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Development of Science learning E-module with online media materials on water pollution in Lake Tondano at SMP Negeri 9 Manado

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Abstract
This study aims to produce and determine the feasibility and effectiveness of e-modules for science learning with online media materials on water pollution in Lake Tondano at SMP Negeri 9 Manado. Manado State, 1 science teacher at SMP Negeri 9 Manado. This type of research and development refers to the Borg and Gall development model. Data collection was done by observation, interviews, questionnaires, and tests (online media). The research data are; (1) produce learning media products in the form of E-Module for Science Learning Materials for Lake Tondano Water Pollution for class VII SMP Negeri 9 Manado, (2) E-modules are declared suitable for use with an average score of all aspects by material experts 90.8% and media experts I and II by 95% and 93.3% and by student responses as users of 87.6% so that the feasibility of the e-module developed is included in the "Very Good" category and (3) the E-module is declared to be effectively used with obtain an average student learning outcomes of 76.7% in the category of high/very effective criteria.

Keywords: e-module, science learning, online media, water pollution, Lake Tondano

Introduction

Lake Tondano is the largest natural lake in North Sulawesi. Lake Tondano is located in the upper part of the Tondano river which is located in Minahasa Regency. The location of Lake Tondano is at an altitude of ± 600m above sea level (from sea level) and the waters of Lake Tondano are 51,000 ha (Anonymous, 2009). The inlet (river that enters) from several large rivers and small rivers, most of which are seasonal rivers. Apart from rivers, other sources of water are irrigation canals and residential canals. While the outlet (river that comes out) there is only one channel, namely the Tondano River which empties into Manado Bay.

Over time, the area around Lake Tondano is used as residential land, agricultural land, household waste disposal, fish farms, tourist attractions and so on. Besides, the water from this lake that comes out through the Tondano River is used for Hydroelectric Power Plants (PLTA). (Jeujanan, 2019) [4]. Residential, agricultural and industrial wastes have contributed a lot of nutrients, especially phosphate and nitrate into the lake. In addition, fishery techniques using KJA (Floating net cages) cause a lot of excessive feed ingredients to settle and break down into high nutrient sources. This nutrient enrichment in the waters has triggered the growth of aquatic flora in the lake such as water hyacinth (Eichornia crassipes). Water hyacinth as a floating plant has covered a large area in Lake Tondano, it is estimated that it reaches about 20% of the lake area (Sittadewi, 2008) [6]. The fast growth and high density of water hyacinth causes this plant to be considered as a weed that can damage the aquatic environment.

According to Jeujanan (2019) [6], in his research he explained that the increase in water acidity (pH) for polluted water was caused by the content of organic acids from the disposal of food scraps, dishwashing waste from restaurants and the disposal of household waste directly into Lake Tondano and the number of decrease in acidity level due to the presence of weak acid compounds such as HPO_4^{-2}., HCO_3^- and CO_2.

Environmental pollution, especially water pollution in Lake Tondano, is very interesting to be used as a real lesson to be studied and developed in the world of education, especially with regard to learning for junior high school students, more precisely, junior high school students who live on the mainland with Lake Tondano

This year there has been a change in learning in schools that makes it difficult for students to learn directly in nature because the world has been shaken by the corona virus pandemic so that the whole world including Indonesia decided on new learning rules by the Minister of Education and Culture (Mendikbud) Nadiem Anwar Makarim issued a letter Circular Number 4 of 2020 concerning the Implementation of Education in the Corona virus Disease (Covid-19) Emergency Period.

Based on the temporary findings of the researcher and an interview with one of the teachers at SMP Negeri 9 Manado that this junior high school is conducting online learning using online media in the form of google classroom, google meet, zoom meet, google quitz and google froms. Such conditions make students unable to see the problems that occur in nature directly. In the field of education, ICT (Information and Communication Technology) plays a very important role in educating and educating the nation's life. In addition, the development of ICT encourages the creation of creative innovations such as the concept of electronic learning (e-learning). E-learning is a learning or teaching process that uses electronic circuits to deliver learning content, interaction or guidance. E-learning is also a form of distance learning that is carried out through the internet. (Wan, 2009) [8]. This learning concept makes it easier for students and teachers to obtain learning resources with easy

and light access. In order to teach students, especially in critical thinking skills, creativity, collaboration and communication in learning (Depdiknas 2017), a teaching material media is needed in the form of electronic modules (e-modules). Related to the existing problems regarding environmental pollution in Lake Tondano where this has a relationship with science learning materials in junior high schools about environmental pollution, especially water pollution which consists of the causes and impacts as well as ways to overcome water pollution and the presentation of material in online learning through online media in order to facilitate the learning and teaching process, so this research was carried out to produce research products for e-modules for science learning with online media for water pollution materials in Lake Tondano and to determine product feasibility and product effectiveness.

Research Methods

The research method used in this research is the research and development method. In this study, multi-material teaching materials were developed, namely e-modules. The subjects of this study were seventh grade students of SMP Negeri 9 Manado, 3 experts consisting of 2 science lecturers at Manado State University, 1 science teacher at SMP Negeri 9 Manado. The object of this research is the science learning e-module on Water Pollution Materials at Lake Tondano, the 2020/2021 academic year.

This study refers to the modified Borg and Gall model from Palilingan (2014) [5], this model includes: 1) Planning, 2) Exploration Studies, 3) Initial Form Development, 4) Data collection and analysis instruments, 5) Validation consists of Expert Validation and Field Test, 6) Revision Based on the Results of Product Validation and Dissemination.

Results and Discussion

Learning and product planning

At this stage, planning is carried out to identify the learning objectives achieved and develop an "E-Module for Learning Science of Lake Tondano Water Pollution Materials" by utilizing online media and using the Flip Pdf Corporate Edition application. Initial product embodiment stage, approval of learning experts and product publishers for testing.

Exploration Studies

Preliminary research or initial observations of the school where the research will be carried out. Conducting a survey in schools by interviewing subject teachers in schools regarding learning and the media used to support learning in the midst of the COVID-19 pandemic.

Early form development

The materials contained in this e-module come from the results of the author's own thesis research in 2018//2019 on Water Pollution in Lake Tondano which is used as a source besides that there are research sources in the form of printed books, the internet, journals and books. other online. All materials are processed into MS-Word to produce a science learning module for Lake Tondano water pollution. The creation of the Science Learning E-Module Framework and the use of the Flip Pdf Corporate Edition application to convert science learning modules into e-modules, namely the developed E-modules containing videos, audio and images.

Data collection and analysis instruments

The instruments used in data collection are Questionnaires and Tests. Questionnaires used by researchers are e-module material expert questionnaires, e-module media experts and student/student respondent questionnaires. Meanwhile, the tests used are the initial test questions (posttest) and the final questions (prettest). Data analysis using MS. Excel to calculate instrument data and learning outcomes obtained.

Validation

Media expert validation

Based on the validation data of learning media experts, the total number of very suitable categories (SS) 19, suitable categories (S) 11, not suitable categories (TS) and very unsuitable categories (STS) did not exist.

The data obtained above by comparing the number of scores achieved with the maximum number of values then multiplied by 100% according to (Arikunto, 2006) [7], as follows:

(Total score achieved)/(Total maximum score) x 100%= 109/120 x100%=90.8%

From the above calculation, the percentage is 90.8%. The percentage is included in the valid category (no revision needed).

Material expert validation

Based on the data of material expert 1 (Lecturer) and material expert 2 (Teacher) obtained the total number of categories in material expert 1 very suitable (SS) 24, appropriate category (S) 6, inappropriate category (TS) and very inappropriate category (STS). does not exist, while in material expert 2 it is very suitable (SS) 22, the category is appropriate (S) 8, the category is not suitable (TS) and the category is not very suitable (STS) is not present.

The data obtained above by comparing the number of values achieved with the maximum number of values then multiplied by 100% according to (Arikunto, 2006) [7].

Results of material experts' percentage 1

(Total score achieved)/(Total maximum score) x 100%= 114/120 x100%=95%

Results of material expert's presentation 2

(Total score achieved)/(Total maximum score) x 100%= 112/120 x100%=93.3%

From the above calculation, the percentage of material expert test 1 is 95% and material expert 2 is 93.3%. The percentage is included in the valid category (no revision is needed).

Student response validation

Based on student response data, it was obtained that the total category was very suitable (SS) 87.6%, suitable category (S) 33%, not suitable category (TS) 55% and very unsuitable category (STS) 85.2%. Thus, it can be concluded that students gave a positive response to the e-module of science learning about Lake Tondano water pollution that was given and there were no changes to be revised in the revision phase 2, so the trial could be continued to the field trial stage.

Field test

Small group test

Based on small group test data, it can be obtained that all respondents 1-5 gave varied responses to 30 indicators of eligibility criteria for content, language, usefulness of graphics with categories at very suitable (SS) 71.33%, appropriate category (S) 64.5%, the unsuitable category (TS) and the very unsuitable category (STS) did not exist. From the calculation above, the percentage that is included in the category is quite valid / does not need revision.

Large group Test

Table 1: Summary of pretest and posttest result data

No.	Statistics	Statistic Value	
		Pre-test	Post-test
1.	Minimum Score	20	50
2.	Maximum Score	85	95
3.	Sum (∑)	1810	2305
4.	Mean ($\bar{x}$)	60,3	76,8
5.	Completenes percentage	23.3%	76.7%

The results of the learning outcomes test that was carried out to 30 students with the KKM determined by the school was 75. Based on table 3.4 it can be seen that the average analysis of the pretest test results was 60.3 learning outcomes with completeness reaching 23.3% while the analysis of the average results posttest test is 76.8 learning outcomes with completeness reaching 76.7%. This means that the learning device meets the qualifications effectively because it has high/very effective criteria.

Revision based on validation results

After going through the stages of product development and testing to students.

This science learning module teaching material product has been revised or improved. The results of the development of "E-Module Science Learning Materials for Lake Tondano Water Pollution". (Product Link: https://s.id/BU87c), this link may be shared via online media with the following display:

Fig 1: E-module display on laptop

Fig 2: Display of e-modules on android (Hp)

Fig 3: Display of e-modules on I pad Ip

Conclusion

Based on the results of research and discussion regarding the development of the E-Module Learning Science of Lake Tondano Water Pollution, it can be concluded as follows:

1. This development research produces a learning media product in the form of an E-Module for Science Learning Materials on Lake Tondano Water Pollution for class VII SMP Negeri 9 Manado. This research refers to the Borg and Gall development model.
2. E-Module for Learning Science of Lake Tondano Water Pollution Materials for class VII, after being tested for validation, material experts and media experts obtained valid validity levels or very feasible to use.
3. The effectiveness of learning outcomes in students of SMP Negeri 9 Manado obtained high / very effective criteria.

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