Development of Science E-Modules on the Functions of Living Organs Topic to Improve Science Literacy for Elementary School Students

by Lindawati Muslih

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Abstract

The purpose of this research is to create a Science E-Module on the content of the motor function functions of living things in order to increase the literacy of primary school pupils. The 4-D Thiagarajan development model is used to guide the creation of e-modules in this project. The development step comprises defining, designing, creating, and distributing (dessiminate), although it is not completed entirely at the dessiminate stage. The subjects of this study are SDN Simomulyo students, with a total of 15 persons from class 5F and 15 people from class 5H. Study This will take place in the odd semester of the 2021/2022 school year. Statistics This gadget compared with the experimental results satisfied the requirements of validity, practicability, and efficacy, according to the findings of this investigation. The validity of learning aids is comprised of conceptual validity, device readability, and the device's level of difficulty. The usefulness of learning tools covers the execution of learning and the limits encountered during learning activities. An increase in learning outcomes, students, student activities during the learning process, and student reactions to learning activities all contribute to increased learning efficacy. The learning tools produced are appropriate for use in learning based on the fulfillment of validity requirements, practicality criteria, and effectiveness criteria.

INTRODUCTION

The presence of technology about anything at any time, the use of machines or computing, automation so that it reaches all jobs, and communication that can be done anytime and anywhere without being bound by distance limits characterize the twenty-first century (Kemendikbud 2018). The advancements that happened throughout the industrial age 4.0 resulted in numerous breakthroughs and highly quick transformations. Era 4.0 necessitates the availability of high-quality human resources who are dependable and talented in certain areas; as a result, era 4.0 necessitates the presence of experts in their field.

The 4.0 era have seen the rapid evolution of information, technology, and knowledge. The inventions that arise have an influence on people's lives. People in rural regions are now technologically savvy, indicating that rural towns may swiftly grow to match metropolitan societies. People are no longer limited to hunting for work in cities, but are also capable of creating jobs in the countryside. Innovations in the 4.0 era that are supported by regional development advancements are capable of resolving numerous difficulties that have occurred in the past, such as the welfare gap between the city and the rural. The development of

science and technology also has an impact on effectiveness and efficiency in terms of work so that people are more productive.

According to Shahroom and Hussin (2018), the implementation of the Industrial Revolution 4.0 necessitates careful planning. Revolution 4.0 in education is a new invention with the goal of developing human resources via the use of technology (Hussin, 2018). People must be literate, capable, and talented in using cutting-edge technology to support all parts of life in a more effective and efficient manner. To attain a proficient level, the community must first be digitally literate, hence education through learning or guidance/mentoring is required.

Trilling and Fadel (in Karim and Daryanto, 2017) divide 21st-century skills into three categories: 1. Life and career skills, which include flexibility and adaptability, initiative and self-regulation, socio-cultural interaction, productivity and accountability, and leadership and responsibility; 2. Learning and innovation skills, which include thinking and problem solving, communication and collaboration, and creativity; and 3. Creativity and innovation skills, which include creativity and innovation skills. The goal is that through mastering these talents, people will be able to compete on a global scale in the Fourth Industrial Revolution.

The explanation of the current situation offers an overview of how education, both formal and informal, should focus on the abilities that students must attain in order to be ready for the Industrial Revolution 4.0. Teachers are required to be able to arrange a learning process based on the four pillars of learning advocated by the UNESCO International Commission for education (in Karim & Daryanto, 2017), particularly regarding: learning to know, learning to do, learning to be, and learning to live togetherAccording to Sani (2014), education at this time should lead to a process of activities that can shape students to be able to face the era of globalization, pollution, advances in information technology, convergence of science and technology, knowledge-based economy, the rise of creative and cultural industries, shifting power. world economy, and the influence and impact of science-based technology. Institutions that provide education and learning must commit to creating information and communication technology aimed at enabling all available facilities inside educational and learning institutions (Qusthalani, 2018).

In accordance with the vision and objective of national education, science learning in schools attempts to develop pupils via scientific literacy, technology, and character. The goal of science education in schools is to develop individuals who are scientifically and technologically literate, in the sense of having sufficient knowledge of scientific facts, concepts, principles, and theories and the ability to apply them; being able to make decisions based on scientific concepts, principles, and theories; being able to solve problems in everyday life scientifically; being able to sort and choose technology and anticipate its negative impacts; and being able to solve problems in everyday life scientifically (Sadia, 2015).

The study of scientific literacy has grown in popularity in recent years. The creation of information is extremely rapid, resulting in a flood of information. Students must become wiser and more proactive in their analysis of dispersed information. According to Hazen and Trefil (1991), learners are not needed to memorize important concepts and principles in physics, chemistry, and biology. Concepts and principles do not need to be remembered, but they must be understood. Concepts and concepts are crucial and should be utilized to analyze scientific data.

One of the issues discovered by education experts is pupils' insufficient scientific vocabulary. Students are less adept at reading scientific text books, articles, journals, and other scientific publications. Students are less able to comprehend the scientific material they study in school. This issue is caused by a lack of scientific literacy. The emergence of

scientific literacy issues is a major worry for instructors. Literacy skills, according to Akbar (2017), will be a provision for pupils to tackle real-life challenges in the globalization age. Literacy is one determinant of educational performance. Literacy was originally defined as the ability to read, but its definition has grown through time. Literacy is linked to a variety of skills. According to the School Literacy Movement (2016), basic literacy is defined as the ability to listen, speak, read, write, and count in relation to analytical skills to calculate, perceive information (perceiving), communicate, and describe information (drawing) based on personal understanding and drawing conclusions.

Literacy introduction is required at the elementary school level. Teachers must provide students with scientific literacy abilities so that they do not struggle at the following level. Teachers must achieve scientific literacy through study and habituation (school culture). Teachers and schools create programs that are simple and enjoyable to execute in order to increase student interest in reading. The literacy culture program considers the peculiarities of pupils, is adaptable to different contexts, and is interwoven with courses.

The OECD's PISA study results for 2018 show that Indonesian students' reading ability achieved an average score of 371, with an average OECD score of 487, math ability achieved an average score of 379, with an OECD average score of 487, and students' science ability achieved an average score of 389, with an OECD average score of 489. Indonesia is in the low-performance, high-equity quadrant. Results The PISA report confirms the problem of poor literacy. This is consistent with the findings of Merta et al (2020), who determined that the majority of participants' pupils have poor levels of scientific literacy. One of the factors affecting students' scientific literacy abilities is never being presented with science questions in the form of a discourse that demands them to grasp the meaning of each phrase contained in the discourse. Students' reading culture is still poor, which instructors and schools must address.

Literacy in science must be supported by reading competence, which is beneficial since the text in science literacy questions comprises scientific phenomena that must be examined by every student in order to solve a problem addressed in the phenomenon. Scientific literacy is critical in preparing for the Industrial Revolution 4.0. Various methods can be utilized to assist participants in teaching so that they can be science and technology literate, think rationally, critically, creatively, and argumentatively truthful, and communicate (Pertiwi, et al. 2018). An e-module is one method suggested to combat inadequate literacy in student science. E-modules enable learning to take place not just in the classroom but also outside of it. E-modules created by instructors and groups of teachers can govern the information that students learn so that it aligns with the intended curriculum. E-modules, according to Suarsana and Mahayukti (2013), are interactive, allowing for simple transfer of learning information since they can contain audiovisual and animation media, as well as exams.

Currently, Indonesia is suffering with a COVID-19 epidemic. The teachings that are taught change in accordance with the policies of the central government. This necessitates teachers being prepared in every learning setting, both online (online) and off the network (face to face). E-module, a module having a different physical shape than the print module, is one of the flexible media that is suitable for usage today. The E module has the same components as the print module, but it is handled in such a way that it is changed into an electronic form. The implementation of e-modules is supposed to pique students' interest in the learning process. Participant students may access it whenever and whenever they choose, as long as they have necessary equipment, and they are not tough students (Iriani et al., 2020).

Learning modules in electronics have an intermediate character, while some are self-instructional, which means they only feature one subject to study, allowing students to focus on the content being taught. The whole material components stated in the module are self-contained; The term "stand alone" refers to a module that may be utilized independently and is not dependent on any other media. Because e-module development is ideal for character learners, it is adaptable. User-friendly indicates that it is friendly to its users. Consistency in the use of typefaces and other components is a property that is shared by modules in general (Fausih, 2015). Based on the above description, the researchers performed a study to establish the viability of the E-Modul with the material for the function of living things in improving primary school students' scientific literacy.
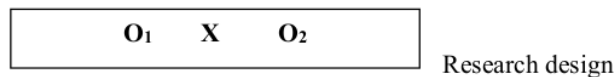
METHODS

The research was carried out as part of a development research (development) project. This study creates e-module material that includes lesson plans and assessment papers. Because the situation is still widespread, learning is done remotely. Because it adhered to modern learning techniques, the research was conducted online. The researcher consults with lecturer's supervisor I and II on dan data collecting technique learning activities, and it is agreed that data collection would be done through online learning.

Online learning is a technique that combines web-based learning with traditional face-to-face learning programs (Andi Prastowo, 2013:83). The learning process is completed almost entirely, yet students are given the ability to connect with one another directly through the app. Teachers employ laptops, the internet, and smartphones as learning tools, however participants are only educated enough to access study materials and Learning Activities via mobile phone parents. Online learning employed whatsapp group media to coordinate the students and an explanation of the task or the link sharing, google form for problem solving pre-test and post-test, and taking Mark. Learning To integrate online learning, Google Meet or Zoom may be used virtually. Learning is carried out in accordance with the specified RPP.

Google Meet is used as a face-to-face medium between students and teachers for online learning. Students can work on e-modules after completing online learning, which comprise materials, activity/activity sheets, and assessment sheets. The designed e-module allows students to learn autonomously. This e-module trial was place in SDN Simomulyo 1 Surabaya during the even semester of the 2021/2022 school year. Data retrieval three times using the Ms. Teams application. Use of a goggle form to implement the pretest and posttest. The participants in the experiment are Simomulyo Elementary School children from classes 5Fb and 5H, with a total of 15 persons in each class. This study was carried out during the odd semester of the 2021/2022 academic year. Researchers are also instructors when it comes to learning implementation. This is a development study that creates an e-module product and examines its validity, practicability, and efficacy. Several steps were made to create a realistic and legitimate product so that the development's findings may be used more broadly. The development approach included a small trial (trial I) and a bigger trial (trial II) with a larger sample.

The 4-D Thiagarajan development paradigm guides the creation of the e-module. Define (define), design (design), develop (develop), and distribute (dessiminate) are the stages of development. The development outcomes were implemented utilizing the One Group Pre-test Post-test Design trial design, which employed only one group and no comparison group (Tuckman in Suprapto, 2006:66). The groups utilized, class 5 F and 5 H, received the identical therapy, which was e-module-based learning. To measure the growth in scientific literacy between the two groups, a pretest was administered first, followed by a

posttest. This was done to determine whether the designed e-module produced almost identical outcomes for the two courses or not. Figure 3.3 illustrates the research design.

| **O₁** | **X** | **O₂** | Research design |

Information:
O 1   :*Pre -test*
X   : Treatment of the application of the developed e-module
O 2   :*Post -test*

The data collection method is used to get data that is relevant to the study objectives. Several techniques of data collection will be employed in this study. Implementation and constraints utilizing observation sheets and rubrics, Learning Goals Data in the form of a multiple-choice test with a total of 30 questions, each with four response possibilities, administered twice, namely pre-test and post-test t and data Respond Participant Educate Using a Questionnaire

RESULTS AND DISCUSSION

The e-module development study was conducted in two stages: the first module design (draft I) and a restricted trial. Before being tested, Draft I was validated by material and media specialists, and the findings formed revision I (draft II). In January 2021, a short experiment was undertaken at Simomulyo Elementary School with research subjects from classes 5F and 5H comprising 15 pupils each.

1. **Analyst Validation Findings**

    The module is subsequently submitted for approval to specialist lecturers and media lecturers after being created with the help of the supervising lecturer. The module is changed again based on the validator's feedback. The validator evaluates the module once it has been altered. Based on the validator's evaluation, the module to be utilized meets the eligibility conditions.

    To measure the dependability of a module that has been validated by experts in a qualitative descriptive way, the percentage of agreement is determined. If the proportion of agreement value is greater than 75%, the module is deemed dependable.

Tabel 4.1   Module Assessment Results By Validator

Material Aspect Validation	*Percentage of Agreement* (%)	Media Aspect Validation	*Percentage of Agreement* (%)
3.50	92.36	3, 61	92.74
Valid	Reliable	Very Valid	Reliable

In addition to delivering an assessment, the validator offers ideas and advice to help enhance the created evaluation. Table 4.2 shows some inputs for modules that need follow-up (improvements) before being deployed in a limited trial.

Tabel 4.2   Validator Input Results

Validator	Revised Page	Revised part	Types of Revisions Performed
1	6	given a contextual description of the story before entering the material	Added story descriptions that appear daily
	7	The first paragraph uses the active voice, an interesting picture is added	Improve sentences into active sentences and add pictures
	20	The title of the material and the	Changing the title of the

Validator	Revised Page	Revised part	Types of Revisions Performed
		contents of the caricature do not match	material according to the caricature
2	list of contents	Added KB sentence (Learning Activities)	Adding Learning Activity sentences
		Added Concept Map	Added Concept Map
	2	Replacing the word mastery with speed	mastery word replaced speed
	7	Replacing the question sentence how and why	how to replace the question sentence why
	8, 10, 16	Enlarged image	Enlarge image
	14	Replacing the word a lot with that is	the word a lot is replaced by
	15	Some sentences are crossed out to be effective	Making sentences effective
	27	The answer key is wrong	Replace the answer key with the correct one
		Added Summary after answer key page	Adding a short summary
	29	Replacing Subjective Test Sentences with Formative Tests	Subjective Test Sentence replaced Formative Test

2. Module Readability

The module's readability was assessed using Raygor diagrams, which yielded the desired results. The Raygor diagram test results are displayed below.
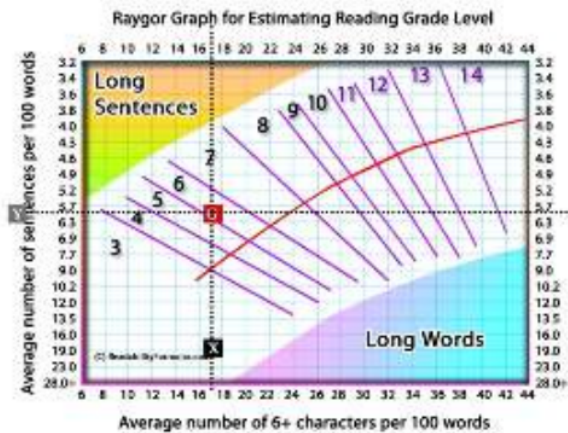
Raygor Chart Results

The point G on the graph is formed by the junction of the X and Y lines. Point G is a reference for the module's readability based on the grade indicated. The X value is 17 and the Y value is 5.9. The modules created are appropriate for pupils in the fifth grade.

3. Implementation of RPP

Table 4.3 shows the findings of observations on the implementation of RPP in classes 5F and 5H conducted by two observers across three meetings.

Tabel 4.3   Results   Implementation of   RPP

Implementation	Aspects of the implemented RPP	Average	Category	*Percentage of Agreement* (%)
Meeting I				
5F	100%	3.33	Well	92.06
5G	100%	3.36	Well	91.27
Meeting II				
5 F	100%	3.44	Well	92.06
5G	100%	3.39	Well	92.06
Meeting III				
5F	100%	3.47	Well	92.86
5G	100%	3.47	Well	91.27

During three sessions, all of the aspects contained in the RPP were fully implemented. The average rating for RPP execution is 3.33–3.47 in the good category, with a percentage of agreement of 91.27–92.86 in the high category.

4. Student Activities

Observers use observation sheets to evaluate student activity. Filling up the observation sheet involves putting a check mark in each available column based on the conditions that surfaced at the moment. Observers are also provided a column in which they can jot down anything that comes up during the class as material for later discussion in order to boost learning. The average score b the evaluation given by b observers is used to estimate the g quality of activation g of students b. Table 4.6 displays the outcomes of student activities.

Tabel 4.4   Observation Results   Activity   Learners

No	Observation Aspect	Class 5F			Average	5G class			Average
		I	II	III		I	II	III	
1	Student attendance	4	4	4	4.00	3	4	4	3.67
2	Student activity during learning	3.5	4	4	3.83	3	3.5	4	3.50
3	Thinking ability during learning	3.5	3	4	3.50	3	3	3.5	3.17
4	Communication skills	3	3	3.5	3.17	3	3	3.5	3.17

5. Student Response

A questionnaire supplied on the goggle form is used by students to respond to the deployment of the e-module. The average score of favorable student replies is 83 - 93 percent, according to student answers. This shows that the designed curriculum was well appreciated by pupils.

6. Constraints in KBM

Two observers identified obstacles b that happened during learning activities, specifically pupils did not answer promptly when the teacher posed questions. Students are sometimes hampered by internet signals, making it difficult to provide precise replies. The teacher overcomes network limits during learning by distributing learning recordings so that students who fall behind in their learning can listen back through the recording.

7. Cognitive Realm Learning Outcomes

A pre-test was used to assess the domain of learners. This is done to assess pupils' starting abilities. The pretest questions at the start of the course are the same as the posttest questions at the end, but the quantity of questions is randomized. A post-test is provided to pupils to assess their abilities after being treated with e-module learning. The results of the pre-test and post-test will reveal whether or not there are differences in students' abilities, as well as the success or failure of the use of e-modules in enhancing students' reading skills. The following descriptions summarize the student learning outcomes.

a. Indicator Achievement Level

Tabel 4.5   Indicator Achievement Level

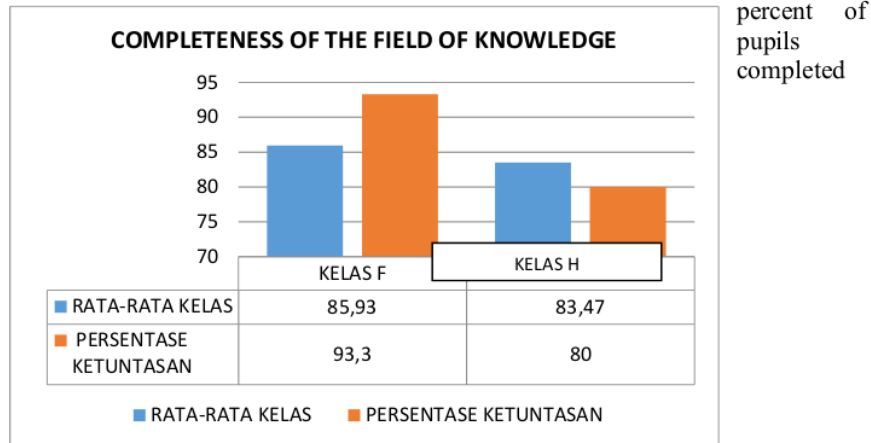| Item number	Cognitive Realm	Class		Item number	Cognitive Realm	Class	
		5F	5H			5F	5H
1	C2	86.67	100	11	C1	86.67	73.33
2	C3	93.99	86.67	12	C2	80.00	80.00
3	C2	73.33	73.33	13	C2	73.33	73.33
4	C2	86.67	73.33	14	C2	80.00	73.33
5	C2	80.00	93.33	15	C2	86.67	66.67
6	C3	93.33	80.00	16	C2	73.33	80.00
7	C4	80.00	80.00	17	C3	80.00	66.67
8	C2	86.67	73.33	18	C3	73.33	80.00
9	C2	86.67	93.33	19	C3	80.00	73.33
10	C1	80.00	73.33	20	C4	86.67	100

Based on the degree of achievement of indicators, class 5F has 0 things (0 percent) that are not obtained and 20 items (100 percent) are achieved, whereas class 5H contains 2 items (10 percent) that are not achieved and 18 items (90 percent) are accomplished. Figure 4.1 depicts a comparison of the achievement of the question indicators.
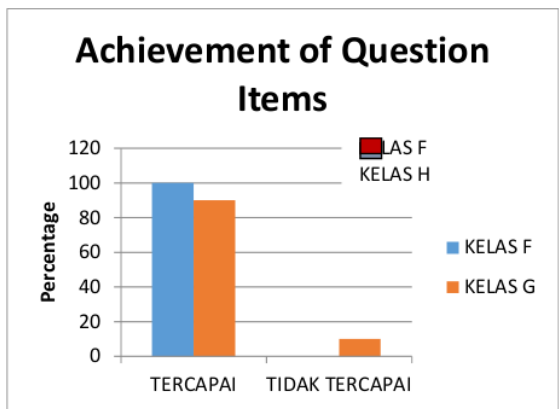
Gambar 4.1 Item Achievement Chart

b. Individual and Classical Completeness

Individual competency is calculated using the post-test results of the pupils. Classical completeness is determined by individual skill. Traditional completion standards are stated to be met if 75% of pupils acquire individual mastery. The post-test scores for class F varied from 69 to 98, with details of class F completion ranging from 1 (6.67 percent) to 14 (93.33 percent). The post-test results for class H varied from 68 to 100, with 3 (20 percent) pupils failing and 12 (80 percent) passing. With a score of 75 percent of pupils completed

COMPLETENESS OF THE FIELD OF KNOWLEDGE

	KELAS F	KELAS H
RATA-RATA KELAS	85,93	83,47
PERSENTASE KETUNTASAN	93,3	80

■ RATA-RATA KELAS   ■ PERSENTASE KETUNTASAN

individually, traditional indications of completeness were met. Overall, the average classical class F score is 85.93, while the average classical class H score is 83.47. The classical completeness class F is 93.3 percent, whereas the classical completeness class H is 80%.

Gambar 4.2   Classical Mastery Diagram

c.   N-Gain Test

The N-Gain score in class 5F varies from 0.69 to 0.99, with 13.33 % of pupils meeting the medium condition and 86.67 % meeting the high threshold. With strong requirements, the average N-Gain value for the 5G class is 0.83. The N-Gain score in class 5H varies from 0.65 to 1.00, with 20% of students meeting medium criterion and 80% meeting high requirements. With strong requirements, the average N-Gain value for class 5H is 0.81.

8. Module Test Results Data

The next stage is a limited trial once it has been evaluated by experts and amended based on expert feedback. Simomulyo Elementary School undertook a small experiment of e-module creation. The researcher conducted a short study with two teachers serving as observers and 30 students. The learning and assessment processes are both involved in the implementation of a restricted experiment. The results obtained from limited trials, then analyzed using descriptive statistics

a.   Prerequisite Test
1)   Normality test

Tabel 4.6   Normality Test Results

	Kolmogorov-Smirnov [a]			Shapiro-Wilk		
	Statistics	df	Sig.	Statistics	df	Sig.
Pretest	.136	30	**.167**	.947	**30**	.142
Posttest	-121	30	**.200** [*]	.970	**30**	.535

a. Lilliefors Significance Correction

Because the sample size is more than 20, the normalcy b test employs the Kolmogorov-Sminov b test. The Kolmogorov-Sminov b test was used, with a significance threshold of 0.05. According to the Kolmogorov-Sminov b test findings, the pretest had a sig value of 0.167 > 0.05 and the post-test had a sig value of 0.200 > 0.05. These findings show that data b is derived from a regularly distributed population.

2) Homogeneity Test

Tabel 4.7   Homogeneity Test Results

		Levene Statistics	df1	df2	Sig.
Pretest	**Based on Mean**	**1.501**	**1**	**28**	**.231**
	Based on Median	1,292	1	28	.265
	Based on Median and with adjusted df	1,292	1	27,662	.265
	Based on trimmed mean	1,529	1	28	.227
Posttest	**Based on Mean**	**.037**	**1**	**28**	**.849**
	Based on Median	.030	1	28	.863
	Based on Median and with adjusted df	.030	1	27,970	.863
	Based on trimmed mean	.036	1	28	.851

The b test of homogeneity seeks to determine whether or not the data obtained is homogenous. b Use Levene's test with level of significance = 0.05 to test for homogeneity. The findings of Levene's test indicated a sig value of 0.231 > 0.05 for the pretest and a sig value of 0.849 > 0.05 for the post-test. Based on its significance value, the data that was tested was judged to be homogenous. The significance value (p) 0.05 implies that the data group is drawn from a population with similar variation (homogeneous).

b. Hypothesis testing
   a. Independent T Test

Tabel 4.8   Independent T Test Results

		Levene's Test for Equality of Variances		t-test for Equality of Means					95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
PRETEST	Equal variances assumed	1.501	.231	1.902	28	.068	3,800	1998	-.294	7,894
	Equal variances not assumed			1.902	26,210	.068	3,800	1998	-.306	7.906

POSTTEST	Equal variances assumed	.037	.849	.783	28	.440	2.467	3.152	-3.990	8.924
	Equal variances not assumed			.783	27,991	.440	2.467	3.152	-3.990	8.924

The significant value (2-tailed) is used to determine the Independent T test, which examines whether there is an average difference in the individuals being tested. The significance value (2-tailed) is greater than 0.05, indicating that there is no difference in average between the research individuals. The difference in pretest results between the two groups reveals the usefulness of Sig. 0.231 is more than 0.05. These findings show that there is no difference in pretest scores between the 5F and 5H groups. Both groups' posttest results have a Sig value. 0.849 is more than 0.05. There is no difference in posttest scores between classes 5F and 5H, according to these findings.

b.   Paired T Test

Table 4.9   Paired T Test Results

					95% Confidence Interval of the Difference				
		mean	Std. Deviation	Std. Error Mean	Lower	Upper	t	df	Sig. (2-tailed)
Pair 1	Posttest 5F–Pretest5F	69,000	9,813	2,534	63.566	74.434	27,234	14	.000
Pair 2	Posttest 5H–Pretest5H	70,333	10.012	2,585	64,789	75,878	27,208	14	.000

This result's significance value (2-tailed) was 0.000 (p 0.05), indicating that the findings of the initial and final tests differed significantly. According to descriptive statistics, the first test and the final test were both higher in the final exam.

CONCLUSION

Based on the outcomes of the research, it is possible to infer that the tools established in this study fit the criteria of validity, practicability, and efficacy. The validity of learning aids is comprised of conceptual validity, device readability, and the device's level of difficulty. The usefulness of learning tools covers the execution of learning and the limits encountered during learning activities. An increase in learning outcomes, students, student activities during the learning process, and student reactions to learning activities all contribute to increased learning efficacy. The learning tools produced are appropriate for use in learning based on the fulfillment of validity requirements, practicality criteria, and effectiveness criteria.

SUGGESTION

Based on the data discussion and discussion, e-modules in scientific instruction should be utilized to assist students' autonomous learning. The teacher advises and explains how to utilize the module to students so that teaching and learning may take place efficiently. Before students carry out projects or activities in the module, the teacher offers stability by offering direction.

ACKNOWLEDGMENTS

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