CONSTRUCTION OF AN E-MODULE FOR ONLINE LEARNING OF NATURAL SCIENCE USING AN ETHNOSCIENTIFIC APPROACH

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ABSTRACT

Purpose: The aim of this research was to create an online scientific learning module at SMP Kota Padang using an ethnoscience method. Analysis, design, development, implementation, and evaluation are the five phases of the ADDIE development paradigm, which is used in this research and development (R&D) project. Students from SMP Kota Padang's class VII served as the study's subjects.

Theoritical Framework: The idea behind ethnoscience learning is to include culture into the curriculum of elementary, middle, and high schools by developing learning experiences and environments that support it.

Methodology: This study was conducted in Padang City Middle School. Interviews, tests to gauge the media's effectiveness, questionnaires to assess the media's suitability, and documentation were the methods utilized in this study to collect data.

Result and discussion: E-module creation that was web-based has undergone testing of viability and efficacy. Several phases of the tryout implementation were completed, including individual trials, small group trials, field testing with large groups, and review with media and material specialists. An extremely valid category with an average of 94% is the outcome of expert validation. Students' assessments of the practicality test, however, place it in the very practical category, averaging 89%, 90%, and 88% across three schools. Next, it was discovered that there was a significant difference between the experimental group and the control group in the three schools regarding the usage of web-based E-Modules in scientific learning with an ethnoscience approach.

Conclusion: As a result, the web-based E-Module for science instruction using an ethnoscience method falls into the legitimate, useful, and efficient category.

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CONSTRUÇÃO DE UM MÓDULO ELETRÔNICO PARA A APRENDIZAGEM EM LINHA DAS CIÊNCIAS NATURAIS UTILIZANDO UMA ABORDAGEM ETNOCIENTÍFICA

RESUMO

Propósito: O objetivo desta pesquisa foi criar um módulo de aprendizagem científica on-line no SMP Kota Padang usando um método de etnociência. Análise, design, desenvolvimento, implementação e avaliação são as cinco fases do paradigma de desenvolvimento ADDIE, que é usado neste projeto de pesquisa e desenvolvimento (P&D). Alunos da classe VII da SMP Kota Padang serviram como disciplinas do estudo.

Estrutura Teórica: A ideia por trás do aprendizado da etnociência é incluir a cultura no currículo das escolas de ensino fundamental, médio e médio, desenvolvendo experiências de aprendizado e ambientes que a apóiem.

Metodologia: Este estudo foi realizado na Padang City Middle School. Entrevistas, testes para avaliar a eficácia da mídia, questionários para avaliar a adequação da mídia e documentação foram os métodos utilizados neste estudo para coletar dados.

Resultado e discussão: a criação do módulo eletrônico baseado na Web passou por testes de viabilidade e eficácia. Várias fases da implementação do ensaio foram concluídas, incluindo ensaios individuais, ensaios em pequenos grupos, ensaios de campo com grandes grupos e revisão com especialistas de mídia e material. Uma categoria extremamente válida, com uma média de 94%, é o resultado da validação de especialistas. As avaliações dos alunos do teste de praticidade, no entanto, colocam-no na categoria muito prática, com média de 89%, 90% e 88% em três escolas. Em seguida, descobriu-se que havia uma diferença significativa entre o grupo experimental e o grupo de controle nas três escolas no que diz respeito ao uso de E-Modules baseados na web no aprendizado científico com uma abordagem etnociência.

Conclusão: Como resultado, o módulo eletrônico baseado na web para instrução científica usando um método de etnociência se enquadra na categoria legítima, útil e eficiente.

Palavras-chave: E-Module, Web, ethnoscience, ADDIE Model.

1 INTRODUCTION

Learning with an ethnoscience approach emphasizes the acquisition of holistic understanding rather than just insight. Students learn to connect classroom material with context in their lives and the relationship between science and technology. Ethnoscience is in line with the demands of the Independent Curriculum that learning should be contextually based to assist students in constructing their own knowledge, should learning be linked to cultural knowledge which is inherent in students' daily lives or
what is commonly called ethnoscience (Lubis, 2021). The ability to communicate, share, and use information to solve complex problems, to innovate and adapt in response to new needs and changing conditions, and to harness the power of technology to develop new knowledge are more important success indicators (Yanto, 2022). Web-based Information Technology is developing and becoming a part of life, especially in the field of education. However, what is often used by teachers in their learning activities is only in the form of whiteboards, books, LKS and others. This conventional tool has not been able to achieve its goals optimally (Munir, 2013). The rapidly developing development of technology today affects all spheres of life, including education. This technology can be used to improve the quality of education by providing teaching materials that are easy to obtain, understand and attract the attention of readers, such as electronic modules (Sari et al., 2014). This kind of learning has an impact on the transformation from conventional education to digital forms, both in content and system, so that the learning process becomes technology-based (Wahono, 2005).

Teaching materials have various types, some are printed and non-printed. Interactive teaching materials such as CIA (Computer Assisted Instruction), compact discs (CDs) of interactive learning multimedia, and web-based learning materials (Prastowo, 2013). The better the resources and media used, the better the learning outcomes will be so that they can achieve learning goals, motivate students in an interesting way, stimulate student attention and allow students to learn independently (Al-Tabany, 2014). The world of education must take advantage of the technological advances of devices, it can be said that electronic modules are based on the web in the format of mobile versions such as accessible learning materials from the hand.

Based on the explanation above, the following problems were identified: there is no development of science learning E-Modules with ethnoscience-based ethnoscience approaches as teaching materials at Padang City Junior High School, there are still many teachers using bold books for teaching and learning activities, students have difficulty learning material in science learning because of the monotonous and verbalistic presentation of textbooks (Guo et al., 2023; Hayudi et al., 2023; Imrani & Jafarov, 2023).

Understanding the description, the author felt the need to conduct a study of educational literature as a module of ethnoscience. Modules are teaching materials that are systematically arranged in the discussion can be understood by students according to their level of understanding and age to be used with or without a teacher.
This research aims to develop a web-based E-Module on science learning with an ethnoscientific approach at SMP Padang City. This innovation is expected to help education and students in learning activities. The use of this media is junior high school as a solution to problems in science learning, especially in terms of varied teaching materials. In this study, it will be revealed how the results of the development of web-based E-Modules on science learning with an ethnoscientific approach at SMP Padang City based on the development carried out.

2 THEORITICAL FRAMEWORK

Ethnoscience is based on views constructivism, prioritizing learning meaningful. Meaningful learning is learning that is packaged appropriately with student characteristics. Learning that means allowing students to learn while do "learning by doing". Learning by doing causes students to be able to create productive relationships meaning when students are able connecting the contents of the subjects’ academics with the context of students’ lives who find meaning. Ethnoscience is knowledge culture of a region and nation. Munir (2013) in an article entitled “Cultural Dimensions of Learning: Addressing the Challenges of Multicultural Instruction” explains that learning is based culture is very necessary for students, because by implementing based learning culture will teach an attitude of love towards culture and nation, because of learning ethnoscientific-based will introduce to students about the potential of a area, so that students will know more about it regional culture. Ethnoscience as Cultural knowledge also teaches children to be considerate of fellow friends who have backgrounds different culture. Noble cultural heritage ancestors will gradually disappear pressured by foreign culture transformed electronic media. It is hoped that there will be a world role education in cultivating insight ethnoscientific-laden, students will have wider knowledge about surrounding environment and avoid it alienation from the environment.

3 METHODOLOGY

3.1 RESEARCH DESIGN

Research and Development (R&D) is the sort of study done. It is done utilizing the ADDIE paradigm, which has five stages: analysis, design, development (development, implementation, and evaluation), and analysis. The validity test on the
embattled product is carried out by experts consisting of design, content and language experts. Analysis of practicality data obtained from the web-based E-Module implementation observation instrument in science learning with an ethnoscientific approach using teacher assessment sheets and student assessment sheets for the developed E-Modules. While for the effectiveness test using two-way anova analysis.

<table>
<thead>
<tr>
<th>School Category</th>
<th>Model (Experiment)</th>
<th>(Control)</th>
</tr>
</thead>
<tbody>
<tr>
<td>High (A)</td>
<td>X1 AND1</td>
<td>X2 AND1</td>
</tr>
<tr>
<td>Moderate (B)</td>
<td>X1 AND2</td>
<td>x 2 and2</td>
</tr>
<tr>
<td>Low (C)</td>
<td>X1 AND3</td>
<td>X2 AND3</td>
</tr>
</tbody>
</table>

Source: Prepared by authors

The experiment was carried out in four meetings with the subject matter of the classification of living beings. To investigate the effectiveness of web-based E-Modules on science learning with an ethnoscientific approach, it was observed using a web-based E-Module assessment sheet on science learning with an ethnoscientific approach at each meeting. Furthermore, the effectiveness of the web-based E-Module on science learning with an ethnoscientific approach to learning outcomes (cognitive realm) is assessed from the results of students' post-test scores in experimental classes using learning outcome test items. Hypothesis testing for effectiveness testing is a 2 x 3 factorial design. Statistical analysis for the two-way Anova test using the SPSS version 26 application. Before the two-way anova test is carried out, a pre-requisite test is first carried out, namely the normality test using the Kolmogorov-Smirnov test and the homogeneity test using the Leven test. Population and sample: In this study for validity testing there were 4 expert validators consisting of linguists, content, design and WEB midwife experts as well as science teachers and students class VII of SMP Negeri in Padang City, namely, SMP N 3 Padang, SMP N 7 Padang and SMPN 40 Padang. Learning outcomes test questions and 21st Century Skills assessment sheets are the study tools utilized to gather data. The performance appraisal and peer assessment forms make up the 21st-Century Skills assessment sheet. The indicators of the 21st-Century Skills survey instrument by R. Kelley et al. (2019) served as the foundation for the development of the 21st-Century Skills assessment. While analyzing data A percentage is used to verify the uji validity and practicality, with adjustments made to meet the following criteria: 80% < x 100% ≤ (very valid/practical), 60% < x ≤ 80%
(valid/practical), and 4 0% < x ≤ 60% (sufficiently valid/practical). Two categories: less valid/practical (0% < x ≤ 40%) and invalid/practical (0% ≤ x ≤ 20%). whereas a two-way ANOVA test was used to examine the results from the web-based E-Module efficacy test on scientific learning using an ethnoscience method. The criterion for making a decision is that H1 must be approved if the significant value (p) at the SPSS output is less than 0.05.

4 RESULT AND DISCUSSION

Development of Web-based learning E-Modules through 5 stages of analysis, design, development, implementation, and evaluation activities (Tegeh et al., 2014) as follows:

In the 1st activity, the analysis carried out was the collection of data related to the problems faced in current learning which then identified solutions to overcome the problems that occurred. The purpose of this needs analysis is to identify the problem and find out the cause of the problem in the learning process. Data at this stage of needs analysis was obtained by conducting interviews with the Padang City Education Office and several schools that were the destination of the research. From the results of the discussion and analysis carried out, it was found that the development of web-based e-modules with an ethnoscience approach is important to be developed to meet learning needs in SMP Kota Padang is currently creating a contextual and fun learning atmosphere.

In the 2nd activity the design/design is carried out to create a product development design. At this stage, the design of interactive e-modules and websites that will be used in research is carried out, as well as the design design made, namely the design of interactive e-modules with an approach web-based ethnosciences. The material design of the e-module was made using the articulate storyline 3 application. This application is one of the applications used to create interactive learning media with content in the form of text, images, videos, sounds, and animations. E-modules are made interactive by adding several buttons that can be clicked while in use. Website design is made using wordpress. The stages of website creation are; (1) request hosting and domains to UNP; (2) installation of wordpress on FTP (File Transfer Protocol) account; (3) enter the database account; (4) installation of the Astro
theme; (5) installation of tutor LMS plugin; (6) the launch of WordPress; (7) add some menus; (8) create courses/lessons; and (9) the website is ready to use.

In the 3rd activity, namely the product development stage, at this stage, the validity and practicality of the product are carried out. After the interactive e-module product with a web-based ethnoscientific approach is designed, the next step is the validation stage. Validation is carried out to assess the validity of the products made. The components of the validation questionnaire include the feasibility of the content, language, presentation and graphic design of the e-module and the resulting website. The data obtained are used to reveal the degree of validity of the web-based e-module designed. Based on the results of e-module validation that has been carried out by validators with an average value of 94% with very valid categories, this identifies that the Integrated IPA Based e-module Ethnoscience on the Nature of Science, Measurement and Scientific Method for class VII students is very valid from the aspects that have been given. For the results of the validity test of the product developed can be seen in the following table:

Figure 1. Product validity test results

The practicality test was carried out by involving teachers, students, and observers. The practicality stage as carried out to test the feasibility of this developed product. The data obtained from this stage of practicality was used to reveal the level of practicality of the web-based e-module designed. The complete data on the calculation of practicality values by teachers and learners can be seen in the following graph:
Based on the graph above, the average practicality by teachers was 90% (very practical) and pre-practicality by students is 87% (very practical) in terms of ease of use, time efficiency learning and the benefits of use. So that the e-module developed was very practical to use by teachers and students in terms of ease of use, efficiency of learning time, and benefits of use.

In the 4th activity, the implementation was carried out by testing web-based e-modules directly through the learning process. This activity was carried out in several schools in the city of Padang, including SMPN 1 Padang, SMPN 3 Padang, SMPN 8 Padang, SMPN 22 Padang, SMPN 34 Padang, SMPN 35 Padang, SMPN 36 Padang and SMPN 40 Padang. At the Implementation stage, the first activity carried out is to divide classes for research, namely into control classes and experimental classes with an average learning value was almost the same. The control class was carried out with the usual learning method carried out by the teacher daily while for the experimental class, the learning method is carried out using the Website. The stage carried out in the experimental class was the delivery of learning materials with web-based e-modules to grade VII junior high school students using a computer lab or cellphone.
Table 2. Normality Test Results

<table>
<thead>
<tr>
<th>Source: Research data processed using a statistical software</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Kolmogorov-Smirnov</strong></td>
</tr>
<tr>
<td>Statistic</td>
</tr>
<tr>
<td>SMP 7 experiment</td>
</tr>
<tr>
<td>control</td>
</tr>
<tr>
<td>SMP 3 experiment</td>
</tr>
<tr>
<td>control</td>
</tr>
<tr>
<td>SMP 40 experiment</td>
</tr>
<tr>
<td>control</td>
</tr>
<tr>
<td>a. Lilliefors Significance Correction</td>
</tr>
</tbody>
</table>

Based on the table above from the three schools above, both experimental classes and control classes show a significance value of > 0.05 using kolmogorov-Smirnov analysis a or using Shapiro-Wilk analysis means that the three classes are normally distributed, then the following table describes the results of the homogeneity test to the three classes in the experimental class as follows:

Table 3. Homogeneity Test Results

<table>
<thead>
<tr>
<th>Source: Research data processed using a statistical software</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Levene's Test of Equality of Error Variances</strong>&lt;sup&gt;a,b&lt;/sup&gt;</td>
</tr>
<tr>
<td><strong>Levene Statistic</strong></td>
</tr>
<tr>
<td>Value Based on Mean</td>
</tr>
<tr>
<td>Based on Median</td>
</tr>
<tr>
<td>Based on Median and with adjusted df</td>
</tr>
<tr>
<td>Based on trimmed mean</td>
</tr>
</tbody>
</table>

Tests the null hypothesis that the error variance of the dependent variable is equal across a. Dependent variable: Value

b. Design: Intercept + School + Learning Model + School * Learning Model

The above-mentioned homogeneously distributed data can then be continued for hypothesis testing utilizing two-way analysis anova factorial design 2 x 3. This is because the analysis yielded results with a significance value of > 0.05. Statistical analysis was conducted for the two-way Anava test using the SPSS version 26 application. The analysis's findings are shown in the table below:
Table 4. Results of the Bidirectional Anova Analysis Test

<table>
<thead>
<tr>
<th>Source</th>
<th>Type III Sum of Squares</th>
<th>df</th>
<th>Mean Square</th>
<th>F</th>
<th>Itself.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept</td>
<td>616.307.584</td>
<td>1</td>
<td>616.307.584</td>
<td>4.331.074</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Sekolah</td>
<td>1.013.370</td>
<td>2</td>
<td>506.685</td>
<td>3.561</td>
<td>.031</td>
</tr>
<tr>
<td>Model_Pembelajaran</td>
<td>1.916.803</td>
<td>1</td>
<td>1.916.803</td>
<td>13.470</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Sekolah * Model_Pembelajaran</td>
<td>3.586.888</td>
<td>2</td>
<td>1.793.444</td>
<td>12.603</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Error</td>
<td>24.333.130</td>
<td>171</td>
<td>142.299</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>649.825.000</td>
<td>177</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Corrected Total</td>
<td>31.089.266</td>
<td>176</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

a. R Squared = .217 (Adjusted R Squared = .194)

Source: Research data processed using a statistical software

The significance score of the aspect of the model is less than 0.05, which is 0.001. This shows that H1 is accepted which means that there is a significant difference in the level of use of web-based E-Modules in science learning with ethnoscientific approaches between experimental groups that use web-based E-Modules in science learning with ethnoscientific approaches and control groups that use conventional learning. The school component has a significance value of 0.031, which is less than 0.05. This demonstrates that H1 is accepted, indicating that there are notable variations in how web-based E-Modules are used in science education among the experimental groups in the three school categories when using an ethnoscientific method. The interaction between school types and the features of employing web-based E-Modules in science instruction with ethnoscientific techniques has a significance value of 0.01, which is less than 0.05. This implies that H1 is accepted, indicating that the school category variable and the WEB-based e-module variable interact.

Apart from the results of the two way anova test above, it can also be seen the results of the interaction between the three schools based on the chart below:

![Figure 3. Interaction Graph of the three Schools](source)

Source: Research data processed using Microsoft Excel
Based on the chart above, it can be concluded that SMPN 7 Padang in the experimental class increased while SMP3 there was a not so significant increase while SMP 40 there was a slight decrease.

5 DISCUSSION

The purpose of the validation test stage is to evaluate the instructional materials' design, which are integrated science e-modules based on ethnoscientific. The substance of the questions or assertions in the instrument pertaining to conformance, truth, clarity, accuracy, and validity should, in theory, be included in an instrument for evaluating a product's validity (Silalahi, 2017). The validation results that have been deemed legitimate, according to Jannah (2016), demonstrate that instructional materials can and are appropriate for use as instructional materials in the learning process. According to the findings of Arsih's research (2017), instructional resources that have been deemed legitimate by validators are those that can be used in the learning process. Based on the results of practicality to teachers related to the benefit aspects of use, a percentage of 94% was obtained with a very practical category. And the results of practicality carried out to students related to the benefit aspect of use get a percentage of 90% with a very practical category. The practicality category of the IPA e-module on the aspect of use benefits is in the range of 81-100%. The beneficial aspects of using e-modules by teachers and students are considered very practical. Practically related to how easy it is to use a product. The practicality test aims to see how easy the product offers when implemented or used in an activity (Harisman, 2017; Eva, et al., 2018). This shows that teachers can act as facilitators in learning because e-modules can help students learn because the e-modules are presented with pictures and videos that make it easier for students to understand the learning material. This is in accordance with the opinion (Pratama et al., 2021) that e-modules can be used by teachers as an alternative teaching material in increasing understanding of concepts for students. The overall results of practicality to teachers and students obtained an average percentage of 93% of teachers and 88% of students with each category very practical. Students' knowledge may increase as students' activeness in learning increases (Shu & Liu, 2019). The use of web-based E-Modules in science learning with an ethnoscientific approach is proven to increase students' knowledge competence in learning. The electronic module is one of the modules developed using
technology, information and communication that can display text, audio, video or animation and is equipped with an evaluation test by which users can obtain feedback (Suarsana, 2013). According to Sardjijo & Pannen (2005); Rini et al. (2021), the ethnoscientific approach is a strategy to create a learning environment and design learning experiences that integrate cultures as part of the process learning. Science learning should bring learners to become literate about science and technology.

In the opinion of Sudarmin (2014), learning both science and non-science subjects needs to be able to include the values of the local way of life. Creativity in thinking can be enhanced in pupils by their local learning culture. Students will believe that entosanin-based learning is predicated on the understanding of community culture as a basic (fundamental and significant) component of education (Atmojo, 2012). Teaching students to define and construct their own knowledge based on societal understanding is another goal of ethnoscientific-based science education (Syukri et al., 2014).

6 CONCLUSION

Experts evaluated web-based e-modules on science education using an ethnoscientific approach, and the results showed that the modules had very valid ratings in a number of categories, including content eligibility, linguistics, presentation and graphing, self-instructional, contained, stand-alone, adaptive, and user-friendly, with an average score of 94%. In the meantime, the average practicality of teachers' 90% (extremely practical) and students' 87% (very practical) practicality was used to determine the outcomes of the practicality test in the context of web-based E-Modules in science learning with an ethnoscientific approach. Reviewing from the perspectives of usability, learning time efficiency, and advantages of usage. Following that, regarding effectiveness, the results showed that, in the three schools, there was a significant difference (p = 0.01) between the experimental and cooperative groups' use of web-based E-Modules for science instruction using an ethnoscientific method. The experimental groups' levels of 21st Century Skills varied significantly throughout the three school types (p=0.01). Additionally, in all three institutions, there is a relationship between ethnoscientific methods and web-based E-Modules for science instruction.

School category variables and web-based E-Module variables improve student competence in science learning using an ethnoscientific approach (p=0.031). In this
way, the research advances the use of an ethnoscientific web-based E-Module for science instruction in junior high schools. Additionally, educators and legislators should think about integrating web-based E-Modules into science curricula that use ethnoscientific methodologies that are pertinent to the modern world and could eventually lead to the digitization of education. This research has limitations, even if web-based E-Modules on science learning with an ethnoscientific approach seem to be beneficial in boosting student competence. Future studies must regulate the psychological variables involved (e.g., student IQ, student learning styles, student interests, instructor competencies, etc.) and use teaching modules at all educational levels and in various scientific domains.
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