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The Validity of Clues is Practical on Human Sensory Materials to Improve the Critical Thought Skills of Learners

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Martika Arisma Sari[1], Tabitha Sri Hartati Wulandari[2*]
[1,2]Department of Biology Education, Faculty of Teacher Training and Education,
Universitas PGRI Ronggolawe, Tuban, Indonesia

Corresponding Email: *tabithawulandari7@gmail.com

Abstract

The primary purpose of this study is to describe the design and validity of the teaching material of electronic practice through problem-based learning (PBL) to improve critical thinking skills. The type of research used is development or research and development (R&D) using the 4D development design by Thiagarajan (1974). The research subject researchers use as the validator expert is the lecturer and biology teacher of SMAN 3 Tuban. Research and development data collecting that researchers use is a validation sheet. The research data analysis USES descriptive and verifiable techniques from the study. The results show the validity of the electronic practical instructions in terms of content/material worthiness achieves an average of 80% in valid categories, terms of systemic worthiness achieve an average of 82% in valid categories, terms of language worthiness achieves an average of 80% valid categories, and in terms of eligibility scores an average of 77% valid categories. The overall validity score of the electronic practical clue developed by 79.75% valid categories.

Keywords: Problem of Based Learning (PBL), Practical Instructions, Critical Thinking, Validity

INTRODUCTION

The problem of based learning is a model of learning that involves principle 4c (critical thinking, communication, communication, and valence) in its application and thus is considered ideal for fulfilling education objectives in the 21st century (Santoso *et al*., 2023). Problem-based learning (PBL) can be an excellent choice for developing critical learners' thinking skills (Hussin *et al*., 2018). The stages of problem-based learning are: 1) orienting the problem on learners; 2) organizing learners to study; 3) assisting self-investigation and group; 4) expanding and expand; and 5) process analysis and evaluation address the problem (Hung *et al*., 2008; Rerung *et al*., 2017).

The 21st-century benefit of biology lessons can increase learners' critical thinking by using electronic practical instructions (Mortensen & Nicholson, 2015). The guide to an electronic project is an interest-framed teaching form in an electronic format that contains materials, problems, pictures, videos, and links that make the user more interactive (Aprilia, 2021). Learners in this age of technological development are more interested in learning media that utilize other media such as computers/computers, even smartphones than those learning media that are printed (Chodzirin, 2016). A learning model that can improve critical thinking skills in an age of technological development is the learning model-based learning (PBL) problem (Agnesa & Rahmadana, 2022).

Practical instruction is one of the learning media that contains practice activities and practical procedures so that it can assist educators and learners in the lengthening process of

practicality (Widyaningrum & Wijayanti, 2019). The characteristics of practical instructions that are able to improve students' critical thinking are the presence of indicators in practical instructions consisting of interpretation, analysis, evaluation and inference. Practical activities such as the implementation of active learning are expected to be able to train critical learners' thinking skills (Nafiah & Suyanto, 2014). Furthermore, the existence of the 21st century where the development of the world in the 21st century was marked by the utilization of information technology and communication in all aspects of life. In this century, the only subject of improvement is natural science, a vast number of learning fields, one of which is biology. Biology as a science can be learned through the tangible realities of daily life (Jayawardana & Gita, 2020).

Critical thinking is a meaningful way of thinking and has a reason and a purpose in deciding a problem (Nada *et al*., 2022). In addition, critical thinking skills are individual abilities in evaluative thinking that show the ability to see the gap between reality and truth based on idealism and truth, evaluate and create the problem-solving stage (Rachmadtullah, 2015). Then it can be concluded that critical thinking skills are a thinking ability that each individual has in analyzing and resolving problems that can be seen from reality and truth. Critical thinking skills become one of the basic problem-solving skills. The learner's indicator of critical thinking ability is (1) the capability to analyze information and problems; (2) the ability to formulate ideas; (3) being able to make strategies to solve problems; (4) the ability to evaluate; (5) the ability to conclude (Masrinah *et al*., 2019).

The material that researchers use is the human sensory system. The human sensory system consists of eyes, ears, skin, mouth, and nose. Researchers use the eye and ear sensory sub matter, the reason researchers use the eye and ear senses is because of the frequent interference with learners between those two sub-materials. To test an electronic instructional product, practical to improve critical thinking skills, learners use 4 aspects which are content/material worthiness: an aspect of systemic worthiness; aspects of propriety; and the feasibility aspect. This researchers are developing predictive products practical using mobile Canva applications. Electronic practical guidelines are designed to allow students to participate actively in learning and improve students critical thinking skills (Minasari & Susanti, 2023). The research carried out by the current researcher is "Development of E-Practical Instructions on Human Sensory System Material to Improve Students' Critical Thinking Skills". The previous research that the researcher took was research conducted by Setiawan (2021) entitled “Development of a Guided Inquiry Based Biology Practical Guide Pteridhophyta Sub-Material as a Learning Resource for Class X Students in High School Muhammadiyah I Sekampung Udik".

The study aims to describe the design and validity of the teaching materials of electronic practices through problem-based learning (PBL) to improve the critical thinking skills of learners developed based on the validator scheme. Thus, the goal is to achieve a single-part contribution toward the inclusion of quality of infertile across the strait to alternative innovative and legalistic teaching on biology study.

METHOD

The type of research used is development or research and development (R&D) using the 4D development design by Thiagarajan (1974), define, design, design, flour, and develop ate, but is limited to the specific (deployment) stages. The research subject that researchers use as the validator expert is the two lecturer and one biology teacher of SMAN 3 Tuban. Research and development data collecting that researchers use is a validation sheet. This research data analysis USES a descriptive technique that can be obtained from real data by presenting valiant data and research results. The formula used to calculate the validity of each aspect of the following criteria:

$$P\ (\text{Presentation Each Criteria}) = \frac{\textit{Score per criteria}}{\textit{Maximum Score}} \times 100\ \%$$

Source: Arikunto (2013)

Table 1. Assessment Criteria

Score	Information
5	Very Good
4	Good
3	Pretty Good
2	Not Good
1	Very Bad

Table 2. Percentage of Assessment Results

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

Source: Arikunto (2013)

RESULTS AND DISCUSSION

Based on the 4-D development model define, design, development (compact), and diffusion (desseminate). Researchers, however, undertake research only to the point of development. As for the development of teaching materials, electronic applications on the material of the human sensory system to improve learner's critical thinking skills, learning ability is obtained:

a. Defining (define) where there is 1) a final preliminary analysis of the content of learning and PBL learning measures (based learning problem) and an explanation or basis of human sensory system material theory; 2) students' disposition tells of the needs of learners; 3) finish task analysis of assignments that have been presented in cbi steps; 4) the final concept analysis consists of concepts identification in the development of the teaching material considering the attainment of learning and the purpose of learning; 5) the goal specifications contained about analysis created the purpose of the teaching material to be made so that in the process it could be pointed in the direction one would expect to solve the problem. The goal of this stage is to analyze the initial learning needs by watching and adjusting the school's learner's learning needs (Saraswati *et al*., 2022).

Figure 1. Initial Cover Design

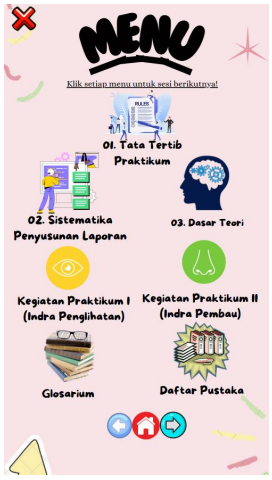


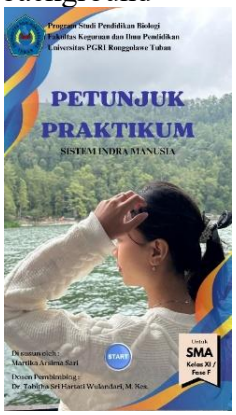
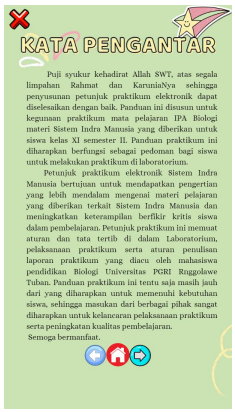
Figure 2. Initial Design of the Main Menu

b. Design stage (design), this stage consists of 1) the photo text that contains the validation of learners' analysis; 2) media elections, where researchers use the Canva application to puzzle steps from CBI; 3) selecting format, researchers using simple themes and easy fonts read by learners; 4) initial summary, the design that researchers used was the canvas media application to design the title and content of the electronic practical instructions. The purpose of the design stage is to design the format of systematic modules and the modules produced according to the needs of learners (Saraswati *et al*., 2022).

c. Development stage (develop) which contains the front cover, the identity of the teaching material, filling out the learners' identity using Google forms, prepositions, directories, glossaries, and so on. Can be viewed in lines as a brick:

Table 3. Product Revision Results

Feedback/Suggestions	**Revision Results**

Feedback/Suggestions	Revision Results
Please tidy up the title page and fix the background 	Changed the title page and added and improved the background 
Pay attention to the font type, font size for easy reading, and the location of the next button 	Change the font type, font size, button location, and add a home button 
Add danger during practical work	Additional dangers during practicum implementation 
The image source is not valid	Changing images from valid sources or references from articles

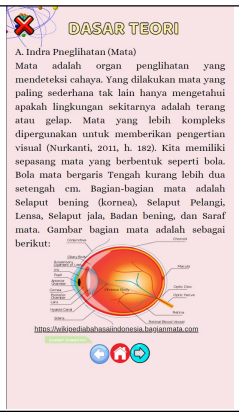
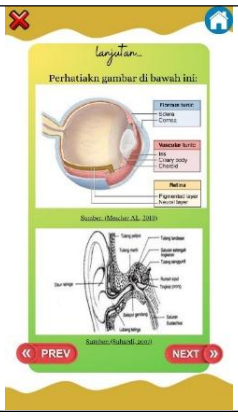
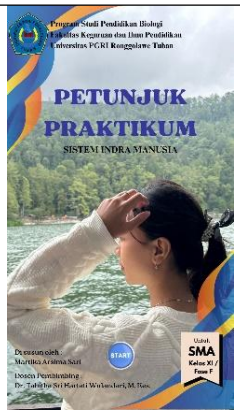
Feedback/Suggestions	Revision Results
	

Table 4. Fill Out the Electronic Directory



The cover/cover on these electronic practical clues contains the identity of the teach material starting from the title, the name of the writer, the origin of the writer's agency, the name of the guidance counselor, and assigned class information.

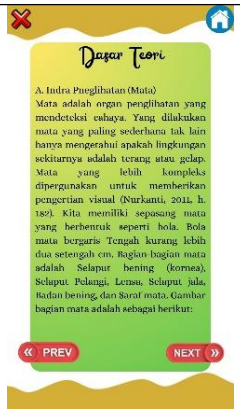
The content of the introductory instructions above explains gratitude and thanks as well asan explanation of electronic instructions.

The presentation of attendance and the roll call in clear so that learners can fill out the attendance list first before attending activity.

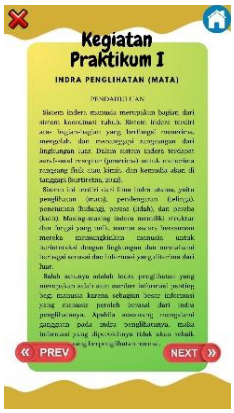
The attainment of learning and the purpose of learning includes the content or insignificance of the learning activities in human sensory material according to curriculum 2013.

In the view the main menu describes some of the content of the electronic practical instructions: the rules of the practice, the systemic creation of progress reports, the basis of the theory of the sensory perception and smell, the impractical activities of the sensory perception (eye), the activities of the smeller (nose), the glosary, the library list, and the writer's biography.

The content of the orderly instructions of the electronic practice system consists of time of practice, of clothes of practice, of provisions during practice taking place, and of the peril of practicality.



The basis of the theory is that the explanation of the material system of the human senses, the sense of sight, and the sense of smell.



The introduction to practical activities contains I brief explanation of the sensory matter (the eye) while the introduction to the action of the imposition II contains a brief description of the smeller (nose) matter.

The menu views of the above PBL steps consist of: problem orientation, organizing learners to learn, guide individual and group inquiry, develop and present the results of learning, and analyze and evaluate learning.

The glossary on the above practical clues explains a particular domain of knowledge coupled with definitions for the terms found in electronic imposition instructions.

Library lists contain references or directories used to quote scientific literature. These resources may be obtained from books, magazines, articles, news, and other materials for the processing of electronic deductions.

The above resume lists documents that depict a history of education, work experience, and the skills of authors.

d. Validation test stage of electronic practical instructions, validation tests are performed to ensure that the product meets expected standards and can function properly according to established purposes. The completion of the personal module of the four components of the in-line/material, systemic navigational, language worthiness, and grappling (Dewi *et al*., 2018). The application of this load is presented in Table 5, extending the Lakeland e-module diagram presented in Figure 3.

Table 5. The Results of Redating Validation by Validator

No.	Assesment Aspect	Validator Score			Average	Paule
		I	II	III		
1.	Content/material	84%	75%	81%	80%	Valid
2.	Systemic	88%	80%	80%	82%	Valid
3.	Language	84%	76%	80%	80%	Valid
4.	Predictability	76%	76%	80%	77%	Valid
Average Percentage Score Criteria					**79,75%**	**Valid**

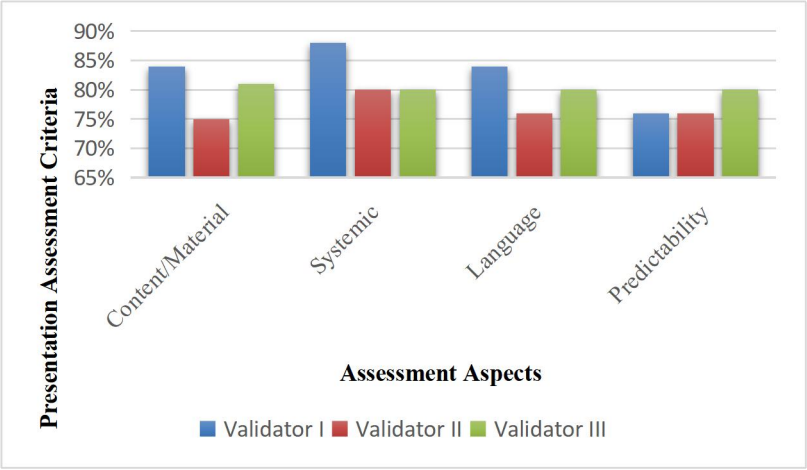


Figure 3. Diagram by Extensive Validation of the Sole Validator Expert

From the recapitalization results in Table 5 get an average of the appropriateness of content/material 80% belong to a valid category, 82% obtained from a valid category of systemic worthiness, language worthiness gets an average of 80% falls into valid categories

and 77% derived from an average of charitable worth. In addition, the total parcellation average as big as 79.75 percent cellular to the guide in this electronic system is stated as valid, based on the reliability of Arikunto (2013), and is stated to be valid and worthy of use in the efficacy of remedial repairs.

Table 6. Product Revision

Before Revision	Revision Results
No harm while the execution is in effect	Adding danger to the implementation of the practice
Invalid image source	Change pictures from valid sources or references from the article
Please update the title page and background corrections	Change title page and addition and repair background
Look at font types, font sizes for readability, and the place of the next button	Change the font type, font size, the location of the keys, and the addition of home buttons

Based on the results of validation by three validator experts, it could be concluded that the highlighted e-modules are worthy of a test.

CONCLUSION

The product of this electronic practical instruction is designed to use a 4D development model developed by Thiagarajan (1974) that has four stages in its development: 1) define (define); 2) design stages; 3) stage of development (application); and 4) deployment stages (disseminate). However, researchers do research only on the stage of development or only on the test of validity. Validation points out this electronic practical to improve the critical thinking skills of the developing learners gets an average percentage of 79.75% score, which means that these electronic practical instructions are valid and worthy of a test.

REFERENCES

Agnesa, O. S., & Rahmadana, A. (2022). Model problem-based learning sebagai upaya peningkatan keterampilan berpikir kritis pada pembelajaran biologi. *Journal on Teacher Education*, *3*(3), 65-81.

Aprilia, A. (2021). *Pengembangan E-Modul Menggunakan Flip PDF Professional pada Materi Fungi Kelas X SMA* (Doctoral dissertation, IAIN Metro).

Arikunto, S. (2013). *Prosedur Penelitian: Suatu Pendekatan Praktik*. Jakarta: Rineka

Chodzirin, M. (2016). Pemanfaatan information and communication technology bagi pengembangan guru madrasah sub urban. *Jurnal Pemikiran Agama Untuk Pemberdayaan*, *16*(2), 309-332.

Dewi, E. M., Annisa, M., & Kunadi, D. (2018). Pengembangan Modul IPA Berbasis Keterampilan Proses Sains dalam Mengembangkan Karakter pada Siswa Kelas VA SDN 007 Tarakan. *LENSA (Lentera Sains): Jurnal Pendidikan IPA*, *8*(2), 54-66.

Hung, W., Jonassen, D. H., & Liu, R. (2008). Problem-based learning. In *Handbook of research on educational communications and technology* (pp. 485–506). Routledge.

Hussin, W. N. T. W., Harun, J., & Shukor, N. A. (2018). Problem based learning to enhance students critical thinking skill via online tools. *Asian Social Science*, *15*(1), 14.

Jayawardana, H. B. A., & Gita, R. S. D. (2020, August). Inovasi pembelajaran biologi di era revolusi industri 4.0. In *Prosiding Seminar Nasional Biologi* (Vol. 6, No. 1, pp. 58-66).

Masrinah, E. N., Aripin, I., & Gaffar, A. A. (2019, October). Problem based learning (PBL) untuk meningkatkan keterampilan berpikir kritis. In *Prosiding Seminar Nasional Pendidikan* (Vol. 1, pp. 924-932).

Minasari, U., & Susanti, R. (2023). Penerapan Model Problem Based Leaning Berbasis Berdiferensiasi berdasarakan Gaya Belajar Peserta Didik pada Pelajaran Biologi. *Ideguru: Jurnal Karya Ilmiah Guru*, *8*(2), 282-287.

Mortensen, C. J., & Nicholson, A. M. (2015). The flipped classroom stimulates greater learning and is a modern 21st century approach to teaching today's undergraduates. *Journal of animal science*, *93*(7), 3722-3731.

Nada, Q., Zaini, M., & Ajizah, A. (2022). Implementation of e-LKPD live worksheets of archaebacteria and eubacteria: Its effect on cognitive learning outcomes and critical thinking skills of MIPA grate X students. *Practice of The Science of Teaching Journal: Jurnal Praktisi Pendidikan*, *1*(2), 88–96.

Nafiah, Y. N., & Suyanto, W. (2014). Penerapan model problem-based learning untuk meningkatkan keterampilan berpikir kritis dan hasil belajar siswa. *Jurnal Pendidikan Vokasi*, *4*(1), 125-143.

Rachmadtullah, R. (2015). Kemampuan berpikir kritis dan konsep diri dengan hasil belajar pendidikan kewarganegaraan siswa kelas V sekolah dasar. *Jurnal Pendidikan Dasar*, *6*(2), 287-298.

Rerung, N., Sinon, I. L., & Widyaningsih, S. W. (2017). Penerapan Model Pembelajaran Problem Based Learning (PBL) untuk Meningkatkan Hasil Belajar Peserta Didik SMA pada Materi Usaha dan Energi. *Jurnal Ilmiah Pendidikan Fisika Al-Biruni*, *6*(1), 47–55. https://doi.org/10.24042/jpifalbiruni.v6i1.597

Santoso, G., Supiati, A., & Galih, S. (2023). Kemampuan Pemecahan Masalah Matematika Melalui Problem Based Learning (PBL) Siswa Kelas IV SDN Periuk 1 Kota. *Jurnal Pendidikan Transformatif*, *2*(4), 365-371.

Saraswati, S. A., Widiyaningrum, P., & Indriyanti, D. R. (2022). Development of mobile learning (My Repro) based on contextual teaching learning to improve cognitive understanding senior High school student. *Journal of Innovative Science Education*, *11*(1), 38-47.

Setiawan, A. (2021). *Pengembangan Panduan Praktikum Biologi Berbasis Inkuiri Terbimbing pada Sub Materi Pteridophyta sebagai Sumber Belajar Siswa Kelas X di SMA Muhammadiyah 1 Sekampung Udik* (Doctoral dissertation, IAIN Metro).

Thiagarajan, S. (1974). Instructional development for training teachers of exceptional children: A sourcebook.

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.