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The Effectiveness Of Developing An Adaptive Physics E-Module In Moodle-Based Blended Learning On Students' Representation Ability On Thermodynamics Material

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Abstract

The research aims to develop adaptive electronic modules using Moodle-based blended learning as a solution to improve representation skills in the school environment. This research combines online and face-to-face learning methods (blended learning) with the use of Moodle as a digital learning platform. Three forms of representation in the concept of physics, are (1) verbal representation; (2) visual representation; and (3) mathematical representation. The formulation of the problem in this research is the characteristics, validity, and effectiveness of the E-module. This module aims to provide learning content that is tailored to the needs and abilities of each individual student. Adaptive features allow students to access materials, assignments, and learning resources appropriate to their skills level. Learning is done through a combination of classroom teaching and e-modules through Moodle. E-module development model uses the research and development method. The research design used is a true experimental design in the form of a "Posttest-Only Control Design". Assessment includes data collection through surveys, observation, and evaluation of learning outcomes. The purpose of the evaluation is to analyze the effectiveness and efficiency of using adaptive e-modules with Moodle based on blended learning to improve students' representation skills at school. The research results showed that the E-module assessment by experts obtained a content percentage and eligibility criteria of 91.7% (feasible). To determine the level of effectiveness through the t test and comparison of posttest results. This is evidenced by the test using SPSS version 23 which shows a significance value of 0.00 <0.05. In visual representation, a percentage of 87.5% was obtained in a very good category, for mathematical representation, a percentage also was obtained in a very good category, 88.5%, and in verbal representation, a percentage was obtained in a category of 90%, as the greatest. With an average post-test score of 88.8 for the experimental of the class and 74.2 for the control of the class. Adaptive e-modules through Moodle-based blended learning can be an effective choice for increasing representational abilities and facilitating personalized and flexible learning. The results of this study are expected to encourage the development of adaptive learning systems in schools and support the improvement of student learning outcomes.

***Keywords**: E-Module, Blended Learning, Moodle, Representation*

INTRODUCTION

Research, study, and physics are all parts of knowledge (science). Facts, theories, laws, principles, models, and laws are all part of the natural sciences (IPA). Successful learning is a prerequisite for fitness as a process and outcome (Astuti, 2015).

Diagrams, drawings, concepts, equations, and graphs are used in physical education. Each concept in the learning materials must be explained and shown to

work in the actual world. This task has been finished. Students in the eleventh grade are known as Generation Z since they are always using technology. From my findings at SMK Kota Masai 2 in Johor Bahru, Malaysia, students prefer representational learning. This school prioritizes conceptual learning compared to SMA Negeri 1 Gubug. They don't need to explain or describe all ideas, experiments, outlines, sketches, diagrams, or graphs. Thus, the basic data has 72 average values. These skills are beneficial for students. Students learn everything and follow the instructor. Multi-representation occurs because students must understand abstract information.

Simamora, Sinaga, and Jauhari (2016) claim that instructors don't address the difficulties that students have learning physics. Learning issues can be brought on by inadequate resources (packages, books, and literature), student unhappiness with learning methodologies, and a lack of support or understanding, according to Maas (2004). The existence of humans is influenced by information and communication technology, according to Prahani, Limatahu, Yuanita, and Nur (2016). Teachers are unable to develop technology because it is necessary for teaching during the epidemic. The classroom's technology is outdated. Creating modules or e-modules increases the use of electronics in the classroom. Students can get involved through e-modules. Student progress is most important, although instructional resources can help instructors design classes. such as self-instruction, independent, and stand-alone. Easy to use, customize and use. Students grow more competent through mental, physical and social activities. Indonesia's competency requirements require that physical education emphasizes students and academics. Relevant student learning experiences, viewpoints, knowledge, and talents should be recognized through diverse representations.

Iwandani (2014) defines multi-representation as the physical translation of linguistic symbols. This strategy allows you to communicate comparable ideas in different ways. The problem is explained, diagrams and pictures are used, and mathematical formulas are used to solve it.

The various representations, which impact recognition and retrieval, are explained by theories. Because academics employ representation to communicate and resolve issues, Sunyono (2015:6) refers to it as the foundation of science.

Some PER experts say that children need five academic abilities to overcome various problems, including multi-representation. Rosengrant, Heuleven, Etkina 2006 Thus, student representation is still low. These factors also affect the problem-solving abilities of traditional students and instructors.

Due to the outbreak, students must accomplish their own assignments. According to Hidayat, Victory, and Henry (2016), online adaptive modules enhance learning and tailor instruction. To improve education, they adapt knowledge, technology, and flexibility.

With representation skills, instructors can evaluate learning. The results can help instructors design learning models or adapt curricula to suit student needs. Teachers must have sufficient knowledge to help students improve their visual, mathematical and verbal abilities.

From the explanation above, research will be conducted on students' multiple representation skills with the title "Effectiveness of Adaptive Physics E-Module in Moodle-Based Blended Learning on Students' Representation Ability in Thermodynamics Material".

Research Purposes

1. Explain how the Moodle-based adaptive blended learning physics e-module affects students' representation abilities.
2. Creating adaptive physics e-modules on moodle-based blended learning based on

students' thermodynamic representation abilities to create valid learning media.
3. Assessing the impact of the Moodle-based blended learning physics adaptive e-module on students' representation abilities.
4. Assess students' reactions to adaptive physics e-modules in moodle-based blended learning to improve representation.can prepare quality work-ready graduates.

RESEARCH METHODS

A development and research method is used in this thesis. According to Sugiiyono (2015), research and development are utilized to produce and evaluate products. In many situations, research is utilized in product development to study demand and evaluate efficacy. As a result, development and research take place over time.

The research and development process involves studying industry demands, creating and developing a product, testing it, and revising it to fix bugs. R&D investigates how the object of research develops over time. Thus, research and development improves education. This is in accordance with research. The goal is to create physically flexible E-modules for thermodynamically related materials.

Product Trial

1. Research Subject
   a. Population

      This research involved class XI students from SMA Negeri 1 Gubug.

   b. Sample

      This research sample was chosen after taking into account several factors and the available classes. A mixed learning approach was employed to treat Class XI MIPA 3 as an experimental class (Sugiyono, 2016:118).
2. Experimental Design

To increase the internal validity of the study, the original experimental design "Posttest-Only Control Design" was used.

Table 1 Posttest Design-Only Control Design

Research Group	Treatment	*Posttest*
R_1	X	O_1
R_2	-	O_2

Information :
R1 : experimental class
R2 : control class
X : treatment given
O1 : experimental class posttest score
O2 : control class posttest score

In actual research, the effect of treatment is analyzed using a difference test (Sugiyono, 2016).

3. Sampling technique

A sampling methodology is a sampling method that is proportional to the sample size that will be used as the real data source. This method takes the population distribution into account in order to obtain representative sample data. Purposive sampling, which refers to selecting samples based on certain criteria, was employed in this study (Sugiyono, 2016: 124).

After sampling techniques have been considered, the experimental class, which uses the blended learning model, and the control class, which uses the discovery learning model, will be given.

4. Data Collection Techniques
   a. Observation

      Researchers used non-participatory observation to collect data and observations about physics learning at SMA N 1 Gubug. Some classes conduct physics learning assessments. The aim of classes X, XI, and XII MIPA is to evaluate how effective the learning carried out so far has been using existing media. take brief notes and make in-depth observations.

   b. Interview

      To obtain oral data, interviews were conducted. This data is then processed and used to create research proposals, instruments, and materials for the e-module. Physics teachers in

schools who are competent in their field have been tested. This is important for researchers to consider making e-modules.

c. Documentation

Data collection involving images or videos is very important, because without it, research results will not be good. Therefore, the documentation stage must be done as well as possible.

d. Likert Scale

This study uses a validator and research subject scale. The validator scale is an evaluation sheet of the test instrument for the representation ability and e-module goods (media experts, materials, and practitioners).

RESULTS AND DISCUSSION

1. Preliminary study results

Further investigations were carried out at SMA N 1 Gubug. Researchers interviewed physics professors. The three physics professors did not use personal materials. Teaching materials use institutional or online sources.

Researchers added multi-representational qualities to school physics resources after observing underrepresented teaching materials at SMA N 1 Gubug. Thermodynamics is taught to students. Moodle is the representational technique. Moodle is a dynamic learning environment that is modular and object-oriented. Using Moodle, online learning resources are produced. There are learning resources available in online "classrooms."Product design

a. Types of Teaching Materials

Physics e-modules with Moodle representations of thermodynamic principles were created to improve students' multi-representation abilities. This device works with laptops, PCs, computers and mobile phones.

b. Product Description

1) Opening Part

The front page of the e-module, table of contents, author's preface, and abstracts (teaching and learning materials) are included. To help readers understand the history of product creation and the intended use of the product, the product cover contains the title, illustrations of bati work, and K-13 information.

Figure 2 E-Module Cover

2) Information Section

To increase students' understanding of the product reading flow, this section contains instructions for using the product. Students must follow these instructions in order to use and operate the product effectively.

Figure 3 Instructions for using the e-module

3) Learning design section

Content guidelines and product concept diagrams are included in this section. The objectives of content standards are to use the created goods to achieve learning outcomes. According to information, the learning materials created using the K–13 curriculum, which comprises Core Competencies, Basic Competencies, and Learning Indicators, fully comply with government laws. The

flow of the product learning chapters is depicted in the concept map.

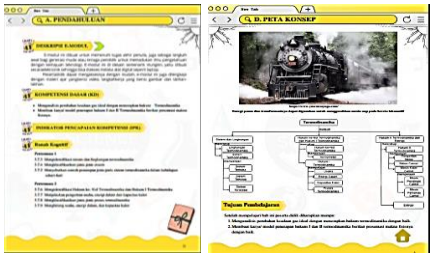

Figure 4 competency and concept map

4) Contents section

a. The Canva platform produces adaptive e-modules that can be used on computers, laptops or cellphones.

b. Since Canva has the ability to pipe videos directly to YouTube, the e-module can be integrated with YouTube.

Figure 5 e-module integrated with youtube

c. The e-module is linked to Moodle so it can be shared via a link and readers don't need to install the Canva app to read it.

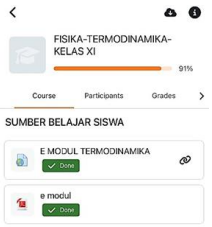

Figure 6 e-module in moodle

d. E-modules can be easily integrated with presence relationships.

e. This module saves files on Google Drive, Dropbox, One Drive, and PowerPoint.

f. Development of an e-adaptive thermodynamics module for class XI senior high school material on energy, heat, work, and entropy.

g. Adding graphics, audio, and video enhances students' visual understanding of customizable e-modules so they can better demonstrate topics.

h. The e-module contains questions and assessments to help students learn.

5) Concluding Section

This section includes learning summaries, practice questions, vocabulary, and references. Content summaries help students remember what they learned from the beginning. The glossary contains terminology that is difficult or rarely heard by students.

Figure 7 glossary

3. Expert Validation Results

a. Moodle validation

Table 1. Moodle Validation Assessment Results

No.	Aspect	Score Earned	Max Score	Appropriateness (%)	Category
1	convenience Moodle	15	16	93.7	Very good
2	Fit for Purpose	13	16	81.2	Very good
3	Moodle Design	17	20	85	Very good
4	Security	8	8	100	Very good
	Average Percentage			89.9%	Very good

Based on this description, Moodle has a high quality assessment and can be tested in the field.

b. E-Module Media Validation

Masturi and Dr. Fianti as material and media validator. The evaluation, shown in Table 2, reveals that the adaptive physics e-module for blended learning based on moodle can teach students thermodynamics.

Table 2. Media Validation Assessment Results I

No.	Aspect	Score Obtained	Max Score	Appropriateness (%)	Category
1	E-Module View	14	16	87.5	Very good
2	E-Module Structure	70	72	97.2	Very good
3	Proportionality E-Module	23	28	82.1	Very good
4	Explainability E-Module	16	20	80	Very good
5	E-Module Technical	4	4	100	Very good
	Average Percentage			90.7	Very good

Based on this explanation, the media validator gave a good assessment of the e-module product and recommended a field test.

Table 3 Results of media validation research I

No.	Aspect	Score Earned	Max Score	Appropriateness (%)	Category
1	E-Module display	14	16	87.5	Very good
2	E-Module Structure	70	72	97.2	Very good
3	E-Module Proportionality	25	28	89.2	Very good
4	E-Module Explainability	18	20	90	Very good
5	E-Module Technical	4	4	100	Very good
	Average Percentage			92.8	Very good

Based on this description, the media expert validator proposes a field test of the e-module product. The two special judgments confirmed everything. Figure 8 is a bar chart of the % validation of the learning e-module assessment by the two validators.

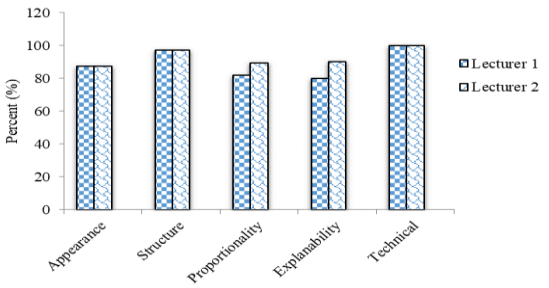

Figure 8 Expert Lecturer Validation Results

c. Practitioner Validation

The practical validator is science teacher Darsono, M.Pd. Evaluation of the adaptive physics e-module in Moodle-based blended learning on students' thermodynamic representation skills is shown in table 4.

Table 4. Practitioner Validation Assessment Results

No.	Aspect	Score Obtained	Max Score	Appropriateness (%)	Category
1	Expediency E-Module	15	16	93.7	Very good
2	Enhancement Quality	23	24	95.8	Very good
3	Authorship	8	8	100	Good
4	Language	8	8	100	Very good
	Average Percentage			97.4	Very good

Based on this description, expert learning practice validators rated the e-module items favorably and encouraged field testing. Physics teacher at SMA N 1 GUBUG Ellyana, S.Pd., is the second practitioner validator.

Table 5 Practitioner Validation Assessment Results

No.	Aspect	Score Earned	Max Score	Appropriateness (%)	Category
1	Benefits of E-Module	16	16	100	Very good
2	Quality	24	24	100	Very

	Improvement				good
3	Authorship	8	8	100	Good
4	Language	8	8	100	Very good
	Average Percentage			100	Very good

Based on this description, expert learning practice validators rated the e-module items favorably and encouraged field testing. The two special assessments confirmed everything. Figure 9 is a bar chart showing the % validation of learning e-module assessments by the two validators.

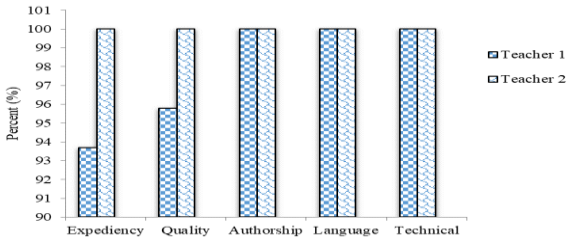

Figure 9 Expert Practitioner Validation Results

d. Validation of learning tools

Table 6 lists three considerations before using two Learning Implementation Plan (LIP) validators for the control class and the experimental class.

Table 6. LIP Validation Results

No.	Assessment Aspects	Control class	Criteria	Experimental Class	Criteria
1.	Lesson Plan Format	94.9%	Very Valid	96.7%	Very Valid
2.	Language	91.6%	Very Valid	100%	Very Valid
3.	Time	100%	Very Valid	100%	Very Valid
Average		95.6%	Very Valid	98.9%	Very Valid

Table 6 shows that the average RPP assessment aspect is 98.9%, indicating that the instrument is feasible and very good. valid criteria. Calculation of validation of observation sheets for both validators is attached.

4. Limited Trial Results

1) Test the Internal Consistency of Question Items

Criteria	Question Number
Valid	1,4,5,6,7,8,9,10,12,13,15
	Total 11
Invalid	2,3,11,14
	Total 3

2) Reliability

To find out, it is the same as the value r_{11}which is consulted with the product moment and a significance level of 5% (0.05) with a total of n of 36 students.

Table 8. Reliability Results of Question Items

Alpha/ r_{11}	r_{tabel}	Number of questions	Criteria	Category
0.6098	0.3202	15	Reliable	Medium _

The table indicates a high determination value for the question, with r_{11}=0.6098 > " 〖 r 〗 _"table" "=0.3202". Testing the questions is trustworthy. See attachment for reliability estimates.

3) Degree of Difficulty

If the task isn't too difficult or complicated, that's great. The number used to determine a problem quickly and easily is called the success index. Easy, moderate, and difficult are the three categories of task success. Rent 0.00–1.00.

Table 9 results of difficulty level

Criteria	Question Number	Amount
Hard	-	0
Currently	6,7,8,9,12,15	6
Easy	1,2,3,4,5,10,11,13,14	9

4) Discriminating Power

The discriminating power of the questions is tested to see how well they can distinguish between students from the top class and students from the lower

class. The file contains the findings of the discriminating power calculation for each item. The outcomes of table 10's test questions' differentiating power are listed below.

Table 10 Results of differentiating power analysis

Criteria	Question Number	Amount
Very good	-	0
Good	7.9	2
Enough	4,5,6,8,10,12,15	7
Bad	1,2,3,11,13,14	6

Based on the results of the analysis of 15 item descriptions that have been tested for validity, reliability, level of difficulty and distinguishing power, questions that meet the requirements are obtained and can be used as a measuring tool or assessment of posttest questions, namely numbers 1,4,5,6,7,8,9 ,10,12,13,15. More clear calculations can be seen in the attachment.

Research Analysis

1. Normality test

Table 11 Shapiro-Wilk Normality Test Results

Group	Shapiro-Wilk			Conclusion
	Statistics	Df	Sig.	
Experiment	0.967	36	0.345	Normally distributed
Control	0.966	36	0.317	Normally distributed

You can look at the Sig column (significance) in Table 11 to determine the probability value in the Shapiro-Wilk normality test. The experimental class has a significance value of 0.345 > 0.05, which indicates that it is regularly distributed according to decision-making. The control class's sample data was normally distributed because it received a significance value of 0.317 > 0.05. The attached document details how to perform a Shapiro-Wilk normality test analysis using SPSS version 23.Homogeneity Test

Table 12 Oneway ANOVA Homogeneity Test Results

Statistical Level	df1	df2	Sig.	Conclusion
2,579	1	70	0.113	Homogeneous

The steps in analyzing the Oneway ANOVA homogeneity test using SPSS version 23 can be seen in the attachment.

Final Research Analysis

Hypothesis t test

Table 13 Independent Sample T-Test Hypothesis Test Results

Variant	Q	df2	Sig.
Equal variances are assumed	**8,258**	**70**	**0.000**
Equal variances are not assumed	**8,258**	**66,100**	**0.000**

The blended learning paradigm can influence the multi-representational abilities of class XI MIPA students at SMA Negeri 1 Gubug because there is a large disparity between the control and experimental classes. The file shows the stages of analysis of the independent t-test hypothesis test SPSS version 23.

Results Of Student Response Analysis

Table 14 Implementation Questionnaire Results

Assessment Aspects	Experiment
Convenience	**92%**
Benefit	**91%**
Interesting	**97%**
Security	**95%**

With the highest percentage of interesting aspects for the experimental class at 97%. This data can be seen in the attachment.

Results Of Presentage Analysis Of Representation Capability Indicators

Table 15. Percentage of representation ability

Aspect		Indicator	Control class	Criteria	Experimental class	Criteria
Visual	1A	Representing thermodynamic process data from representation into tabular form	76 %	Good	86%	Very good
	1B	Describe thermodynamic graphs or processes	75 %	Good	89%	Very good
Mathematical	2A	Create mathematical equations or models	74 %	Good	90%	Very good
	2B	Solve a problem thermodynamics through equations math	70 %	Good	87%	Very good
Verbal	3A	Write an interpretation of a representation	77 %	Good	92%	Very good
	3B	Write down the solution to the problem through sentences in writing	77 %	Good	90%	Very good
	3C	Solve statistical problems using words or written text	74 %	Good	88%	Very good
		Average	75 %	Good	89%	Very good

RESULTS OF OBSERVATION ANALYSIS

Table 16 Observation Analysis Results

Class	Average	Highest value	Lowest Value	Complete Student	Not Completed
Experiment	88.8	100	75	36	-
Control	74,2	88	56	16	20

The experimental class that used Moodle-based blended learning had better cognitive scores than the Discovery Learning control class. The higher average value in the experimental class compared to the control class confirms this.

DISCUSSION

Through this project, e-modules will be developed, applications for problem-solving will be tested, and students' representational skills will be improved. These issues are examined in field investigations. Students participating in blended learning using Moodle can use an adaptive physics e-module to explain thermodynamics. This module has undergone limited testing. Analysis, data gathering, design, validation, modification, and use testing are all influenced by science. Student learning styles must be accommodated in the classroom. It is necessary to have flexible learning resources, course content, and navigation (Maaliw, 2020). Product quality is evaluated via individual testing.

In December 2020, exploratory research collected five physics teaching

materials from instructors to analyze opportunities and obstacles. This investigation found that the school's learning programs did not reflect students' lifestyles or technology. Therefore, researchers suggest.

Previous research data is collected next. Homeschooling, indoor study habits, and the best e-module creation software. The team will then create a mixed thermodynamics adaptive physics e-module based on Moodle. E-modules and interactive representations are researched for product development. Learn representations and Moodle from source, then build e-modules and Moodles to learn in production. Software for e-module representation and finding indications. E-modules are 1) self-instruction evaluation activities or self-assessments that are interconnected so that students can learn independently; 2) packaged—contains all the necessary learning information; and 3) standalone—does not require teaching materials or other media and can connect to YouTube. 5) Usability/compliance.

The third step is product creation. Researchers create product e-modules. Starting on page 1, emphasize visual, verbal, and mathematical representations. Children understand through emotions and effective communication. E-modules teach thermodynamics, exercises, and exploration online.

The fourth step is validation. Defects during product validation. Field experts assess. It analyzes scientific data for field testing.

The content is validated by representation research, learning design, e-module success, and implementation. The material expert validation questionnaire was tested by Fianti, S.Si, M.Sc., Ph.D., and Masturi, M.Sc., lecturer in physics education at Semarang State University. A product that is 91% good can be tested for repair. Reviewing an excessive number of publications weakens a material specialist. Students prefer the simplicity and interest of easily configurable visual e-modules.

Masturi, M.Sc., M.Sc., Ph.D., lecturer in Physics Education, Semarang State University, and Fianti, S.Sc., evaluated the presentation, structure, proportionality, clarity and technology of e-modules. This 90.7 percent product requires input. Low qualifications due to font and writing inconsistencies. Learning specialists verified by e-module, student quality, author, and language. Darsono, S.Pd., M.Pd., and Ellyana Lutfiyaningrum, S.Pd., physical education teachers at SMP N 1 Selamatharjo and SMA N 1 Gubug, Central Java, examined this practitioner validation questionnaire. A good product has 92.7 percent feasibility, so it requires further testing and development.

Class A has 36 students. Tuesday, September 20 2022 to Friday, October 7 2022 is a trial. The researcher practiced group prayer, attention, and apperception before the presentation. Researchers evaluate e-modules before teaching. This experiment examines health and thermodynamics knowledge in students. Test response. The trial lasts 90 minutes, or two hours. The researcher analyzed the data and created research class questions after a short pilot test.

The first class introduces Moodle to the students. Online learning management system called Moodle. LMS software helps professors and students learn more quickly. Like Google Classroom, Moodle enables students to download resources, keep tabs on their classmates, and have instructors grade their assignments. Through Google Classroom Calendar, students receive features such as assignment deadlines. This Moodle application might not function elsewhere.

Moodle is used in the second class with e-modules, PowerPoint, and other teaching tools. Zoom simplifies learning in the Moodle blended learning model. Three 35-minute learning sessions were conducted. Student interests and behavior are tracked in Moodle conversations. Students can submit assignment results to the teacher for review at the next meeting

using the Assignment feature. Write it in the Moodle assignment column or upload a work file and use Quizz.

This research tests it descriptively. The final test consists of 15 essay questions, this one 10. Competent professors assess the questions based on subject, organization and language. The findings are attached. Validity, dependability, problem complexity, and discriminatory power were evaluated. The research results table shows validity. Four inconsistent questions and eleven consistent questions make this question reliable. The dependency level of 0.6098 exceeds 0.3291. Results for intermediate and basic difficulty levels with different scores. make post-test questions.

The findings indicate that both experimental and control subjects are impacted by the learning model. A hybrid model was given to the Discovery Learning control and experiment class. In the experimental lesson, the researcher teaches the following seven thermodynamic indicators using the e-module: A thermodynamic process data table should be created, a graph or process displayed, a mathematical equation or model should be created, problems based on equations should be resolved, and equality issues should be investigated and resolved.

We checked the posttest findings of the control and experimental classes for normality and homogeneity. The SPSS normality test shows a normal distribution for the control and experimental classes with a significance of 0.317 and 0.345 above 0.05.

This study examines the representation of Ha junior high school students who participate in integrated learning. The hypothesis is tested at a significance level (α) of 0.05 or 5%. If 0.000 <0.05 then the hypothesis is accepted and Ho is rejected.

The control class had a posttest average of 75 and the experimental class 89. The Moodle-based blended learning experimental class outperformed the Discovery Learning control class in this test. Moodle-based blended learning prioritizes multitasking, tests show.

Teachers must organize each level of learning and manage time so that the class remains enjoyable.

Independent hypothesis test sample t test rejects Ho and accepts Ha, with a significance value of 0.000 <0.05. This shows that blended learning and Moodle modules are considered different. Physics-based integrated learning in Moodle helps students understand common problems.

Dynamic physics E-Module and Moodle help students get better at representing ideas. According to Driscol (2002), blended learning leverages online resources to accomplish educational objectives. Moodle is a learning tool for researchers. Moodle satisfies the requirements of learning in a variety of ways. In this curriculum, the internet and educational websites are employed. This program supports social constructionism in the classroom.

Students learn by gathering ideas, obtaining information, analyzing options, and offering solutions with the instructor. Because adaptive e-modules in Moodle-based blended learning help students think and solve challenges. Students must use many representational skills to solve physics problems.

CONCLUSION

1. This research improves the representation capabilities of E-modules using Moodle and integrated learning. Description of content, activities, student instructions, and self-evaluation questions. These modules can adapt to scientific and technical advances and be used on different hardware, making learning simpler in any context. The e-module uses linguistics, physics and mathematics. To teach children abstract ideas. Summary of visual, verbal, and computational modules teaching students.

2. Language, design and study specialists evaluate the e-module. The product can be field tested after two evaluations of the e-module media by experts and practitioners resulting in a validation finding of 95.2%.
3. Moodle-based adaptive blended learning physics e-module increases class representation. Experimental students had stronger representation skills (89% versus 75% in controls).
4. 97% of students appreciate e-module thermodynamics, and 80% meet the norm.

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