

Analysis of problem-based digestive system interactive e-module needs to improve students' critical thinking

Yuyun Yuliani ^(1,2), Rita Retnowati ^{(1)*}, Prasetyorini Djarot ⁽¹⁾

⁽¹⁾ Study Program of Science Education, School of Postgraduate, Universitas Pakuan, Bogor, West Java, Indonesia

⁽²⁾ SMA YPHB, Bogor, West Java, Indonesia

*Corresponding Author Email: ritaretnowati@unpak.ac.id

Article Information

Keywords:

Needs analysis; Teaching Materials; Learning media; Troubleshooting; Electronic modules

Kata Kunci:

Analisis kebutuhan; Bahan Ajar; Media pembelajaran; Pemecahan masalah; Modul elektronik

History:

Received : 18/02/2023

Accepted : 20/06/2023

Abstract

The learning process in schools still experiences several problems, including in helping students to have critical thinking skills. Critical thinking skills can be optimized with the development of learning resources. This research aims to develop learning resources in the form of problem-based teaching materials. The research method uses R&D (Research and Development) with a qualitative descriptive approach. Research data collection instruments in the form of interview sheets for teacher needs analysis and student needs analysis questionnaires, as well as students' critical thinking skills. The results of the needs analysis of 60 grade XI science students found that 66.7% had a handbook for learning biology, but 96.7% only had a handbook in the form of daily material, the majority of which were difficult for students to understand. So according to 78.3% of students the handbook used is inadequate as a learning resource, 86.6% of students need other learning resources to support learning activities, and 86.7% of students need other learning resources that can be understood independently. The results of the critical thinking test analysis of 50 grade XI science students were obtained 15.73%, which is included in the very low category. These results show the need to develop teaching materials in the form of problem-based digestive system interactive E-modules.

Abstrak

Proses pembelajaran di sekolah masih mengalami beberapa permasalahan, diantaranya dalam membantu peserta didik untuk memiliki keterampilan berpikir kritis. Keterampilan berpikir kritis dapat dioptimalkan dengan pengembangan sumber belajar. Penelitian ini bertujuan untuk mengembangkan sumber belajar berupa bahan ajar berbasis masalah. Metode penelitian menggunakan R&D (*Research and Development*) dengan pendekatan deskriptif kualitatif. Instrumen pengumpulan data penelitian berupa lembar wawancara untuk analisis kebutuhan guru dan angket analisis kebutuhan siswa, serta keterampilan berpikir kritis siswa. Hasil analisis kebutuhan dari 60 siswa kelas XI IPA diperoleh 66,7% memiliki buku pegangan untuk pembelajaran biologi, namun 96,7% hanya memiliki buku pegangan berupa materi sehari-hari yang mayoritas sulit dipahami oleh siswa. Sehingga menurut 78,3% siswa buku pegangan yang digunakan kurang memadai sebagai sumber belajar, 86,6% siswa membutuhkan sumber belajar lain untuk mendukung kegiatan pembelajaran, dan 86,7% siswa membutuhkan sumber belajar lain yang dapat dipahami secara mandiri. Hasil analisis tes berpikir kritis 50 siswa kelas XI IPA diperoleh 15,73%, dimana hal tersebut termasuk kategori sangat rendah. Hasil tersebut menunjukkan perlunya mengembangkan bahan ajar berupa *E-module* interaktif sistem pencernaan berbasis masalah.

A. Introduction

Education has an important role in human life because life can be more advanced and developed (Hakim et al., 2020). Indonesia's education level is still ranked relatively low compared to other countries (Anisa et al., 2021). This was revealed through the results of the Program for International 286 Student Assessment (PISA) survey conducted by the Organization for Economic Cooperation and Development (OECD) and Trends in Mathematics and Science Study (TIMSS), which showed a reading ability score of 396, below the average score is 496. The scientific literacy score is 386, below the average score of 501. Likewise, the TIMSS results obtained by Indonesian students scored 397, below the average score of 500 (Rofiah et al., 2018).

Science and technology that continues to develop affect various areas of life, including the world of education (Astuti et al., 2022). Education is the most influential aspect in forming a nation ready to face problems in the globalization era (Rofiah et al., 2018). Critical thinking skills are needed in dealing with a problem (Mawarni et al., 2022). Critical thinking can be interpreted as a person's attempt to check the truth of information using the availability of evidence, logic, and awareness of bias (Sulaiman & Syakarofath, 2018).

In an education system that applies the concept of self-directed learning, it is necessary to study materials specifically designed to be studied by students independently because it requires professionals who can develop independent learning materials (Setiyadi, 2017). Teaching materials are not only in the form of books or worksheets based on print media. Non-print-based teaching materials can also be used in learning, such as electronic teaching materials (Kunahyono, 2018). Teaching materials are materials or subject matter arranged systematically by teachers and students in the learning process (Magdalena et al., 2020). To realize effective and enjoyable learning, it is necessary to have a component form in the teaching and learning process or also known as a module (Widiana & Rosy, 2021). One of the learning material development innovations is the electronic module. Electronic modules or commonly referred to as E-modules, are an innovative form of printed modules that utilize technology so that students can use them for independent learning (Pujiati et al., 2019). E-module is a module in digital form, consisting of text, images, or both, which contains digital electronic material accompanied by simulations that can and are appropriate for use in learning (Herawati & Muhtadi, 2018).

One of the subjects that requires teaching materials in the form of electronic modules is Biology. Science, especially biology, is learning in which all aspects of learning are based on scientific processes, such as practicum activities, observing, analyzing, experimenting, and others (Khairunnisa et al., 2019). Biology includes science or knowledge related to life in this universe. This knowledge can be in the form of facts, concepts, theories, or generalizations that explain the symptoms of life (Suryaningsih, 2017). In general, most students have a poor perception of Biology subjects. Based on observations at school, some students still think that biology is quite a difficult subject because there is so much material and Latin terms are difficult to understand (Jayawardana, 2017). Therefore, this negative assumption needs to be removed, and the mindset of students needs to be changed about this negative assumption.

Thus interactive E-module can be used as the best alternative to increase students' understanding, so a problem-based E-module is developed with a model commensurate with the learning process, namely using the Problem-Based Learning syntax. This e-module can be designed using the Articulate Storyline 3 application. Articulate Storyline 3 is an application for creating learning media supported by text, image, audio and video content that can be adapted to learning objectives. The resulting media is also supported by interesting quiz content, so students can immediately actively interact in learning activities (Husain & Ibrahim, 2021). Using innovative learning media based on information technology has great potential to improve the quality of learning because it is an effective and efficient way of conveying information (Hutahaean et al., 2019).

B. Material and Method

This research begins with the observation method of supporting theories for conducting this development research. The previous research that is sought is related to the analysis of the development of interactive biology E-modules as problem-based teaching materials. In contrast, the supporting theory of biological material is digestive system material which will be discussed in product development. This type of research is qualitative descriptive research. Qualitative research is a process of understanding human or social phenomena by creating a comprehensive and complex picture that can be presented in words, reporting detailed views obtained from informant sources, and being carried out in natural settings (Fadli, 2021). Qualitative descriptive research aims

to describe and describe existing phenomena (Zulkhairi et al., 2018).

This research was conducted on Monday, 31 October 2022, at YPHB High School, Bogor City. The sample population used was 60 class XII students to collect data on critical thinking skills, 2 Biology teachers as co-authors at SMA YPHB, and 10 Science teachers to find out the need for problem-based interactive E-modules to improve students' critical thinking skills.

The research procedure used was to analyze the need for problem-based E-module through several responses from science subject teachers and class XII students regarding the advantages and disadvantages of current learning. The analysis carried out was curriculum analysis to determine the material studied and an analysis of the critical thinking skills of YPHB Bogor City High School students. The research procedure used can be more clearly seen in Figure 1.

Data Retrieval

Data collection techniques were collected through interviews, questionnaires, and written tests. The data used in this research are primary data and

secondary data. Primary data were obtained from direct observations in the field by interviewing biology teachers. The primary data used are the results of a questionnaire given to science teachers and class XII students related to biology learning. The instrument used in this study was an essay question with five aspects totaling ten questions. The secondary data used is in the form of scientific articles, which can be used as a source of data in writing.

Data Analysis

Data analysis was carried out by determining the percentage of the problem-based E-module needs questionnaire results. This percentage can be calculated using Formula 1.

$$\text{Percentage} = \frac{\text{The number of answered students}}{\text{The total number of students}} \times 100\% \dots \text{Formula 1}$$

Analysis of students' critical thinking skills was determined by filling out a questionnaire in the form of a Likert scale in the form of a checklist with a range of 0 to 3. Guidelines for scoring critical thinking essay questions can be seen in Table 1.

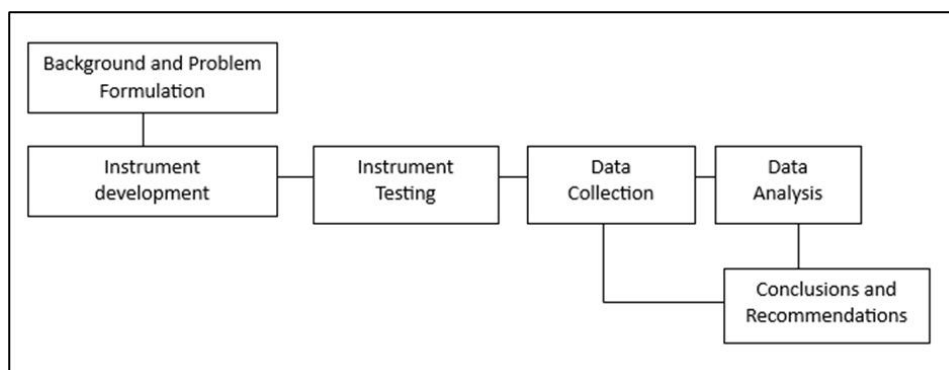


Figure 1 Research Procedure

Table 1 Guidelines for Scoring Critical Thinking Questions according to Stiggins

Category	Score	Indicator
High Score	3	Suppose the answers given are clear, focused and accurate. Relevant points are put forward (related to the questions in the problem) to support the answers given.
Moderate Score	2	Suppose the answers given are clear and sufficiently focused but incomplete.
Low Score	1	Suppose the answers do not follow what is meant in the question. They contain inaccurate information and indicate a lack of mastery of the material.
Very Low Score	0	No Answer

C. Results and Discussion

The results obtained based on the analysis of the teacher's needs for learning media carried out through the process of taking a questionnaire are that most teachers need learning aids in the form of

problem-based interactive E-modules that can improve students' critical thinking skills. The results of the questionnaire distribution are shown in Figure 2.

Based on Figure 2, students feel enthusiastic about studying Biology. The material provided is

not difficult to understand, but 91.7% of students have difficulty analyzing the material. Most students already have handbooks for studying biology, but only 66.7% have additional reference books, so only some students rely on handbooks from schools. Students who need other learning resources to support learning activities are 93.3%, and students who feel the need for a problem-based E-module are 83.3%. E-Module is needed to provide convenience for students in learning to be more active and independent. According to Serevina et al. (2018), learning by using the E-Module will improve students' skills in learning independently without depending on the teacher.



Figure 2
 Questionnaire Distribution. (Information: Q = Question)

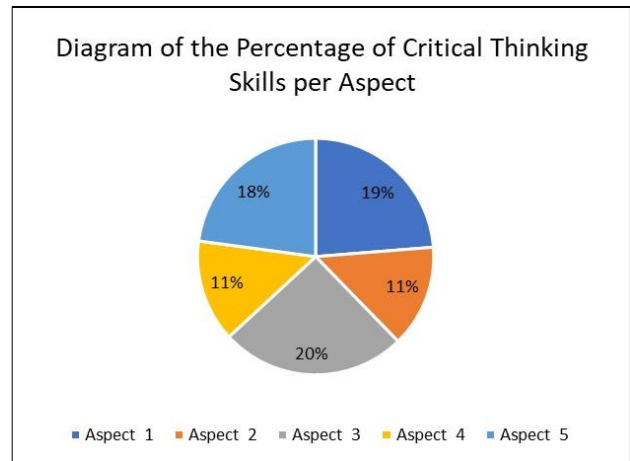


Figure 3 Diagram of the Critical Thinking Skill Percentage

Table 2 shows this study's aspects and indicators of critical thinking. The results of the critical thinking test conducted on YPHB SMA students based on Ennis' aspects and indicators can be seen in the diagram in Figure 3.

These results indicate that the lack of critical thinking skills of YPHB SMA students is caused by several factors, including they are still not trained to use learning that familiarizes students with solving problems, and learning is still conventional. From the results of the analysis of students' critical thinking skills, the percentage per aspect is giving simple explanations (elementary clarification) at 19%, building basic skills (basic support) at 11%, drawing conclusions (inference) at 20%, providing further explanations (advance clarification) by 11%, Set strategy and tactics (strategies and tactics) by 18%. The average YPHB high school student's critical thinking ability was 15.73%. Several possibilities cause the low critical thinking skills of students in learning. The low level of critical thinking skills on the elementary clarification indicator is because students are not used to focusing on questions and analyzing the test questions being tested first (Arum, 2014). In summary, it can be said that critical thinking is a dynamic process that allows students to detect differences in information, collect data, analyze data, and evaluate and conclude the information or data obtained (Anugraheni et al., 2020).

Based on the questionnaire results from the three teachers interviewed, it was found that additional teaching materials were needed to be given to students to improve their critical thinking skills. One of the demands of learning in the 21st century is that students are able to think critically, creatively, and analyze, thus making researchers think about developing teaching materials that are adapted to current needs, namely teaching materials in the form of problem-based E-modules.

Students can use this E-module without being limited by space and time. Islahiyah et al. (2021) said that problem-based interactive E-modules are essential in improving students' problem-solving abilities. The E-Module that will be developed is integrated with learning with PBL syntax. Developing E-Module with PBL syntax can improve students' critical thinking skills by oriented to everyday problems (Sujiono & Widiyatmoko, 2014). In the E-module, students are also trained in solving problems that refer to aspects in the critical thinking skills indicator (Ennis) so that students are accustomed to solving problems that usually occur in everyday life and can improve students'

critical thinking skills. The developed e-module is also made more interactive with animations or videos related to digestive system material, which can attract students to further increase their interest in learning the material. E-module is a form of presenting independently structured learning materials that are systematically designed for specific learning and displayed in an electronic format, where each learning activity is connected with a link as navigation, making students more interactive with the program. , equipped with video tutorials, animations and audio to enrich the learning experience, thus making students more interactive (Najuah et al., 2020).

Table 2 Aspects dan Critical Thinking Indicators Ennis

Aspect	Critical Thinking Indicator	Sub Indicator
1	Give a simple explanation (elementary clarification)	a. Focusing questions b. Analyze arguments c. Ask and answer questions that require explanation or challenge
2	Build basic skills (basic support)	a. Consider the credibility of the source b. Make observational considerations
3	Conclusion (inference)	a. Compile and consider deductions b. Construct and consider induction c. Formulate decisions and consider the results
4	Provide further explanation (advance clarification)	a. Identify terms b. Consider definition c. Identify assumptions
5	Set strategy and tactics (strategies and tactics)	a. Define an action b. Interact with others

(Source: Susanti, 2017)

D. Conclusion

Based on the results of the questionnaire given to students and interviews with biology teachers, the conclusion is that students need teaching material that can increase students' understanding of the digestive system material independently so as to improve students critical thinking skills. Teaching materials suitable for use are problem-based interactive E-module teaching materials, which can contain text, images, and videos, which are made more interesting, unlike handbooks in general, as well as E-modules which already contain material and practice questions that lead to critical thinking. For further research, based on needs analysis, it can be seen that there is a need for media in the form of teaching materials for students to study independently, wherever and whenever. The teaching material should be a problem-based E-module.

E. References

Anugraheni, I., Kristen, U., & Wacana, S. (2020). Analisis kesulitan mahasiswa dalam

menumbuhkan. *Jurnal Cendekia: Jurnal Pendidikan Matematika*, 4(1), 261–267. DOI: <https://doi.org/https://doi.org/10.31004/cendekia.v4i1.197>

Anisa, A. R., Ipungkarti, A. A., & Saffanah, K. N. (2021). Pengaruh kurangnya literasi serta kemampuan dalam berpikir kritis yang masih rendah dalam pendidikan di Indonesia. In *Current Research in Education: Conference Series Journal* (Vol. 1, No. 1, pp. 1-12). Universitas Pendidikan Indonesia. Retrieved from <https://ejournal.upi.edu/index.php/crecs/article/view/32685>

Arum, D. R. (2014). Penerapan metode pembelajaran studi kasus berbantuan modul untuk meningkatkan keterampilan berpikir kritis. *Chemistry in Education*, 3(2), 177-184. Retrieved from <https://journal.unnes.ac.id/sju/index.php/chemined/article/view/3289>

Astuti, N., Kaspul, K., & Riefani, M. K. (2022). Validitas modul elektronik "Pembelahan Sel" berbasis keterampilan berpikir kritis. *Jurnal Eksakta Pendidikan (Jep)*, 6(1), 94–102. DOI: <https://doi.org/10.24036/jep/vol6-iss1/667>

- Fadli, M. R. (2021). Memahami desain metode penelitian kualitatif. *Humanika*, 21(1), 33–54. DOI: <https://doi.org/10.21831/hum.v21i1.38075>
- Hakim, L. N., Wedi, A., & Praherdhiono, H. (2020). Electronic module (E-Module) untuk memfasilitasi siswa belajar materi cahaya dan alat optik di rumah. *JKTP: Jurnal Kajian Teknologi Pendidikan*, 3(3), 239-250. DOI: <https://doi.org/10.17977/um038v3i32020p239>
- Herawati, N. S., & Muhtadi, A. (2018). Developing interactive chemistry e-modul for the second grade students of senior high school. *Jurnal Inovasi Teknologi Pendidikan*, 5(2), 180–191. DOI: <http://dx.doi.org/10.21831/jitp.v5i2.15424>
- Husain, R., & Ibrahim, D. (2021). Pengembangan media pembelajaran interaktif menggunakan Articulate Storyline di sekolah dasar. *Aksara: Jurnal Ilmu Pendidikan Nonformal*, 7(3), 1365-1374. DOI: <https://doi.org/10.37905/aksara.7.3.1365-1374.2021>
- Hutahaean, L. A., Siswandari, S., & Harini, H. (2019, November). Pemanfaatan e-module interaktif sebagai media pembelajaran di era digital. In *Prosiding Seminar Nasional Teknologi Pendidikan Pascasarjana UNIMED*, (Vol. 1, pp. 298–305). Retrieved from <http://digilib.unimed.ac.id/id/eprint/38744>
- Islahiyah, I., Pujiastuti, H., & Mutaqin, A. (2021). Pengembangan e-modul dengan model pembelajaran berbasis masalah untuk meningkatkan kemampuan pemecahan masalah matematis siswa. *AKSIOMA: Jurnal Program Studi Pendidikan Matematika*, 10(4), 2107-2118. DOI: <https://doi.org/10.24127/ajpm.v10i4.3908>
- Jayawardana, H. B. A. (2017). Paradigma pembelajaran biologi di era digital. *Jurnal Bioedukatika*, 5(1), 12-17. DOI: <https://doi.org/10.26555/bioedukatika.v5i1.5628>
- Khairunnisa, K., Ita, I., & Istiqamah, I. (2020). Keterampilan proses sains (KPS) mahasiswa Tadris Biologi pada mata kuliah biologi umum. *BIO-INOVED: Jurnal Biologi-Inovasi Pendidikan*, 1(2), 58-65. DOI: <http://dx.doi.org/10.20527/binov.v1i2.7858>
- Kuncahyono, K. (2018). Pengembangan e-modul (Modul Digital) dalam pembelajaran tematik di sekolah dasar. *JMIE (Journal of Madrasah Ibtidaiyah Education)*, 2(2), 219. DOI: <https://doi.org/10.32934/jmie.v2i2.75>
- Magdalena, I., Sundari, T., Nurkamilah, S., Nasrullah, N., & Amalia, D. A. (2020). Analisis bahan ajar. *Jurnal Pendidikan dan Ilmu Sosial*, 2(2), 311–326. Retrieved from <https://ejournal.stitpn.ac.id/index.php/nusantara>
- Mawarni, H., Sholahuddin, A., & Badruzsaufari, B. (2022). Validitas modul interaktif pembelajaran IPA untuk meningkatkan kemampuan berpikir kreatif. *Jurnal Biologi dan Pembelajarannya*, 14(1), 54–64. DOI: <http://dx.doi.org/10.20527/wb.v14i1.13662>
- Najuah, N., Pristi, S. L., & Winna, W. (2020). *Modul elektronik: Prosedur penyusunan dan aplikasinya*. Jakarta: Yayasan Kita Menulis
- Pujiati, P., Rahmawati, F., & Rahmawati, R. (2019, July). Pentingnya e-module pembelajaran peserta didik di era revolusi. In *The 2nd Proceeding Annual National Conference for Economics and Economics Education Research*, (Vol. 2, pp. 81–87), STKIP PGRI Sumatra Barat. Retrieved from <http://repository.lppm.unila.ac.id/15804/>
- Rofiah, E., Aminah, N. S., & Sunarno, W. (2018). Pengembangan modul pembelajaran IPA berbasis High Order Thinking Skill (HOTS) untuk meningkatkan kemampuan berpikir kritis siswa kelas VIII SMP/MTs. *INKUIRI: Jurnal Pendidikan IPA*, 7(2), 285. DOI: <https://doi.org/10.20961/inkuiri.v7i2.22992>
- Setiyadi, M. W. (2017). Pengembangan modul pembelajaran biologi berbasis pendekatan saintifik untuk meningkatkan hasil belajar siswa. *Journal of educational science and technology*, 3(2), 102-112. DOI: <https://doi.org/10.26858/est.v3i2.3468>
- Serevina, V., Astra, I., & Sari, I. J. (2018). Development of e-module based on Problem Based Learning (PBL) on heat and temperature to improve student's science process skill. *Turkish Online Journal of Educational Technology-TOJET*, 17(3), 26-36. Retrieved from <https://www.learntechlib.org/p/189646/>
- Sujiono, S., & Widiyatmoko, A. (2014). Pengembangan modul IPA Terpadu berbasis problem based learning tema gerak untuk meningkatkan kemampuan berpikir kritis siswa. *Unnes Science Education Journal*, 3(3), 685-693. DOI: <https://doi.org/10.15294/usej.v3i3.4287>
- Sulaiman, A., & Syakarofath, N. A. (2018). Berpikir kritis: Mendorong introduksi dan reformulasi konsep dalam psikologi Islam. *Buletin Psikologi*, 26(2), 86-96. DOI: <https://doi.org/10.22146/buletinpsikologi.38660>
- Suryaningsih, Y. (2017). Pembelajaran berbasis praktikum sebagai sarana siswa untuk berlatih menerapkan keterampilan proses sains dalam materi biologi. *Bio Educatio*, 2(2), 49-57. DOI: <http://dx.doi.org/10.31949/be.v2i2.759>
- Susanti, O. I. (2017). *Pengaruh model discovery learning terhadap kemampuan berpikir kritis*

dalam pemecahan masalah pada pembelajaran IPA siswa kelas V SD Segugus III Kecamatan Jatinom Kabupaten Klaten. (Unpublished Undergraduate Thesis, Universitas Negeri Yogyakarta).

Widiana, F. H., & Rosy, B. (2021). Pengembangan e-modul berbasis Flipbook Maker pada mata pelajaran teknologi perkantoran. *Edukatif:*

Jurnal Ilmu Pendidikan, 3(6), 3728–3739. DOI: <https://doi.org/10.31004/edukatif.v3i6.1265>
Zulkhairi, Z., Arneliwati, A., & Nurchayati, S. (2018). Studi deskriptif kualitatif: Persepsi remaja terhadap perilaku menyimpang. *Jurnal Ners Indonesia*, 8(2), 145-157. DOI: <https://doi.org/10.31258/jni.8.2.145-157>