

Development of Biological E-Module Based on Contextual Teaching and Learning (CTL) Learning on Structure and Function of Plants and Animal Networks to Improve Critical Thinking Skills of Class XI MIPA SMA Students



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ABSTRACT: In the field of education, the presence of technology has helped teachers a lot in carrying out learning. Future education cannot only focus on cognitive aspects. To face various problems and challenges of the times in the future, students are expected to have much better attitudes, skills, and knowledge competencies, to be more creative, innovative, and productive. The purpose of this research is to analyze the feasibility and effectiveness of the development *e-module* Biology based on *Contextual Teaching and Learning* (CTL) on the material structure and function of plant and animal tissues to improve the critical thinking skills of students in class XI MIPA SMA that are valid, practical, and effective. The results showed that the *e-module* Biology based on *Contextual Teaching and Learning* (CTL) on the structure and function of plant and animal tissues to improve critical thinking skills of students in class XI MIPA SMA has a very valid category with a validator value of 89.33%, very practical 93.33% by Biology teachers and students with a score of 87.52% and the results of the effectiveness test of the CTL - based *e-module* showed that it was very effective, there was a significant difference between classes that used CTL - based *e-modules* and classes that did not use CTL - based *e-modules*. So, it can be concluded that the CTL-based Biology *e-module* that has been developed is very valid, very practical, and very effective.

KEYWORDS: Contextual Teaching and Learning, E-Module, Critical Thinking, Development.

I. INTRODUCTION

Developments in the digital era in this century, bring convenience in aspects of global life that are growing rapidly with the presence of technology. Advances in information and communication technology are currently bringing changes and affecting various aspects of life including human lifestyles, both in work, socializing, playing and in the field of education (Jahnke (2020).

Learning in the world of education to be able to achieve learning success, students must have broad insight to deal with advances in science and technology in changing global society. Zubaidah (2018), learning in the 21st century, technology is one of the key things in the implementation of various activities. In the field of education, the presence of technology has helped teachers a lot in carrying out learning. Future education cannot only focus on cognitive aspects. To face various problems and challenges of the times in the future, students are expected to have much better attitudes, skills, and knowledge competencies, to be more creative, innovative, and productive.

Critical thinking skills and problem solving are fundamental skills in 21st century learning. Thinking skills are a mental activity to acquire knowledge and need to be developed in every learning process. Teaching critical thinking skills can help students to become critical thinkers effectively. (Yustyan et al., 2015). Learning resources that can be used as supporters in the current learning process of students are using interactive learning media that can be accessed via smartphones (Pratama, 2020).

Improving critical thinking in teaching materials can be done with a series of activities based on real experiences gained by students, the better the learning process that occurs in them. So that students can explore and interact directly with friends and their environment. Regarding the results of observations that have been made with one of the Biology teachers at SMA Negeri 1

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Seberida, namely Mrs. Minar Situmorang, M.Pd on January 8, 2021. During the interview the teacher said that students' critical thinking skills were still low because students were still not trained. in their critical thinking skills, so that the Biology learning process carried out in the classroom still shows students lack of mastery of Biology concepts and difficulties in solving problems. Through a test of critical thinking skills using a description of the material on the structure and function of plant tissues.

II. RESEARCH METHODS

This type of research is research and development which aims to produce e-module based on Contextual Teaching and Learning (CTL) that is valid, practical, and effective. The development model used in the development of e-module based on Contextual Teaching and Learning (CTL) is the Plomp model developed by Tjeerd Plomp. The Plomp development model has three stages, namely the preliminary research phase , the development or prototyping phase and the assessment phase . Plomp and Nieveen (2013) revealed several formative evaluation methods in development research designs which are illustrated in Figure 1.

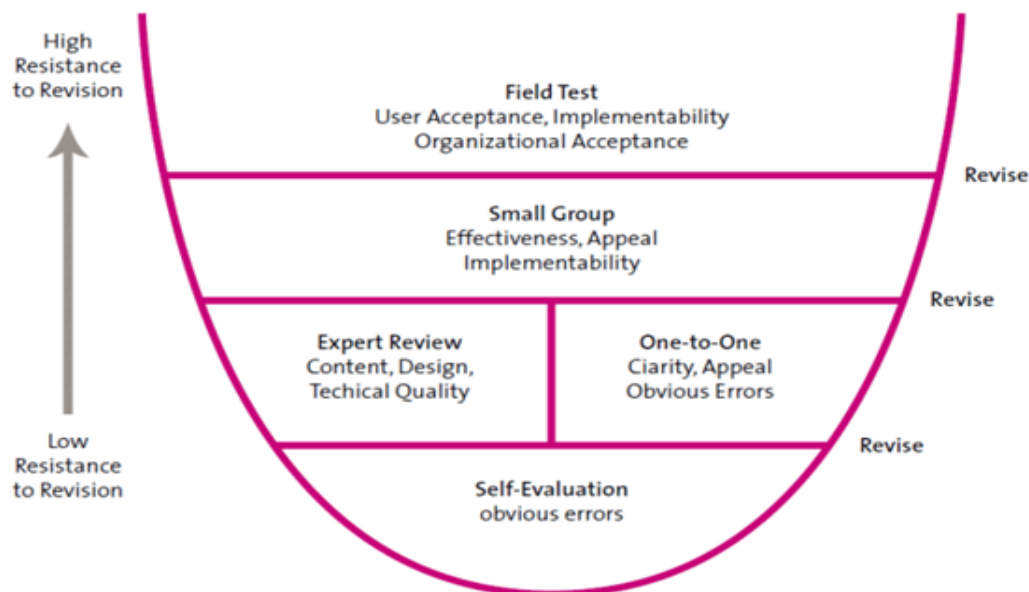


Figure 1. Formative Evaluation Layer
(Source: Plomp and Nieveen, 2013)

Plomp development consists of three stages. The stages of Plomp development can be seen in Table 2.

Table 1. Criteria and Description of Activities at the Plomp Development Stage.

Stage	Criteria	Description
Initial investigation	More emphasis on content validity than consistency and practicality	Literature review and problem analysis. The results will be used as a guide in developing the product framework
Development or prototyping	Focus on consistency (construct validity) and practicality	Development of a prototype sequence to be tried and revised based on formative evaluation. Formative evaluation is carried out through the assessment of experts in order to produce the expected practicality
Evaluation	Practicality and effectiveness	Evaluate whether users can use the product (practicality) and are willing to apply it in their teaching (relevance and sustainability), as well as whether the product is effective.

(Source: Plomp and Nieveen, 2013)

The last stage is the assessment phase (assessment phase). At this stage of the assessment, a semi-summative evaluation is carried out which aims to determine the effectiveness of the products that have been produced in the second stage, namely the development or manufacture of prototypes.

III. RESULTS AND DISCUSSION

A. Validity

Validation is a stage in the development research method used to develop or validate products used in education and learning (Sugiyono, 2011). Valid means that the instrument can be used to measure what should be measured (Sugiyono, 2013).

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At the validation stage, there are three validators, each of which validates three aspects, namely didactic aspects, construct/media aspects, and technical aspects. The results of product validation by experts can be reviewed in Table 2.

Table 2. Results of Validation Data Analysis of Three Validators

No.	Assessment Aspect	Mark (%)	Criteria
1.	Activated	90.00	Very valid
2.	Construct	90.48	Very valid
3.	Technical	87.50	Very valid
Average Validity Value		89.33	Very valid

Based on the validation results in Table 2. it can be concluded that the requirements to meet the e-module validity criteria have been met. This can be seen from the overall average based on didactic, construct, and technical aspects, showing the validity value of the CTL-based Biology e-module on the structure and function of plant tissue and structure and function of animal tissue developed is 89.33% with very valid criteria.

B. Practicality

Practicality is carried out at the assessment stage. However, the e-module must first be evaluated for its practicality before it is ready to be tested during the research process (assessment stage). The results of the small group evaluation obtained can be seen in Table 3.

Table 3. Results of Small Group Evaluation.

No.	Aspect	Mark (%)	Criteria
1.	Ease of use	86.81	Very practical
2.	Efficient	87.50	Very practical
3.	Attractiveness	85.42	Very practical
4.	Easy to interpret	86.11	Very practical
5.	Have Equivalence	85.42	Very practical
Average Practicality Score		86.25	Very practical

CTL-based Biology E-module on the structure and function of plant tissue and animal tissue structure and function which was developed based on a practical test questionnaire, the results obtained were 86.25% with (very practical) criteria and could be used for class experiments and further tests.

The CTL-based Biology e-module practicality assessment is also carried out by teachers based on aspects of the use of e-modules in the classroom. The teacher who assesses is a Biology teacher who teaches in the odd semester 2021/2022 experimental class. The results of the practicality questionnaire filled in by the teacher can be seen in Table 4.

Table 4. Teacher Practicality Assessment.

No.	Aspect	Mark (%)	Criteria
1.	Ease of use	100	Very practical
2.	Efficient	100	Very practical
3.	Attractiveness	91.67	Very practical
4.	Easy to interpret	87.50	Very practical
5.	Have Equivalence	87.50	Very practical
Average Practicality Score		93.33	Very practical

Practical results by the teacher are known that the average practicality value of the CTL-based Biology e-module that is filled by the teacher is 93.33% with criteria (very practical). The results of the field test can be seen in Table 5.

Table 5. Field test results

No.	Aspect	Mark (%)	Criteria
1.	Ease of use	88.48	Very practical
2.	Efficient	87.87	Very practical
3.	Attractiveness	86.40	Very practical
4.	Easy to interpret	87.75	Very practical

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No.	Aspect	Mark (%)	Criteria
5.	Have Equivalence	87.13	Very practical
Average Practicality Score		87.52	Very practical

Based on Table 5. it is known that the average practicality value of the CTL-based Biology e-module filled in by 34 experimental class students is 87.52% are categorized with (very practical).

C. Effectiveness

Learning outcomes data were obtained through learning outcomes tests conducted at the final meeting. The test is given in the form of essay questions. Data on the assessment of students' critical thinking skills is presented in Table 6.

Table 6. Assessment of Students' Critical Thinking Skills.

Class	N	Xmin	Xmax	mean ()	Standard deviation
Experiment	34	52	92	74.59	11.004
Control	34	40	84	59.18	10,641

The average result of the students' critical thinking skills in the experimental class was higher than the average in the control class. The results of the assessment of students' critical thinking skills in Table 6, the average value of the experimental class was 74.59 and the control class was 59.18. Furthermore, the prerequisite test is carried out, the prerequisite test is a normality and homogeneity test. The results of normality and homogeneity tests can be reviewed in table 7.

Table 7. Results of the Prerequisites for Normality and Homogeneity of Critical Thinking Skills

No.	Parameter	Significant	Description
1.	Normality	0.200	Normal
2.	Homogeneity	0.601	Homogeneous

Based on the results of the normality test, it shows greater significance, namely $0.200 > 0.05$ and the homogeneity test is $0.601 > 0.05$, meaning that the value of critical thinking skills is normally distributed and homogeneous. Furthermore, the data on critical thinking skills is tested for hypotheses using the Independent Samples T Test or t-test. The results of hypothesis testing of critical thinking skills in the experimental and control classes can be seen in Table 8.

Table 8. Calculation Results of t-test of Critical Thinking Skills for Experiment and Control class

No.	Class	Significant	Description
1.	Experiment	0.000	H_0 rejected
2.	Control		

Based on Table 8. it is known that the significance value of students' critical thinking skills is 0.000. This indicates that the significant value of <0.05 , which means that H_0 is rejected and H_1 accepted. Thus, it is known that the use of the CTL-based Biology e-module on biodiversity and virus materials affects the critical thinking skills of the XI grade students of SMAN 1 Seberida.

IV. CONCLUSION

Based on the development of the CTL-based Biology e-module for class XI students of SMAN 1 Seberida, the following conclusions were obtained:

- The results of the validation by the validators showed that the Biology e-module based on Contextual Teaching and Learning (CTL) on the material on the structure and function of plant tissues and the structure and function of animal tissues showed a very valid category.
- The results of practical tests conducted by teachers and students show that the e-module Biology based on Contextual Teaching and Learning (CTL) on the material structure and function of plant tissue and structure and function of animal tissue shows a very practical category.
- The results of the effectiveness test of the use of the Biology e-module based on Contextual Teaching and Learning (CTL) on the structure and function of plant tissue and the structure and function of animal tissue show that it is effective in improving critical thinking skills.

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