 2023; Ardianti & Amalia, 2022). In the context of 21st-century learning in Indonesia, the focus is on strengthening 21st-century skills, also known as the 4Cs. This aims to create students who can innovate, have strong learning skills, master technology and information, and apply these skills in everyday life (life skills) (Rifai et al., 202; Koh et al., 2018). The 21st-century learning system revolves around students to enable them to develop thinking skills,

including communication, collaboration, critical thinking, problem-solving, as well as creativity and innovation.

Educational providers must be able to produce students who can flexibly solve problems, possess communicative and collaborative skills, critical thinking, and creativity (Caena & Redecker, 2019; McGunagle & Zizka, 2020). This is a challenge, especially in the increasingly competitive world of education. Despite this, the education sector remains consistent in promoting and developing character education. However, various factors may influence it, one of which is constant change (Salsabila et al., 2022; Ardianti & Amalia, 2022). Therefore, real efforts are needed to advance and develop human resources, especially in the field of quality development, to meet qualifications and character enhancement.

How to Cite:

Budiarti, R. S., Harlis, & Siburian, J. (2023). Development Of STEM-Based PjBL E-Student Worksheet to Foster Character Building. *Jurnal Penelitian Pendidikan IPA*, 9(11), 9818–9828. <https://doi.org/10.29303/jppipa.v9i11.6169>

Based on the literature study, it emphasizes the role of teachers in strengthening character education for students. It underscores the importance of teachers as role models for students and the implementation of character education based on five core values: integrity, religiosity, nationalism, independence, and mutual cooperation (Brown et al., 2019; Jacobs & van Jaarsveldt, 2016; Kadek Suartama et al., 2020). Consistent with the research by Watson. (2019) it highlights the need for character development in higher education, emphasizing that character education is a lifelong process involving the participation of both parents and teachers. This study also discusses the role of higher education institutions in shaping students' character through school culture and extracurricular activities. Additionally, research by Dewi et al., (2018) obtained favorable results from expert validation, teacher perceptions, and student responses, indicating that character education-loaded E-Student Worksheet are considered suitable in terms of material and media quality. Therefore, the character education-loaded Student Worksheet developed can be used as a learning medium in Senior High School 2 in Kota Jambi for 10th-grade students in the Bacteria topic.

An individual's character still needs to be studied and researched further. According to Mishra et al., (2019), the importance of character building is expected to have a positive impact on dealing with various stressful situations. Individuals may feel pressured by various conditions, both in the family and in the social environment. Therefore, character education in the learning process is expected to influence and improve an individual's skills, attitudes, and behaviour, shaping their personality (Jamaluddin et al., 2022; Santika, 2020). An individual's character is a crucial aspect that needs continuous reinforcement and improvement through character education (Maduretno & Andriani, 2018; Indasari, 2018). This not only helps individuals cope with stress and difficult situations but also builds better and more meaningful individuals in society. Hence, research and attention to individual character should continue to provide maximum benefits for personal development and individual well-being (Hidayat et al., 2022; Rinnanik et al., 2023; Suryanto et al., 2023).

The teaching method employed combines the Project-Based Learning (PjBL) model integrated with the STEM approach. The PjBL model emphasizes the implementation of projects or small research activities as an integral part of the learning process (Jalinus et al., 2017; Jalinus & Nabawi, 2018; S. H. Mukaromah & Wusqo, 2020). PjBL involves steps that include problem-solving, investigative skills, decision-making, and the ability to design a work. In the process of finding solutions or answering emerging questions, learners are

expected to focus on understanding the concepts and principles related to the project they are working on (W. S. Dewi et al., 2023; Nurhidayah et al., 2021; Rahim et al., 2019). Meanwhile, STEM is an acronym for four disciplines: Science, Technology, Engineering, and Mathematics (Asrizal et al., 2023; Fikriana et al., 2023; Nazifah & Asrizal, 2022). Adopting the STEM approach has several advantages, one of which is training students' skills in applying design knowledge to solve problems related to the environment, utilizing modern technology (Mukaromah et al., 2022; Safitri & Tanjung, 2023).

Project-Based Learning (PjBL) integrated with STEM (Science, Technology, Engineering, and Mathematics) is an effective learning method for fostering students' character development (Ashari et al., 2021; Hasibuan et al., 2022). In this method, students learn through real projects that require the application of STEM concepts to complete. This learning approach can help students develop critical thinking, collaboration, communication, and problem-solving skills, all of which are essential characteristics in education (Rahmania, 2021; Sawu et al., 2023; Syukri et al., 2021). Project-based learning integrated with STEM can assist students in understanding scientific and mathematical concepts more deeply, as they can experience the direct application of these concepts in the projects they undertake (Capraro & Jones, 2013; Kartini et al., 2021; Putri, 2023; Sudarmin et al., 2019). Thus, STEM-integrated PjBL not only helps students acquire knowledge and skills in STEM fields but also shapes the character necessary for success in the future.

The integration of technology in implementing teaching methods using Student Worksheets reflects a significant transformation in education (Marshall & Ratnawulan, 2020; Ranti & Usmeldi, 2019). Technological advancements have brought about meaningful changes, manifesting positive impacts through an increasingly diverse range of learning media, this evolution includes the emergence of new models of learning that integrate technological progress (Appio et al., 2019; Fang et al., 2020). One concrete form of technology integration in education is the use of E-Student Worksheets, E-Student Worksheets, as a digital adaptation of traditional Student Worksheets, provides greater interactivity in the teaching and learning process, students can access learning materials digitally, making information more dynamic and engaging (Adawiyah et al., 2022; Khoiri et al., 2023; Mardhatilah et al., 2022; Windari et al., 2022). Another advantage is the availability of instant feedback, accelerating the understanding of concepts and enhancing student engagement. By integrating technology through E-Student Worksheets, education becomes more

responsive to the changing times, creating a learning environment that is more modern, relevant, and effective for students.

The E-Student Worksheets PjBL contains instructional material packaged in such a way that learners can independently study the material, encouraging them to become more actively involved in creating STEM-based projects. Learners are challenged in the learning process, making it more interactive compared to one-directional teaching methods. E-Student Worksheets is an instructional material designed to facilitate the learning process in the form of a digital book accessible through computers, notebooks, and smartphones (Pebriani et al., 2022; Shalahuddin & Hayuhantika, 2022; Wahono et al., 2022). The main advantages of E-Student Worksheets include time and space efficiency, allowing users to make important notes, having a smaller size and capacity, and reducing paper usage (Cholifah & Novita, 2022; Friska et al., 2022; Hidayah & Kuntjoro, 2022; Shalahuddin & Hayuhantika, 2022). The primary goal of instructional materials like Student Worksheets is to guide learners in understanding concepts, reinforcing and solidifying these concepts, determining the right learning direction, and providing guidance in practical implementation (Barlenti et al., 2017; Dermawati et al., 2019; Putra et al., 2018; Sujanem, 2012).

Previous research indicates that the utilization of technology through the use of Student Worksheets yields results categorized as good and suitable for enhancing critical thinking (Melania et al., 2021). Providing Student Worksheets can have a positive impact on learning, creating an enjoyable and meaningful learning experience for absorbing the material (Celikler & Aksan, 2012). This type of instructional material can enhance the quality of the learning process and achieve good learning outcomes (Dini Rahma Diani, Nurhayati, 2019), and E-Student Worksheets is deemed suitable for use in learning based on aspects of validity, practicality, and effectiveness for learners (Fitriasari & Yuliani, 2021).

Based on an interview with one of the lecturers in the Biology Education program at the Faculty of Teacher Training and Education, University of Jambi, in microbiology education, there is currently no use of STEM-based PjBL Worksheets as an additional learning resource. Instead, the method used relies solely on the textbooks provided in schools without any extra learning resources. This condition can lead to a lack of motivation for students to actively participate in learning and potentially hinder the development of students' character. In this context, the absence of additional STEM-based learning resources may limit the freedom of students to engage in more interactive and

explorative learning activities, as well as reduce opportunities for them to sharpen various aspects of character that are crucial in education. Based on these issues, the author chose to develop instructional material, specifically E-Student Worksheets PjBL integrated with STEM (Science, Technology, Engineering, and Mathematics), to foster character building.

Method

This type of research falls under the category of Research and Development (R&D). According to Sugiyono (2016) development research involves producing a product through the processes of researching, designing, creating, and testing for validity. This study employs the 4D research model (Four D models), adapted from Thiagarajan (Rizqika et al., 2019). The development in this 4D model consists of four stages: Define, Design, Development, and Disseminate.

Table 1. Validity Criteria

Percentage (%)	Criteria
0-20	Very low
21-40	Low
41-60	Moderately high
61-80	high
81-100	Very high

The development procedure in this research consists of four stages. The first stage is Define, which involves formulating requirements for learning. In this stage, the researcher will gather various information about learners or issues that pose challenges, determine the necessary media for development, and provide efficient solutions in learning. The second stage is Design, where the focus is on designing the produced product according to the defined analysis, including the selection of media, format, and color preferences based on the learners' needs. The third stage is Development, which involves realizing the designed product. Subsequently, the product is validated by experts and tested on a limited scale with learners. Additionally, this stage includes revisions from various experts in the field based on their suggestions and input. The fourth stage is Disseminate, which aims to distribute the product after its development by the researcher.

The subjects of this research are students in the Biology Education Program at the Faculty of Teacher Training and Education, University of Jambi, who have taken the Microbiology course. The testing is conducted in three stages: product validation, revision of the product based on validation results, and practicality testing of the product. The interpretation of expert

validation in the Development stage, based on the questionnaire, it shows on Table 1.

Based on the criteria in Table 1, the instrument can be considered valid if the validation results fall within the "high" to "very high" criteria. Furthermore, the practicality assessment is reviewed based on students' responses, as indicated in the following Table 2. According to the validation criteria, the instrument is deemed suitable if the percentage is $\geq 61\%$.

Table 2. Practicality Criteria

Percentage (%)	Criteria
0-20	Not practical
21-40	Less practical
41-60	Fairly practical
61-80	Practical
81-100	Very practical

Result and Discussion

This research follows the 4D stages, which consist of Define, Design, Development, and Disseminate. The first stage of this study involves an analysis of the students, specifically an analysis of Biology Education students at the Faculty of Teacher Training and Education, University of Jambi. Each student in the class has diverse characteristics. During online learning sessions using Zoom, some students actively participate by asking and answering questions from the lecturer. On the other hand, there are also students who tend to be more passive when the learning session begins. In the current pandemic situation, some students attend classes at school, while others engage in online learning from home. This situation naturally results in differences in delivering the material, even within the same context.

Define Stage

The first stage is the Define stage, in which the researcher undertakes three aspects: needs analysis, student analysis, and content analysis. Broadly speaking, the analysis stages conducted by the author are as follows.

Needs Analysis

In-depth assessment through the analysis of the curriculum Independence Learning Plan conducted gradually until the learning process in the classroom. Aligning the Study Program Learning Outcomes with the Course Performance Criteria (CPMK) derived into Sub-CPMK, implementing character building in each learning implementation indicator. The demand in preparing learning resources that must already be available during the project model implementation. Surveys are conducted by providing questionnaires to students to obtain data on the needs of E-Student

Worksheets based on STEM in developing character building. The evaluation of these needs is practiced by starting with evaluating the existing learning media and assessing the availability of learning media that support the implementation of the learning process.

Learner Analysis

Student analysis is conducted to understand the characteristics of the students, which serve as the basis for the design and development of instructional media. From the questionnaire results, data regarding the characteristics of the students were obtained. The students demonstrated good and accurate computer operation skills. With an average age between 18-20 years, they are in the formal operational stage, where the ability to think abstractly and solve problems has been developed. Interestingly, nearly 90% of the students show a tendency to like audiovisual learning media. However, it is regrettable that the Student Worksheets used in the context of the microbiology course were perceived as uninteresting. This indicates the need for improvement or development in presenting learning materials to make them more appealing and aligned with the students' interests, thus enhancing the effectiveness of learning in that course.

Content Analysis

Through competence analysis, it can be seen that microbiology materials have a very wide scope. However, due to time constraints, this learning media limits the materials that can be introduced. Based on observations, microbiology materials are considered difficult and abstract by students, so innovation is needed in using traditional Student Worksheets. The content to be presented in this learning media is the development of atomic models. The goal of the basic competency to be achieved through this learning media is the ability to analyse the evolution of microbiology.

Design Stage

The second stage is the design stage. In this stage, a media is designed to meet the needs of the students. Since only a few students have textbooks, the E-Student Worksheets provides material within the application accompanied by examples. There is a worksheet feature that must be completed by each group or individual to support the understanding and critical thinking skills of students in solving problems. The design stage produces an initial design based on the define stage. The format of the initial design of the STEM-based PjBL E-Student Worksheets to foster Character Building is based on a teaching material development guide consisting of a cover, supporting pages, instructions for using the E-Student Worksheets, competencies to be achieved, learning objectives, supporting information (required

material summaries), tasks and work steps, and assessment. The creation of the E-Student Worksheets is processed using Microsoft Word 2021, Adobe Photoshop CC 2021, Canva, and Flipbook Maker Pro to produce an engaging and satisfactory E-Student Worksheets as expected.

Development Stage

The third stage is the development stage, where the previously designed product is created. The next steps in the development process of the STEM-based PjBL E-Student Worksheets to foster Character Building are in the development stage. In this stage, several activities are carried out to design the instructional media that will be created. The development stage includes the validation of the first draft of the instructional media. The validation process covers both media and content validation.

Table 3. Media Validator Assessment Results

Assessed Aspects	Average Score	Percentage per Aspect (%)	Criteria
Functionality	2.67	90.28	Very high
Reliability	11.33	94.44	Very high
Usability	7.33	91.67	Very high
Integrity	3.67	91.67	Very high
Average Percentage %		91.67	Very high

Based on Table 3, validation results by media experts were obtained. The average percentage for all aspects is 91.67% with a criterion of "highly valid," meaning it can be used for the implementation stage with students. Material Validation Material validation is conducted by expert validators, where the assessed aspects include the suitability of the material content with basic competencies, competency achievement indicators, material sequence, and Microbiology concepts. The results of material validation are used as the basis for determining the suitability of the E-Student Worksheets. The results of material validation can be seen in Table 4. Based on Table 4, validation results by material experts were obtained. The average percentage for all aspects is 88.89% with a "highly valid" criteria, which means it can be used for the implementation stage with students.

Revision

The revision stage aims to improve the electronic parts of the STEM-PjBL E-Student Worksheets for Character Building that were considered not suitable by the validators before conducting the testing of the resulting product. The revision is considered complete when the developed E-Student Worksheets is deemed valid by the validators.

Table 4. Material Validator Assessment Results

Assessed Aspects	Average Score	Percentage per Aspect (%)	Criteria
Basic Competence/Learning Objectives/Indicators	3.33	88.33	Very high
Content Material	29.00	90.63	Very high
Differentiated Learning	3.33	88.33	Very high
Language	17.67	88.33	Very high
Average Percentage %		88.89	Very high

Practicality

The next stage is the Practicality Testing of the STEM-based PjBL E-Student Worksheets to foster Character Building for students. The process involves limited trials with the aim of assessing the response or feedback on the developed E-Student Worksheets instructional media. The developed and validated E-Student Worksheets instructional media are then tested on students. This limited trial involves students in the Biology Education Program who are currently enrolled in the microbiology course. The test uses a Likert scale questionnaire with a scale of 4. The trial phase took place on September 14-15, 2023. The results of the media trial are presented in Table 5. Based on Table 5, the percentage of practicality of the media, as assessed from the students' responses, is 90.83% with a "highly practical" criteria.

Table 5. Student Response Results

Total Average Score	54.50
Percentage of Average Score	90.83%
Media Practicality Criteria	highly practical

Discussion

E-Student Worksheets PjBL stands based on Project-Based Learning (PjBL)." E-Student Worksheets PjBL refers to electronic teaching materials developed using a project-based learning approach (PjBL). PjBL is a teaching method in which students learn through practical experiences in tackling challenging and results-oriented projects (Lely et al., 2020; Safaruddin et al., 2020). E-Student Worksheets PjBL is designed to support this type of learning by providing electronic learning materials that students can use in the context of relevant projects (Linda, 2023). Electronic teaching materials like E E-Student Worksheets PjBL typically include various elements, such as learning content, task instructions, supporting resources, and assessment tools. The goal of E-Student Worksheets PjBL is to provide students with easy and interactive access to learning materials that support them in carrying out specified learning projects.

This approach is often used in education to enhance student engagement, problem-solving skills, and the application of knowledge in real-world contexts. E-Student Worksheets PjBL is a means to integrate technology into this learning approach, enabling students to access learning resources online.

Integrating E-Student Worksheets PjBL with the STEM (Science, Technology, Engineering, and Mathematics) approach is a strategic step in developing relevant and future-oriented learning (Ayuni et al., 2022; Nurhaisa et al., 2023; Ratnasari et al., 2023). In this approach, students not only gain theoretical understanding but also actively engage in applying science, technology, engineering, and mathematics in authentic learning projects (Riyanto, 2018). The use of technology is an integral part of this approach, enriching the learning experience. Through the STEM approach, students develop critical thinking, problem-solving, and interdisciplinary collaboration skills. They experience how science and technology interact in real-world situations, allowing them to connect theory with practice. Integrating E-Student Worksheets PjBL effectively provides guidance, resources, and relevant tasks for STEM-based projects.

Based on the results of the feasibility of the STEM-based PjBL E-Student Worksheets, which has successfully passed the validation stage, with a media validation percentage of 91.67% and material validation reaching 88.89%, this E-Student Worksheets is considered highly valid and ready to be tested on Biology Education students at FKIP Jambi University. This high validation percentage indicates that the instructional content and media presentation have undergone evaluation by media and content experts, ensuring that the content is accurate, and the presentation aligns with established standards. The results of the practicality test involving student responses are also very encouraging, with a percentage of 90.83%, indicating that the STEM-based PjBL E-Student Worksheets is highly practical in its use. Positive responses from students indicate that they feel engaged and comfortable using this instructional media in their learning process. Thus, these strong feasibility and practicality results affirm that the STEM-based PjBL E-Student Worksheets to foster Character Building is an effective and relevant learning tool for Biology Education students at FKIP Jambi University. Learning that integrates STEM, the PjBL approach, and character formation holds great potential in creating meaningful and useful learning experiences for the scientific and character development of students.

This is in line with the study Ayuni et al. (2022) titled "The Influence of the E-Student Worksheets Assisted by PjBL-STEM Learning Model on Scientific

Thinking Skills and Argumentation Performance of Twelfth Grade Students in Renewable Energy Material." The research explores the impact of this learning model on students' scientific thinking skills and argumentation performance. The study provides insights into the positive effects of the E-Student Worksheets assisted by PjBL-STEM learning model on academic performance and the development of students' skills. Consistent with another study Furthermore, a literature review on project-based learning (PjBL) emphasizes its contribution to academic achievement and students' scientific attitudes. This review highlights the significant effects of PjBL-STEM on students' scientific attitudes, curiosity, openness, and collaboration with others, demonstrating the positive impact of PjBL-STEM on students' development (Nurhidayah et al., 2021). Additionally, a study on the influence of project-based learning (PBL) in science, technology, engineering, and mathematics (STEM) on students' achievement in mathematics topics shows favorable results when implementing STEM PBL lessons in schools. This study further supports the effectiveness of project-based learning in improving students' achievements (Han et al., 2016). These findings affirm the positive impact of this learning approach on learning outcomes and the mastery of students' skills.

Furthermore, the use of technology in Student Worksheets can assist students in analyzing complex data, simulations, and decision-making based on data, this creates a more interactive and profound learning experience (Agustina & Yanthi, 2023; Efriani et al., 2023; Hamidah et al., 2023). Students will also understand how technology can be used to enhance efficiency and innovation in STEM projects. Thus, the integration of Student Worksheets PjBL with the STEM approach, which includes technology and artificial engineering, not only provides a deeper insight into science and technology but also prepares students to meet the demands of a workforce increasingly connected to high technology and innovation. This creates a learning experience that is relevant, practical, and in line with the advancements of the times.

Effective learning involves not only acquiring academic skills but also the formation of a strong character, which is crucial. E-Student Worksheets PjBL based on STEM has a highly relevant goal, which is to shape the character of students alongside the development of their academic abilities. Through this approach, students not only master scientific and technological content but also acquire important values such as teamwork, resilience, responsibility, and work ethics. Project-based learning in the STEM context emphasizes collaboration and problem-solving that aligns with real-world challenges. In this process,

students learn to communicate effectively, manage their time, overcome obstacles, and collaborate within a team. All of these are crucial aspects in the formation of a strong character.

This is reinforced by the research (Setyosari, 2017) titled "Creating Effective and Quality Learning," which discusses that effective learning is not only related to the achievement of specific learning goals but also involves many interconnected aspects, including the development of strong character. Effective learning involves many interconnected elements, not only related to the quality of learning but also to the formation of students' character. Furthermore, for character education to be effective, it emphasizes the importance of designing character education based on classroom and the interaction between teachers and students in forming a holistic character. Therefore, the development of a strong character is crucial in effective learning, and these articles provide support for this statement.

Conclusion

The development of STEM-based PjBL E-Student Worksheets shows tremendous potential in shaping students' characters while enhancing their academic abilities. The integration of technology and project-based learning (PjBL) creates interactive and contextual learning experiences, preparing students to face the technological challenges of the workforce. The feasibility and practicality results indicate that STEM-based PjBL E-Student Worksheets is not only content-valid but also practical in its implementation. Positive responses from students affirm their engagement in the learning process, providing evidence that this E-Student Worksheets is effective in fostering character development, including collaboration skills, responsibility, and work ethics. This study aligns with previous research indicating the positive impact of PjBL-STEM approaches on learning outcomes and character development in students. Therefore, the integration of STEM-based PjBL E-Student Worksheets is an effective and relevant educational strategy in creating meaningful learning experiences and supporting the scientific and character development of students.

Acknowledgments

The author would like to thank both parents who have provided support. Furthermore, she would like to thank the providers of PNPB funds from the Teaching and Education Faculty and all parties who cannot be mentioned one by one who contributed to the smooth running of this research.

Author Contributions

Conceptualization, RSB.; methodology, H. and JS.; validation, H. and JS.; formal analysis, RSB.; investigation, JS.; resources, RSB.; data curation, JS supervisor in research activities to article writing, reviewed and edited JS. H. and RSB.

Funding

This research was funded by the Research Grant from the Faculty of Education and Teacher Training (FKIP) at the University of Jambi.

Conflicts of Interest

The authors declare that there is no conflict of interest regarding the publication of this paper

References

- Adawiyah, R., Zaini, M., & Ajizah, A. (2022). Hasil Belajar Dan Keterampilan Berpikir Kritis Peserta Didik Menggunakan LKPD-Elektronik Konsep Virus. *Practice Of The Science Of Teaching Journal: Jurnal Praktisi Pendidikan*, 1(2), 78–87. <https://doi.org/10.58362/hafecspost.v1i2.18>
- Agustina, N. S., & Yanthi, N. (2023). Development of STEM-based Worksheet in Elementary School. *Jurnal Penelitian Pendidikan IPA*, 9(5), 3839–3848. <https://doi.org/10.29303/jppipa.v9i5.3501>
- Appio, F. P., Lima, M., & Paroutis, S. (2019). Understanding Smart Cities: Innovation ecosystems, technological advancements, and societal challenges. *Technological Forecasting and Social Change*, 142, 1–14. <https://doi.org/10.1016/j.techfore.2018.12.018>
- Ardianti, Y., & Amalia, N. (2022). Kurikulum Merdeka: Pemaknaan Merdeka Dalam Perencanaan Pembelajaran Di Sekolah Dasar. *Jurnal Penelitian Dan Pengembangan Pendidikan*, 6(3), 399–407. <https://doi.org/10.23887/jpppp.v6i3.55749>
- Ashari, R. M. R., Suwono, H., & Fachrunnisa, R. (2021). Students HOTS In Pjbl Based STEM Learning In Biology Classroom: An Experimental Analysis. *AIP Conference Proceedings*, 2330, 030013. <https://doi.org/10.1063/5.0043256>
- Asrizal, Usmeldi, & Azriyanti, R. (2023). Meta-Analysis of the Influence of the STEM-Integrated Learning Model on Science Learning on 21st Century Skills. *Jurnal Penelitian Pendidikan IPA*, 9(8), 339–347. <https://doi.org/10.29303/jppipa.v9i8.3094>
- Ayuni, M. S., Distrik, I. W., & Viyanti, V. (2022). The Effect of E-LKPD Assisted PjBL-STEM Learning Model on Scientific Reasoning Ability and Argumentation Performance of Class XII Science Students in Renewable Energy Materials. *Physics Education Research Journal*, 4(1), 79–86. <https://doi.org/10.21580/perj.2022.4.2.12634>

- Barlenti, I., Hasan, M., & Mahidin, D. (2017). Pengembangan Lks Berbasis Project Based Learning Untuk Meningkatkan Pemahaman Konsep. *Jurnal Pendidikan Sains Indonesia*, 5(1), 81–86. <http://jurnal.unsyiah.ac.id/jpsi>
- Brown, J., Bearman, M., Kirby, C., Molloy, E., Colville, D., & Nestel, D. (2019). Theory, a lost character? As presented in general practice education research papers. *Medical Education*, 53(5), 443–457. <https://doi.org/10.1111/medu.13793>
- Caena, F., & Redecker, C. (2019). Aligning teacher competence frameworks to 21st century challenges: The case for the European Digital Competence Framework for Educators (Digcompedu). *European Journal of Education*, 54(3), 356–369. <https://doi.org/10.1111/ejed.12345>
- Capraro, M. M., & Jones, M. (2013). Interdisciplinary Stem Project-Based Learning. In *STEM Project-Based Learning*, 51–58. https://doi.org/10.1007/978-94-6209-143-6_6
- Celikler, D., & Aksan, Z. (2012). The Effect of the Use of Worksheets About Aqueous Solution Reactions on Pre-service Elementary Science Teachers' Academic Success. *Procedia - Social and Behavioral Sciences*, 46, 4611–4614. <https://doi.org/10.1016/j.sbspro.2012.06.306>
- Cholifah, S. N., & Novita, D. (2022). Pengembangan E-LKPD Guided Inquiry-Liveworksheet untuk Meningkatkan Literasi Sains pada Submateri Faktor Laju Reaksi. *Chemistry Education Practice*, 5(1), 23–34. <https://doi.org/10.29303/cep.v5i1.3280>
- Dermawati, N., Suprpta, & Muzakkir. (2019). Pengembangan lembar kerja peserta didik (LKPD) berbasis lingkungan. *Jurnal Pendidikan Fisika*, 7(1), 74–78. <https://doi.org/10.24252/jpf.v7i1.3143>
- Dewi, R., Budiarti, R. S., & Aina, M. (2018). Pengembangan Lembar Kegiatan Peserta Didik (LKPD) Bermuatan Pendidikan Karakter Dengan Model Pembelajaran Guided Inquiry Pada Materi Bakteri Bagi Siswa Kelas X Sekolah Menengah Atas. *Biodik*, 3(1), 17–26. <https://doi.org/10.22437/bio.v3i1.4878>
- Dewi, W. S., Safitri, G., & Mairizwan. (2023). The Practicality of the Physics Module Based on the PjBL Model with a Portfolio Assessment to Improve Students' Critical Thinking Skills. *Journal of Physics: Conference Series*, 2582(1), 012054. <https://doi.org/10.1088/1742-6596/2582/1/012054>
- Dini Rahma Diani, Nurhayati, D. S. (2019). Pengembangan Lembar Kerja Peserta Didik (LKPD) Menulis Cerpen Berbasis Aplikasi Android Dini Rahma Diani, Nurhayati, D. S. (2019). Pengembangan Lembar Kerja Peserta Didik (LKPD) Menulis Cerpen Berbasis Aplikasi Android. *Jurnal Bahasa, Sastra, Dan Pengajara. Jurnal Bahasa, Sastra, Dan Pengajarannya*, 7, 2. <https://doi.org/10.20961/basastra.v7i2.37800>
- Efriani, A., Zulkardi, Putri, R. I. I., & Aisyah, N. (2023). Developing A Learning Environment Based On Science, Technology, Engineering, And Mathematics For Pre-Service Teachers Of Early Childhood Teacher Education. *Journal on Mathematics Education*, 14(4), 647–662. <https://doi.org/10.22342/jme.v14i4.pp647-662>
- Fang, Y., Zheng, Y., Fang, T., Chen, Y., Zhu, Y., Liang, Q., Sheng, H., Li, Z., Chen, C., & Wang, X. (2020). Photocatalysis: An Overview Of Recent Developments And Technological Advancements. *Science China Chemistry*, 63(2), 149–181. <https://doi.org/10.1007/s11426-019-9655-0>
- Fikriana, M. F., Wiyanto, W., & Haryani, S. (2023). Development of the Diary Book of Science with the STEM Approach of Discovery in Improving Students' Concept Understanding and Scientific Communication Skills. *Jurnal Penelitian Pendidikan IPA*, 9(4), 1641–1649. <https://doi.org/10.29303/jppipa.v9i4.3032>
- Fitriasari, D. N. M., & Yuliani, Y. (2021). Pengembangan Lembar Kegiatan Peserta Didik-Elektronik (E-LKPD) Berbasis Guided Discovery untuk Melatihkan Keterampilan Proses Sains Terintegrasi pada Materi Fotosintesis Kelas XII SMA. *Berkala Ilmiah Pendidikan Biologi (BioEdu)*, 10(3), 510–522. <https://doi.org/10.26740/bioedu.v10n3.p510-522>
- Friska, S. Y., Nanda, D. W., & Husna, M. (2022). Pengembangan e-LKPD dengan 3D Pageflip Professional Berbasis Problem Solving pada Tema Lingkungan Sahabat Kita di Sekolah Dasar. *Jurnal Basicedu*, 6(2), 3200–3206. <https://doi.org/10.31004/basicedu.v6i2.1685>
- Hamidah, A., Ayunasari, D. S., & Sanjaya, E. (2023). Development of E-LKPD in Motion System Materials for High School Class Using PageFlip 3D Software. *Jurnal Penelitian Pendidikan IPA*, 9(3), 1233–1241. <https://doi.org/10.29303/jppipa.v9i3.3396>
- Han, S., Rosli, R., Capraro, M. M., & Capraro, R. M. (2016). The Effect Of Science, Technology, Engineering And Mathematics (STEM) Project Based Learning (PBL) On Students' Achievement In Four Mathematics Topics. *Journal of Turkish Science Education*, 13(Specialissue), 3–30. <https://doi.org/10.12973/tused.10168a>
- Hasibuan, M. P., Sari, R. P., Syahputra, R. A., & Nahadi, N. (2022). Application Of Integrated Project-Based And STEM-Based E-Learning Tools To Improve

- Students' Creative Thinking And Self-Regulation Skills. *Jurnal Penelitian Pendidikan IPA*, 8(1), 51-56. <https://doi.org/10.29303/jppipa.v8i1.1050>
- Hidayah, I. N., & Kuntjoro, S. (2022). Pengembangan E-LKPD Perubahan Lingkungan Berbasis Science Literacy untuk Melatihkan Keterampilan Berpikir Kritis Peserta Didik Kelas X SMA. *Berkala Ilmiah Pendidikan Biologi (BioEdu)*, 11(2), 384-393. <https://doi.org/10.26740/bioedu.v11n2.p384-393>
- Hidayat, T., Irwandi, I., Nasral, N., & Asmara, L. Y. (2022). Analysis of the Application of Character Education in Genetic Engineering Materials. *Jurnal Penelitian Pendidikan IPA*, 8(3), 1385-1388. <https://doi.org/10.29303/jppipa.v8i3.1499>
- Indasari, M. (2018). Mendidik Karakter Anak melalui Model Pembelajaran Berbasis Proyek (Sebuah Desain Pembelajaran Matematika yang Berkarakter). *Scholaria: Jurnal Pendidikan Dan Kebudayaan*, 8(1), 105-108. <https://doi.org/10.24246/j.js.2018.v8.i1.p105-108>
- Irawan, H., & Masyitoh, I. S. (2023). Implementation of Collaborative Learning Model In Realizing Gotong Royong Character As An Effort To Strengthen Profil Pelajar Pancasila At SMP Negeri 1 Belitang Madang Raya. *Proceedings of International Conference on Education Teacher Training & Education Faculty Universitas Serambi Mekkah* 2987-4564. Retrieved from <https://jurnal.serambimekkah.ac.id/index.php/ice/article/view/425>
- Jacobs, A. C., & van Jaarsveldt, D. E. (2016). "The Character Rests Heavily Within Me": Drama Students As Standardized Patients In Mental Health Nursing Education. *Journal of Psychiatric and Mental Health Nursing*, 23(3-4), 198-206. <https://doi.org/10.1111/jpm.12302>
- Jalinus, N., & Nabawi, R. A. (2018). The Instructional Media Development Of Welding Practice Course Based On Pjbl Model: Enhancing Student Engagement And Student Competences. *International Journal of Innovation and Learning*, 24(4), 383-397. <https://doi.org/10.1504/IJIL.2018.095365>
- Jalinus, N., Nabawi, R. A., & Mardin, A. (2017). The Seven Steps of Project Based Learning Model to Enhance Productive Competences of Vocational Students. *Proceeding of The International Conference on Technology and Vocational Teachers* 2017, 102, 251-256. <https://doi.org/10.2991/ictvt-17.2017.43>
- Jamaluddin, J., Jufri, A. W., & Lestari, T. A. (2022). Strengthening Student Character Education Through Biology Learning in High School. *Jurnal Penelitian Pendidikan IPA*, 8(2), 975-984. <https://doi.org/10.29303/jppipa.v8i2.1575>
- Kadek Suartama, I., Usman, M., Triwahyuni, E., Subiyantoro, S., Abbas, S., Umar, Hastuti, W. D., & Salehudin, M. (2020). Development Of E-Learning Oriented Inquiry Learning Based On Character Education In Multimedia Course. *European Journal of Educational Research*, 9(4), 1591-1603. <https://doi.org/10.12973/EU-JER.9.4.1591>
- Kartini, F. S., Widodo, A., Winarno, N., & Astuti, L. (2021). Promoting Student's Problem-Solving Skills through STEM Project-Based Learning in Earth Layer and Disasters Topic. *Journal of Science Learning*, 4(3), 257-266. <https://doi.org/10.17509/jsl.v4i3.27555>
- Khoiri, N., Kurniawan, A. F., & Ismawati, E. Y. (2023). Analisis Validasi e-LKPD berbasis PBL pada Topik Pengukuran Besaran Fisis Kelas X SLTA. *Jurnal Penelitian Pembelajaran Fisika*, 14(2), 251-255. <https://doi.org/10.26877/jp2f.v14i2.17268>
- Koh, J. H., Chai, C. S., & Natarajan, U. (2018). Developing Indonesia teachers' technological pedagogical content knowledge for 21 st century learning (TPACK-21CL) through a multi-prong approach. *Journal of International Education and Business*, 3(1), 11-33. Retrieved from http://crie.org.nz/journal/vol3no1/Koh%20et%20al%20TPACK_indonesia.pdf
- Kurniatullaila, & Albahri, F. P. (2022). Tips for Religious Teachers When Implementing Religious Curriculum. *International Journal Education and Computer Studies (IJECs)*, 2(2), 54-60. <https://doi.org/10.35870/ijecs.v2i2.792>
- Lely, P., Prabawati, S., Ngurah, G., & Agustika, S. (2020). Project-Based Learning Based On Stem (Science, Technology, Engineering, And Mathematics) Enhancing Students Science Knowledge Competence. *Jurnal Ilmiah Sekolah Dasar*, 4(4), 621-629. <https://doi.org/10.23887/jisd.v4i4.26670>
- Linda, D. (2023). Analisis Kebutuhan Pengembangan e-LKPD Berbasis STEM-PjBL pada Materi Koloid untuk Meningkatkan Kemampuan Berpikir Kreatif Siswa. *Jurnal Pendidikan Matematika Dan Sains*. <https://doi.org/10.21831/jpms.v11i1.59399>
- Maduretno, T. W., & Andriani, V. S. (2018). Implementasi Pendidikan Karakter Pada Model Project Based Learning Melalui Sumber Belajar Smartphone. *Jurnal Dharma Pendidikan*, 13(April), 96-104. Retrieved from <https://journal.stkipnganjuk.ac.id/index.php/jdp/article/view/86>
- Mardhatilah, R., Zaini, M., & Kaspul, K. (2022). Pengaruh LKPD-Elektronik Sistem Gerak Terhadap Hasil Belajar Dan Keterampilan Berpikir Kritis Peserta Didik. *Practice of The Science of Teaching Journal: Jurnal Praktisi Pendidikan*, 1(2), 53-64. <https://doi.org/10.58362/hafecspost.v1i2.13>

- Marshel, J., & Ratnawulan. (2020). Analysis of Students Worksheet (LKPD) integrated science with the theme of the motion in life using integrated connected type 21 st century learning. *Journal of Physics: Conference Series*, 1481(1), 012046. <https://doi.org/10.1088/1742-6596/1481/1/012046>
- McGunagle, D., & Zizka, L. (2020). Employability Skills For 21st-Century STEM Students: The Employers' Perspective. *Higher Education, Skills and Work-Based Learning*, 10(3), 591-606. <https://doi.org/10.1108/HESWBL-10-2019-0148>
- Melania, I., Pantjawati, A. B., & Mulyanti, B. (2021). Development of Student Worksheet for Infrared Technology Material Using Project Based Learning and Science Technology Engineering Mathematics Learning Model. *Proceedings of the 6th UPI International Conference on TVET 2020 (TVET 2020)*, 520, 240-243. <https://doi.org/10.2991/assehr.k.210203.125>
- Mishra, P., Bhatnagar, J., Gupta, R., & Wadsworth, S. M. (2019). How work-family enrichment influence innovative work behavior: Role of psychological capital and supervisory support. *Journal of Management and Organization*, 25(1), 58-80. <https://doi.org/10.1017/jmo.2017.23>
- Mukaromah, L., Mustadi, A., & Nisa, A. (2022). Study of STEM Based on Local Wisdom in Hoening Science Process Skills in the 21st Century Era. *Jurnal Penelitian Pendidikan IPA*, 8(3), 1168-1174. <https://doi.org/10.29303/jppipa.v8i3.1445>
- Mukaromah, S. H., & Wusqo, I. U. (2020). The Influence Of Pjbl Model With Stem Approach On Global Warming Topic To Students' Creative Thinking And Communication Skills. *Journal of Physics: Conference Series*, 1521(4), 042052. <https://doi.org/10.1088/1742-6596/1521/4/042052>
- Nazifah, N., & Asrizal, A. (2022). Development of STEM Integrated Physics E-Modules to Improve 21st Century Skills of Students. *Jurnal Penelitian Pendidikan IPA*, 8(4), 2078-2084. <https://doi.org/10.29303/jppipa.v8i4.1820>
- Nurhaisa, N., Khaeruddin, K., & Jasruddin, J. (2023). Physics Student Worksheet Based On Science, Technology, Engineering And Mathematics (STEM) To Practice Creative Thinking Skill. *Jurnal Penelitian Pendidikan IPA*, 9(3), 1451-1456. <https://doi.org/10.29303/jppipa.v9i3.2303>
- Nurhidayah, I. J., Wibowo, F. C., & Astra, I. M. (2021). Project Based Learning (Pjbl) Learning Model In Science Learning: Literature Review. *Journal of Physics: Conference Series*, 2019(1), 3-9. <https://doi.org/10.1088/1742-6596/2019/1/012043>
- Pebriani, N. P. I., I.B. Putrayasa, & I.G. Margunayasa. (2022). Pengembangan E-LKPD Berbasis Hots (Higher Order Thinking Skill) Dengan Pendekatan Saintifik Pada Pembelajaran IPA Tema 8 Kelas V Sd. *Jurnal Penelitian Dan Evaluasi Pendidikan Indonesia*, 12(1), 76-89. <https://doi.org/10.23887/jpepi.v12i1.980>
- Putra, A., Syarifuddin, H., & Zulfah, Z. (2018). Validitas Lembar Kerja Peserta Didik Berbasis Penemuan Terbimbing dalam Upaya Meningkatkan Pemahaman Konsep dan Kemampuan Penalaran Matematis. *Edumatika: Jurnal Riset Pendidikan Matematika*, 1(2), 56. <https://doi.org/10.32939/ejrpm.v1i2.302>
- Putri, A. K. (2023). Applying Project-Based Learning To Reinforce The Students' Character. *Primary: Jurnal Pendidikan Guru Sekolah Dasar*, 12(3), 737. <https://doi.org/10.33578/jpfkip.v12i3.9823>
- Rahim, A. C., Jumadi, Wilujeng, I., & Kuswanto, H. (2019). The Effect of PjBL Model based on Skill Approach Process to Physics Critical Thinking Ability of High School Student. *Journal of Physics: Conference Series*, 1233(1), 012040. <https://doi.org/10.1088/1742-6596/1233/1/012040>
- Rahmania, I. (2021). Project Based Learning (PjBL) Learning Model with STEM Approach in Natural Science Learning for the 21st Century. *Budapest International Research and Critics Institute (BIRCI-Journal): Humanities and Social Sciences*, 4(1), 1161-1167. <https://doi.org/10.33258/birci.v4i1.1727>
- Ranti, S., & Usmeldi. (2019). Development of integrated science student's worksheet (LKPD) based on research-based learning integrated with religion value. *Journal of Physics: Conference Series*, 1185(1), 012143. <https://doi.org/10.1088/1742-6596/1185/1/012143>
- Ratnasari, R., Doyan, A., & Makhrus, M. (2023). Pengembangan Perangkat Pembelajaran Berbasis Proyek Terintegrasi STEM pada Materi Suhu dan Kalor untuk Meningkatkan Keterampilan Generik Sains Dan Kreativitas Peserta Didik: Instrumen Validasi. *Jurnal Penelitian Pendidikan IPA*, 9(9), 6992-6999. <https://doi.org/10.29303/jppipa.v9i9.4178>
- Rifai, I., Setiadi, C. J., Renaldo, J., & Andreani, W. (2021). Toward society 5.0: Indonesia and Japan on the 21stcentury literacy skills. *IOP Conference Series: Earth and Environmental Science*, 729(1), 0-7. <https://doi.org/10.1088/1755-1315/729/1/012102>
- Rinnanik, Novaria, R., Mukholid, A., & Fradito, A. (2023). Development of Natural Science Learning Designs to Improve The Character of Pancasila Students in Critical and Creative Reasoning

- Aspects. *Jurnal Penelitian Pendidikan IPA*, 9(10), 8751-8758.
<https://doi.org/10.29303/jppipa.v9i10.5459>
- Riyanto, S. &. (2018). Pengembangan E-LKPD berbasis PjBL Untuk Meningkatkan Kemampuan Berpikir Kritis Dan Keterampilan Proses Sains Mahasiswa Pendidikan Biologi Di Universitas Negeri Semarang. *EduFisika Jurnal Pendidikan Fisika*, 7, 1-8. Retrieved from <https://online-journal.unja.ac.id/EDP/article/view/16401>
- Rizqika, P., Hobri, & Pratama Murtikusuma, R. (2019). Pengembangan Perangkat Pembelajaran Berbasis Problem Based Learning Dan Jumping Task Pada Pokok Bahasan Kaidah Pencacahan Untuk Siswa Sma. *Kadikma*, 10(1), 13-24. Retrieved from <https://jurnal.unej.ac.id/index.php/kadikma/article/download/11654/6829>
- Safaruddin, S., Ibrahim, N., Juhaeni, J., Harmilawati, H., & Qadrianti, L. (2020). The Effect of Project-Based Learning Assisted by Electronic Media on Learning Motivation and Science Process Skills. *Journal of Innovation in Educational and Cultural Research*, 1(1), 22-29. <https://doi.org/10.46843/jiecr.v1i1.5>
- Safitri, N., & Tanjung, I. F. (2023). Development of STEM-Based Student Worksheets on Virus Material to Improve Student Science Literacy. *Jurnal Penelitian Pendidikan IPA*, 9(3), 1457-1464. <https://doi.org/10.29303/jppipa.v9i3.3288>
- Salsabila, U. H., Khoirunnisa, J. F., Herbanu, R., Saputra, I., & Hafidhdin, M. (2022). Teknologi Pendidikan Berbasis Blended Learning Dalam Pembelajaran Pendidikan Agama Islam. *Jurnal Educatio*, 8(4), 1634-1640.
<https://doi.org/10.31949/educatio.v8i4.4116>
- Santika, I. W. E. (2020). Pendidikan Karakter pada Pembelajaran Daring. *Indonesian Values and Character Education Journal*, 3(1), 8-19.
<https://doi.org/10.23887/ivcej.v3i1.27830>
- Sawu, M. R. F., Sukarso, A., Lestari, T. A., & Handayani, B. S. (2023). Effect of STEM Learning in Building Creative Dispositions and Creative Thinking Skills of Junior High School Students. *Jurnal Penelitian Pendidikan IPA*, 9(8), 6219-6229.
<https://doi.org/10.29303/jppipa.v9i8.4180>
- Setyosari, P. (2017). Menciptakan Pembelajaran Yang Efektif Dan Berkualitas. *JINOTEP (Jurnal Inovasi Dan Teknologi Pembelajaran) Kajian Dan Riset Dalam Teknologi Pembelajaran*, 1(5), 20-30.
<https://doi.org/10.17977/um031v1i12014p020>
- Shalahuddin, M. H., & Hayuhantika, D. (2022). Pengembangan E-LKPD Berbasis Kontekstual dengan Media Liveworksheets Pada Materi Lingkaran Di Kelas VIII. *Jurnal Tadris Matematika*, 5(1), 71-86.
<https://doi.org/10.21274/jtm.2022.5.1.71-86>
- Sudarmin, S., Sumarni, W., Rr. Sri Endang, P., & Sri Susilogati, S. (2019). Implementing The Model Of Project-Based Learning : Integrated With ETHNO-STEM To Develop Students' Entrepreneurial Characters. *Journal of Physics: Conference Series*, 1317(1), 012145. <https://doi.org/10.1088/1742-6596/1317/1/012145>
- Sugiyono. (2016) Metode Penelitian Kuantitatif, Kualitatif, dan R & D. Jakarta: Alfabeta.
- Sujanem, R. (2012). Pengembangan Modul Fisika Kontekstual Interaktif Berbasis Web untuk Meningkatkan Pemahaman Konsep dan Hasil Belajar Fisika Siswa SMA di Singaraja. *Jurnal Nasional Pendidikan Teknik Informatika (JANAPATI)*, 1(2), 103.
<https://doi.org/10.23887/janapati.v1i2.9825>
- Suryanto, A., Saliman, S., & Sudrajat, S. (2023). Weakness of Character Education in Indonesian Teenager. *Jurnal Penelitian Pendidikan IPA*, 9(5), 3869-3874.
<https://doi.org/10.29303/jppipa.v9i5.3721>
- Syukri, M., Yanti, D. A., Mahzum, E., & Hamid, A. (2021). Development of a PjBL Model Learning Program Plan based on a STEM Approach to Improve Students' Science Process Skills. *Jurnal Penelitian Pendidikan IPA*, 7(2), 269-274.
<https://doi.org/10.29303/jppipa.v7i2.680>
- Wahono, R. H. J., Supeno, S., & Sutomo, M. (2022). Pengembangan E-LKPD dengan Pendekatan Saintifik untuk Meningkatkan Keterampilan Berpikir Kritis Siswa Sekolah Dasar dalam Pembelajaran IPA. *Jurnal Basicedu*, 6(5), 8331-8340.
<https://doi.org/10.31004/basicedu.v6i5.3743>
- Watson, L. (2019). Educating for inquisitiveness: A case against exemplarism for intellectual character education. *Journal of Moral Education*, 48(3), 303-315.
<https://doi.org/10.1080/03057240.2019.1589436>
- Windari, G. I., Rahayu, Y. S., & Dewi, S. K. (2022). Pengembangan E-LKPD Materi Pertumbuhan dan Perkembangan Berorientasi Pendekatan Saintifik untuk Melatihkan Keterampilan Proses Sains. *Berkala Ilmiah Pendidikan Biologi (BioEdu)*, 11(3), 537-548. <https://doi.org/10.26740/bioedu.v11n3.p537-548>