Jurnal Paedagogy:
Jurnal Penelitian dan Pengembangan Pendidikan
https://e-journal.undikma.ac.id/index.php/pedagogy/index
Email:paedagogy@undikma.ac.id

Vol. 12 No. 4 : October 2025
E-ISSN: 2722-4627
pp. 1279-1290

Development of the EDU-ECON E-Module Based on Problem-Based Learning to Enhance Students' Critical Thinking Skills on the Topic of Economic Actors

Nadhia Yuliana*, Retno Mustika Dewi
Economic Education, Faculty of Economic and Business,
Universitas Negeri Surabaya, Indonesia.
*Corresponding Author. Email: nadhia.21010@mhs.unesa.ac.id

Abstract: This development research aimed to create a problem-based learning (PBL)-based EDU-ECON e-module and to evaluate its feasibility, effectiveness, and practicality using the ADDIE development model. The research subjects were 36 students from Class X-3 at State Senior High School 21 Surabaya. The research instruments included interview guidelines for the economics teacher, questionnaires, and pre-test and post-test assessments. Data were analyzed using descriptive statistics and t-tests. The results showed that the developed e-module was feasible for use, with average validation scores of 92% from media experts and 90.67% from content experts, classifying it as highly valid. The module's effectiveness was also high, with an N-gain value of 0.76, indicating its ability to improve students' critical thinking skills. Furthermore, student responses were positive, with a practicality score of 82.45%, categorized as very practical. Therefore, the developed e-module is both feasible and effective in enhancing students' critical thinking skills.

Article History
Received: 17-07-2025
Revised: 24-08-2025
Accepted: 10-09-2025
Published: 25-10-2025

Key Words:
E-Module; Problem Based Learning; Critical Thinking

How to Cite: Yuliana, N., & Dewi, R. M. (2025). Development of the EDU-ECON E-Module Based on Problem-Based Learning to Enhance Students' Critical Thinking Skills on the Topic of Economic Actors. *Jurnal Paedagogy*, *12*(4), 1279-1290. https://doi.org/10.33394/jp.v12i4.17028

https://doi.org/10.33394/jp.v12i4.17028

Introduction

Technological and scientific developments in the 21st century have driven significant transformations, particularly through rapid advances in Information and Communication Technology (ICT), which have made various aspects of life more convenient and efficient. Therefore, technological progress needs to be balanced with improvements in the quality of human resources through high-quality education (Rahma et al., 2024). In this century, as knowledge and technology have advanced, education has also experienced substantial changes as a result of these innovations (Alisa H. Kadir et al., 2024). The development of better quality human resources requires an improvement in educational standards. This change is supported by advances in Information and Communication Technology (ICT) in the field of education, which has encouraged a shift in the learning approach from one that focused on the role of teachers to one that is more oriented towards students (Ulfa & Sari, 2021).

In this century, students actively participate in the educational process, so cooperation between schools, teachers, students, and a number of more stakeholders are required to facilitate learning that is relevant to real life, therefore, teachers must apply methods that encourage students to apply the knowledge, values, and beliefs they have acquired during learning, 21st-century learning is characterized by the 4C: Critical Thinking, Creativity, Communication, and Collaboration (Nurhayati et al., 2024), so, it can be said that learning in the 21st century does not only focus on mastering material, but also on implementing

creativity, critical thinking, problem solving, and communication skills to improve oneself in order to be able to compete competitively (Sumardi et al., 2020).

Technological advances and scientific developments require teachers to continuously develop their skills so that they can act as facilitators who facilitate the learning process and encourage students to be courageous and active in learning (Fardany & Dewi, 2020). Technology use in the classroom can boost student interest in the process and help them develop abilities like creativity, problem-solving, and teamwork. (Vlachopoulos & Makri, 2024), the role of teachers as facilitators. The impact of this technological advancement requires teachers to create a learning environment that encourages active student engagement through the use of digital technology, the use of innovative instructional methods, and differentiated strategies aimed at addressing each student's unique learning needs (Darling-Hammond et al., 2020). One may argue that a more interactive and collaborative learning environment is greatly facilitated by the usage of technology in the classroom, making instructors' roles as facilitators more effective in helping students acquire 21st century skills (Mardiana et al., 2024).

Based on the various statements presented, it can be said that one of the skills that must be developed is critical thinking in education. This skill refers to the ability to understand and accept other people's opinions well, as well as training someone to think logically (Ardiansyah et al., 2022). Critical thinking includes focus, reason, inference, situation, clarity, and overview (Fatmarani & Setianingsih, 2022). Critical thinking skills do not come naturally, but need to be trained through a learning process in order to develop properly (Legina & Sari, 2022). By emphasizing problem based, exploratory, or discovery approaches, learning strategies can help improve critical thinking skills, enabling teachers to design learning strategies that focus on problem solving, exploration, or discovery (Dwijayanti et al., 2020).

In actuality, the critical thinking skills of students in Indonesia are considered low (Rahayu & Alyani, 2020), as evidenced by data from the Programme for International Students Assessment (PISA) which shows that in 2018 Indonesia experienced a decline, ranking 74th out of 79 countries (Rangkuti et al., 2023), and in 2022 Indonesia ranked 66th out of 81 countries, although its ranking improved compared to 2018. Indonesia's PISA scores have declined, and these PISA data results are a benchmark that the abilities of students in Indonesia are still relatively low and efforts are needed to improve them (Aggraini et al., 2024), as well as teachers' reports that 65.7% of students did not show significant progress (Atma et al., 2021). This confirms the need for solutions to improve critical thinking skills in line with the demands of 21st century learning.

Actual conditions, the critical thinking skill of pupils at State Senior High School 21 Surabaya remain low, according to evidence gathered by researchers through observations and interviews. This is a result of students' inadequate understanding of the subject matter, which is centered on teacher explanations, and the fact that teacher approaches continue to dominate learning activities and a lack of diverse media in teaching, with teachers still relying on blackboards as their main teaching aids. Additionally, classroom learning activities also focus on completing worksheets that are not directly created by the teacher but rather from student worksheets containing subject matter and practice questions. As a result, students passively participate in providing feedback, asking questions, and expressing opinions during the learning process because they only listen to the material presented by the teacher. This statement is reinforced by data from X-3 students through daily tests in economics with material on economic actors, which shows that students did not achieve mastery. The

Jurnal Paedagogy:
Jurnal Penelitian dan Pengembangan Pendidikan
https://e-journal.undikma.ac.id/index.php/pedagogy/index
Email:paedagogy@undikma.ac.id

Vol. 12 No. 4 : October 2025
E-ISSN: 2722-4627
pp. 1279-1290

Minimum Competency Criteria for the economics subject is set at 78. Out of 36 students, 33 did not achieve competency in the economic actors material. This suggests that students are struggling to understand the economic actors material.

Regarding these concerns, educators must use student-centered approaches to modify their instruction to meet the requirements of their students, encourage critical thinking and curiosity, and explicitly train cognitive skills through practice and feedback (Leibovitch et al., 2025). Through the problem-based learning approach, students are able to develop and assess their critical thinking abilities to effectively solve problems (Windi Mareti & Herlina Dwi Hadiyanti, 2023). Problem based learning is an instructional model that uses real life issues as a context to develop students' critical thinking abilities through problem solving activities and understanding key concepts (Aslan, 2021). In addition, this model places students at the center of learning based on the principles of learning (Trullàs et al., 2022), so that this model can encourage students to learn independently in order to foster awareness, initiative, and creative spirit within themselves (Ding & Zhang, 2018).

This problem based learning model is based on constructivist theory, which requires active participation from students in understanding knowledge, developing critical thinking skills, and analyzing and applying solutions to real life problems (Salsabila & Muqowim, 2024). This model is related to constructivism theory in improving critical thinking skills, namely encouraging active involvement of students in analyzing and solving problems in accordance with constructivism principles through student-centered learning to build knowledge independently (Husna, 2023).

Learning through e-modules adopts the problem based learning model as its instructional approach. E-modules are media for structured learning that contain materials, methods, and evaluations to support the achievement of learning objectives (Kautsari et al., 2023), so that teachers can facilitate learning activities with e-modules that enable students to practice their independence in seeking and acquiring knowledge without having to rely on information provided by teachers (Laili et al., 2019).

Previous research supports this study (Ridlo et al., 2024) which offers the findings of studies on the creation of e-modules for natural science courses that use problem-based learning, using Google Collaboratory for design and assisted by canva and flip pdf professional applications in the design process. Students' critical thinking abilities have improved because to this e-module. What distinguishes this research from previous studies is that it develops educational media using a problem-based learning model grounded in constructivist theory principles, with the aim of improving students' critical thinking skills, as indicated by the following indicators focus, reason, inference, situation, clarity, and overview.

Based on the description of the background and previous research, it provides researchers with the view that the development of interactive learning media in the form of e-modules with a problem based learning model on economic actors material has the potential to become an innovative and practical learning resource that can improve critical thinking skills. The product to be developed in this study is an EDU-ECON e-module with the term Education in Economic. This product is designed in accordance with the syntax of problem-based learning by summarizing important points and presenting them in the form of exercises so that students can actively participate during learning activities.

Research Method

The Research and Development (R&D) approach is used in this study. This kind of research aims to develop a particular product and evaluate its efficacy (Sugiyono, 2017). This

Vol. 12 No. 4 : October 2025
E-ISSN: 2722-4627
pp. 1279-1290

development uses the ADDIE model, which provides flexible guidelines and helps learning designers create effective support tools through five stages, including Analyze, Design, Development, Implementation, dan Evaluation (Sharifah & Faaizah, 2015).

The study's subjects were 36 students from class X-3 at State Senior High School 21 Surabaya. This study, which used purposive sampling, focused on students who could use cell phones and were interested in learning economics more especially, the issue of economic actors through e-module learning materials.

This study used a pretest-posttest group design, in which the test was conducted on one group that was given a pretest, followed by treatment with a posttest. The pretest and posttest were conducted during three meetings in class X-3 at State Senior High School 21 Surabaya. Data collection was conducted using various instruments, including interviews, expert validation questionnaires for media and content experts, student response questionnaires, as well as pretest and posttest questions. In addition, an N-gain score calculation was conducted to determine the effectiveness of the e-module media in improving students' critical thinking skills. The next analysis technique is normality, which aims to determine whether the data has a normal distribution or not, and t-tests, which aim to analyze the differences in paired data from one group that was given different treatments in the pretest and posttest.

Results and Discussion

Analysis Stage

Needs Analysis

Researchers carried out this analysis to ascertain how educators employ learning media as well as the models and techniques they employ in their lesson plans. The data obtained from interviews with economics teachers revealed that economics learning activities primarily focused on teacher based methods, whiteboard based media, and power point presentations dominated by text, as well as practice exercises through student worksheets. This aligns with data from students, the majority of whom agreed that learning was theoretical and monotonous, leading to boredom and a decline in learning interest.

Student Analysis

This analysis was conducted by distributing questionnaires to 36 students in class X-3 to tailor learning media to the needs and characteristics of the students. The findings demonstrated that every student could use a smartphone. Additionally, economic learning activities were still dominated by the use of worksheets as the primary source for understanding the material, indicating limitations in the use of more varied and interactive media, which hindered students' understanding of the material presented during learning.

The solution to creating interesting learning, reducing boredom, and improving student understanding can be done by selecting the right learning media. The majority of students agree with the use of interesting and varied learning media, such as text, images, videos, and animations, so that it can improve understanding and reduce boredom in learning activities, as well as the use of e-modules as learning media in economics subjects, especially material on economic actors.

The selection of e-module as a learning medium is based on their effectiveness in helping students understand the material, which is easily accessible anytime and anywhere, thereby supporting independent learning among students (Saidah et al., 2024). The e-module foundation is problem based learning, which prioritizes problem solving, enhancing critical thinking abilities, and enhancing the significance and relevance of learning (Hidayanti et al., 2022).

Jurnal Paedagogy:
Jurnal Penelitian dan Pengembangan Pendidikan
https://e-journal.undikma.ac.id/index.php/pedagogy/index
Email:paedagogy@undikma.ac.id

Vol. 12 No. 4 : October 2025
E-ISSN: 2722-4627
pp. 1279-1290

Curriculum and Material Analysis

Curriculum and material analysis at State Senior High School 21 Surabaya has implemented the merdeka curriculum. Thus, e-modules have been systematically developed based on learning outcomes, learning objectives, and learning objective flows in accordance with the curriculum, with a focus on economic actors in the classroom.

Design Stage

In this design stage, researchers plan and design products by collecting content references to compile economic actor materials. Researchers select media, choosing problem based learning e-modules as learning media designed with consideration for student characteristics and the independent curriculum. E-modules are compiled in text, image, video, and animation formats and contain learning components.

At this stage of the design process, colors, fonts, and design applications were also selected. Blue was chosen as the base color for the e-module design. Blue is a cool color and is often associated with idealism, conservatism, and predictability, giving the impression of calmness, freedom, and life (Ferninaindis et al., 2020). To create the design, researchers used figma software, as it supports the creation of compatible responsive designs. In addition to its attractive appearance, the e-module design output can be accessed via a website without requiring large storage space or additional applications. Figure 1 shows the logo and cover of the e-module, which serve as its identifier.

Figure 1. Logo and Cover of the E-Module

Figure 2. E-Modul Main Menu

Figure 2 shows the e-module main menu, which serves as a navigation center containing various features, such as learning activities, references, and developer profiles. This menu also includes components such as usage instructions, learning outcomes, learning objectives, and learning objective flow, materials, videos, and practice questions. Figure 3 shows the core components that contain learning outcomes, learning objectives, and learning objective flow.

Jurnal Paedagogy:
Jurnal Penelitian dan Pengembangan Pendidikan
https://e-journal.undikma.ac.id/index.php/pedagogy/index
Email:paedagogy@undikma.ac.id

Vol. 12 No. 4 : October 2025
E-ISSN: 2722-4627
pp. 1279-1290

Figure 3. Core Components

Figure 4. Learning Activities

Figure 4 shows the learning activities structured around the five stages of the problem based learning syntax, emphasizing problem solving.

Figure 5. Learning Materials

Figure 5 shows learning materials designed to help students understand economic actors.

Figure 6. Practice Questions

Figure 6 shows practice questions that include analysis and evaluation questions.

Jurnal Paedagogy:
Jurnal Penelitian dan Pengembangan Pendidikan
https://e-journal.undikma.ac.id/index.php/pedagogy/index
Email:paedagogy@undikma.ac.id

Vol. 12 No. 4 : October 2025
E-ISSN: 2722-4627
pp. 1279-1290

Development Stage

After the e-module learning media prototype is finished, researchers begin the development phase. The finished product undergoes a validation process before being tested to obtain assessments, comments, and suggestions, thereby obtaining product feasibility from media expert and subject matter expert.

Table 1. Results of Media Expert Validation

Aspect	Average (%)	Category
Physical Attractiveness	86.67%	Highly Valid
Appearance	94.28%	Highly Valid
Learning	86.67%	Highly Valid
Overall Average	**92%**	**Highly Valid**

Source: Compiled by Researchers (2025)

Based on the validation results table, the media expert obtained a rating of 86.67% for the physical attractiveness aspect, which is categorized as highly valid. The appearance aspect, with a percentage of 94.28%, falls under the highly valid category, and the learning aspect, with a percentage of 86.67%, falls within the heading of highly valid as well. Therefore, the overall average score for all three aspects is 92% of the media evaluation for the e-module product, which falls under the highly valid category based on the interpretation results. The validation of this e-module product includes suggestions and input from media experts to add access sequences to each menu and improve the writing of references that are not entirely accurate.

The results of this media expert validation are in line with previous studies that obtained percentage scores for physical attractiveness, appearance, and learning aspects with an overall average score of 86%, which is classified as very good, meaning that it is highly valid, so that the e-module product is suitable for use (Asrofunnisa & Hakim, 2024).

Table 2. Results of Expert Validation of Materials

Aspect	Average (%)	Category
Content Suitability	90%	Highly Valid
Language	92%	Highly Valid
Overall Average	**90.67%**	**Highly Valid**

Source: Compiled by Researchers (2025)

Based on the validation results table, the subject matter expert gave the content suitability a score of 90% for validity, which is classified as highly valid, and the language aspect a score of 92%, which is also classified as highly valid. Thus, in the material validation stage, the overall average score for both aspects was 90.67% for the e-module product, which is classified as highly valid.

The results of this material expert validation are in line with previous research findings, which obtained a percentage score for content and language feasibility with an overall average percentage score of 95%, which is classified as highly feasible or equivalent to highly valid (Andayani et al., 2024).

Implementation Stage

At this stage, a pretest and posttest were administered to 36 students in class X-3 at State Senior High School 21 Surabaya in order to assess the researcher's e-module product. The Minimum Passing Criteria, which is a score of 78, was used to evaluate the pretest and posttest outcomes. The pretest had the highest score of 80, and the posttest had the highest score of 100, indicating an improvement in results. All 36 students successfully completed

Jurnal Paedagogy:
Jurnal Penelitian dan Pengembangan Pendidikan
https://e-journal.undikma.ac.id/index.php/pedagogy/index
Email:paedagogy@undikma.ac.id

Vol. 12 No. 4 : October 2025
E-ISSN: 2722-4627
pp. 1279-1290

the pretest after using the e-module. The following are the results of the pretest and posttest data:

Table 3. Pretest and Posttest Data Result

Aspect	Pretest	Posttest	Average		N-gain Score	Category
			Pretest	Posttest		
Total Students	36	36	61.66	89.86	0.76	High
Highest Score	80	100				

Source: Compiled by Researchers (2025)

Based on the table above, the N-gain values of 36 students show an increase in learning outcomes through improved student understanding of economic actors. The average N-gain value of 0.76, which is categorized as high, was obtained from an analysis of effectiveness after implementing the EDU-ECON e-module based on problem based learning on the subject of economic actors.

Comparing pretest and posttest results following the use of problem based learning e-module that emphasize the capacity to reflect in making decisions or debating, together with the capacity to assess claims and issues, can reveal improvements in learning outcomes. This is consistent with the viewpoint (Aprina et al., 2024) that explains how applying an appropriate learning model specifically, the problem-based learning model in learning activities can foster critical thinking skills by allowing students to analyze ideas more thoroughly, evaluate them, and develop them in a more structured way. Therefore, it may be concluded that students' comprehension of economic actors is demonstrated by their use of this e-module. This assertion is corroborated by (Mutmainnah et al., 2021), which explains that the effectiveness of an e-module can be measured based on the level of the e-module's ability to contribute to improving student learning outcomes, thereby significantly improving pretest and posttest results related to the use of the e-module.

To ascertain whether or not the data was normally distributed, a normality test was performed subsequent to the N-gain score test. The Shapiro-Wilk test was employed in this study's normalcy test, yielding significance values of 0.070 and 0.162 > 0.05. Therefore, the results of the normality test indicate a normal distribution. After confirming the data's normal distribution, a paired sample t-test was conducted to determine whether there was an improvement in students' critical thinking skills following the application of different treatments in the pretest and posttest. The hypothesis test (t-test) yielded a significance level of 0.000 < 0.05, indicating that H0 is rejected and Ha is accepted. Therefore, based on the findings of the pretest and posttest, it can be said that students' critical thinking skill improved after utilizing the e-module.

The students' opinions regarding the employment of e-modules in learning activities were then ascertained by calculating their answers. The outcomes of the students' responses are as follows:

Table 4. Results of Student Responses

Aspect	Average (%)	Category
Appearance	85.23%	Highly Practical
Presentation of Material	82.96%	Highly Practical
Usefulness	78.19%	Practical
Overall Average	**82.45%**	**Highly Practical**

Source: Compiled by Researchers (2025)

Based on the table of student responses, the presentation aspect appearance a score of 85.23%, which falls into the highly practical category, and the material delivery aspect presentation of material a score of 82.96%, which also falls into the highly practical category.

Vol. 12 No. 4 : October 2025
E-ISSN: 2722-4627
pp. 1279-1290

The aspect of usefulness received a percentage of 78.19%, categorized as practical. Thus, the overall average result of the students' responses across all aspects was 82.45% based on their evaluations of the e-module product, which was categorized as highly practical.

The practicality of e-modules includes typography suitability, supporting media, material presentation, and ease of access, thereby receiving positive responses from students. These results are in line with (Prihastuti et al., 2024), who emphasize that material presentation with appropriate grammar and support from images, videos, discussion forums, and interactive navigation can increase interactivity, understanding, and learning outcomes among students

Evaluation Stage

This final stage was carried out through the four previous stages. During this development stage, the e-module was assessed by media experts and subject matter experts, with the result that it was deemed highly suitable for use after changes were made in accordance with the media experts' suggestions, namely the addition of an access sequence and improvements to the writing of references.

After the development stage, we moved on to the implementation stage, as the final stage, which involved testing the electronic module on 36 students, who obtained pretest and posttest results with an average N-gain of 0.76, which is categorized as high. The improvement achieved was accompanied by a better understanding of economic concepts, particularly the subtopic of circular flow diagrams, and the average student response to the practicality of the electronic module reached 82.45%. However, the practicality of the e-module in terms of benefits received a lower average score than the other two aspects. This was due to students' limited understanding of how to use the e-module accessed via smartphones, thus requiring changes to the user instructions to be more comprehensive for students' understanding in using this learning medium. According to research (Milala et al., 2021), learning becomes more engaging and pleasurable when media is created for users and is easy to access and clear in its instructions. It also stimulates curiosity and creativity in learning.

Conclusion

The electronic module was deemed appropriate for use, receiving a 92% validity score from media expert and 90.67% from subject matter expert, categorized as highly valid. The effectiveness was demonstrated through an improvement in students' critical thinking skills, as indicated by an N-gain score of 0.76 from the pretest and posttest results, categorized as high, in line with the t-test results, which rejected H0 and accepted Ha.

Recommendation

The study's findings allow for the formulation of the following suggestions:

1. Educators are advised to use interactive e-modules to enhance classroom instruction and to keep coming up with innovative ways to use technology into teaching strategies based on student requirements.
2. It is advised that future researchers create e-modules with interactive and visual components to enhance student comprehension, broaden the scope of the content to encompass all facets of the course material, and test the development outcomes on larger groups to make sure they are more representative and applicable.

References

Aggraini, M. D., Koto, I., & Gunawan, B. (2024). *The Effect of Problem-Based Learning Integrated Numbered Head Together on the Critical Thinking Ability of Grade XI Students*. *7*(2), 457–469.

Alisa H. Kadir, N., Mardin, H., M. Hasan, A., Wahyuni K. Baderan, D., Nusantari, E., S. Hamidun, M., & H. Husain, I. (2024). *Pengembangan E-Modul Berbasis Problem Based Learning (PBL) Berbantuan Aplikasi Canva Pada Materi Perubahan Lingkungan Kelas X Di SMA Negeri 1 Telaga Biru*. *10*(1), 203–211.

Andayani, D. D., Fathahillah, & Jakob, F. E. (2024). *Pengembangan E-Modul Ajar Kurikulum Merdeka Berbasis Augmented Reality pada Mata Pelajaran TIK (Teknologi Informasi dan Komunikasi) kelas VII UPT SMP Negeri 4 Parepare Development Of AR-Based Independent*. *2*(2), 86–98. https://doi.org/10.31959/js.v2i2.2521

Aprina, E. A., Fatmawati, E., & Suhardi, A. (2024). Penerapan Model Problem Based Learning Untuk Mengembangkan Keterampilan Berpikir Kritis Pada Muatan IPA Sekolah Dasar. *Didaktika: Jurnal Kependidikan*, *13*(1), 981–990.

Ardiansyah, K., Kurniati, D., Trapsilasiwi, D., & Osman, S. (2022). Truth-Seekers Students' Critical Thinking Process in Solving Mathematics Problems with Contradiction Information. *Kreano, Jurnal Matematika Kreatif-Inovatif*, *13*(1), 1–13. https://doi.org/10.15294/kreano.v13i1.33286

Aslan, A. (2021). Problem- based learning in live online classes: Learning achievement, problem-solving skill, communication skill, and interaction. *Computers and Education*, *171*(May), 104237. https://doi.org/10.1016/j.compedu.2021.104237

Asrofunnisa, K., & Hakim, N. (2024). Pengembangan Modul Elektronik Terintegrasi Nilai Keislaman Pada Materi Virus untuk Kelas X SMA/MA. *Biodik*, *10*(1), 43–53. https://doi.org/10.22437/biodik.v10i1.30908

Atma, M., Subekti, S., Charitas, R., & Prahmana, I. (2021). *Developing Interactive Electronic Student Worksheets through Discovery Learning and Critical Thinking Skills during Pandemic Era*.

Darling-Hammond, L., Flook, L., Cook-Harvey, C., Barron, B., & Osher, D. (2020). Implications for educational practice of the science of learning and development. *Applied Developmental Science*, *24*(2), 97–140. https://doi.org/10.1080/10888691.2018.1537791

Ding, Y., & Zhang, P. (2018). Nurse Education in Practice Practice and e ff ectiveness of web-based problem-based learning approach in a large class-size system : A comparative study. *Nurse Education in Practice*, *31*(April), 161–164. https://doi.org/10.1016/j.nepr.2018.06.009

Dwijayanti, I., Nugroho, A. A., & Pratiwi, Y. I. (2020). Meta-Analysis: the Effect of Problem Approach and Inquiry Approach Toward Students' Mathematical Critical Thinking Skill Over the Past 4 Years. *Al-Jabar : Jurnal Pendidikan Matematika*, *11*(1), 1–10. https://doi.org/10.24042/ajpm.v11i1.4944

Fardany, M. M., & Dewi, R. M. (2020). Pengembangan Media Pembelajaran Powtoon Berbasis Pendekatan Saintifik Pada Mata Pelajaran Ekonomi. *Jurnal Pendidikan Ekonomi (JUPE)*, *8*(3), 101–108. https://doi.org/10.26740/jupe.v8n3.p101-108

Fatmarani, D., & Setianingsih, R. (2022). Analisis Kemampuan Berpikir Kritis Siswa SMP dalam Menyelesaikan Soal Aljabar Mengacu pada Watson-Glaser Critical Thinking Appraisal. *MATHEdunesa*, *11*(3), 904–923.

https://doi.org/10.26740/mathedunesa.v11n3.p904-923

Ferninaindis, N. K. W., Wirawan, I. K. A., & Santosa, H. (2020). Penerapan Konsep Warna Dingin Pada Tata Artistik Program Televisi Dunia Anak TVRI Bali. *Mudra Jurnal Seni Budaya*, *35*(1), 40–47. https://doi.org/10.31091/mudra.v35i1.715

Hidayanti, N., Supratman, & Noviati, W. (2022). Pengembangan E-Modul Biologi Berbasis Problem Based Learning untuk Meningkatkan Literasi Sains Siswa. *Jurnal Kependidikan*, *7*(2), 19–27.

Husna, H. (2023). *Penerapan Model PBL (Problem Based Learning) Pada Pendekatan Teori Konstruktivisme Untuk Meningkatkan Kemampuan Berpikir Kritis*. *2022*, 2177–2188.

Kautsari, M., Hairida, H., Masriani, M., Rasmawan, R., & Ulfah, M. (2023). Pengembangan E-Modul Berbasis Problem Based Learning pada Materi Zat Adiktif. *Edukatif : Jurnal Ilmu Pendidikan*, *4*(6), 8116–8130. https://doi.org/10.31004/edukatif.v4i6.3850

Laili, I., Ganefri, & Usmeldi. (2019). Efektivitas Pengembangan E-Modul Project Based Learning Pada Mata Pelajaran Instalasi Motor Listrik. *Jurnal Imiah Pendidikan Dan Pembelajaran*, *3*(3), 306–315. https://ejournal.undiksha.ac.id/index.php/JIPP/article/download/21840/13513

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

Leibovitch, Y. M., Beencke, A., Ellerton, P. J., McBrien, C., Robinson-Taylor, C. L., & Brown, D. J. (2025). Teachers' (evolving) beliefs about critical thinking education during professional learning: A multi- case study. *Thinking Skills and Creativity*, *56*(December 2024). https://doi.org/10.1016/j.tsc.2024.101725

Mardiana, E., Kusuma, Z. N. A. W., & Iskandar, S. (2024). *Karakteristik dan Peran Guru Sebagai Fasilitator Pembelajaran Abad 21 Sekolah Dasar*. *24*(7), 28–42.

Milala, H. F., Endryansyah, E., Joko, J., & Agung, A. I. (2021). Keefektifan Dan Kepraktisan Media Pembelajaran Menggunakan Adobe Flash Player. *Jurnal Pendidikan Teknik Elektro*, *11*(02), 195–202. https://doi.org/10.26740/jpte.v11n02.p195-202

Mutmainnah, M., Aunurrahman, A., & Warneri, W. (2021). Efektivitas Penggunaan E-Modul Terhadap Hasil Belajar Kognitif Pada Materi Sistem Pencernaan Manusia Di Madrasah Tsanawiyah. *Jurnal Basicedu*, *5*(3), 1625–1631. https://doi.org/10.31004/basicedu.v5i3.952

Nurhayati, I., Satum, K., Pramono, E., & Farida, A. (2024). *Keterampilan 4C (Critical Thinking, Creativity, Communication and Collaboration) dalam Pembelajaran IPS untuk Menjawab Tantangan Abad 21*. *8*(1), 44–53.

Prihastuti, E., Sukaesih, S., & Sekaran, R. (2024). *Efektivitas Pengembangan E-Modul Interaktif Berbasis Project Based Learning Materi Sistem Ekskresi Manusia untuk Meningkatkan Literasi Siswa SMA*. 1–9.

Rahayu, N., & Alyani, F. (2020). Kemampuan Berpikir Kritis Matematis Ditinjau Dari Adversity Quotient. *Prima: Jurnal Pendidikan Matematika*, *4*(2), 121. https://doi.org/10.31000/prima.v4i2.2668

Rahma, S., Ningsih, S., & Dewi, R. M. (2024). *Edukatif : Jurnal Ilmu Pendidikan Pengembangan E-LKPD Berbasis Problem Based Learning pada Pembelajaran Ekonomi guna Melatih Keterampilan Berpikir Kritis*. *6*(2), 1675–1685.

Rangkuti, S. R., Khairuna, K., & Jayanti, U. N. A. D. (2023). Pengaruh Model Problem

Based Learning Terhadap Kemampuan Berpikir Kritis Peserta Didik Pada Materi Sistem Indera Kelas XI. *JUPEIS : Jurnal Pendidikan Dan Ilmu Sosial*, *2*(4), 7–15. https://doi.org/10.57218/jupeis.vol2.iss4.832

Ridlo, Z. R., Ahmad, N., Jember, U., & Timur, J. (2024). *Pengembangan E-Modul Berbasis Terintegrasi Dengan Google Colaboratory Untuk Meningkatkan Kemampuan Berpikir Kritis Siswa*. 1270–1279.

Saidah, N. U., Handoyo, E., Supriyadi, Dirwanto, & Akanto, B. (2024). *Pengembangan E-Modul Berbasis Problem Based Learning Terintegrasi Wordwall untuk Meningkatkan Kemampuan Kognitif Siswa*. *8*(2), 340–350.

Salsabila, Y. R., & Muqowim. (2024). Korelasi Antara Teori Belajar Konstruktivisme Lev Vygotsky Dengan Model Pembelajaran Problem Based Learning (PBL). *LEARNING : Jurnal Inovasi Penelitian Pendidikan Dan Pembelajaran*, *4*(3), 813–827. https://doi.org/10.51878/learning.v4i3.3185

Sharifah, R., & Faaizah, S. (2015). The Development of Online Project Based Collaborative Learning using ADDIE Model. *Procedia - Social and Behavioral Sciences*, *195*, 1803–1812. https://doi.org/10.1016/j.sbspro.2015.06.392

Sugiyono. (2017). *Metodologi Penelitian Kuantitatif, Kualitatif dan R & D* (Cetakan Ke). Alfabeta.

Sumardi, L., Rohman, A., & Wahyudiati, D. (2020). Does the teaching and learning process in primary schools correspond to the characteristics of the 21st century learning? *International Journal of Instruction*, *13*(3), 357–370. https://doi.org/10.29333/iji.2020.13325a

Trullàs, J. C., Blay, C., Sarri, E., & Pujol, R. (2022). Effectiveness of problem-based learning methodology in undergraduate medical education: a scoping review. *BMC Medical Education*, *22*(1), 1–12. https://doi.org/10.1186/s12909-022-03154-8

Ulfa, Y., & Sari, P. M. (2021). Pengembangan Macromedia Flash Berbasis Keterampilan Berpikir Kritis di Sekolah Dasar. *Edukatif : Jurnal Ilmu Pendidikan*, *3*(5), 3131–3144. https://doi.org/10.31004/edukatif.v3i5.1235

Vlachopoulos, D., & Makri, A. (2024). *Studies in Educational Evaluation A systematic literature review on authentic assessment in higher education : Best practices for the development of 21st century skills , and policy considerations*. *83*(November).

Windi Mareti, J., & Herlina Dwi Hadiyanti, A. (2023). Penerapan Model Problem Based Learning untuk Meningkatkan Kemampuan Berpikir Kritis dan Hasil Belajar IPA Siswa Kelas V SD. *JIIP - Jurnal Ilmiah Ilmu Pendidikan*, *6*(12), 10641–10646. https://doi.org/10.54371/jiip.v6i12.3212