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Implementation of the Independent Learning Curriculum in Science Learning through Web Learning-Based Teaching Materials

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Abstract: This research is motivated by advances in science and technology, as well as the lack of variation in learning methods integrated with technology in learning. The purpose of this study is to determine the feasibility of web learning in supporting independent learning. The research method used is Research and Development (R&D) with the ADDIE development model which includes five stages, namely analysis, design, development, implementation, and evaluation. Validation was carried out by media experts and material experts, followed by a field trial involving 35 students of SMKN 1 Bintan Utara. The research instrument used a structured questionnaire on a Likert scale to assess the validity, practicality, and effectiveness of the media. The validation results showed that the learning media was valid and in accordance with learning needs. The practicality test produced an average score of 85.71% with a very practical category. The effectiveness test through gain score analysis showed an increase in student learning outcomes with a gain value of 0.6 with a moderate category. In conclusion, web-based learning materials are effective, valid, and practical in improving students' understanding of concepts and learning outcomes in science subjects.

Keywords: Freedom to Learn; Teaching Materials; Sciences Learning; Web learning

Introduction

Education is currently an important capital to improve and develop the quality of human resources (Wijayanti & Ghofur, 2021). Education can be defined as an effort made to learn new pedagogical ideas, utilize several teaching aids to facilitate and accelerate student learning, improve student literacy and create a positive and inclusive learning environment (Mohamed Mohamed Ali El Deen, 2023).

Improving the quality of education is a priority for all countries, including Indonesia. The policy of adjusting learning during the pandemic indicates that the quality of education must remain a top priority, because the level of quality of education is considered a bridge to improving a person's quality of life (Serevina & Raida, 2021). There are at least three aspects of education, curriculum, and learning that must be considered if you want to achieve educational excellence. Learning that is designed and developed with the help of technology in an effort to make it more effective, efficient, and interesting. Learning using media is very good and effective as a learning medium (Suri et al., 2023).

One of the easy-to-use media is interactive learning media, which is able to provide different colors in learning and make students not easily bored in learning (Al-Farisih & Yunus, 2021). Students will be more involved, visualizing and thinking about concepts will be simpler, teachers' workload will be reduced, and overall teaching standards will increase thanks to the use of web learning media. Technology is used in education to support the learning process and improve the quality of learning.

The main advantage of using multimedia web learning is that it allows students to explore learning materials in various ways (Shahzad et al., 2021). Efforts made to realize a quality learning process include

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adopting technology in the learning process (Sidiq & Muskhir, 2020). It is hoped that the development of web learning media will be able to support learning activities where students can view and review content using the technology they have, students get guidance when practicing, students can maximize the use of technology to support learning. In the learning process, educators must provide learning that is in accordance with an interesting and enjoyable learning atmosphere (Yunus et al., 2023). Through this process, students' understanding and knowledge can increase. This web learning media can reduce static atmosphere and can create an effective, interesting, interactive and enjoyable learning process (Novita & Harahap, 2020).

Web-based learning includes all forms of education that are closely related to the use of the internet. Web-based learning can be interpreted as all learning activities that occur inseparable from the use of internet technology (Dermawan & Fahmi, 2020). Teachers and students alike can benefit from utilizing the web properly in the classroom to help achieve learning goals. Currently, a large amount of knowledge that students acquire to complete their assignments comes from web-based media. The web is an interesting learning resource especially for students (De Simone et al., 2022).

Research shows that web-based media can increase students' learning motivation, because its characteristics support the visualization of abstract concepts to be more real (Yunus et al., 2023). With interactive features such as videos, simulations, and quizzes, this media not only improves students' understanding but also strengthens critical thinking skills and problem-solving skills.

The low interest in learning among children is because teachers only focus on textbooks as the only source of learning (Panjaitan et al., 2020). If students have a high interest in learning, they will quickly remember and understand what they are learning and do it with pleasure (Sopia, 2022). The lack of variation in learning methods and the minimal use of technology in learning are also factors that affect student understanding. Teachers must be able to provide material that can be accessed online and offline, so they do not always present material from books only (Ardianti & Susanti, 2022).

Based on the complexity of the problem, systematic and comprehensive efforts are needed to improve students' understanding of science subjects. Developing more effective learning methods, improving the quality of teaching materials, optimizing the use of learning technology, and strengthening teacher competencies are strategic steps that need to be taken to overcome students' difficulties in understanding science. The use of web-based e-learning media can overcome learning problems and improve students' learning outcomes and learning motivation (Rumahorbo, 2020). One of the factors in creating a conducive learning environment with a visual and auditory environment (audio-visual) which in this case can be created by utilizing information technology (Zamroni, 2020). Therefore, the researcher conducted a study entitled "Implementation of the Independent Learning Curriculum in Science Learning through Web Learning-Based Teaching Materials".

Method

In this study, the ADDIE model development model was used, where the ADDIE model can determine the design process for the design display system (Arshavskiy, 2017). One example of developing a product as an illustration for users directly so that they can know the steps of designing an interactive web and how interactive web works in supporting modules in the independent learning curriculum. The following is a picture of the ADDIE media development stage:

Figure 1. ADDIE Development Stages

In data collection, the instrument for making this product uses a non-test device to collect data. The instrument is made in the form of a structured questionnaire. In collecting data, the questionnaire created will be given to media experts, material experts, and students. This study uses a Likert scale which is one of the measurement scales in research.

A test instrument is a tool for measuring and collecting information about the characteristics of an object (Sembiring & Nasution, 2021). A validation questionnaire is the tool used to determine the degree of validity of web-based learning resources for science-based learning about energy and its fluctuations. The questionnaire is used to analyse the study's performance, specifically whether web learning based on technological and material components is possible. The purpose of this analysis is to ascertain the degree of success achieved by this research. Respondent answers are gathered in order to do this. Validity, practicality, and efficacy tools are employed.

The learning media validation analysis technique is carried out to see the validation data of the learning media that has been developed whether it is worthy of being continued to the next stage or not. The validity

value is given using the Aiken's V statistical formula (Formula 1).

$$V = \sum s/[n(c-1)] \quad (1)$$

Description:
V : The Validity Index
s : r – lo
n : The Number of validators
lo : The Lowest validity number
c : The Highest validity number
r : The Number given by a validator

The results of the evaluation or answers from students that show the practicality of the media can or cannot be implemented in the field. The questionnaire filled out by practitioners used to evaluate the product is checked to ensure the level of practicality of the product. To calculate the practicality value, the formula 2 can be used:

$$P = \frac{f}{N} x100\% \quad (2)$$

Explanation:
P : The Final Value Obtained
f : The Score obtained
N : The Maximum score

Effectiveness is reviewed from the classical completeness aspect in this case web learning is said to be effective if the student's graduation rate is equal to or more than 80%. The minimum completeness criteria for the subject of science and energy material and its changes set by the teacher lecturer is 70. By using the Formula 3.

$$K = \frac{JT}{JS} \times 100\ \% \quad (3)$$

Explanation:
PK : The Percentage of completion
JT : The Number of students who completed
JS : Total students

From the perspective of the Gain Score, the efficacy of this investigation is also examined. By comparing the differences between the Pretest and Posttest findings, the Gain Score component is utilised to evaluate how well student learning outcomes have improved.

$$N - Gain = \frac{Spost - Spre}{Smaks - Spre} \quad (4)$$

Explanation:
Spost = Average posttest score
Spre = Average pretest score
Smax = Ideal maximum score (100)

The pre-experimental design approach of a single group pretest-posttest type is used to evaluate effectiveness. Data analysis includes steps such as grouping data by variables and respondent types, tabulating data by variables from all respondents, presenting data from each variable under investigation, performing computations to answer research questions, and testing the proposed hypotheses. The data normalcy test was completed before the analysis began. This test, known as a t-test, is used to ascertain the data analysis that was conducted using parametric statistics.

Result and Discussion

Based on the results of the analysis of learning media assessment data, the results obtained showed the feasibility of the media from various aspects assessed. The field trial steps include testing interactive web teaching resources that have passed the validation process by experts and teachers. A total of 35 students or two grade X students were the samples used in the field trial. The table below shows the student answer data. The appendix contains a summary of information obtained from student reactions to more in-depth learning materials.

Table 1. Results of student response questionnaire

Indicator	Percentage	Criteria
Presenting	85.71	Very practical Very
Information	86.67	practical
User-Friendly	87.29	Very practical
Navigation	87.14	Very practical
Design		
Completeness		
Average score	86.70	Very practical

The effectiveness test of experimental learning media in conducting effectiveness tests was carried out using the one-group design method (sample test design with one group). This experimental design involves collecting data from one group of subjects without a comparison group. The results of the effectiveness analysis based on classical completeness from 35 students who had taken the pretest and posttest can be seen in the following table.

Table 2. Results of pretest and posttest scores

Information	Pretest	Posttest
Number of participants	35	35
Participants completed	9	30
Participants did not complete	26	K5
Percentage of completion	25,71%	85,71%
Category	Ineffective	Effective

According to the results of the classical completeness study, prior to adopting web-based learning materials, only 9 of 35 students completed the course, with a completion percentage of 25.71%. This means that before using web-based learning materials, student learning outcomes were categorized as

ineffective. Meanwhile, after using web learning media, the posttest results of 35 students showed that 30 students completed the course with a completion percentage of 85.71% in the effective category.

The table below shows the findings of the effectiveness analysis based on the gain scores of 35 students who took the pretest and posttest.

Table 3. Gain score analysis results

N		Average	N-Gain	% N-Gain
	Posttest - Pretest	SMaks - Pretest	Score	Score
35	29.07	48.86	0.60	60
Category				Currently

Based on the findings of the effectiveness test analysis employing 35 students' pretest and posttest scores, the average N-Gain Score was 60, placing it in the moderate range. As a result, we can conclude that web-based teaching resources are effective learning media.

This study's success is also evaluated using the Gain Score. The Gain Score element is used to evaluate the improvement of student learning outcomes by comparing the disparities between pretest and posttest findings. The IBM SPSS 29 programme is used to analyse normalcy tests. The Shapiro-Wilk Test normality test data analysis results are presented in Figure 2.

Tests of Normality

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Pretest	.139	35	.082	.939	35	.053
Posttest	.112	35	.200*	.963	35	.289

*. This is a lower bound of the true significance.

a. Lilliefors Significance Correction

Figure 2. Results of the Shapiro-Wilk Normality Test

The Shapiro-Wilk Test normalcy test yielded a significance value (Sig.) of 0.053 for the pretest data and 0.289 for the posttest. This result indicates that the pretest data is normally distributed, as (Sig. = 0.053) is bigger than 0.05. Then, for the posttest data, (Sig. = 0.289) is greater than 0.05, indicating that it is regularly distributed.

The t-test is used to assess student learning outcomes before and after receiving therapy (via web-based learning resources). The t-test analysis is aided by IBM SPSS 29 software. The findings of the t-test data analysis are shown in Figure 3.

Paired Samples Test

		Paired Differences					t	df	Significance	
					95% Confidence Interval of the Difference					
		Mean	Std. Deviation	Std. Error Mean	Lower	Upper			One-Sided p	Two-Sided p
Pair 1	Pretest - Posttest	-26.21429	19.05267	3.22049	-32.75911	-19.66946	-8.140	34	<.001	<.001

Figure 3. Results of t-test data analysis

The two-sided p value generated is 0.001 according to the findings of the parametric statistical test (t-test) on the sig. The t value (0.001) is less than 0.05, indicating that there is a significant difference in the learning outcomes of students who use web-based learning resources as a scientific learning medium. The t-table value for df (34) is thus -1.690 when the t-count value is compared to the t-table. The t-count value (-8.140) < (-1.690) t-table shows a significant difference in learning outcomes between students who use web-based resources as a science learning medium.

This research and development produces practical, effective, and valid web-based teaching materials for use in the science learning process for class X at SMK. Web-based learning materials have contributed to improving the quality and standard of learning. The existence of media can help teachers and students in the process of science learning activities. This can be seen from the results of the student pretest before using 25.71% to 85.71% of the posttest results carried out. This research is in line with the study by the Author (Nevi Dila Restu Anggraeni, 2023) with the title "Development of website-based learning media with problem-based learning model on cloud computing subjects at SMKN 1 Kemlagi". The purpose of the study was to determine the differences in student learning outcomes using website-based learning media compared to conventional methods. The results of the study showed that the average post-test score of students using website-based media was 74.2, better than 67.2 in the conventional method.

This is because every abstract science concept can be explained more concretely using web learning. The function of web learning in science learning can make students happy and increase their interest in participating in learning process activities, present abstract learning concepts in concrete forms so that they are easier to understand and comprehend by students, and help students see the relationship between learning and objects around them (contextual).

Conclusion

The assessment data of web-based learning materials in supporting the independent curriculum were obtained after going through all stages of the research. The assessment of interactive web-based teaching materials includes 3 aspects, namely, feasibility, practicality and effectiveness. Web-based teaching materials are declared valid and can be integrated into the learning process, according to the results of data analysis regarding media feasibility. Data study on the feasibility and effectiveness of media shows that web-based learning tools are appropriate for increasing science learning outcomes. So, based on the overall assessment results of each stage of the research that has been completed, this web-based learning material media is included in the criteria that are

practicable, practical, and effective for enhancing scientific learning outcomes for class X students at SMK Negeri 1 Bintan Utara.

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Conflicts of Interest
in this study there is no conflict of interest in this research article

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