

Validity of mobile learning-based practicum instructions with a guide inquiry approach to improve critical thinking skills

by Windhiana Ayu Lestari

Submission date: 02-Nov-2022 05:28PM (UTC+0700)

Submission ID: 1942307035

File name: 2105-Research_Results-11851-1-6-20221101_Layout.pdf (644.79K)

Word count: 6625

Character count: 39582



Research Article



Validity of mobile learning-based practicum instructions with a guide inquiry approach to improve critical thinking skills

Windhiana Ayu Lestari, Imas Cintamulya*

Biology Education Department, PGRI Singgolawe Tuban University, Tuban, Indonesia

Email: windhiansayu2305@gmail.com, cintamulya66@gmail.com

Article Information

Submitted: 2022 – 08 – 25

Accepted: 2022 – 11 – 02

Published: 2022 – 11 – 02

ABSTRACT

Mobile learning-based practicum instructions to improve critical thinking have not been maximally empowered in schools. This study aims to design mobile learning-based practicum instructions with a guided inquiry approach to enhance critical thinking skills and describe the valid mobile learning-based practicum instructions with a Guided inquiry approach to improve critical thinking skills that have been designed. This research uses the Research and Development method with the ADDIE development model. The procedure of this research is analysis, design, and development. This research comes to the stage of product validity. The instrument used in this study is a validation sheet covering aspects of material, systematics, linguistics, and graphics. The data analysis technique used in this study is a quantitative descriptive technique to describe validation data and comment on validator advice. The results of this study show that mobile learning-based practicum instructions have met valid criteria with an average percentage of 84.95%. Thus, it can be concluded that the mobile learning-based practicum instructions with a guided inquiry approach improve critical thinking skills that are designed to be valid.

Keywords: Critical thinking; inquiry guide; mobile learning; practicum instructions

Publisher

Biology Education Department
IKIP Budi Utomo, Malang, Indonesia

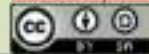
How to Cite

Lestari, WA & Cintamulya, I (2022). Validity of mobile learning-based practicum instructions with a guide inquiry approach to improve critical thinking skills. *Edubiotik: Jurnal Pendidikan, Biologi Dan Terapan*, 7(2), 61-73.
<https://doi.org/10.33503/ebio.v7i02.2100>



Copyright © 2022, Lestari & Cintamulya

This is an open access article under the CC-BY-SA license



INTRODUCTION

The development of science and technology in the 21st century has brought significant changes in various fields of human life, both in terms of culture, economy, and education. This causes the purpose of education to prepare human resources who can face future challenges effectively and efficiently. Learning activities are required to utilize all aspects of existing resources, including information and communication technology (ICT) or known as ICT (Information and Communication Technology) (Tanwir et al., 2018). The American Association College of Teacher Education (AACTE)

(AACTE & P21, 2013) states that in the 21st century, educators must collaborate technology in learning. It can develop creativity and skills in using technology according to the required lessons' demands (Jogezai et al., 2018). The use of ICT is related to the packaging of technology-based learning media that can bring innovations and improve the quality of learning media (Juliana & Muslem, 2017). The use of technology in learning aims to provide a proactive teaching and learning environment and achieve higher understanding and learning outcomes (Ghavifekr & Rosdy, 2015; Sujanem, 2012).

Learning media is one of the keys to success in the learning process (Ulfah et al., 2016). The use of learning media can increase students' interest, motivation, and active interaction in the classroom. Learning media collaborated using technology can create more effective, interactive, exciting, and fun learning so that learning objectives can be easily achieved (Oktavianingtyas et al., 2018; Sanirati et al., 2021). Similar to what was stated by Hendraningrat & Fauziah (2021), digital learning media makes the delivery of learning materials more varied, not only verbally but can be in the form of text, video, visual and audio. Thus making it easier for students to understand and visualize learning materials can increase student interest, activity, and learning outcomes (Muid & Aziz, 2020). Learning media has a reasonably vital function in learning, so educators often use it in classroom learning for all subject matter and learning methods, one of which is the practicum method (Daud & Rahmadana, 2019).

Practicum is a learning method to develop concepts, providing opportunities for students to test and apply the results from the theory learned in everyday life (Maulidatu et al., 2019). Practicum activities require learning media to support practicum implementation, namely practicum instructions. Practicum instructions learning media that present information in tools, materials, procedures, or work steps that make it easier for students and teachers to carry out practicum activities (Prayitno, 2017; Widyaningrum & Wijayani, 2019). Practicum instructions are generally in the form of printed teaching materials that are less effective, practical, and efficient when used in practicum and are not following the development of the 21st era based on ICT (Hamidah et al., 2014; Mahrawi et al., 2022). With the increasingly sophisticated development of ICT, conventional practicum instructions require changes to improve quality by applying ICT, namely mobile learning-based practicum instructions.

One of the factors for the success of the learning process is no less important than learning media, namely the learning approach (Handhika, 2012). Accurately choosing a learning approach will make it easier to achieve the planned learning objectives (Rusyadi, 2021). In the 21st century, the learning objectives are to achieve 4C skills, one of which is critical thinking skills (Septikasari & Frasandy, 2018). Critical thinking skills are the ability of an individual to examine his own opinions, make generalizations by evaluating different facts, and interpret experiences experientially rationally (Nugrahaeni et al., 2017; Ratnasari & Cintamulya, 2021). Several factors can determine the success of forming critical thinking skills in the learning process, namely expertise in choosing the appropriate learning approach (Karim & Normaya, 2015; Nikmah & Cintamulya, 2017). Several learning approaches are suitable for improving critical thinking skills through the practicum method, one of which is the guide inquiry approach. The Guide Inquiry approach is a learning approach where students act as researchers who carry out scientific activities (Trisna Puspita et al., 2013). This will maximize students' ability to investigate, dig up information and formulate new ideas to solve problems systematically, critically, logically, and analytically using high-level thinking skills (Kurniawan, 2013). The same thing was also stated by Handayani (2017) and Indriwati et al. (2018) that the Guide Inquiry learning approach can improve the understanding of students' critical thinking concepts and skills implemented in Biology subjects.

Biology subjects, especially fern plant sub-materials, are materials that can be integrated with the use of local potential as a source of learning (Arital et al., 2018; Vitdiawati et al., 2016). Situmorang (2016) stated that biology learning as a part of education has great potential in utilizing the environment as a learning resource. There are many local potentials, especially those in the Tuban district, which can be integrated into biology learning, one of which is the Bekliharjo natural bathing tourist attraction (Farnadayanti & Mustofa, 2021). Based on the observations, the tourist attraction located in Semanding district, Tuban regency, has an abundance of diversity of fern plant species, as many as seven species with 132 individual fern plants. With the abundance of diverse types of fern plants and comfortable environmental conditions for learning, it is very suitable to be implemented as a source and place to learn fern plant material in practicum instructions.

Many previous researchers have carried out research related to ICT-based practicum instructions. Research on developing electronic practicum guides based on temperature and heat material science process skills for junior high schools/ MTs using the Kvisoft Flipbook Maker application, which features videos, music, and experimental links, has been carried out by Ningsi et al. (2021). Research on developing green chemistry-based electronic practicum guides with a learning cycle-7e learning model on acid-base material designed on flip book maker applications, adobe flash cs6, and canva has also been carried out by Mulyanti et al., (2022). The same research has also been carried out by Pea et al., (2021), namely identifying cell morphology and bacterial types of Tambakrejo river water as a medium for electronic practicum guide designed using Microsoft Word then converted to pdf then through the Anyflip application formed into flipped learning. Oktaviani et al., (2020) also researched the development of an e-guide to the science practicum of guided inquiry-based living creature classification materials designed using the 3D PageFlip application. Based on the results of previous researchers' research, research on ICT-based practicum instructions was designed using the Articulate Storyline3 application by utilizing local potential as a learning resource for new research. Compared to mobile learning-based practicum instructions from previous research, which are usually in the form of pdf, power points, and flipbooks, the update of mobile learning-based practicum instructions in this study is in the form of an application made using the Articulate Storyline3 program. Another novelty of this study is that the author uses local potential in the form of tourist attractions as a source and place of learning as well as a Guided Inquiry approach to improve critical thinking skills.

Based on the background above, the author aims to design mobile learning-based practicum instructions with a Guide Inquiry approach to improve critical thinking skills and describe the validity of mobile learning-based practicum instructions with a Guide Inquiry approach to enhance critical thinking skills designed. The absence of previous research on mobile learning-based practicum instructions with a Guide Inquiry approach to improving skills about fern plant material is the author's goal to develop mobile learning-based practicum instructions with this Guide Inquiry approach. Mobile learning-based practicum instruction with the Guide Inquiry approach is expected to improve critical thinking skills and provide new learning experiences for students. These mobile learning-based practicum instructions will also likely help teachers explain fern plant material using attractive mobile learning-based learning media.

RESEARCH METHODS

This research is development research to create a new product, namely mobile learning-based practicum instructions with a Guide Inquiry approach to improving students' critical thinking skills on fern plant material. This study uses the development model used in this study is the ADDIE development

model. The ADDIE development model consists of 5 stages, namely Analysis, Design, Development, Implementation, and Evaluation (Dwitlyanti et al., 2020), as presented in Figure 1.

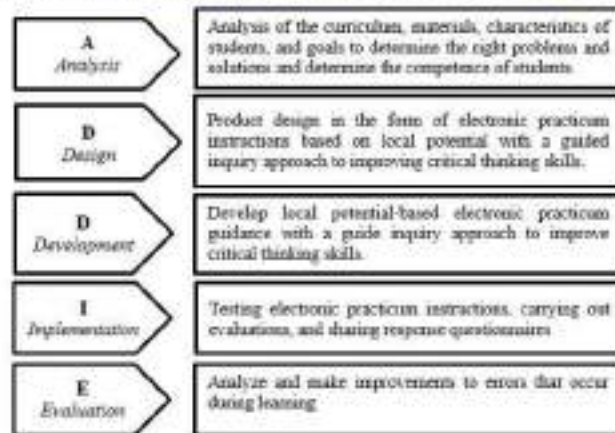


Figure 1. ADDIE Development Research Procedure (Dwitlyanti et al., 2020)

This research is limited to the third stage, namely development by conducting product validation tests. This research reached the third stage due to impossible conditions due to the Covid-19 pandemic, and students are still learning at home. Here are the steps of this research based on the ADDIE development model:

1. Stages of Analysis

The analysis stage is used to analyze the needs of practicum instructions in the field and identify problems regarding practicum instructions that are obstacles in practicum activities by analyzing the curriculum that applies in schools, subjects, and student characteristics.

2. Design Stages (design)

The design stage is the stage of starting to design a mobile learning-based practicum instruction product with a Guide Inquiry approach to improve critical thinking skills by collecting several references and things needed to support the preparation of mobile learning-based practicum instructions such as backgrounds, fern plant images, decoration icon images, and so on. Mobile learning-based practicum instructions with a Guide Inquiry approach to improving critical thinking skills using the Articulate Storyline3 application. At this stage, a validation sheet is also compiled, which will be used for validation assessment of mobile learning-based practicum instructions covering aspects of material, systematics, linguistics, and graphics.

3. Stages of Development (development)

The development stage is the stage of realizing the product to be developed. After the product development is completed, the mobile learning-based practicum instructions will be validated by validators, namely biology subject teachers and biology lecturers. Validation is carried out to assess the quality of mobile learning-based practicum instructions against validity requirements, including material validity, systematics, grammar, and graphics.

Research on mobile learning-based practicum instructions with a Guide Inquiry approach on fern plant material was carried out for four months. Designing mobile learning-based practicum instructions with a Guide Inquiry approach on fern plant material was conducted on May 21 – June 28, 2022.

Meanwhile, the implementation of the product validity assessment will be on July 18-25, 2022, and the analysis of research results and article preparation will be carried out on July 26 - August 8, 2022.

This research data was collected using validity instruments undergoing the instrument validation stage. Validation instruments that contain material, systematic, linguistic, and visual aspects. The material aspect validation instrument is decomposed into nine statements, systematics into twelve statements, linguistics into eight statements, and graphicality into fifteen statements. Validation sheets are used to obtain quantitative data in the form of product validation assessment scores and qualitative data in the form of validator comments and suggestions collected with product validation sheets carried out by validators. The data analysis technique used in this study is descriptive quantitative, which is used to describe the validity data of mobile learning-based practicum instructions with a Guide Inquiry approach to improving critical thinking skills by calculating all scores on validation sheets with Likert scale criteria referring to Janti (2014) (Table 1).

Table 1. Likert Scale Score Criteria.

Score	Description
5	Very Valid
4	Valid
3	Valid Enough
2	Less Valid
1	Invalid

The entire value of each validation criterion from the validation of aspects of material, systematics, linguistics, and graphics is recapitulated with the number of respondents. Furthermore, the score that has been obtained from each criterion is divided by the maximum score of each criterion and multiplied by 100% (Figure 2).

$$\text{Validity} = \frac{\text{Total Score Result}}{\text{Total Score Maximum}} \times 100\%$$

Figure 2. Validity Value Formula

After obtaining the validity value of each criterion, the sum of validity percentages for criteria will be averaged. Such average results are guidelines for assessing validity based on the scores obtained. The results of the percentage data obtained will be interpreted according to the validity criteria referred to by Arikunto (2013) (Table 2).

Table 2. Validity Assessment Criteria

Percentage	Criteria
90%-100%	Very Valid
75%-89%	Valid
65%-74%	Valid Enough
40%-64%	Less Valid
0%-39%	Invalid

FINDING AND DISCUSSION

Research on the development of mobile learning based practicum guidance with a Guide Inquiry approach to improve critical thinking skills using the 3 stages of the ADDIE developer model, namely Analysis, Design, and Development. The stages of analysis include the analysis of the curriculum subjects, learning objectives, and student characteristics. The design stages have the selection of mobile learning applications, the choice of media formats, the preparation of materials, compiling the

structure of practicum instructions, and assembling the design of practicum instructions. The stages of development include a test of the validity of the product. ²¹

Curriculum analysis is carried out to determine the Core Competencies, Basic Competencies, and Indicators based on the curriculum applied at SMA/ MA Tuban as a reference for developing mobile learning-based practicum instructions with a Guide Inquiry approach to improving ³⁰ critical thinking skills. The curriculum analysis found that the curriculum in Tuban High School/ Ma used the 2013 curriculum. The Core Competencies, Basic Competencies, and Indicators obtained from the 2013 curriculum syllabus are presented in Table 3.

³³
⁴⁴ **Table 3** Analysis of Core Competencies, Basic Competencies, and Indicators for The Fern Plant Sub-Material

Core Competencies	Basic Competencies	Indicators
KI.3 : Understand, apply, analyze factual, conceptual, procedural knowledge based on his curiosity about science, technology, art, culture, and humanities with insights into society, rationality, statehood, and civilization related to phenomena and events, as well as apply procedural knowledge to specific fields of study in accordance with his talents and interests to solve problems. KI.4 : Processing, reasoning, and studying ¹ in the concrete and abstract realms related to the development of what he learned in school independently and using methods according to scientific principles.	3.7 Grouping plants into divisions based on standard features and attributing their role in life processing, reasoning, and studying in the concrete and abstract realms related to developing what he learned in school independently and using methods according to scientific principles.	3.7.1 Describing the morphological features of fern plants. 3.7.2 Classifying fern plants based on morphological features. 3.7.3 Identifying fern plants in the surrounding environment 3.7.4 Analyze the role of fern plants in everyday life
	4.7 They presented data on the morphology and role of plants in various aspects of life in the form of written reports.	4.7.1 Compiling and presenting practicum reports on fern plants. 4.7.2 Communicate the results of the practicum in the class and discuss it.

The subject analysis is carried out after analyzing the curriculum to find out and detail the materials that will be contained in the practicum instructions. Based on the study of the subjects, the appropriate material will be applied to the mobile learning-based practicum instructions with a guide inquiry approach, namely the kingdom Plantae material of the fern plant sub-material. The fern plant material contained in the mobile learning-based practicum instructions was selected based on the results of observations on May 21, 2022 at one of the local potentials in Tuban regency, which will be used as a source and place for learning in this mobile learning-based practicum guide.

Learning objectives are analyzed to determine the learning objective ³ that students will achieve on plant material based on learning indicators. After the learning activities, students are expected to be able to describe the morphological characteristics of fern plants, classify fern plants based on morphological traits, identify fern plants in the surrounding environment, analyze the role of fern plants in daily life, compile and present practicum reports on fern plants, and communicate practicum results in class.

Student characteristics are analyzed to determine the characteristics of class X SMA students as a reference for choosing the right learning approach. Based on the observations of student characteristics, it was found that Class X SMA is a transitional class ³ from junior high school to high school, so class X high school students still need teacher guidance in learning. Based on the analysis of student characteristics, the appropriate learning approach applied to local potential-based electronic

practicum instructions for class X SMA students is the guide inquiry approach. In this learning approach, the teacher acts as a guide and facilitator.

The design stage aims to produce mobile learning-based practicum instructions with a Guide Inquiry approach to improving critical thinking skills. The steps to design mobile learning-based practicum instructions with the Guide Inquiry approach are to analyze the curriculum, determine essential competencies and subjects, determine the title of practicum instructions, compile fern plant materials, compile fern plant catalogs, compile the structure of mobile learning-based practicum instructions, compile a mobile learning-based practicum instruction design in the articulate storyline application. The display of mobile learning-based practicum instructions can be seen in Figure 3. The main menu display on mobile learning-based practicum instructions be seen in Figure 4. The introductory slide view on mobile learning-based practicum instructions presented as in Figure 5. The slide view of learning steps guide inquiry on mobile learning-based practicum instructions can be seen in Figure 6. The fern plant catalog slide view on mobile learning-based practicum instructions presented as in Figure 7. The information slide view in mobile learning-based practicum instructions reflected in Figure 8.



Figure 3. Title Display of Mobile Learning-Based Practicum Instructions



Figure 4. Main Menu Display on Mobile Learning-Based Practicum Instructions



Figure 5. Introductory Slide View on Mobile Learning-Based Practicum Instructions



Figure 6. Slide View of Learning Steps Guide Inquiry on Mobile Learning-Based Practicum Instructions



Figure 7. Fern Plant Catalog Slide View on Mobile Learning-Based Practicum Instructions



Figure 8. Information Slide View in Mobile Learning-Based Practicum Instructions

The display of several slides of mobile learning-based practicum instructions above is the final design of the mobile learning-based practicum instructions that have been improved based on comments and suggestions provided by validators. This mobile learning-based practicum instruction is designed using the Articulate Storyline3 application. Articulate Storyline3 is an application to design interactive learning media that can present text, audio, video, animation, and others (Indriari et al., 2021). This mobile learning-based practicum instruction has several components consisting of 1) Title; 2) The main menu slide consists of an introduction menu, learning steps, a catalog of fern plants and information; 3) Introductory slides containing core competencies, essential competencies, indicators, learning objectives and practicum rules; 4) Slide learning steps with a Guide Inquiry approach which consists of six stages, namely identifying problems, formulating hypotheses, designing experiments, conducting experiments, analyzing data, and communicating conclusions; 5) Slides of fern plant material contained in the slide of the step of learning stages identify problems containing material on the introduction of kingdom Plantae, kingdom Plantae charts, definitions of fern plants, the body structure of fern plants, reproduction of fern plants, pictures of the stages of metagenesis of fern plants and grouping of fern plants; 6) The fern plant catalog slide contains a brief description of the morphological features, drawings and scientific classification of some species of fern plants; 7) Information slides contain glossaries, bibliography, image contributions, and author profiles. This mobile learning-based practicum instruction is also equipped with several navigation buttons: the following button, previous button, close button, gray home (back to the main menu) button, and orange colored home (back to the initial slide) button. The use of images and background colors that complement the appearance of mobile learning-based practicum instructions is adjusted to the material presented and uses the right colors to be balanced and harmonious to attract students to learn (Pranita et al., 2016).

The validation data for mobile learning-based practicum instructions were obtained from the validation assessment of mobile learning-based practicum instruction products conducted by three validators on July 18 and 25, 2022, at PGRI Ronggolawe Tuban University and MA Al-Ma'arif Cempleng. The validator here in question is a biology teacher. According to Ikhtiami et al., (2021), biology teacher validators are responsible for checking the suitability of the material, language, systematics, and graphics of a product. Biology teachers are assumed to understand the material, systematics, language, and graphics in practicum instructions, so they are considered suitable as validators of this mobile learning-based practicum instruction. Assessment of the validity of mobile learning-based practicum instructions is carried out based on the achievement of material, systematics, linguistics, and graphics aspects. Validators also provide comments and suggestions that are used as a basis for improving mobile learning-based practicum instructions. The results of the recapitulation of material validation, systematics, linguistic, and graphic tests by validators can be shown in Table 4. the following:

Table 4. Recapitulation of User Validation Results by Teachers and Lecturers of Biology

No.	Assessment Aspects	Validator Score			Average	Criterion
		Validator I	Validator II	Validator III		
1.	Material criteria	84%	87%	89%	86,7%	Valid
2.	Systematic criteria	82%	90%	85%	85,7%	Valid
3.	Linguistic criteria	80%	85%	90%	85 %	Valid
4.	Graphic criteria	79%	83%	85%	82,4%	Valid
Average Percentage of Score Criteria					84,95%	Valid

Table 4 above shows that the validity assessment results are reviewed from the material, systematic, linguistic, and visual aspects of three validators. The material aspects of the mobile

learning-based practicum instructions obtained valid categories with an average total percentage of 86.7%. This shows that the material, learning steps, and practicum steps contained in the mobile learning-based practicum instructions follow the core competencies, essential competencies, indicators, learning objectives, and syntax of the learning approach used. The results of material validation provide concrete evidence that shows that the material presented is appropriately used in practicum activities so that learning objectives can be achieved (Fajrianingtyas & Hidayat, 2019). The total average score of the percentage of validation of systematic aspects in mobile learning-based practicum instructions was 85.7%, with valid categories. This result can be stated that the systematics of the mobile learning-based practicum instruction following the title of the practicum instruction, essential competencies, indicators, learning objectives, class level, semester, steps of the Guide Inquiry learning approach, and the collapse of the material arrangement following the fern plant material (Anggraini, 2016; Rusmana et al., 2019). The learning steps with the Guide Inquiry approach used in the mobile learning-based practicum instruction are systematically arranged following the syntax of the Guide Inquiry approach and sequence so that students can easily understand and carry out practicum activities (Chan & Budono, 2019; Ramadhani & Fitri, 2020).

The linguistic aspect of mobile learning-based practicum instructions obtained a valid category with an average total percentage of 85%. From the results of language validation, it shows that the language used in the mobile learning-based practicum instructions follows the enhanced spelling (EYD), and the sentence preparation used is clear, unambiguous, effective, efficient, and follows the intellectual development of students, the language used arouses student learning motivation when reading it, the writing of the correct scientific name and the sentence used represents the content of the image or information to be conveyed by keep following the Indonesian grammar. This follows what Prayitno (2017) that the use of language in learning media must be by the correct Indonesian rules, clear language, communicative, simple, and unambiguous so that students can easily understand the content of the learning media. Saniriani et al., (2021) the results of linguistic validation show that the language used in learning media is by the correct Indonesian language rules and on student intellectual development.

The Graphic Aspect of mobile learning-based practicum instructions received an average validation percentage of 82.4% with valid categories. The results of this graphic validation less show that the graphics in the mobile learning-based practicum instructions display have a good proportion of layout, image quality, and a good combination of background color compositions, to the statement of Ayu Renita & Arbaul Fauziah (2020) that the attractiveness of a learning media lies in the design of the appearance of the media. The same thing was also stated by Budiarti et al., (2016) that the selection of background color, images, and icons supporting the design of the appearance of learning media must be harmonious. Based on the test results, the validity of material aspects, systematics, language, and graphics in the general mobile learning-based practicum instructions can be declared valid. However, because they have not yet achieved practicality and effectiveness in their use, the mobile learning-based practicum instructions the Guide Inquiry approach to improving critical thinking skills developed cannot be said to be feasible for use in biology learning in the classroom.

CONCLUSION

Based on the results of this study, it can be concluded that mobile learning-based practicum instructions have been designed with the articulate storyboard application, and mobile learning-based practicum instructions with a Guide Inquiry approach to improving critical thinking skills are valid. Mobile

learning-based practicum instructions with a Guide Inquiry approach are expected to enhance critical thinking skills, increase learning motivation and provide new experiences for students. And can help teachers in explaining nail plant material. Mobile learning-based practicum instructions with a Guide Inquiry approach to improving critical thinking skills that are developed need to be followed up to the practicality and effectiveness test stage so that these mobile learning-based practicum instructions are suitable for use in learning.

REFERENCES

- AACTE & P21. (2013). Teachers for the 21st Century. *Education*, September, 22–29. http://www.oecd-ilibrary.org/education/teachers-for-the-21st-century_9789264193864-en
- Anggraini, A. (2016). Pengembangan Petunjuk Praktikum Biologi pada Materi Jamur dengan Pola Pemberdayaan Berpikir Melalui Pertanyaan (Studi Kasus di Kelas X.3 SMA Muhammadiyah 1 Metro tahun Pelajaran (2013/2014). *BIOEDUKASI (Jurnal Pendidikan Biologi)*, 7(1), 73–80. <https://doi.org/10.24127/bioedukasi.v7i1.494>
- Anikunto, S. (2013). *Prosedur Penelitian Suatu Pendekatan Praktik*. Jakarta: Rineka Cipta.
- Arital, S., Kamal, S., & Agustina, E. (2018). Keanekaragaman gastropoda di Danau Lut Tawar Kabupaten Aceh Tengah. *Prosiding Seminar Nasional*, ISBN: 978-, 402–408. <https://jurnal-ar-raniry.ac.id/index.php/PBiotik/article/view/4277/2814>
- Ayu Renita, E. S., & Arbau Fauziah, N. P. (2020). Pengembangan Ensiklopedia Tumbuhan Paku sebagai Sumber Belajar Keanekaragaman Hayati. *Jurnal Biologi Dan Pembelajarannya (JB&P)*, 7(1), 1–6. <https://doi.org/10.29407/jbp.v7i1.14797>
- Budiarti, S., Nuswawati, M., & Cahyono, E. (2016). Guided Inquiry Berbantuan E-Modul untuk Meningkatkan Keterampilan Berpikir Kritis. *Journal of Innovative Science Education*, 1(1), 1–9. <http://journal.unnes.ac.id/sju/index.php/jise>
- Chan, F., & Budiono, H. (2019). Pengembangan Buku Petunjuk Praktikum IPA Berbasis Learning Cycle Bagi Siswa Kelas IV Sekolah Dasar. *Jurnal Gentala Pendidikan Dasar*, 4(2), 166–175. <https://doi.org/10.22437/gentala.v4i2.7919>
- Daud, F., & Rahmadana, A. (2019). Pengembangan Media Pembelajaran Biologi Berbasis E-Learning Pada Materi Ekskresi Kelas XI IPA 3 Sman 4 Makassar. *Jurnal Bionature*, 16(1), 28–36. <https://ojs.unm.ac.id/bionature/article/view/1566/630>
- Dwityanti, N., Kumala, S. A., & Widiyatun, F. (2020). Using the ADDIE model in development of physics unit conversion application based on Android as learning media. *Formatif: Jurnal Ilmiah Pendidikan MIPA*, 10(2), 125–132. <https://doi.org/10.30998/formatif.v10i2.5933>
- Fajariningtyas, D. A., & Hidayat, J. N. (2019). Validitas Buku Petunjuk Praktikum Biologi Dasar Berbasis Pemecahan Masalah Untuk Mahasiswa Pendidikan Ipa Di Universitas Wiraraja. *LENZA (Lentera Sains): Jurnal Pendidikan IPA*, 9(2), 37–45. <https://doi.org/10.24929/lenza.v9i2.67>
- Farnadayanti, Y. S., & Mustofa. (2021). Mitos Pemandian di Desa Bektiharjo dan Petilasan Sunan Kalijaga di Desa Medalem Kabupaten Tuban (Kajian Fungsi, Nilai, dan Resepsi Masyarakat). *EDU-KATA: Jurnal Bahasa, Sastra Dan Pembelajarannya*, Vol 7 No 2 (2021): Agustus 2021, 143–155. <https://doi.org/https://doi.org/10.52166/kata.v7i2.2722>
- Ghafilikr, S., & Rosdy, W. A. W. (2015). Teaching and learning with technology: Effectiveness of ICT integration in schools. *International Journal of Research in Education and Science*, 1(2), 175–191. <https://doi.org/10.21890/ijres.23596>
- Hamidah, A., Sari, E. N., & Budianingsih, R. S. (2014). Persepsi Siswa tentang Kegiatan Praktikum Biologi di Laboratorium SMA Negeri Se-Kota Jambi. *Jurnal Sainmatika*, 8(1), 49–59. <https://www.neliti.com/publications/221111/persepsi-siswa-tentang-kegiatan-praktikum-biologi-di-laboratorium-sma-negeri-se>
- Handayani. (2017). Penerapan Metode Guided Inquiry dalam Meningkatkan Motivasi dan Hasil Belajar

- Siswa Pada Mata Pelajaran Biologi. *Syntax Literate: Jurnal Ilmiah Indonesia*, 2(11), 111. <https://www.jurnal.syntaxliterate.co.id/index.php/syntax-literate/article/view/258>
- Handhika, J. (2012). Efektivitas media pembelajaran im3 ditinjau dari motivasi belajar. *Jurnal Pendidikan IPA Indonesia*, 1(2), 109–114. <https://doi.org/10.15294/jpii.v1i2.2127>
- Hendraningrat, D., & Fauziah, P. (2021). Media Pembelajaran Digital untuk Stimulasi Motorik Halus Anak Usia Dini. *Jurnal Obsesi: Jurnal Pendidikan Anak Usia Dini*, 6(1), 58–72. <https://doi.org/10.31004/obsesi.v6i1.1205>
- Ikhtiani, F., Ardi, A., & Darussyamsu, R. (2021). Validity of ESQ booklets about structure and function of animal tissue as biology learning supplement. *Edubioik: Jurnal Pendidikan, Biologi Dan Terapan*, 6(01), 26–39. <https://doi.org/10.33503/ebio.v6i01.1223>
- Indriani, S. M., Artika, W. I., & Ningtias, W. R. D. (2021). Penggunaan Aplikasi Articulate Storyline dalam Pembelajaran Mandiri Teks Negosiasi. *Jurnal Pendidikan Bahasa Dan Sastra Indonesia*, 11(1), 25–36. <https://doi.org/10.23887/jpbs.v11i1.29316>
- Indriwati, S. E., Susilo, H., & Anggrela, D. P. (2018). Penerapan Model Pembelajaran Inkuiri Terbimbing Berbasis Lesson Studypada Matakuliah Keanekaragaman Hewan untuk Meningkatkan Kecakapan Komunikasi dan Hasil Belajar Kognitif Mahasiswa Pendidikan Biologi. *Jurnal Pendidikan Biologi*, 09(02), 38–46. <http://journal2.um.ac.id/index.php/jpb>
- Janti, S. (2014). Analisis Validitas dan Reliabilitas dengan Skala Likert terhadap Pengembangan SITI Dalam Penentuan Pengambilan Keputusan Penerapan Strategic Planning Pada Industri Garmen. *Prosiding Seminar Nasional Aplikasi Sains & Teknologi (SNAST)*, November, 211–216. <https://journal.akprind.ac.id/index.php/snast/article/view/3493>
- Jogzai, N. A., Ismail, S. A. M. M., & Baloch, F. A. (2018). Secondary school teachers' concerns about ICT integration: Perspectives from a developing part of the Globe. *Eurasia Journal of Mathematics, Science and Technology Education*, 14(12). <https://doi.org/10.29333/ejmste95124>
- Juliana, R., & Muslem, A. (2017). The Use Of Information And Communication Technology (Ict) Amongst Efl Teachers: Perceptions And Challenges. *English Education Journal*, 8(4), 469–487. <https://jurnal.unsyiah.ac.id/EEJ/article/view/9211/7220>
- Karim, K., & Normaya, N. (2015). Kemampuan Berpikir Kritis Siswa dalam Pembelajaran dalam Pembelajaran Matematika dengan Menggunakan Model Jucama di Sekolah Menengah Pertama. *EDU-MAT: Jurnal Pendidikan Matematika*, 3(1). <https://doi.org/10.20527/edumat.v3i1.634>
- Kumiawan, A. D. (2013). Metode inkuiri terbimbing dalam pembuatan media pembelajaran biologi untuk meningkatkan pemahaman konsep dan kreativitas siswa SMP. *Jurnal Pendidikan IPA Indonesia*, 2(1), 8–11. <https://doi.org/10.15294/jpii.v2i1.2503>
- Mahrawi, M., Rifqiawati, I., & Mulyani, D. (2022). Pengembangan Panduan Praktikum Biologi pada Konsep Sistem Pencernaan untuk Mengembangkan Keterampilan Berpikir Kritis. *Jurnal of Nusantara Education*, 1(2), 68–78. <https://doi.org/10.57176/jn.v1i2.11>
- Maulidatul, H. A., Ismail, & Mukhlisoh, S. S. (2019). Pengembangan Modul Biologi Benilai Islami Materi Sistem Reproduksi pada Manusia. *Bioeduca: Journal of Biology Education*, 1(65), 18–28. <https://doi.org/10.21580/bioeduca.v1i1.4951>
- Muid, A., & Aziz, M. (2020). Inovasi Pembelajaran Berbasis Ict Di Mts Manbaul Ihsan Mojopurogede Kecamatan Bungah Kabupaten Gresik. 1–54. <https://jurnal.maziyatulilmi.com/index.php/jippl/article/view/39/78>
- Mulyanti, S., Pratiwi, R., & Mardiyah, A. (2022). Penuntun Praktikum Elektronik Berbasis Green Chemistry dengan Model Pembelajaran Learning Cycle-7e pada Materi Asam-Basa. *Orbita: Jurnal Pendidikan Kimia*, 6(1). <https://ummaspul.e-journal.id/maspuj/article/view/1159>
- Nikmah, I. N., & Cintamulya, I. (2017). Analisis Berfikir Kritis Siswa yang Bergaya Kognitif Reflektif dan Implusif pada Pembelajaran Biologi melalui Model Problem Base Learning (PBL) dengan Media Puzzle Analysis of Critical Thinking of Cognitive Stylistic Students Reflective and Implusive on. *Proceeding Biology Education Conference*, 14, 551–555. <https://jurnal.uns.ac.id/prosbi/article/download/21068/16384>

- Ningsi, A. P., Purwaningsih, S., & ... (2021). Pengembangan penuntun Praktikum Eelektronik Berbasis Keterampilan Proses Sains Materi Suhu dan Kalor untuk SMP/MTs. *Edumaspu* 5(1), 242–251. <https://ummaspuj.e-journal.id/maspuj/article/view/1159>
- Nugrahaeni, A., Wayan Redhana, I., & Made Arya Kartawan, I. (2017). Penerapan Model Pembelajaran Discovery Learning Untuk Meningkatkan Kemampuan Berpikir Kritis Dan Hasil Belajar Kimia. *Jurnal Pendidikan Kimia Indonesia*, 1(1), 23–29. <https://doi.org/10.23867/jpk.v1i1.12808>
- Oktaviani, R., M. D., & Muhalmin. (2020). Pengembangan E-Penuntun Praktikum IPA Materi Klasifikasi Makhluk Hidup Berbasis Guided Inquiry untuk Siswa Kelas VII SMP. *Edu-Sains*, 9(2). <https://online-journal.unja.ac.id/edusains/article/view/16970>
- Oktavianingtyas, E., Salama, F. S., Fatahillah, A., Monalisa, L. A., & Setiawan, T. B. (2018). Development 3D Animated Story as Interactive Learning Media with Lectora Inspire and Plotagon on Direct and Inverse Proportion Subject. *Journal of Physics: Conference Series*, 1106(1). <https://doi.org/10.1088/1742-6596/1108/1/012111>
- Pea, O., Meishanti, Y., & Ami, M. S. (2021). Identifikasi Morfologi Sel Dan Tipe Bakteri Air Sungai Tambakrejo Sebagai Media Panduan Praktikum Elektronik. 07(01), 67–74. <https://doi.org/10.32764/eduscope.v7i1.2067>
- Pranita, H. S., Mahanal, S., & Sari, M. S. (2016). Inventarisasi Tumbuhan Paku Kelas Filicinae di Kawasan Wail Ono sebagai Media Belajar Mahasiswa. *Seminar Nasional Pendidikan Dan Sainstek 2016*, 2016, 733–740. <https://publikasiilmiah.ums.ac.id/handle/11617/8007>
- Prayitno, T. A. (2017). Pengembangan Petunjuk Praktikum Mikrobiologi Program Studi Pendidikan Biologi. *Biota*, 3(1), 31. <https://doi.org/10.19109/biota.v3i1.1041>
- Ramadhani, R., & Fitri, Y. (2020). Validitas E-Modul Matematika Berbasis EPUB3 Menggunakan Analisis Rasch Model. *Jurnal Gantang*, 5(2), 95–111. <https://doi.org/10.31629/jg.v5i2.2535>
- Ratnasari, S., & Cintamulya, I. (2021). Validitas petunjuk praktikum elektronik untuk meningkatkan kemampuan berpikir kritis siswa melalui problem based learning. 6(1), 579–585. <http://prosiding.unirow.ac.id/index.php/SNasPPM/article/view/568>
- Rusmana, J., Ramdiah, S., & Prayitno, B. (2019). Pengembangan Booklet Sebagai Sumber Belajar Biologi Melalui Nilai-Nilai Kearifan Lokal Dalam Pembuatan Bakul Purun. *Prosiding Seminar Nasional Lingkungan Lahan Basah*, 4(3), 603–607. <https://snlib.ulm.ac.id/prosiding/index.php/snlib-lit/article/view/254>
- Rusyadi, A. (2021). Pembelajaran Ipa Berbasis Inkuiri Terbimbing. *Prosiding Magister Pendidikan Ilmu Pengetahuan*, 61–66. <http://jbsc.ulm.ac.id/index.php/PMPIPA/article/view/25>
- Sanriati, D. M. D., Dafik, D., & Murtikusuma, R. P. (2021). Pengembangan Media Pembelajaran Adobe Animate Berbarituan Schoology Pada Materi Barisan dan Deret Aritmetika. *Jurnal Riset Pendidikan dan Inovasi Pembelajaran Matematika (JRPIPM)*, 4(2), 132. <https://doi.org/10.26740/jrpijm.v4n2.p132-145>
- Septikasari, R., & Frasandy, R. N. (2016). Keterampilan 4C Abad 21 dalam Pembelajaran Pendidikan Dasar. *Tarbiyah Al-Awlad*, VII(2), 112–122. <https://doi.org/10.15548/alawlad.v8i2.1597>
- Situmorang, R. P. (2016). Analisis Potensi Lokal untuk Mengembangkan Bahan Ajar Biologi di Sma Negeri 2 Wonosari. *Jurnal Pendidikan Sains Universitas Muhammadiyah Semarang*, 4(1), 51–57. <https://doi.org/10.26714/jps.4.1.2016.51-57>
- 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.v1i2.9625>
- Tanwir, T., Rahman F. A., & Rahman F. A. (2018). Dampak Penggunaan Media Pembelajaran Berbasis Ict Terhadap Hasil Belajar Pai Peserta Didik Pada Smk Negeri 1 Kota Parepare. *AL-ISHLAH: Jurnal Pendidikan Islam*, 16(1), 11–36. <https://doi.org/10.35905/alishlah.v16i1.732>
- Trisna Puspita, A., Jatmiko, B., Fisika, J., Matematika, F., Ilmu, D., & Alam, P. (2013). Implementasi Model Pembelajaran Inkuiri Terbimbing (Guided Inquiry) Terhadap Keterampilan Berpikir Kritis

- Siswa Pada Pembelajaran Fisika Materi Fluida Statis Kelas XI Di Sma Negeri 2 Sidoarjo. *Jurnal Inovasi Pendidikan Fisika*, 02(03), 121–125. <https://doi.org/10.26740/ijpf.v2n3.p%25p>
- Ulfah, T. A., Wahyuni, E. A., & Nurtamam, M. E. (2016). Pengembangan Media Pembelajaran Permainan Kartu Uno Pada Pembelajaran Matematika Materi Satuan Panjang. *Prosiding Seminar Nasional Matematika Dan Pembelajarannya. Jurusan Matematika, FMIPA UM.*, 3(3), 955–961. <https://osf.io/qt4mv/>
- Vitdiawati, R., Nusantari, R., & Tyas, D. N. (2016). Pengembangan Petunjuk Praktikum Berbasis Geopark Dengan Pendekatan Inquiry Learning untuk Mata Kuliah Ekologi. *Universitas Ahmad Dahlan*, 301–310. http://symbion.pbio.uad.ac.id/prosiding/prosiding/ID_310-Rina%20Vitdiawati-Revisi_Hal%20301-310.pdf
- Widyaningrum, D. A., & Wijayanti, T. (2019). Implementasi buku petunjuk praktikum biokimia berbasis inkuiri terbimbing untuk meningkatkan kemampuan kerja ilmiah. *Edubiotik : Jurnal Pendidikan, Biologi Dan Terapan*, 4(02), 58–67. <https://doi.org/10.33503/ebio.v4i02.437>

Validity of mobile learning-based practicum instructions with a guide inquiry approach to improve critical thinking skills

ORIGINALITY REPORT

18%

SIMILARITY INDEX

16%

INTERNET SOURCES

11%

PUBLICATIONS

4%

STUDENT PAPERS

PRIMARY SOURCES

1	ejournal.budiutomomalang.ac.id Internet Source	3%
2	Submitted to Universitas Negeri Jakarta Student Paper	2%
3	repository.lppm.unila.ac.id Internet Source	1%
4	moam.info Internet Source	1%
5	journal.uinsgd.ac.id Internet Source	1%
6	Nanan Abdul Manan, Emzir, Aceng Rahmat. "Moodle-Based Speaking Learning Model", Journal of Physics: Conference Series, 2020 Publication	1%
7	jurnal.radenfatah.ac.id Internet Source	<1%
8	journal.stkipsingkawang.ac.id Internet Source	<1%

9	jppipa.unram.ac.id Internet Source	<1 %
10	Submitted to Universitas Islam Internasional Indonesi Student Paper	<1 %
11	Nuril Hidayati, Farizha Irmawati. "Developing of science environment technology and society based on multimedia in human anatomy physiology learning", JP BIO (Jurnal Pendidikan Biologi), 2020 Publication	<1 %
12	ejournal.undiksha.ac.id Internet Source	<1 %
13	www.ilomata.org Internet Source	<1 %
14	M K Nais, K H Sugiyarto, J Ikhsan. "Virtual chemistry laboratory (virtual chem-lab): potential experimental media in hybrid learning", Journal of Physics: Conference Series, 2019 Publication	<1 %
15	ejournal.unikama.ac.id Internet Source	<1 %
16	ojs.unm.ac.id Internet Source	<1 %

www.jurnal.stkipbjm.ac.id

17

Internet Source

<1 %

18

eprints.walisongo.ac.id

Internet Source

<1 %

19

Irma Risdiyanti, Rully Charitas Indra Prahmana. "DESIGNING LEARNING TRAJECTORY OF SET THROUGH THE INDONESIAN SHADOW PUPPETS AND MAHABHARATA STORIES", *Infinity Journal*, 2021

Publication

<1 %

20

Nia Alfitriyani, Indarini Dwi Pursitasari, Surti Kurniasih. "Biotechnology Module Based on Sociosaintific Issues to Improve Student's Critical Thinking Ability Through Online Learning", *Jurnal Pendidikan Matematika dan IPA*, 2021

Publication

<1 %

21

R P Murtikusuma, A Fatahillah, E Oktavianingtyas, S Hussen, N Lailiya. "The development of interactive mathematics learning media based on schoology and visual basic through industrial revolution 4.0", *IOP Conference Series: Earth and Environmental Science*, 2019

Publication

<1 %

22 W F Putri, Irwan. "Validity of learning devices mathematical based on quantum teaching and learning model for improving critical thinking", Journal of Physics: Conference Series, 2019
Publication <1 %

23 garuda.kemdikbud.go.id
Internet Source <1 %

24 journal.unnes.ac.id
Internet Source <1 %

25 prosiding.unirow.ac.id
Internet Source <1 %

26 www.scilit.net
Internet Source <1 %

27 Sadraini, Hamdi Rifai. "Validity of physics edupark e-book with scientific approach based on tourism destinations of Rumah Gadang", Journal of Physics: Conference Series, 2021
Publication <1 %

28 Sowel Ilhami, Ellizar, Ananda Putra, Hardeli. " Validity and practicality of salt hydrolysis module based on discovery learning with scientific approach to increase the critical thinking ability of 11 grade high school <1 %

29

Sri Nawangsari, Robby Kurniawan Harahap, Harun Al Rasyid, Nina Herlina, Erik Ekowati, Anugriaty Indah Asmarany. "Design of Mobile Digital Healthcare Application For Pregnant Women Based on Android", MATRIK : Jurnal Manajemen, Teknik Informatika dan Rekayasa Komputer, 2022

Publication

<1 %

30

T Gayatri, H Soegiyanto, P Rintayati. "Development of Contextual Teaching Learning-Based Audio Visual Adobe Flash Media to Improve Critical Thinking Ability of Geography Learning at Senior High School", IOP Conference Series: Earth and Environmental Science, 2018

Publication

<1 %

31

download.atlantis-press.com

Internet Source

<1 %

32

journalppw.com

Internet Source

<1 %

33

I N Hidayah, Fathimatuzzahra. "Development of Math Comic Learning Media on The Subject of Algebraic Expressions for Seventh Grade of Junior High School Students", Journal of Physics: Conference Series, 2019

<1 %

34

Siti Arma, Supriadi Supriadi. "Analysis of Student's Creative Thinking Ability on Colloid Material", Jurnal Akademika Kimia, 2022

Publication

<1 %

35

core.ac.uk

Internet Source

<1 %

36

edukatif.org

Internet Source

<1 %

37

ejournal.nusamandiri.ac.id

Internet Source

<1 %

38

files.eric.ed.gov

Internet Source

<1 %

39

journal.uir.ac.id

Internet Source

<1 %

40

online-journal.unja.ac.id

Internet Source

<1 %

41

www.jurnal.unsyiah.ac.id

Internet Source

<1 %

42

Dhimas Nur Setyawan, Nonoh Siti Aminah, Sarwanto Sarwanto. "The Using of Scientific Based Physics Module in Learning to Enhance High School Students' Critical Thinking Skills on Rotation Dynamics and Equilibrium of Rigid

<1 %

Body", Journal of Education and Learning
(EduLearn), 2017

Publication

43

Mendala, I G P Suryadarma. "Local Potential of West Kalimantan's Mangrove Ecosystem as A Study Material in Biology Education at Mangrove Area School", Journal of Physics: Conference Series, 2019

Publication

<1 %

44

Yerimadesi, Bayharti, S M Jannah, Lufri, Festiyed, Y Kiram. "Validity and Practitality of Acid-Base Module Based on Guided Discovery Learning for Senior High School", IOP Conference Series: Materials Science and Engineering, 2018

Publication

<1 %

Exclude quotes On

Exclude matches Off

Exclude bibliography On