

Development of E-Module on Regulatory System Material for Class XI High School

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Abstract

The purpose of this research is to produce an e-module product that is feasible and valid as alternative teaching material for students. This study uses the 4D development method which consists of 4 stages, namely define, design, develop, and disseminate. The findings of this study succeeded in developing an e-module on material system regulation for class XI SMA. Based on the results of the validation questionnaire that has been carried out with Lecturers and Teachers, the average score is 90.1% with very valid criteria. Thus, the developed e-module is said to be valid for use by students.

Keywords: E-module, 4D models, validation, regulatory system material

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Introduction

Current teaching and learning activities have followed the development of the times which are rich in science and technology and demand variations on patterns by using technology in the learning process. To support the learning process, adequate sources of teaching materials are needed and make it easier for educators and students to achieve learning objectives. Teaching materials are a set of materials that are systematically arranged both written and unwritten to create an environment or atmosphere that allows students to learn (Helendra et al., 2018). The use of media and learning resources is an important part of the components that affect learning. There are three aspects to analyzing learning resources, namely aspects of availability, suitability, and ease of use. Utilization and empowerment of teaching materials to support learning is a necessity, not only to improve the effectiveness and quality of learning but more importantly to increase mastery of the material for both educators and students (Haleem et al., 2022).

Teaching materials are grouped based on form, working method, nature, and substance (material) (Khan et al., 2019);(Bokov et al., 2021); (Darling-Hammond et al., 2020). Teaching materials according to their form are in the form of printed teaching materials, listening teaching materials, and hearing teaching materials. Teaching materials according to how they work consist of non-projected teaching materials, projected teaching materials, audio teaching materials, video teaching materials, and computer media teaching materials (Kathirvel & Hashim, 2020). With the development of science and technology in the world of education, teaching materials are not only in the form of books but can be developed into electronic forms, such as electronic books (e-books) and electronic modules (e-modules) making it easier for students to access various materials to be studied (Zhang et al., 2021); (Ratnasari & Haryanto, 2019); (Malysheva et al., 2022).

Based on the results of interviews conducted with one of the Biology teachers at SMA Negeri 1 Bonjol on December 27, 2021, information was obtained that the Biology learning process used teaching materials in the form of printed modules in the 2019/2020 school year. The module used by teachers and students is a module compiled by the MGMP team (Subject Teacher Conference). The learning process in the classroom is carried out in groups consisting of 4-5 groups with one module for each group, this is due to the limited number of modules with a large number of students in the class. However, since the Covid-19 case, the use of the module has stopped until now.

The second observation was carried out on March 20, 2022, it obtained information that students had been using cell phones in the learning process. In addition to conducting interviews, the author also distributed a questionnaire on the needs of students with class XI students. Based on the results of the questionnaire, one of the difficult Biology subject matter to understand is the regulatory system, because the material has a broad scope, such as relating to the system processes in it. Based on the curriculum, the material for the regulation system is the material contained in the even semester with the coverage of the material on the nervous, endocrine, and sensory systems described in KD 3.10. Curriculum demands for the achievement of these basic competencies are that students can explain relationships, analyze relationships, and evaluate each system. This material also requires students to be able to develop higher-order thinking as mentioned in the related KD.

Based on the above problems, to support and facilitate the learning process, it is necessary to develop teaching materials. One of them is that educators can develop teaching materials in the form of e-modules to be used in the Biology learning process. The advantages of the e-module are that it can be accessed anytime and anywhere by students and educators, is interactive in its easy use because it contains instructions for use, and contains images, videos, and quizzes that have feedback (Dhawan, 2020). Therefore, the development of e-modules at the school can be accessed offline. This development is also supported by data from the questionnaire results of student needs that have been carried out, namely 97% of students stated that educators have used modules in the learning process, and 97% of students agreed to do the development of e-modules on regulatory system materials. 100% of students agree that the e-module is added with videos and images as supporting material. Therefore, it is necessary to develop teaching materials on the regulatory system material for class XI students at SMA Negeri 1 Bonjol are interesting and can help in understanding the material and can be used anytime and anywhere by students independently. The purpose of this research is to produce an e-module product that is feasible and valid as alternative teaching material for students.

Methodology

The type of research conducted is development research using the 4D model developed by Trianto (2012). The 4D model consists of four stages, namely 1) define, 2) design, 3) develop, and 4) disseminate. However, considering the limited time in this research process, the researchers conducted research only up to the development stage (Figure 1).

The validity analysis questionnaire is described in tabular form and suggestions for improvement. The questionnaire assessment sheet will be filled out by lecturers and teachers. the results of the assessment will be analyzed to determine the quality of the e-module from

programming, content, presentation, and evaluation. the steps for validation are as follows:

1. Giving an answer score with criteria based on the Likert scale modified from Riduwan (2009) as follows. the answer score criteria are:

SS = Strongly agree (weight 4)
 S = Agree (weight 3)
 TS = Disagree (weight 2)
 STS = Strongly disagree (weight 1)

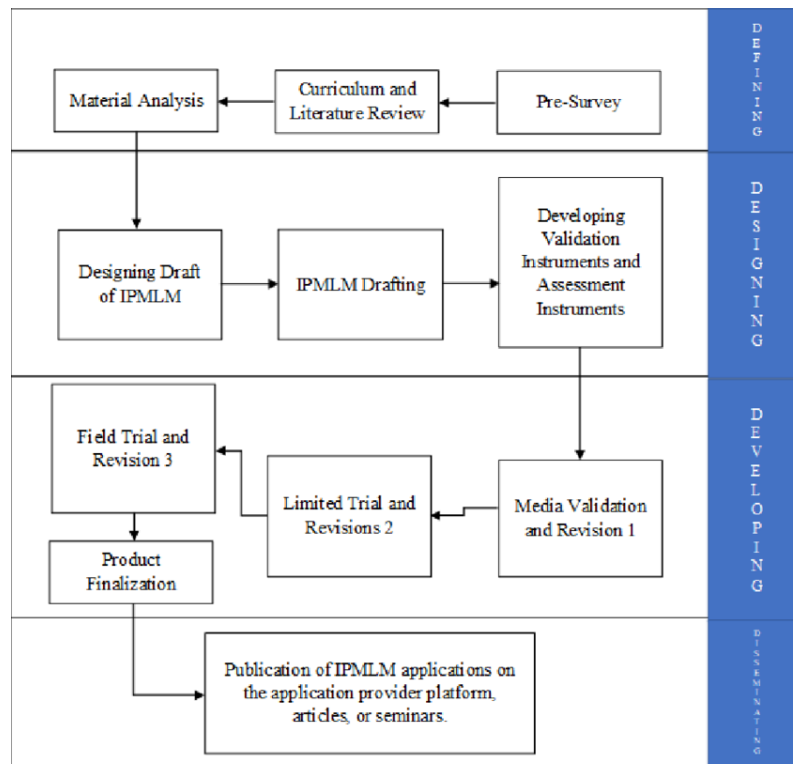


Figure 1. 4D development model drawing (Trianto, 2012)

2. Determination of the highest score
 Highest score = many validators x highest answer score
3. The score is obtained by adding up the scores from each validator
4. Giving validity by:

$$\text{Validation value} = \frac{\text{total score obtained}}{\text{maximum score}} \times 100\%$$

5. The assessment of validity is based on the modified criteria from Riduwan (2009) as follows. Criteria for evaluating validity:

Table 1. Criteria for evaluating validity

76%-100%	= Very valid
51%-75%	= Valid
26%-50%	= Invalid
0%-25%	= Very invalid

Result

It can be seen in Table 2 below for aspects of the feasibility of content, language, and presentation, valid criteria are obtained with the average value of e-module validity being 90.1%. However, there are several revisions suggested by the validator. Validation was carried out with 2 Biology education lecturers at the University of PGRI West Sumatra and 1 Biology teacher at SMA Negeri 1 Bonjol. Based on Table 1 above, the results of the validity questionnaire by lecturers and teachers with an average value of 90.1% with very valid criteria. The validity of the content feasibility aspect of the e-module is stated to be very valid with a value of 92.5% because this e-module in its development has been adapted to the 2013 curriculum which includes the suitability of the material with KI and KD to be achieved by students. This is the opinion of (Jessica Alfa & Asrizal, 2024), in their research stating that the clarity and linkage of teaching materials with indicators and learning objectives will be achieved. In the opinion of (Asrial et al., 2020) that the module must be adapted to the interests, concerns, and needs of students.

Table 2. The results of validation by lecturers and teachers

Aspect	Validator			Amount	Validity	
	I	II	III		Value	Criteria
Content eligibility	18		19	37	92.5%	Very valid
Language	18	19	19	56	93.3%	Very valid
Presentation	32	45	45	122	84.73%	Very valid
	Total				270.53%	
	Average				90.1%	Very valid

For the validity of the e-module with linguistic aspects, it was declared very valid by the validator with an average value of 92.3%. This shows that the grammar used in the e-module has been adapted to the correct Indonesian language rules, both in terms of legibility, sentence structure, and communicativeness. In the opinion of (Susanto, 2017), stated that communicative language is a way of using language under communication functions so that it is easily understood by readers. According to (Nowell et al., 2017), the language used in e-modules should be in simple and effective sentences. The sentence structure in the e-module must be precise so that it forms communicative and familiar sentences for students. The sentences and language used are under the opinion of (Marlena et al., 2022); (Khurana et al., 2023) in their research that the linguistic aspect assesses the delivery of information in e-modules has arrived well to the development of the intended readers (students), communicative, informative, and conformity with the rules. good and correct Indonesian. The appropriateness and readability of the right text will be easily accepted by the sense of sight so that the message will be conveyed to students properly.

The validity of the e-module is also seen from the presentation aspect which is stated to be very valid with an average value of 84.73%. In developing the e-module, it contains clear learning indicators, and clear learning objectives, the order of presentation is by the indicators, contains the main and complete details of the material and the images presented are relevant to the material. The e-module is equipped with pictures and videos related to the regulatory system material so that it can help strengthen their understanding of the material. This is under research (Coman et al., 2020) e-modules will be more interactive and equipped with other learning media such as video, audio, and animation to enrich the learner's experience. The images contained in the e-module aim to help students understand and memorize learning materials. Generally, the material on the regulatory system contains pictures and there are also some relevant videos. Thus, this material is suitable to be developed into an e-module with pictures because it can make it easier for students to master the

material. Under the opinion of (Dwivedi et al., 2023) in their research, the advantages of e-modules compared to print modules are that they are interactive, making them easier to navigate, besides displaying video, images, and audio, and equipped with formative tests that can provide feedback with fast (Dewi et al., 2022).

For writing on e-modules using the Alegriya writing type, the choice of this type is because the letters are simple so that they are easy to read and look attractive. According to (Leny et al., 2021) in his research states that the readability of e-modules will make it easier for students to understand the material by around 79%. Letters have the characteristics and functions of meaning, so the appropriate use is important so that meaning can be conveyed and minimize misunderstandings. All aspects of the e-module were declared valid by validators (lecturers and teachers) with an average value of 90.1%. With that, it can be concluded that the e-module in the regulatory system material produced is suitable for use in learning and has advantages, including 1) Can be used offline or online 2) There are no viruses and display ads that will interfere with the use 3) Its use is easy because there are instructions and can be done directly on the e-module.

Discussion

The first step in this research is to conduct a front-end analysis to find out the problems needed and solve the right solutions. At this stage, observations and interviews were conducted with one of the Biology teachers at SMA Negeri 1 Bonjol. Furthermore, the researchers analyzed students which aimed to analyze the characteristics and needs of students in several aspects, namely during the learning process, the material that was considered difficult, age, and color. Analysis of students was carried out on 30 students of class XI science by distributing questionnaires on the needs of students.

After the required problems have been obtained, then proceed with task analysis. The author's task analysis is to detail the subject matter consisting of a content structure (KI, KD, Indicators), concept analysis, and analysis of learning objectives.

Conclusion

Based on the results of the front-end analysis, it was found that the print-based module used during the learning process was carried out in the 2019/2020 school year. The module is no longer used due to the impact of Covid-19 and the limited number of modules available during online learning. For current learning, the school has returned to face-to-face teaching materials in the form of printed books available at school but experiencing problems with the number of books with a large number of students. Based on the results of the analysis of students, it is known that students have difficulty understanding the material of the regulatory system. Because the scope of the material is broad, it concerns the system processes that are in it. Based on the results of interviews, for the regulatory system material in the learning process, there is no use of print-based or online-based modules.

Conflicts of Interest

The authors declare no conflict of interest

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