JPPIPA 9(7) (2023)

Jurnal Penelitian Pendidikan IPA

Journal of Research in Science Education

http://jppipa.unram.ac.id/index.php/jppipa/index

The Validity of Coffee Cocoa Local Wisdom-Based Digital Modules In Senior High School

Singgih Bektiarso[1], Lailatul Nuraini[1*], Alex Harijanto[1], Subiki[1], Maryani[1], Sekar Langit Dwi Arini[1], Balya Aulia Assiddiqi[1]

[1] Physics Education, Faculty of Teacher Training and Education, University of Jember, Jember, Indonesia

Received: February 15, 2023
Revised: June 4, 2023
Accepted: July 25, 2023
Published: July 31, 2023

Corresponding Author:
Lailatul Nuraini
lailatul.fkip@unej.ac.id

DOI: 10.29303/jppipa.v9i7.3183

Abstract: This study aims to analyze the validity aspects of a digital module based on the local wisdom of cocoa coffee that has been developed. The research method used is the R and D (Research and Development) research method with the Four-D development model (Define, Design, Develop, Disseminate). In the 4D development stage, in the Develop section, module development and validation activities are carried out by three media and material experts. The data collection technique used a validation questionnaire. The data analysis technique used descriptive analysis. The validation results for each aspect are 86.06% construct validation, 91.11% content validation, and 87.78% language validation, and these three aspects are in the very good category. The overall validation results show that the digital module based on local wisdom of cocoa coffee reaches a validity score of 88.32% which is in the very good category and is feasible to use. Thus, it can be concluded that the digital module based on the local wisdom of cocoa coffee can then be used in the physics learning process in high school as an alternative solution for innovative learning resources based on local wisdom.

Keywords: Aspects of Validity; Local Wisdom; Coffee-Cocoa; Digital Module

Introduction

The Jember Regency area has many plantations. The plantation runs the activities of the coffee and cocoa industry. The coffee and cocoa industry that has been run for many years has become part of the local wisdom of Jember. Local wisdom is the nation's identity and personality that encourages it to absorb outside culture into its own character and culture (Wibowo, 2015). The research development master plan (RIPP) of the University of Jember 2021-2025 was developed for superior research with environmental, business, and industrial agriculture insights. The superior research of the University of Jember referred to its character and competitive education. The research theme referred to is the development of multicultural education based on local wisdom (Tim Penyusun, 2022). From an educational perspective, society in the environment of the coffee cacao industry can be viewed as a phenomenon that can be attributed to the knowledge, skills, and attitudes of coffee-cacao science, including the application of physical concepts.

High school students are part of the community. Students' knowledge can be sourced from the coffee-cocoa environment so that it becomes students' initial knowledge before participating in Physics lessons. Factors that affect the educational process and outcomes include student, teacher, and environmental factors (Handayani, 2019). Environmental factors can be in the form of schools and residential environments. Teacher factors are related to learning strategies applied during the learning process. Learning strategies based on environmental phenomena where students live are suitable for developing students' problem-solving abilities and creativity.

The learning strategy developed in this study is the Project Based Learning (PjBL) model. PjBL is a model that emphasizes project assignments carried out by students. Jean Piaget's theory of learning states that before studying in school, students already have

How to Cite:
Bektiarso, S., Nuraini, L., Harijanto, A., Subiki, Maryani, Arini, S. L. D., & Assiddiqi, B. A. (2023). The Validity of Coffee Cocoa Local Wisdom-Based Digital Modules in Senior High School. *Jurnal Penelitian Pendidikan IPA*, *9*(7), 5182–5191. https://doi.org/10.29303/jppipa.v9i7.3183

preliminary knowledge. Students in learning to build their own knowledge (Kurniawan & Rahman, 2019). Jerome Brunner's learning theory states that optimal learning uses inquiry or discovery because by discovering for yourself, the knowledge that students acquire is more durable (Gusmardin et al., 2019). David Ausubel's theory states that learning can be meaningful if there is a conformity of knowledge given by the teacher according to the student's conception (Istiadah, 2020). In order to support learning strategies to be more effective, learning media needed to be relevant to the development of communication technology, namely digital media.

Digital media contain combined information from various forms of content, namely data, text, sound and images stored in digital formats disseminated over the internet network. Forms of digital media include social media, websites, digital photos, digital audio, digital video, digital modules, and e-books (Muhasim, 2017). Learning media is needed to support the process of providing visualization in the learning process. As the results of research show that the use of video becomes more interesting because it contains audio and visuals that can be seen by the audience (Day et al., 2022). Explanatory videos online can also help give students a better understanding because students can repeat to learn (Kulgemeyer & Wittwer, 2023). The use of digital media as an effort to support the needs of teachers and students in improving the ability of teachers and students to engage in active learning (Wilson, 2021). Based on these descriptions, local wisdom-based PjBL learning strategies with digital media can improve the quality of the learning process because it is able to provide opportunities for students to explore and develop knowledge, skills and creativity from the dailycoffee-cacao environment through project exercises.

Learning at this time uses many technologies, including digital media. Digital media engages students in acquiring basic knowledge through instructional videos before class, and therefore more time is available for practice, applying knowledge, or student-teacher interaction in class (Chang & Hwang, 2018). Utilization of this digital media can significantly increase students' knowledge (Irwan et al., 2019). The results of research conducted by previous researchers show this digital media can increase interest in learning and student learning outcomes. The increase in learning interest in the use of digital media is moderate, while the increase in learning outcomes in the use of digital media is high (Arriany et al, 2020). Digital media effectively improves students' physics learning outcomes (Affandi et al., 2020). Digital media can foster enthusiasm for students in learning physics (Azhar, 2018). Based on the results of relevant research, digital media can foster motivation to learn physics so that it can improve learning outcomes in physics learning.

Modules are teaching materials needed in learning activities. Modules can be created digitally. Digital modules can be used as teaching materials for students, which contain learning materials according to the competencies to be achieved. This digital module can help students learn independently (Ramadhani & Fitria, 2021). Digital modules developed with letters that can be read well and equipped with images, audio, and video can facilitate students in understanding the material and can motivate students to learn independently so as to improve students' abilities (Suryani et al., 2020). The use of digital modules is very effective in increasing student learning motivation and learning outcomes and students' critical thinking skills (Puspitasari, 2019). Based on these descriptions, digital modules created by connecting local wisdom, namely coffee, and cocoa, with physics materials can help students to learn independently and can improve students' abilities because students are motivated to learn with an attractive digital module display so that it is very effective to improve student's learning motivation and learning outcomes and thinking skills.

The Project Based Learning (PjBL) learning model includes three main characteristics: process-oriented, context-related, and student-centered. This PjBL model can improve students' creativity (Ismuwardani et al., 2019; Ismuwardani et al., 2019). Learning models that involve students working in groups to complete projects can then improve students' collaborative and communicative skills when working together in groups. In addition, PjBL is effective in increasing the expected learning outcomes (Sukerti & Susana, 2019). The implementation of PjBL is effective in increasing students' critical thinking skills (Sianturi et al., 2020) Task the project cannot be separated from the guidance of the teacher so that the final task is good and according to the desired expectations, the achievement of learning objectives can be achieved properly (Dewi, 2021). The application of PjBL is effective in improving students' abilities, both cognitive, affective, and psychomotor (Diana et al., 2021). Based on this description, Project Based Learning (PjBL) which is carried out in learning by linking local wisdom in making coffee and chocolate, is very effective in improving students' cognitive, affective, and psychomotor abilities.

The urgency of researching PjBL learning strategies based on local coffee-cacao wisdom with digital media is a learning strategy that utilizes the community environment, namely the agro-plantation environment of the cocoa coffee industry, by being given the task of doing projects through the use of digital media such as

e-modules, e-books, and animated videos to accommodate students' initial knowledge of the cocoa coffee community environment with PjBL so that it can strengthen the learning process through adapting students' physical concepts in learning to support the achievement of RIPP Jember University. Digital media in the form of digital modules that have been developed need to be tested for validity before being used in the physics learning process. This research will discuss the analysis of aspects of the validity of the digital module based on the local wisdom of cocoa coffee.

Method

The research method used is research R and D (Research and Development) with the Four-D development model (Define, Design, Develop, Desiminate). At the 4D development stage, in the Develop section, the module development and validation activities were carried out by three media and material experts. The data collection technique uses a validation questionnaire. Data analysis techniques use descriptive analysis to assess the validity score and the level of validity. The validity criterion is carried out by matching the results of the average percentage of the total validity score, as shown in Table 1.

Table 1. Eligibility Criteria for Validity Analysis Results

Percentage (%)	Validity Eligibility
$75 < p \leq 100$	Very good
$50 < p \leq 75$	Good enough
$25 < p \leq 50$	Less good
$0 \leq p \leq 25$	Not good

Source: Sugiyono, 2019

Result and Discussion

This research was conducted in the second semester of the 2022/2023 academic year. The research begins by examining the high school curriculum and the physics concepts that will be discussed. Furthermore, research observation activities were carried out at the Coffee and Cocoa Research Center (Puslitkoka) of Jember Regency and the KETAKASI Cooperative of Silo District of Jember Regency. Based on the results of observations related to coffee and cocoa processing, an analysis of the physics concept of the process was carried out. The next step is to develop digital media in the form of digital modules based on local wisdom of cocoa coffee. This digital module consists of a front page, a drafting team, instructions for using the module, a collection of material (text and video), practice questions, and posttest questions. The display of results of this digital media development can be shown in Figure 1.

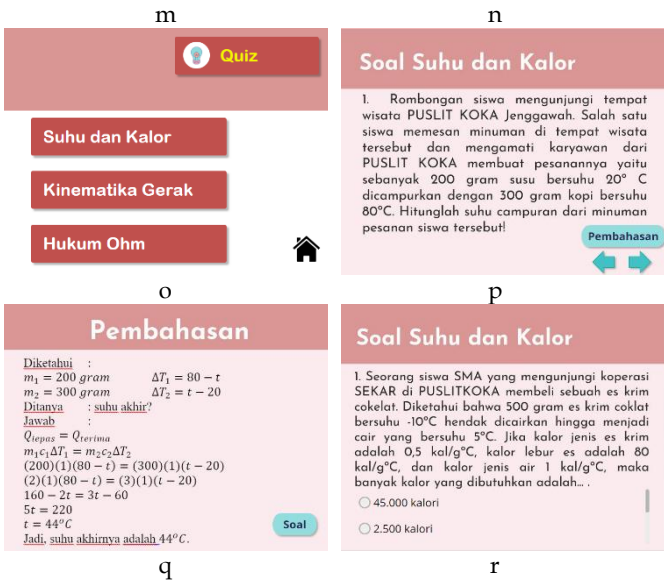
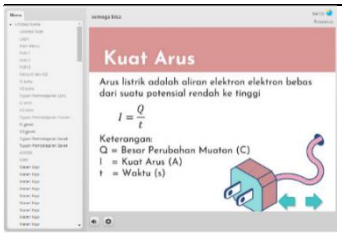
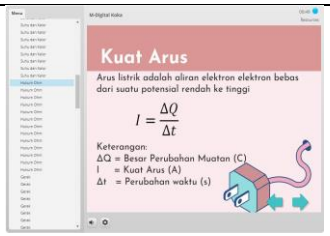
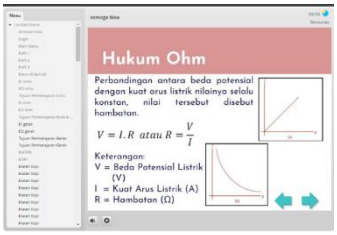
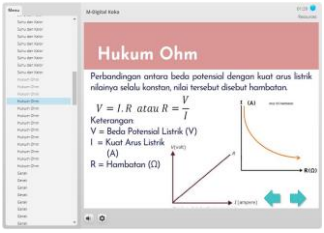
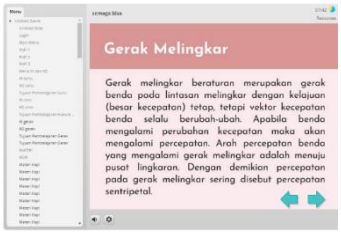


Figure 1. Coffee-Cocoa Local Wisdom-Based Digital Module

Figure 1a is an early view of m-digital coca. Figure 1b contains a guide before using m-digital coca. Figure 1c is a login form for a participant's identity. Figure 1d is the main menu of m-digital coca which contains the options to be used. Figure 1e is an m-digital coca maker profile. Figure 1f is the core competencies (KI), basic competencies (KD) menu, and learning objectives of the material related to the process of making coffee and chocolate. Figure 1g is an example of one of the KI found in m-digital coca. Figure 1h contains a selection of material menus from m-digital coca. Figure 1i is a selection of materials related to the coffee-making process. An example of learning material on the choice of coffee is shown in Figure 1j. The image lk contains the travel menu, and there is a video of each selection of travel menu, such as picture ll. Figure 1m is a question menu that contains a selection of sample questions and quizzes, such as Figure 1n and Figure 1o. Figure 1p shows that each example of the problem is equipped with a discussion, such as in Figure 1q. Figure 1r is one of the quiz questions, and students can choose the available answers after choosing the answer that will look wrong or correct from the selected answer.

Three media and materials experts further validate the digital modules that have been developed. The three validators are lecturers in the Physics Education study program. There have been several revisions to the validator's assessment. The results before and after the revision are shown in Table 2. Results of validation by the validator covering the constructed aspect show 86.06% (very good), the content aspect is 91.11% (very good), and the language aspect is 87.78% (very good). The average validity for all aspects is 88.32% in the very good and valid category. Based on this, this medium can be used in the process of learning physics. The results of this digital media validation can be shown in Table 3.

Table 2. Digital Module Validation Results

Before	After	Description
		Improvements to the strong current function equation
		Improvement in the graph of the relationship of strong current (I) with the potential difference (V) and the relationship between strong current (I) with resistance (R). Improvements were made to add units to the chart
		Correction of inaccurate sentences

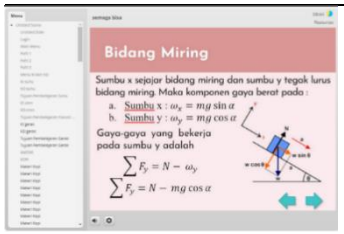
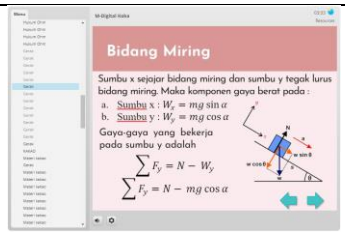
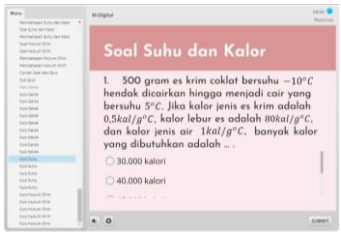
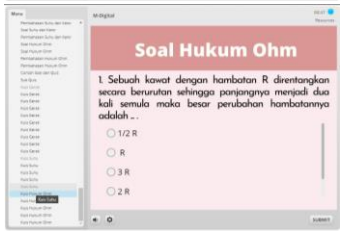
		Improvements to the force function equation
		The question of temperature and heat corresponds to indicators of creative thinking
		The question of movement in accordance with the indicators of creativity of thinking
		Solved ohm law according to the indicators of creative thinking

Table 3. The results of validation of the digital module based on local wisdom of coffee-cacao

Construct	Validator 1	Validator 2	Validator 3
Assessment Criteria			
Compatibility of digital media content with learning outcomes and learning objectives	4	5	4
Suitability of the contents of the material in digital media with learning objectives	5	4	4
The suitability of the content of the material contained in digital media with the level of student development	4	5	4
Clarity of instructions and directions for activities presented coherently and clearly so as not to cause errors in carrying out activities	5	4	4
The presentation of the material is interactive and participatory (in learning to invite active students)	4	5	5
Suitability of the difficulty level of the material with student development	5	5	4
Compatibility of sentences with the level of student development	4	4	4
Material truth from the aspect of science	5	4	4
Learning media is equipped with fundamental questions (problems) that direct students to determine basic concepts	5	4	3
The suitability of the content of the exercise with the material	5	4	3
Type and size of letters according to the level of student development	4	5	4
Percentage	90.91%	89.09%	78.18%
Average Percentage			86.06% Content

Construct	Validator 1	Validator 2	Validator 3
Assessment Criteria			
Project-Based Learning Strategies (PjBL) Based on Coffee-Cocoa Local Wisdom with Digital Media to Increase Creativity of High School Students "Strategic Physics Learning" is something new	5	5	4
Project-Based Learning (PjBL) Learning Strategies Based on Coffee-Cacao Local Wisdom with Digital Media to Increase Creativity of High School Students "Strategic Physics Learning" is needed to increase independence and creativity to support educational goals in Indonesia	5	5	4
Project-Based Learning (PjBL) Learning Strategies Based on Coffee-Cacao Local Wisdom with Digital Media to Increase Creativity of High School Students "Strategic Physics Learning" facilitates students' problems about the scientific analysis of physical concepts on coffee-cacao local wisdom	5	5	3
Percentage	100%	100%	73.33%
Average Percentage			91.11%
			Language
The language used meets the readability aspect	4	4	4
Conformity with Indonesian language rules	4	4	4
The sentences used are simple and easy to understand	5	5	4
Clarity of instructions and directions on the digital physics module	5	5	4
The language used is communicative	5	5	4
The level of language used is in accordance with the cognitive development of students	4	5	4
Percentage	90%	93.33%	80.00%
Average Percentage			87.78%

Table 4. Recapitulation results for each aspect of validity

Aspects	Validators	Precentage Analysis (%)		Criterion
		$\sum p$ (%)	$\bar{p}$ (%)	
Construct	1	90.91	86.06	Very Good
	2	89.09		
	3	78.18		
Content	1	100.00	91.11	Very Good
	2	100.00		
	3	73.33		
Language	1	90.00	87.78	Very Good
	2	93.33		
	3	80.00		

Based on Table 3, the next step is to recapitulate each aspect of validity. The results of the recapitulation of all aspects of validity can be shown in Table 4.

The following points are obtained based on the results of the development of digital modules in Table 4. First, construct analysis showed very good criteria. Thus, this digital module has an excellent form, sentence layout, and material aspects. The implication of this is that students are interested in using digital modules in learning. This is in line with Robert Gagne's learning theory which states that an effective learning process begins with the generation of good motivation; second, content analysis shows that this digital module has content that can facilitate the achievement of goals. In addition to this, this digital module can also evoke creative thinking abilities and scientific attitudes. The implication of this is the smooth process of changing the concept of students who were initially wrong to be right. This is consistent with David Ausubel's theory, which states that effective learning is through real experiences related to everyday life; Third, the language analysis of digital modules shows that these digital modules have very good readability, communication, and simple elements. The implication of this is that students more easily understand the concepts that exist in the text studied. This is in accordance with Jean Piaget's learning theory which states that the process of increasing knowledge can be through concept accommodation. Digital modules that have high readability can facilitate

the accommodation process. Thus, this digital module can increase the effectiveness of learning.

Several previous studies on the module have shown mixed results. The validation results of the development of media assisted by the articulate storyline software also stated that this media was valid in terms of material and convenience of the media, then the pedagogical aspects were in the valid category so that this media could be applied in the learning process to improve students' problem solving abilities (Daryanes et al., 2023). The results of the study of Novianto et al., (2018) stated that the development of PjBL modules on static fluid material is included in the very good category so that it can increase the effectiveness of learning. This has the implication that the PjBL-based physics module has very good quality in terms of material, language, and image display so that the developed module is suitable for use in physics learning in senior high school (SMA/MA). On the other hand, modules that have been declared valid and feasible are used for learning media in the learning process (Nafsiah et al., 2019; Fadieny & Fauzi, 2018). The use of relevant media, easy to access and use, attractive feature components, attractive colors can improve information processing and can help improve students' higher order thinking skills (Kwangmuang et al., 2021).

The results of other studies state that the development of physics modules with local wisdom can optimize the character of students and can make physics learning more diverse because it is supported by local wisdom (Oktaviana et al., 2017; Wati et al., 2017). The result of the study by Dari & Nasih (2020) states that e-modules can improve students' science process skills. This is because the use of e-modules or digital modules can overcome the difficulty and saturation factors of students while studying (Aisy et al., 2020). Based on the results of the research that has been done, it can be concluded that the digital module of PjBL with valid local wisdom is used in the learning process because this module can motivate students with views and contents that attract students' attention so that it can improve student learning outcomes.

Media is a supporting learning process that is able to deliver material effectively and efficiently. The process of receiving abstract material will be faster using media than lectures without tools (Rosyid et al., 2019). The use of interactive media can create positive changes in student learning styles and positive effects on students (Mohanty et al., 2021; Demir et al., 2023). By using the media, stimulation can be provided so that students are more motivated to learn something new (Munir et al., 2012). The results of this study are in line with research conducted by Carreño (2022) which states that the use of mobile application technology can support increasing students' interest and understanding of physics. In the learning process in which there are space, time, and sensory power limitations, media can serve as a bridge to eliminate these limitations. For example, when students need to observe an object that is too large or too small, media images, films, or models can be used as an alternative to direct observation, which is not possible. Likewise, when it is necessary to observe the motion of objects that are too fast or observe an object that is too complex can use the right media (Sadirman, 2017).

In the conventional learning process, students cannot experience an independent experience in discovering new concepts in learning. By using technology-based media such as the use of computers and smartphones, students can adjust the speed of learning and can interact and make observations that can foster a greater sense of curiosity about a physical concept in an event (Rosyid, 2019). Learning media is a tool in the form of media used in learning. One of the advantages of learning media is that, in certain cases, it can represent the teacher in presenting information about the learning that is being taught to students. Learning media is expected to be able to facilitate higher-order thinking skills and students' creative abilities.

Conclusion

The validation results for each aspect are construct validation of 86.06%, content validation of 91.11%, and Language validation of 87.78%. These three aspects are in the very good category. The overall validation results show that the digital module based on cocoa coffee local wisdom achieves a score validity of 87.78%, is in the very good category, and is suitable for use. Thus, it can be concluded that the digital module based on the local wisdom of cocoa coffee has excellent quality based on aspects of constructs, contents, and languages. Furthermore, the digital module can be used in the physics learning process at high school as an alternative to innovative solutions for learning resources based on local wisdom. Recommendations from this study are 1) for teachers, can use this digital module that has been developed for physics learning in schools, 2) for other researchers, can be developed the analysis of physics concepts that have not been discussed in this cocoa coffee local wisdom-based digital module and other forms of local wisdom.

Acknowledgments

We would like to thank the institute of research and community service at the university of Jember for funding this research activity.

Author Contributions

S.B. conceptualizing research ideas and analysis of physics concepts. L.N. developing media design and doing script writing. AH. perform project administration activities. S. conducted field observations. M. coordinating media validation activities. B.A. and S.L. designing and creating media. All authors have read and agreed to the published version of the manuscript.

Funding

This research was funded by research institution and community service Universitas Jember, grant number 14970/UN25/KP/2022. The APC was funded by grant funds research institution and community service Universitas Jember.

Conflicts of Interest

The authors declare no conflict of interest. The funders had no role in the design of the study; in the collection, analyses, or interpretation of data; in the writing of the manuscript; or in the decision to publish the results.

References

Aisy, D. R., Farida, & Andriani, S. (2020). Pengembangan e-modul berbantuan sigil software dengan pendekatan saitifik pada materi sistem persamaan linier dua variabel (SPLDV). *Edu Sains: Jurnal Pendidikan Sains Dan Matematika*, *8*(1), 61–71. https://doi.org/10.23971/eds.v8i1.1499

Affandi, M. R., Widyawati, M., & Bhakti, Y. B. (2020). Analisis efektivitas media pembelajaran *e-learning* dalam meningkatkan hasil belajar siswa sma pada pelajaran fisika. *Jurnal Pendidikan Fisika*, *8*(2), 150–157. http://dx.doi.org/10.24127/jpf.v8i2.2910

Arriany, I., Ibrahim, N., & Sukardjo, M. (2020). Pengembangan modul online untuk meningkatkan hasil belajar Ilmu Pengetahuan Sosial (IPS). *Jurnal Inovasi Teknologi Pendidikan, 7*(1), 52-66. https://doi.org/10.21831/jitp.v7i1.23605

Azhar, Z. (2018). Pembuatan alat praktikum digital pada konsep gerak jatuh bebas sebagai media pembelajaran fisika. *Jurnal Ikatan Alumni Fisika Universitas Negeri Medan*, *4*(1), 22–25. https://doi.org/10.24114/jiaf.v4i1.10884

Carreño, M. J., Castro-Alonso, J. C., & Gallardo, M. J. (2022). Interest in Physics After Experimental Activities with a Mobile Application: Gender Differences. *International Journal of Science and Mathematics Education*, *20*(8), 1841–1857. https://doi.org/10.1007/S10763-021-10228-4/FIGURES/2

Chang, S. C., & Hwang, G. J. (2018). Impacts of an augmented reality-based flipped learning guiding approach on students' scientific project performance and perceptions. *Computers & Education*, *125*, 226–239. https://doi.org/10.1016/J.COMPEDU.2018.06.007

Dari, R. W., & Nasih, N. R. (2020). Analisis keterampilan proses sains mahasiswa pada praktikum menggunakan *e-modu*l. *Jurnal Pendidikan Sains & Matematika*, *8*(2), 12–21. https://doi.org/10.23971/eds.v8i2.1626

Daryanes, F., Darmadi, D., Fikri, K., Sayuti, I., Rusandi, M. A., & Situmorang, D. D. B. (2023). The development of articulate storyline interactive learning media based on case methods to train student's problem-solving ability. *Heliyon*, *9*(4), e15082. https://doi.org/10.1016/J.HELIYON.2023.E15082

Day, J., Devers, C. J., Wu, E., Devers, E. E., & Gomez, E. (2022). Development of Educational Media for Medical Trainees Studying MRI Physics: Effect of Media Format on Learning and Engagement. *Journal of the American College of Radiology*, *19*(6), 711–721. https://doi.org/10.1016/J.JACR.2022.03.009

Demir, B. T., Eşme, S., Patat, D., & Bilecenoğlu, B. (2023). The Effect of Mobile Applied Anatomy Learning on Students' Academic Success, Cognitive Loads, and Attitudes. *Medical Science Educator*, *1*(4), 1–8. https://doi.org/10.1007/S40670-023-01787-Y/TABLES/3

Dewi, P. S. (2021). E-learning: pjbl pada mata kuliah pengembangan kurikulum dan silabus. *Jurnal Cendekia: Jurnal Pendidikan Matematika*, *5*(2), 1332–1340. https://doi.org/10.31004/cendekia.v5i2.572

Diana, N., Yohannes, & Sukma, and Y. (2021). The effectiveness of implementing project-based learning (pjbl) model in stem education: a literature review. *Journal of Physics: Conference Series*, *1882*(1), 1-6. Retrieved from https://iopscience.iop.org/article/10.1088/1742-6596/1882/1/012146

Fadieny, N., & Fauzi, A. (2018). Validitas e-modul fisika terintegrasi materi bencana petir berbasis experiential learning. *Jurnal Penelitian Pembelajaran Fisika*, *7*(1), 17–25. https://doi.org/10.24036/jppf.v7i1.111794

Gusmardin, Y., Bektiarso, S., & Wicaksono, I. (2019). Pengaruh model pembelajaran guided inquiry disertai scaffolding prompting questioning terhadap keterampilan proses sains siswa pada materi gerak lurus di sma. *Jurnal Pembelajaran Fisika*, *8*(2), 93–100. https://doi.org/10.19184/jpf.v8i2.11670

Handayani, R. (2019). Pengaruh lingkungan tempat tinggal dan pola asuh orangtua terhadap motivasi belajar siswa sekolah dasar. *Jurnal Tunas Bangsa*, *6*(1), 15-26. Retrieved from

https://ejournal.bbg.ac.id/tunasbangsa/article/view/916

Hartini, S., Misbah, Helda, & Dewantara, D. (2017). The effectiveness of physics learning material based on South Kalimantan local wisdom. In *AIP Conference Proceedings,* 1868(1), 070006. https://doi.org/10.1063/1.4995182

Irwan, I., Luthfi, Z. F., & Waldi, A. (2019). Efektifitas penggunaan kahoot! untuk meningkatkan hasil belajar siswa. *PEDAGOGIA: Jurnal Pendidikan*, *8*(1), 95-104. https://doi.org/10.21070/pedagogia.v8i1.1866

Ismuwardani, Z., Nuryatin, A., & Doyin, M. (2019). Implementation Of Project Based Learning Model to Increased Creativity and Self-Reliance Of Students On Poetry Writing Skills. *Journal of Primary Education*, *8*(1), 51–58.

Istiadah. (2020). *Teori-teori belajar dalam pendidikan* (R. Permana (ed.); Cetakan Pe). Edu Publisher.

Kulgemeyer, C., & Wittwer, J. (2023). Misconceptions in Physics Explainer Videos and the Illusion of Understanding: an Experimental Study. *International Journal of Science and Mathematics Education*, *21*(2), 417–437. https://doi.org/10.1007/S10763-022-10265-7/FIGURES/3

Kurniawan, M. R., & Rahman, Y. A. (2019). Teori belajar kognitif membedah psikologi belajar jean piaget. Tsaqofah. *Jurnal Pendidikan Islam*, *3*(2), 1–10. https://doi.org/10.58883/tsaqofah.v3i2.78

Kwangmuang, P., Jarutkamolpong, S., Sangboonraung, W., & Daungtod, S. (2021). The development of learning innovation to enhance higher order thinking skills for students in Thailand junior high schools. *Heliyon*, *7*(6), e07309. https://doi.org/10.1016/J.HELIYON.2021.E07309

Mohanty, A., Alam, A., Sarkar, R., & Chaudhury, S. (2021). Design Engineering Design and Development of Digital Game-Based Learning Software for Incorporation into School Syllabus and Curriculum Transaction . *Design Engineering*, *1*(8), 4864–4900. Retrieved from https://www.researchgate.net/publication/367350086

Muhasim. (2017). Pengaruh tehnologi digital terhadap motivasi belajar peserta didik. *Palapa: Jurnal Studi Keislaman Dan Ilmu Pendidikan*, *5*(2), 55–77. https://doi.org/10.36088/palapa.v5i2.46

Munir, M., Zohari, S., & Berg, M. (2012). *Molecular Biology And Pathogenesis Of Peste Des Petits Ruminants Virus.* Germany: Springer Science & Business Media.

Nafsiah, I. N., Rizal, F., & Giataman. (2019). Validitas pengembangan modul pembelajaran project based learning pada mata kuliah manajemen proyek di pendidikan teknik bangunan ft-unp. *Jurnal Pendidikan Teknik Bangunan Dan Sipil*, *5*(1), 26–31. https://doi.org/10.24114/ebjptbs.v5i1JUNI.14199

Novianto, N. K., Masykuri, M., & Sukarmin. (2018). Pengembangan modul pembelajaran fisika berbasis proyek (*project based learning*) pada materi fluida statis untuk meningkatkan kreativitas belajar siswa kelas x sma/ma. *Jurnal Pendidikan IPA, 7*(1), 81–92. https://doi.org/10.20961/inkuiri.v7i1.19792

Oktaviana, D., Hartini, S., & Misbah. (2017). Pengembangan modul fisika berintegrasi kearifan lokal membuat minyak lala untuk melatih karakter sanggam. *Berkala Ilmiah Pendidikan Fisika*, *5*(3), 272–285. http://dx.doi.org/10.20527/bipf.v5i1

Puspitasari, A. D. (2019). Penerapan media pembelajaran fisika menggunakan modul cetak dan modul elektronik pada siswa sma. *JPF (Jurnal Pendidikan Fisika)*, *7*(1), 17–25. https://doi.org/10.24252/jpf.v7i1.7155

Ramadhani, W., & Fitria, Y. (2021). Capaian kemandirian belajar siswa dalam pembelajaran sains tematik menggunakan modul digital. *Jurnal Basicedu*, *5*(5), 4101–4108. https://doi.org/10.31004/basicedu.v5i5.1391

Rosyid, M. Z., Sa'diyah, H., & Septiana, N. (2019). *Ragam Media Pembelajaran*. Malang: CV Literasi Nusantara Abadi.

Sadirman. (2017). *Media Pendidikan (pengertian, pengembangan dan pemanfaatnya)*. Jakarta: Raja Grafindo Persada.

Sianturi, R., Firdaus, M., & Susiaty, U. D. (2020). Komparasi efektivitas antara problem based learning (pbl) dan project based learning (pjbl) terhadap kemampuan berpikr kritis ditinjau dari motivasi belajar matematika. *Edu Sains: Jurnal Pendidikan Sains Dan Matematika*, *8*(2), 57–69. https://doi.org/10.23971/eds.v8i2.1772

Sugiyono. (2019). *Metode Penelitian Kuantitatif, Kualitatif, dan R&D*. Bandung: ALFABETA.

Sukerti, G. N. A., & Susana, K. Y. (2019). Fostering students'presentation skill using infographic: the implementation of project-based learning in english for specific purposes. *IJIET (International Journal of Indonesian Education and Teaching), 3*(2), 227–239. https://doi.org/10.24071/ijiet.v3i2.1940

Suryani, K., Utami, I. S., Khairudin, Ariska, & Rahmadani, A. F. (2020). Pengembangan modul digital berbasis stem menggunakan aplikasi 3d flipbook pada mata kuliah sistem operasi. *Mimbar Ilmu*, *25*(3), 358–367. https://doi.org/10.23887/mi.v25i3.2

Tim Penyusun. (2022). *Rencana Induk Penelitian Dan Pengabdian Kepada Masyarakat Universitas Jember*

Tahun 2021-2025. Jember: Universitas Jember.

Wati, M., Hartini, S., Misbah, & Resy, D. (2017). Pengembangan modul fisika berintegrasi kearifan lokal hulu sungai selatan. *Jurnal Inovasi Dan Pembelajaran Fisika*, *4*(2), 157–162. https://doi.org/10.36706/jipf.v4i2.5411

Wibowo. (2015). *Karakter berbasis kearifan lokal disekolah (konsep, strategi, dan implementasi)*. Yogyakarta: Pustaka Pelajar.

Wilson, K. (2021). Exploring the Challenges and Enablers of Implementing a STEM Project-Based Learning Programme in a Diverse Junior Secondary Context. *International Journal of Science and Mathematics Education*, *19*(5), 881–897. https://doi.org/10.1007/S10763-020-10103-8/METRICS