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Implementation of E-Module Containing Local Wisdom Based on the Theory of Conceptual Change to Improve Understanding High School Students' Concepts on Work and Energy Materials

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Abstract: This research aims to produce e-module teaching material products containing local wisdom from South Sumatra based on the theory of conceptual change that is valid, practical and effective in students' conceptual understanding. The development model used is the Rowntree development model modified with formative evaluation. The subjects in this research were class XI students at SMA 19 Negeri Palembang. Based on this data analysis, it is declared valid, practical, and effective in students' understanding of concepts. The results obtained were: the expert review stage obtained an average score from material experts of 85.71%, linguistic experts of 93.05% and appropriateness of presentation and appearance of 75.48%; the one to one stage obtained an average score of 95.11%; the small group stage obtained an average score of 95.08%. Based on the results of the field test, the N-gain calculation obtained a score of 0.64 with interpretation being seen from the test results calculating the pre-test and post-test scores. Thus, it can be concluded that using e-module teaching materials containing local wisdom based on the theory of conceptual change can improve students' conceptual understanding.

Keywords: Conceptual change theory; Conceptual understanding; Effort and energy; E-module; Local wisdom

Introduction

Physics is a science that studies the universe in everyday life. Physics is a branch of science Natural Science (IPA) which studies objects in nature physically and mathematically. Sekarani et al. (2021) stated that students not only have difficulty learning physics, but students often experience misconceptions, sometimes Some students define physics concepts based on their thoughts which are not in accordance with the concepts agreed upon by experts. Syuhendri (2017b) stated that in science learning various classic problems were found that continued to emerge, namely low understanding of concepts and the discovery of various classic problems that continued to arise, namely low understanding of concepts and the discovery of various misconceptions. Conceptual error or misconception according to Syuhendri (2010) is a term to state that something that is understood is different from the understanding agreed upon by scientists in the relevant field or is contrary to the scientists' conception. Misconceptions are normal in the process of forming the knowledge of someone who is learning (Hamdani, 2014). Misconceptions that occur continuously and are not immediately corrected will hinder students from forming concepts (Artiawati et al., 2016). Purtadi & Sari

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(2012) stated that wrong concepts will result in students experiencing errors for concepts at the next level or an inability to make connections between concepts. Meanwhile, a concept is a person's interpretation of a concept (Syuhendri, 2010). So, if the student's initial concept does not match the actual concept then the student's understanding of the next concept will also be wrong.

Low conceptual understanding of physics concepts and many misconceptions often become obstacles for students in the learning process (Syuhendri, 2017a). Misconceptions can hinder students' understanding and complicate teaching efforts (Syuhendri, 2019). The problem of misconceptions in various fields of science, especially physics, has long been revealed by researchers from various places, where the field of physics is a branch of natural science that discussing phenomena in everyday life (Widodo et al., 2017; Diani et al., 2019).

The field of mechanics is at the top of the fields of physics that experience misconceptions. In line with Syuhendri (2017b) stated that students experience misconceptions about mechanics. Work and energy are quite complex topics in the field of mechanics. The complexity can be seen from the relationship between concepts (Sudarmini et al., 2015; Khaerunnisak, 2018). In the material on work and energy, work, energy (kinetic energy and potential energy) are discussed, and the general law of conservation of energy. Saheb et al. (2018) explained that 21.59% of high school students in Bondowoso experienced 21.59% misconceptions about business and energy.

Based on the results of observations at SMA 19 Negeri Palembang, in the learning process, thick printed books and worksheets are dominant and during the learning process the teacher is more active. In the learning process, especially physics, the delivery of material tends to be more lecturing, which causes students to be less active in the learning process. Based on the results of an interview with one of the physics teachers at SMA 19 Negeri Palembang, the problems faced were: students were less motivated to learn because learning was still theoretical, which resulted in the learning process being less enjoyable and monotonous; Many students still experience errors in completing evaluation questions, one of the materials that gives rise to many misconceptions is the material on work and energy. The cause of students experiencing errors in solving work and energy questions is that students' understanding of concepts is still low, and students' numeracy skills are still lacking; Schools do not yet use interactive teaching materials in the learning process; Schools have not used self-developed e-modules such as E-modules containing local wisdom.

One solution that can overcome these obstacles is by using teaching materials packaged in electronic form, which can increase students' understanding of concepts and make e- modules more attractive to students. In line with Pratama et al. (2021) the use of E-modules can attract students' interest in learning and students' motivation in understanding concepts to increase students' understanding of concepts. E-modules are modules in digital form consisting of text, images or videos, which are produced and published via computer, the results of which can be accessed via mobile phones and computers (Diantari et al., 2018). E-modules via multimedia can make the learning process more interesting, more interactive, and able to convey messages through images and videos and make students enthusiastic about learning (Imansari & Sunaryantiningsih, 2017).

According to Rumiati et al. (2021), learning based on local wisdom is learning that is very appropriate to use in Indonesia because this country is famous for its diversity of cultures, languages and traditions. By implementing local wisdom-based learning, students can optimize understanding of the concepts being studied. Utilizing local wisdom as a physics learning resource is also one of the characteristics expected by the curriculum to make learning more meaningful (Sarah & Maryono, 2014; Wati et al., 2021). In the physics learning process, it is hoped that students will be able to be motivated and challenged to know various natural phenomena and events. In this way, students are not only implanted theoretical concepts from physics material but also applications in real life around where students live (Bakhtiar, 2016). The development of the e- module has various objectives: first, to advance physical science. Of course, development That will add literature and student learning references. Second, the ease of student learning activities in this case is for understanding concepts.

Method

In this research, a development model or what is called research and development (R&D) is applied. R&D is a process or steps to develop a new product or improve an existing product, which can be accounted for. In the research carried out, researchers carried out product development, namely a physics learning e-module containing local wisdom from South Sumatra based on the theory of conceptual change in the material of work and energy. The model that will be used is the model rowntree, which has three stages in

research, including the planning stage, development stage and evaluation stage. At the evaluation stage, researchers used the Tessmer model, namely: self-evaluation, expert review, one-to-one evaluation, small group evaluation, and field tests.

The data analysis technique used is data analysis walk through which is data validation used to evaluate data using a validation questionnaire sheet given to experts in the form of a Likert scale where scores are calculated by categorizing validation values (Apriyani et al., 2018). Next, data analysis techniques one-to-one and small groups which is used to test the practicality of an e-module product being developed. To seek percentage student can use equality:

$$P = \frac{f}{N} \times 100\% \quad (1)$$

Information:
P = Final value
F = Score obtained
N = Maximum score

The final value obtained is confirmed by the practicality category of the e-module teaching materials developed. Practicality level categories can be seen in Table 1.

Table 1. Category of evaluation results one to one and small groups(HEOS) (Wiyono, 2015)

Percentage (%)	Category
86 ≤ HEOS ≤ 100	Very Practical
70 ≤ HEOS < 86	Practical
56 ≤ HEOS < 70	Less Practical
0 ≤ HEOS < 56	Impractical

Test data analysis techniques are used to determine the effectiveness of the products that have been developed. Data analysis activities from effectiveness testing activities are carried out in addition to using a qualitative descriptive approach, but also using quantitative statistical analysis. For quantitative statistical analysis of research data, tests are carried out pretest posttest using the normalized gain formula below:

$$< g >= \frac{\text{Posttest} - \text{Pretest}}{\text{Maximum score} - \text{Pretest}} \quad (2)$$

The results of the n-gain calculation are then interpreted using the classification as in Table 2.

Table 2. N-gain classification

Average N-gain	Classification
$< g > \geq 0.70$	High
$0.30 \leq < g > < 0.70$	Medium
$< g > < 0.30$	Low

Result and Discussion

Research Result

The results obtained in this research are E-Modules containing local wisdom based on the theory of conceptual change. The planning stage is the initial step of this research activity. At this stage, a needs analysis, formulation of learning objectives, observations and interviews with one of the physics teachers at SMA 19 Negeri Palembang were carried out.

Referring to the results of interviews with teachers, it was found that: students were less motivated to learn because learning was still theoretical which resulted in the learning process being less enjoyable and monotonous; Many students still experience errors in completing evaluation questions, one of the materials that gives rise to many misconceptions is the material on work and energy. The reason why students experience errors in solving work and energy questions is that students' understanding of concepts is still low, and students' numeracy skills are still lacking; Schools do not yet use interactive teaching materials in the learning process; Schools have not used self-developed e-modules such as E-modules containing local wisdom.

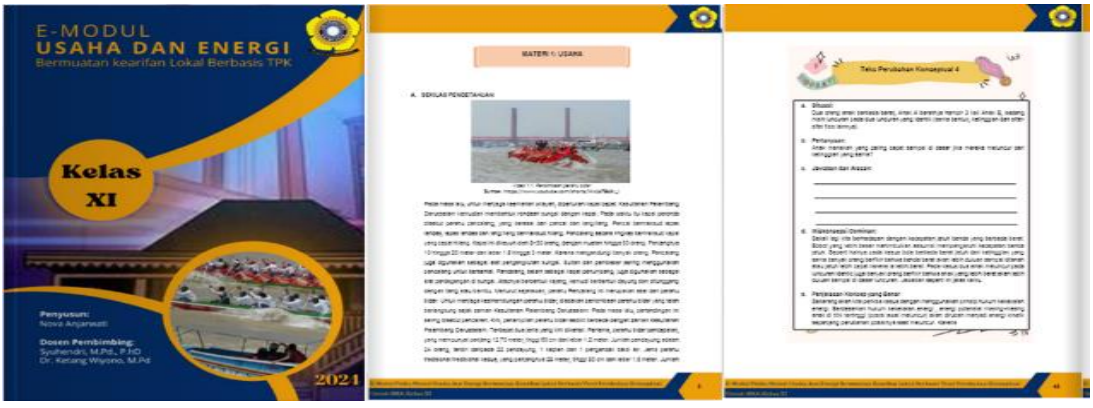

Figure 1. Several displays of e-modules containing local wisdom based on TPK

The development stage consists of three steps, namely determining topic development, drafting, and production prototype. In the topic development stage, researchers develop learning topics that will be adapted to the applicable curriculum. After developing the topic, a draft is prepared which contains the creation flow chart initial design of the product and continued with the preparation of the manuscript (storyboards). The results of drafting the e-module were then developed into prototype 1, the results of prototype 1 which were ready were then evaluated. Figure 1 shows several displays of e-module products that have been developed.

The evaluation stage begins with self-evaluation. This stage is carried out by self-assessment and consultation with the supervisor. This aims to correct deficiencies in the e-module being developed. At stage expert review. The aim is to obtain an e-module containing local wisdom based on a valid theory of conceptual change. The validation of this e-module was assessed by the three validators on three aspects, namely material, language, appropriateness of presentation and appearance. The results of the validation carried out at this stage can be seen in Figure 2 below.

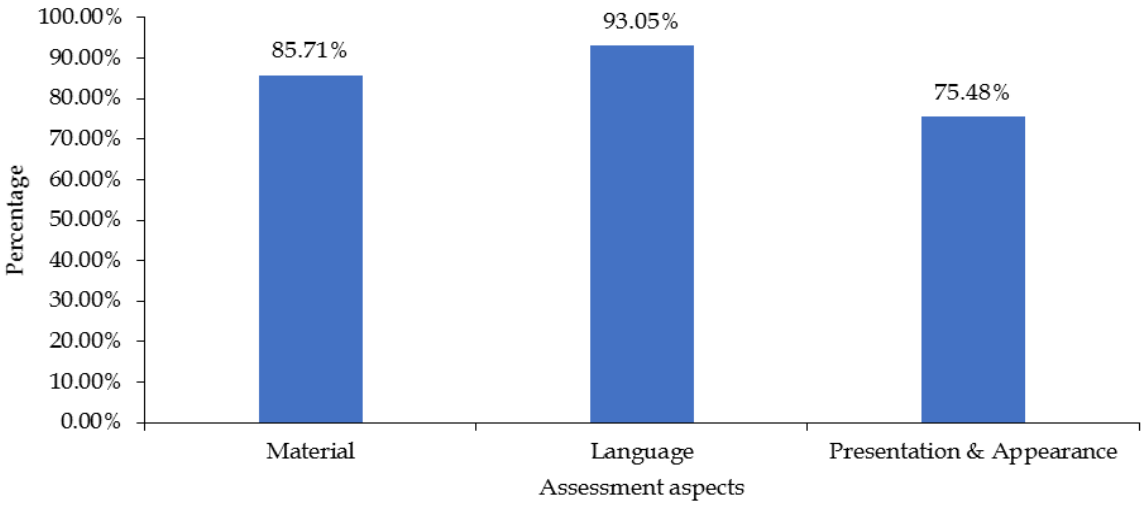

Figure 2. Assessment results expert review

Based on the results of the image above, the results indicates that e-module validation containing local wisdom based on the theory of conceptual change in business and energy material has an average percentage of material validation value of 85.71%, linguistic validation of 93.05%, and validation of appropriateness of presentation and appearance of 75.48% in three aspects are categorized as very valid, but experts still provide suggestions and comments. Stage one to one evaluation aims to determine the practicality of the e-module as well as identifying and reducing overall errors. The results of the student response questionnaire can be seen in Table 3 below.

Table 3. Evaluation results one-to-one evaluation

Aspect	Respondent			Average
	1	2	3	
Convenience use	100	95	100	98.3
Attractiveness Serving	100	90	90	93.3
Benefit	81.25	100	100	93.75
Average				95.11
Category				Very practical

Based on Table 3, the assessment results obtained from three students were 95.11%, so it can be concluded that the e-module is in the very practical category. At stage small group evaluation almost the same as the stage one to one, the difference is that the researchers tested it on eight students to fill out the questionnaire. The following are the results of student responses at this stage small groups in Table 4.

Based on Table 4, the assessment results obtained from the eight students were 95.08%, so it can be concluded that the e-module is in the very practical category. After producing a product in the form of an e-module containing local wisdom based on the theory of conceptual change in business and energy materials that is valid and practical, the next stage is to carry out a field test called field tests. This stage involved a sample class of class XI at SMA Negeri 19 Palembang, totaling 38 students with varying characteristics. This stage is carried out by doing pretest before treating and posttest after treatment using instruments about understanding concepts. N-gain analysis is used to see the criteria for the influence of a physics e-module containing local wisdom based on the theory of

conceptual change in increasing students' conceptual understanding. N-gain analysis of pre-test and post-test presented in Table 5.

Table 4. Evaluation results small group evaluation

Name	Total Score
SP	51
CPA	53
MRM	53
BB	54
EY	55
G	55
NJ	52
DP	54
Total Score	426
Score Maximum	448
Percentage (%)	95.08
Category	Very practical

Table 5. Results of N-gain analysis

The number of students (n = 38)	Average Gain Normalized (g)	Interpretation
12	$(g) \geq 0.7$	Tall
26	$0.3 \leq (g) > 0.7$	Currently
0	$(g) < 0.3$	Low
Average N-gain	0.64	Currently

Based on the results of the analysis in Table 5, it is known that 12 students have high interpretation, 26 other students have medium interpretation and there are no students who have low interpretation. From these data it can be concluded that the average interpretation of class XI students at SMA 19 Negeri Palembang is average. -average n-gain value 0.64.

Discussion

Based on the results of research by researchers, the e-module contains local wisdom based on the theory of conceptual change to improve concept understanding for class XI students at SMA 19 Negeri Palembang which is valid, practical and able to improve students' concept understanding abilities.

Based on needs analysis and formulating learning objectives. Needs analysis was carried out by interviewing physics subject teachers regarding the teaching materials used and the learning process carried out. One of the main problems for every student in class XI.1 SMA 19 Negeri Palembang is the low ability of students to understand concepts. This can be seen when the teacher gives a problem, the students do not show a response to answer the problem given by the teacher. Apart from that, the pretest results from students showed low percentage scores. This shows that the students' ability to understand concepts is still relatively low. Students' ability to understand concepts can influence student learning outcomes. As according to Setiawan (2018), one of the factors that causes low student learning outcomes is the ability to understand students' concepts. Therefore, it is very important for students to understand the concept of the material well.

At the development stage, the design analyzes needs and objectives beginning learning is developed into learning topics. At this stage, the topic of e-module development is limited to the material of motion dynamics with the sub-materials of work and energy. Next, the researcher drafted the e-module based on the context of local wisdom and the theory of conceptual change. In the e-module, the context of local wisdom, conceptual change texts and contains the conditions for conceptual change, namely dissatisfaction with the initial concept. (dissatisfaction), correct and reasonable explanation of concepts (intelligible and plausible) and implementation of new concepts (fruitful) to gain a better understanding of the concept (Posner et al., 1982). The evaluation stage is the final stage in this research. The e-module prototype was evaluated using Tessmer evaluation which is divided into 5 stages, namely: self evaluation, expert review, one-to-one evaluation, small group evaluation, and field test.

The e-module development that has been carried out by researchers must go through several stages of evaluation before being used in research subjects. The first evaluation stage is self-evaluation, where the e-module that the researcher has developed is first evaluated by the researcher together with the supervisor until the product is ready to be validated by experts. After the product has been evaluated by the supervisor, the e-module product will then be evaluated by expert review prototype 1 and validated by physicists consisting of three validators to test the validity of prototype 1 e-module material aspects, language aspects, presentation and appearance feasibility aspects. Based on each aspect of the material with an average gain of 85.71%, linguistics an average of 93.053% and appropriateness of presentation and appearance an average of 75.48% which meets the very valid category.

Prototype 1 e-module which was declared very valid was then tested on 3 (three) students. One to one evaluation was carried out by guiding the three students to study the e-module containing local wisdom of South Sumatra based on the theory of conceptual change and then the students at the end of the learning were asked to fill out a questionnaire to find out their response to prototype 1 that had been used. The average results of the one to one stage

student assessment were obtained based on the assessment The student response questionnaire was 95.116%, meaning that the e-module containing local wisdom of South Sumatra based on the theory of conceptual change meets the very practical category.

Later researchers small group (small groups), this stage is almost the same as one-to-one evaluation, the difference is that the researchers tested prototype 2 studying an e-module containing local wisdom from South Sumatra based on the theory of conceptual change with eight students at SMA 19 Negeri Palembang. At the end of the lesson, students were asked to fill out a questionnaire sheet regarding their responses to prototype 2 that had been used. The eight students assessed prototype 2 to measure the practicality of the e-module product, this stage was carried out face to face. With this, the average practicality of prototype 2 e-modules for the small group stage is 95.08% with a very practical interpretation.

The 3 e-module prototypes which had been declared very valid and very practical were then tested at the field test stage with research subjects totaling 38 students in class XI SMA 19 Negeri Palembang in order to determine the potential effect of e-modules on students' conceptual understanding.

After the learning activities using the e-module that the researcher completed, the researcher gave a final test (posttest) to find out whether there was an increase in students' understanding of physics concepts. After the students' final test scores were obtained, the researchers then calculated the students' N-gain scores to determine the level of students' ability to understand physics concepts. Thus, the average student N-gain was obtained at 0.64 in the medium category. Apart from that, the results of research conducted by Makhmudah et al. (2019) with the title development of a physics module based on local wisdom of traditional Central Kalimantan games on momentum and impulse material, obtained results from N-gain calculations based on pretest and posttest, namely the average obtained was 0.65 in the medium category, and there was also research conducted by Syuhendri et al. (2021) with the results of data analysis were obtained expert review obtained an average expert validation of 4.13 with a valid category. At stage one-to-one and small group evaluation. The average percentage obtained was 81.39 and 81.57% in the practical category. Thus, conceptual change text teaching materials based on conceptual change theory that are valid and practical have been successfully developed.

Based on the results of the research above, it was concluded that the development of e-modules containing local wisdom of South Sumatra based on the theory of conceptual change that researchers carried out was more effective in improving students' conceptual understanding abilities, as evidenced by the average N-gain value of students of 0.64 in the medium category. Thus, it is concluded that developing an e-module containing local wisdom from South Sumatra based on the theory of conceptual change to increase students' conceptual understanding at SMA 19 Negeri Palembang is very appropriate.

Conclusion

The research succeeded in developing e- module teaching materials containing local wisdom based on the theory of conceptual change to improve understanding of business and energy material concepts. This e-module is considered very suitable by experts, teachers and students, and is proven to help students increase their understanding of concepts in the very valid and very practical category, and the e-module is effective in use with the n-gain score criteria being .64 in the medium category.

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Methodology, formal analysis, investigation, resources, data curation, writing—original draft preparation, N.A.; validation, writing—review and editing, visualization, K.W. and I.S. All authors have read and agreed to the published version of the manuscript.

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The authors declare no conflict of interest.

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