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Development of TPACK-Oriented Teaching Materials Assisted by Google Sites in Science Learning for Elementary Schools

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Abstract

This study uses the ADDIE development model. The development of the ADDIE model is one of the models that uses systematic design. The ADDIE model has five steps that need to be carried out sequentially because they are systematic, namely Analysis, 2) Design, 3) Development, 4) Implementation, 5) Evaluation. This study used a sample of 2 class teachers and 34 elementary school students who are in the City of Parepare Indonesia. This research method uses a descriptive qualitative research type. This data is presented in quantitative data. Qualitative data in the form of structured interviews. The researcher added the following questions to the research based on the results of the research and discussion that has been carried out, it can be concluded that: 1. The level of validity of TPACK-oriented teaching materials assisted by Google sites in science subjects class VI UPTD SD Negeri 5 Parepare. The teaching materials developed are in the very valid category. 2. The level of practicality of TPACK-oriented teaching materials with rocky Google sites in the science subject class VI UPTD SD Negeri 5 Parepare. This teaching material is very feasible to use as shown by the responses of students who strongly agree to learn using teaching materials that have been developed, the results of validation from students can be said to be practical. 3. The level of effectiveness of TPACK-oriented teaching materials with rocky Google sites in science subjects for grade VI UPTD SD Negeri 5 Parepare. After collecting data, from 34 students getting an average score of 89, it can be categorized as a valid and effective teaching material used in learning. This teaching material can improve science learning outcomes in class VI students of UPTD SD Negeri 5 Parepare.

Keywords: TPACK-oriented teaching materials, google sites, science learning,

Introduction

Teachers are an important component in the education system. The teacher is a profession that has the main task of educating, teaching, guiding, directing, training, evaluating and evaluating students. A professional teacher must meet competency standards. Competence is a set of knowledge, skills and behaviors that must be owned, internalized and mastered by a teacher or lecturer in carrying out professional duties (Andriani, 2021). Teacher competence includes pedagogic competence, personal competence, social competence, and professional competence obtained through professional education.

Professional teachers have an essential model in social formation to be competitive. The teacher's task is not only to provide subject matter but to package the experience to be interesting which can make it easier for students to understand the subject matter. Teacher Competency Standards are fully developed from four main competencies, namely: 1) pedagogic competence 2) personality

competence 3) professional competence and 4) social competence, which are obtained through professional education (Bayne, 2015).

Professional and qualified teachers are teachers who are able to develop and practice lesson plans before teaching. The lesson plan referred to in this case is the learning device that will be used during the learning process in the classroom, including teaching materials (Bancong, et al, 2018). As stated by Bancong (2021) that learning tools are everything designed by students with the aim that implementation and evaluation in learning can run effectively and as desired. With the existence of learning tools, teachers are expected to be able to carry out learning and manage learning in class more easily. The intended learning devices include syllabus, learning implementation plans, teaching materials, learning media and assessment instruments.

The world is in the 21st century, an era marked by the rapid development of science and technology. So that requires all teachers to master high-level content pedagogical technology knowledge. Teachers need to understand and apply various teaching methods related to technology to support the development of their teaching and learning skills (Bancong, et al, 2019). For example, google classroom, youtube, and Whatsapp have been widely used as teaching and learning media during the co-19 pandemic by teachers. In order to be able to keep up with the rapid progress of science and technology, technology literacy is a necessity for everyone. Technological literacy is also an important requirement in the world of work (Bulfin, 2015). Most jobs require high-level skills that require people to be able to learn, reason, think creatively, make decisions, and solve problems. In this case, humans are indeed encouraged and even ordered to always hone their potential, continue to learn so that they can progress according to the times (De Freitas & Oliver, 2005). In today's era, learning in schools has focused on learning 21 where in learning it is also called the critical century where learning can make students able to think creatively, communicate, and collaborate in accordance with learning in the 2013 curriculum. is the responsibility of the world of education. Integrating technology for learning is a very important action by teachers in this era. Teachers must be able to choose the right technology with learning materials and strategies (Carrier, 2017).

In essence, the use of technology is very helpful and facilitates acceleration in each lesson, so that it can encourage and facilitate independence in learning and can also develop students' skills, and change conventional learning patterns to provide learning opportunities according to students' abilities (Gregory & Bannister, 2017).

Learning that is equipped with the use of ICT will help students in growing interest, achievement, and changes in student behavior. In line with research conducted by Nurlina, et al (2020), the use of media in ICT-based learning can also affect motivation and learning outcomes, ICT-based learning can be a means to assist teachers in the learning process, which can be packaged in such a way from abstract knowledge to concrete (Hsu, 2016).

One type of media that is appropriate in the process of making teaching materials is the Google Sites Application. Dynamic software that can provide opportunities for teachers to improve their abilities. Learning media that provide opportunities for teachers to manipulate objects can increase teacher understanding. This is in accordance with what was stated by Kirner, et al (2012). who stated that knowledge is formed through interaction with experience of objects. This is in line with Marisda & Ma'Ruf (2021) who states that it is important to relate real-life experiences with science ideas in classroom learning so that teachers learn meaningfully.

Through Marisda, et al (2023), it was explained that the advantages of this learning media are that it can be used to assist the learning process because it is easy to create and manage without using a programming language and is easily accessible to users anytime and anywhere. In addition, it gives flexibility to students to understand learning material, increases student independence so that students

can manage their own knowledge and can learn at their own pace. This media was developed to assist students in developing their ability to master concepts and think critically through direct experience because they not only listen to explanations from the teacher but students also carry out other activities such as observing videos, pictures, and carrying out simulations (Marisda, et al, 2022). In addition, the very limited time in learning will make students need time efficiency with neater, superior, and more structured lesson planning.

Research related to Google Sites-based learning media has been carried out by Ma'Ruf, et al (2019) Google sites learning media are very interesting to use as learning media because they are easy to access, attract students' interest, make it easier to understand the material, and the language used is easy to understand in accordance with level of thinking of students (Ma'Ruf, et al, 2020).

Based on the results of interviews with 2 teachers on January 2, 2023, the results of the interviews found that teachers began to be able to adapt technology, learning materials, approaches, models, methods and learning media to student characteristics. Then, based on the results of questionnaires and interviews conducted on January 3, 2023, the results showed that all students were happy when the teacher presented material using technology. So that researchers consider it necessary to develop a learning tool for the TPACK model assisted by Google Sites.

The characteristics of current students who are already familiar with technology are in a generation which is also called generation Z which are familiar with all digital technology, with the existence of generational differences between teachers and students, teachers must be willing and able to adapt to the generation of their students (Maruf & Dhiqfaini, 2023). changes like this also direct teachers and schools to immediately integrate Information Communication Technology in learning (Maruf, 2020).

Obtained from the Ministry of Education and Culture website states that the 2013 Curriculum aims to prepare Indonesian people to have the ability to live as individuals and citizens who are faithful, productive, creative, innovative and affective and able to contribute to the life of society, nation, state and world civilization.

Munro (2018) said that the world is in the 21st century, an era marked by very rapid developments in science and technology. So that requires all teachers to master high-level content pedagogical technology knowledge. A science teacher is expected to have a good Pedagogical Content Knowledge (PCK) in order to carry out an effective science learning process. Furthermore, the development of Technology Pedagogical and Content Knowledge (TPACK) from PCK by teachers is very important to do so that teaching with technology integration becomes effective. As is the case in the development of PCK, prospective teachers or teachers are actively studying various methods to prepare teachers to teach with various technologies (Paige, et al, 2016). For example, google classroom, youtube, and Whatsapp have been widely used as teaching and learning media during the covid-19 pandemic by teachers (Sultan, et al, 2023).

In order to be able to keep up with the rapid progress of science and technology, technology literacy is a necessity for everyone. Technological literacy is also an important requirement in the world of work. Most jobs require high-level skills that require people to be able to learn, reason, think creatively, make decisions, and solve problems. In this case, humans are indeed encouraged and even ordered to always hone their potential, continue to learn so that they can progress according to the times.

In today's era, learning in schools has focused a lot on learning 21 which in learning is also called the critical century where learning can make students able to think creatively, communicate, and collaborate in accordance with learning in the 2013 curriculum. is the responsibility of the world of education (Fahmi, et al, 2022). Integrating technology for learning is a very important action by

teachers in this era. Teachers must be able to choose the right technology with learning materials and strategies (Sultan, 2021).

In essence, the use of technology is very helpful and facilitates acceleration in each lesson, so that it can encourage and facilitate independence in learning and can also develop student skills, and change conventional learning patterns so as to provide learning opportunities according to students' abilities (Nurlina, et al, 2022).

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One type of media that is appropriate in the process of making teaching materials is the Google Sites Application. Dynamic software that can provide opportunities for teachers to improve their abilities. Learning media that provide opportunities for teachers to manipulate objects can increase teacher understanding. This is in accordance with what was stated by Bayne (2015). who stated that knowledge is formed through interaction with experience of objects (Asdar, et al, 2020).

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In recent years, during a pandemic where learning has finally been directed online, one of the schools that has started trying to use several applications in learning that can be used online, especially in providing material direction and evaluation to students is UPTD SD Negeri 5 Parepare. So far the teacher has been using Google Classroom even though the teaching materials used are still taking other teachers' teaching materials via YouTube, as evidenced by the results of observations in the field.

The researcher himself in this case has used Google Sites but it is still at a simple level and is still generally related to class administration, which contains the profiles of the teaching teacher, then online learning documentation and online learning schedules. A statement by a UPTD SDN 5 Parepare teacher showing interest in developing teaching materials that students can make themselves and can access online and that there has been no research or developer developing teaching materials that can be accessed anywhere and anytime digitally. Based on the explanation above, this study aims to develop TPACK-oriented teaching materials assisted by Google Sites in learning to increase the effectiveness of student learning in elementary schools.

Methodology

This study uses the ADDIE development model. The development of the ADDIE model is one of the models that uses systematic design. The ADDIE model has five steps that need to be carried out sequentially because they are systematic, namely Analysis, 2) Design, 3) Development, 4) Implementation, 5) Evaluation.

This study used a sample of 2 class teachers and 34 elementary school students who are in the City of Parepare Indonesia. This research method uses a descriptive qualitative research type. This data is presented in quantitative data. Qualitative data in the form of structured interviews. The researcher added the following questions to the research.

The trial sample involved in this research was one material expert (Teacher Class VI UPTD SDN 5 Parepare), and two media and learning design experts, 1 lecturer at UNISMUH Makassar, 1 UPTD teacher at SD Negeri 5 Parepare and 34 graders VI UPTD SDN 5 Parepare. The reason the researchers chose UPTD SDN 5 Parepare, was because based on observations, the school had not yet researched the development of TPACK-oriented teaching materials assisted by Google Sites. While the school provides opportunities for students to bring communication tools such as cellphones and laptops if needed, there are even some lessons that use cellphones and laptops as learning media.

The sample of this research is class VI students who are determined based on the sampling technique. Based on the sampling technique, the test was only carried out on students in class VI C. This was based on several requirements that met the sampling technique criteria which aimed, among other things, that all students are mobile phone users, and some students have brought laptops, so it is very possible to do trials. This developed Google Sites assisted TPACK-oriented teaching material product. The type of data in this study consisted of quantitative data which was data on the validity of TPACK-oriented teaching materials assisted by Google Sites from experts, practicality data of teaching materials developed and effectiveness data of TPACK-oriented teaching materials assisted by Google Sites developed. The data collection instrument used in this study was the Observation Sheet, namely the activities carried out by researchers in collecting data on research subjects. Preliminary observations were made at UPTD SDN 5 Parepare to be precise with students in grade VI and also with the homeroom teacher for class VI. The purpose of this observation is to find out directly the actual conditions in class and the problems that occur in class so that they can provide appropriate solutions according to problems in the field. Questionnaire is a data collection method that answers respondents, even a series of questions or written statements. The questionnaire in this study included questions about TPACK-oriented teaching materials assisted by Google Sites in science subjects.

Results

The development research carried out refers to the ADDIE model development procedure which includes 5 stages, namely the analysis stage, the design stage, the development stage, the implementation stage, and the evaluation stage.

The analysis stage

The analysis was carried out to find out and classify the problems faced in schools related to teaching materials used so far. After observing in the field, to be precise at the UPTD SDN 5 Parepare, it was found that the learning process for several classes was carried out using teaching materials in student books without any recommendations for other teaching materials. However, there are also teachers who obtain teaching materials via the internet, specifically YouTube, even though it belongs to someone else. After the learning process is carried out students are given pretest questions to find out the learning outcomes obtained. The learning outcomes were still lacking, with a total of 34 students and only 15 students who achieved the Minimum Completeness Criteria score with a percentage

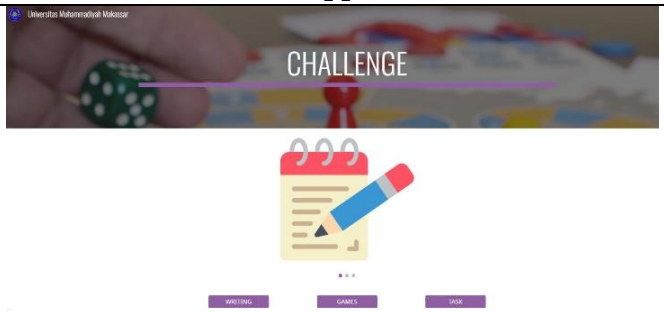
of 44% and there were 19 students who did not achieve the Minimum Completeness Criteria score with a percentage of 56%.

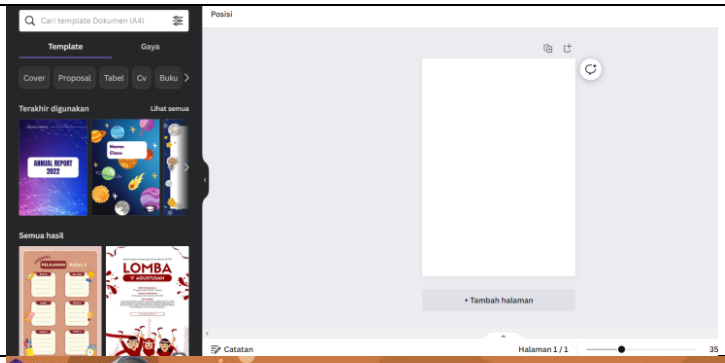
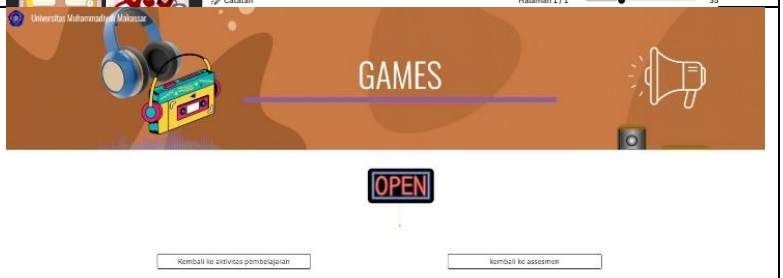
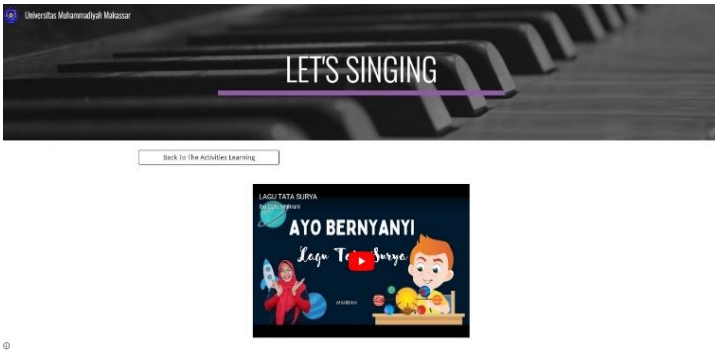
The teaching material used during the pretest is the teaching material in the student's book, to find out the meaning in the book, students are asked to read the material in the student's book. Analysis of student needs, based on the value of the questionnaire that was distributed before the research was carried out, that there were 34 or 100% of students who wanted learning to use teaching materials using technology. After students are given questionnaires and carry out learning achievement tests using student books, students need a way of learning that can make them active and enthusiastic in carrying out the learning process. Analysis of the formulation of objectives, namely the analysis of needs that determine teaching materials, is needed by students in improving student learning outcomes. Thus research on developing TPACK-oriented teaching materials assisted by Google Sites is a possibility that will be able to eliminate student boredom, especially in view of the current developments, where learning resources do not only focus on books, but are very focused on digital-based teaching materials. This TPACK-oriented teaching material assisted by Google Sites has integrated sound, video, text, images, and even games so that the information displayed is richer than student thematic books.

The design stage

The design process is the process of designing a product which is carried out in several processes, starting from selecting the media, selecting the format, initial design, and compiling the benchmark submission test. 1) Selection of Media The selection of teaching materials chosen by researchers is TPACK-oriented assisted by Google Sites. Google Sites was chosen to be presented as a visual learning teaching material to make it easy for students in the learning process. The teaching materials developed were created through the Canva application with an A4 document template type. 2) Format Selection At the format selection stage the researcher collects materials related to thematic learning on theme 9 sub-themes 1 which consists of science learning related to the Solar System material. Researchers also collect pictures and videos related to material from books, the internet, and YouTube. 3) Preliminary Design, There are several components in the preparation of teaching materials including the initial components which include cover, basic competencies and learning indicators, learning objectives, and the core part which includes a review of the discussion of the material to be studied and the last section contains Student Worksheets. Researchers design teaching materials using the Canva application integrated with the heyzine flipbook maker and video recordings as follows in table 1.

Table 1. Stages in designing instructional materials with heyzine flipbook maker

No	Information	Appearance
1	The making of this teaching material uses the Canva application, to be precise, the heyzine flipbook maker. The first step is to select the template that will be used.	

No	Information	Appearance
2	Then choose a template design according to the material.	
3	Arrange material by entering text or images on the template.	
4	After the material has been created, we share it by clicking "other" then selecting the publication option "Heyzine Flipbook"	
5	The prepared design is then directed to our heyzine flipbook to then copy the link provided and then share it on "Google Sites"	

The development stage

The first design teaching materials that have been designed and submitted to the validation team. The three validation teams validated the teaching materials that had been made, the results of the revision on the first validator were that the teaching materials should have a university identity in the teaching materials made. While the second validator's suggestion is that in the initial display, the header should use an easy-to-read font, then in the learning activity menu the watch button is changed to watch, then in the writing assessment it is better to provide questions that provide opportunities for students to write, in other words that the form of the questions is changed be a matter of description. Then the third validator suggested that the initial menu should include the university logo and be accompanied by a verse relating to solar system material.

The results of the development of TPACK-oriented teaching materials assisted by Google Sites are as follows:

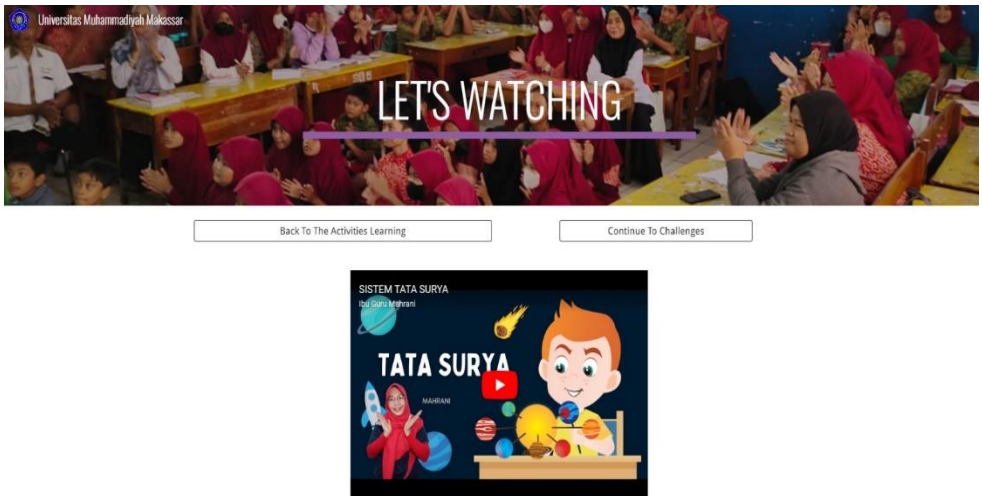


Figure 1. Display of TPACK-oriented teaching materials assisted by Google Sites

Implementation stage

The next stage of the ADDIE model is implementation. Teaching materials that have been designed and validated so that they are suitable for use in schools, then at the dissemination stage the process of distributing teaching materials to UPTD SD Negeri 5 Parepare schools is carried out.

Analysis of trial results data

After carrying out the learning process, of course, a learning achievement test will be carried out to be able to find out student learning outcomes through the TPACK-oriented teaching materials with the help of Google Sites that have been provided. Researchers use learning games through word-wall applications and present game icons in teaching materials, so students can play games with one click via a smartphone. After that, students were again given a learning achievement test after 3 meetings using TPACK-oriented teaching materials. The learning outcomes tests were given in the form of multiple choice tests and essay tests, these tests were answered based on their learning experiences through TPACK-oriented teaching materials. The following is the value of student learning outcomes.

Table 2. Descriptive table of learning outcomes

Pretest		Post test	
Mean	70	Mean	88,603
Standard Error	2,353	Standard Error	1,232
Median	62,500	Median	87,500
Mode	57,500	Mode	82,500
Standard Deviation	13,721	Standard Deviation	7,182
Sample Variance	188,258	Sample Variance	51,588
Kurtosis	-1,461	Kurtosis	-1,168
Skewness	0,093	Skewness	0,366
Range	45	Range	22,5
Minimum	42,5	Minimum	77,5
Maximum	87,5	Maximum	100
Sum	2380	Sum	3012,5
Count	34	Count	34

Based on the statistical test of the learning outcomes of 34 class VI students at Parepare Elementary School, before students were given TPACK-oriented teaching materials, students were given a pretest to determine students' initial abilities before being given treatment by learning using TPACK-oriented teaching materials. The pretest value can be translated by the average achievement value of student learning outcomes is 70. The minimum score is 42.5 and the maximum score is 87.5

After being given treatment using TPACK-oriented teaching materials, students are given a post test to determine the ability of student learning outcomes after being given treatment. As for the post-test results of students with a minimum score of 77.5 and a maximum score of 100, while the average score of student learning outcomes in the post-test is 88.6 Based on the increase in these scores it can be concluded that the use of TPACK-oriented teaching materials can improve learning outcomes class VI UPTD SD Negeri 5 Parepare students. The following is the presentation of the classification of student learning outcomes.

Table 3. The result of student learning outcomes

Interval Value	category	Pretest		Postest	
		Frequency	percentage	Frequency	percentage
91 – 91 - 100	Very high	-	-	13	38 %
81 – 90	high	11	32 %	19	56 %
71 – 80	currently	5	15 %	2	6 %
61 – 70	Low	5	15 %	-	-
0 - 60	Very Low	13	38 %	-	-
Amount		34	100	34	100

Based on the results of the presentation in the table above, it can be explained that in the implementation of the pretest there were 5 students who got moderate scores with a 15% presentation, for low scores as many as 5 people with a 15% percentage. And for very low scores as many as 13 people with a percentage of 38%. Meanwhile, in the implementation of the post test, there were 2 people with a moderate score with a percentage of 6%, there were no low and very low scores. Based on these data it can be concluded that the use of this teaching material can improve the learning outcomes of class VI UPTD SD Negeri 5 Parepare. The following is a data diagram of student learning outcomes.

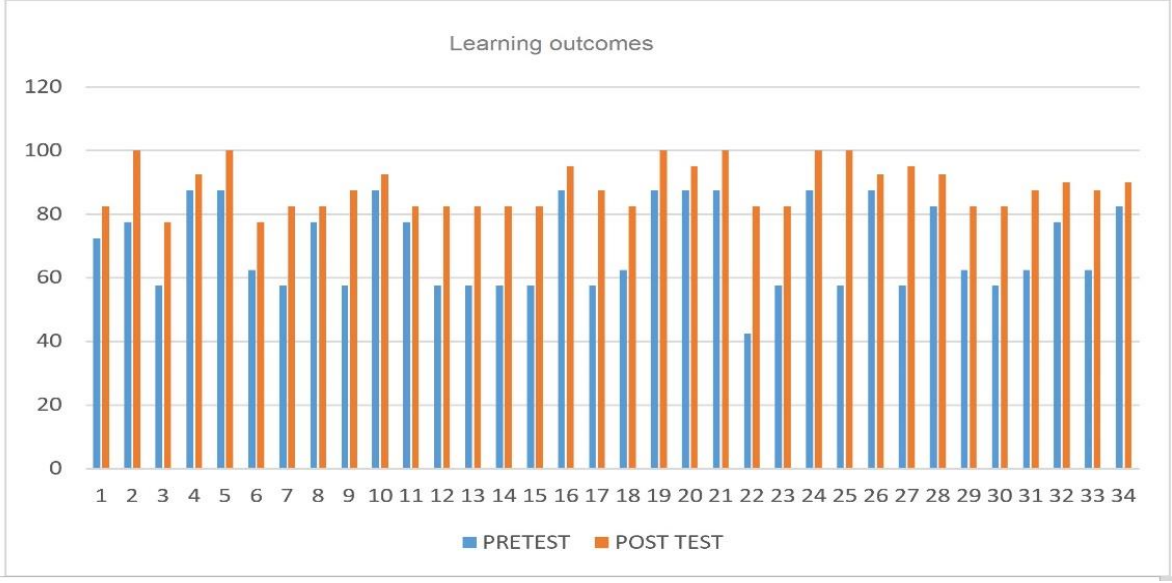


Figure 2. Achievement of class VI students of UPTD SDN 5 Parepare

Based on the graph above, it can be seen clearly that the post test shows that students get higher scores than the pre test scores. By drawing the conclusion that the use of TPACK-oriented teaching materials can improve student learning outcomes. Based on the N-Gain value, the average N-Gain learning result is 1.00 with an N-Gain percentage of 62%. So that based on the percentage value is in the medium value classification. With the conclusion that the value of class VI student learning outcomes of UPTD SD Negeri 5 Parepare increases by using TPACK-oriented teaching materials with an N-Gain value with moderate criteria.

Analysis of student response data

The results of filling in the student response questionnaire to learning media which included the practicality of teaching materials obtained a percentage of 96.11%, which means that most students strongly agree with the practicality of this Google Sites-based TPACK-oriented teaching material.

This step is the stage of implementing teaching materials used in classroom learning. In this stage the researcher involved students to find out student responses and the attractiveness of teaching materials. After validating, the next step is the student's response to the teaching materials developed. Based on student response tests on teaching materials trials involving 34 respondents, TPACK-oriented teaching materials were found to be very suitable for use with an average student rating of 5 or very feasible.

Table 4. Results of student responses

No	Assessment Aspects	Rating result	
		Result	Category
1	The design of this learning teaching material is interesting	5	Very good
2	Navigation design and navigation layout make it easy for me to access media	5	Very good
3	This teaching material is easy for me to use	5	Very good

No	Assessment Aspects	Rating result	
		Result	Category
4	The writing/letters on this teaching material are easy for me to understand	5	Very good
5	The appearance of the background and writing does not interest me	5	Not good
6	The language used in the media is confusing to me	5	Not good
7	The text, images and videos presented on the media are clearly visible on my handphone	5	Very good
8	The buttons used are difficult for me	5	Not good
9	I can understand important information in the material by emphasizing the different colors in the text presented	5	Very good
10	Text or video narration makes it easy for me to understand the material presented	5	Very good
11	The pictures make me distracted and lose concentration in studying	5	Very good
12	Text or video feeds are not working for me	5	Very good
13	The videos presented are interesting	5	Very good
14	Game/practice offerings challenge me to test my skills	5	Very good
15	The wordwall application (game) helps me to check answers	5	Very good
16	Game results report helps me know my skills	5	Very good
17	I feel it is a loss to learn science using teaching materials assisted by Google sites	5	Very good
18	I feel happy using this Google Sites assisted teaching material	5	Very good
19	I feel I need teaching materials assisted by Google sites in the solar system material	5	Very good
20	I feel that I understand more about the solar system with the help of this teaching material	5	Very good
21	I feel more facilitated in learning with the teaching materials assisted by Google sites	5	Very good
22	This teaching material gives (motivation) interest in me to learn	5	Very good
23	I can study actively and independently with teaching materials assisted by these Google sites	5	Very good
24	These teaching materials limit me to study anytime and anywhere	5	Very good
25	I can study according to my independent learning ability	5	Very good

Based on student response tests involving 34 respondents, it was found that the Google Sites assisted teaching materials were very feasible to use with an average student rating of 5 or very feasible.

Evaluation stage

Based on the implementation stage of TPACK-oriented teaching materials, it is necessary to evaluate further. At the evaluation stage, a final revision of the teaching materials was carried out based on suggestions and student input given during the implementation stage. Based on the results of student responses, positive responses were obtained for this TPACK-oriented teaching material, because it can be applied via smartphones and laptops and can be accessed anytime and anywhere.

Then the researcher was finally able to find out that this TPACK-oriented teaching material was very feasible to use in the learning process from the results of product validation and in terms of student responses.

Discussion

Based on the results of the research above, a discussion of the results of research on TPACK-oriented teaching materials assisted by Google Sites will be presented. The discussion that will be put forward is related to the validity, practicality, effectiveness and statistics of increasing student learning outcomes. The level of validity of TPACK-oriented teaching materials rocky Google sites in science subjects class VI UPTD SD Negeri 5 Parepare.

This research develops teaching materials in science subjects with solar system material. The development process uses the ADDIE model, which includes analysis, design, development, implementation, and evaluation. The stages carried out start from the analysis from start to finish which aims to find out and apply the basic problems encountered in the learning process. Then do an analysis of students to determine the characteristics of students through observation. The material analysis is carried out to identify, detail and compile the materials that will be studied by students, so that the selection of teaching material criteria is intended to design and design the contents of teaching materials that are adapted to the curriculum material and student needs. The steps of the validity analysis are to calculate the average design and media quality assessment from expert lecturers and class VI teachers (validators) in each aspect of the point of the statement. After that calculate the average total assessment, then compared with the assessment criteria. Based on the observations from the validation process and the theoretical description above, the TPACK-oriented teaching materials assisted by Google Sites that have been developed show a validity value of 0.83 which is in the very valid category. From the average results of the assessment, it can be concluded that the TPACK-oriented teaching materials assisted by Google Sites that have been developed by researchers are feasible to use and be tested in the field.

All aspects of the assessment are in the valid category, so that the teaching materials that have been developed can be used at a later stage, namely trials on classroom learning, to then measure their practicality and effectiveness. The level of practicality of TPACK-oriented teaching materials rocky Google sites in science subjects class VI UPTD SD Negeri 5 Parepare. The practicality stage of the teaching materials, in this case the respondents were students of class VI UPTD SD Negeri 5 Parepare as many as 34 people, it was found that this teaching material was very feasible to use with an average student rating of 5 or very feasible. By using a Likert scale, the results of 96.11% are at $75\% \leq \bar{x} < 100\%$ with a very good category. This shows that students strongly agree with learning using teaching materials that have been developed, the results of validation from students can be said to be practical.

The level of effectiveness of TPACK-oriented teaching materials assisted by Google sites in science subjects class VI UPTD SD Negeri 5 Parepare. Effectiveness can be seen from teaching materials trials, so it is necessary to test student learning outcomes. After conducting student learning outcomes, they are then analyzed to determine the level of success of student learning using TPACK-oriented teaching materials assisted by Google Sites. After collecting data, from 34 students getting an average score of 89, it can be concluded that this teaching material is effectively used in learning.

The teaching materials developed are also to improve the learning outcomes of class VI UPTD SD Negeri 5 Parepare students, carried out by conducting a pre-test. This pre test was conducted to measure and determine the ability of student learning outcomes before applying TPACK oriented teaching materials with Google sites and was given a post test to determine the increase in student learning outcomes after being given TPACK oriented teaching materials with Google sites.

The post-test results of students with a minimum score of 77.5 and a maximum score of 100, while the average score of student learning outcomes in the post-test is 89. Based on this increase, it can be concluded that the use of TPACK-oriented teaching materials with Google Sites can improve class student learning outcomes VI UPTD SD Negeri 5 Parepare, with an N-Gain value of moderate criteria with a percentage of 62%.

This research is in line with research conducted Maruf (2020) by examining the Development of TPACK-Based Ecoprint Teaching Materials in Mathematics Learning Transformation Materials at SMAN 1 Klaten which has an average score of 3.50 and is in the good category. while for student responses in the implementation of wider trials, the results of student responses showed an average of 3.11 and were included in the good category.

Conclusion

Based on the results of the research and discussion that has been carried out, it can be concluded that: 1. The level of validity of TPACK-oriented teaching materials assisted by Google sites in science subjects class VI UPTD SD Negeri 5 Parepare. The teaching materials developed are in the very valid category. 2. The level of practicality of TPACK-oriented teaching materials with rocky Google sites in the science subject class VI UPTD SD Negeri 5 Parepare. This teaching material is very feasible to use as shown by the responses of students who strongly agree to learn using teaching materials that have been developed, the results of validation from students can be said to be practical. 3. The level of effectiveness of TPACK-oriented teaching materials with rocky Google sites in science subjects for grade VI UPTD SD Negeri 5 Parepare. After collecting data, from 34 students getting an average score of 89, it can be categorized as a valid and effective teaching material used in learning. This teaching material can improve science learning outcomes in class VI students of UPTD SD Negeri 5 Parepare.

References

Andriani, A. A., Sultan, A. D., Rufaida, S., & Nurfadilah, N. (2021). Development of Physics Learning Media Based-Mobile Learning Using Adobe Flash CS6 at Muhammadiyah University of Makassar. Jurnal Pendidikan Fisika, 9(1), 91-97.

Asdar, A., Nurlina, N., & Handayani, Y. (2020). Application of Problem Based Learning Model to Enhance Students' Physics Learning Outcomes at Class XI MIPA 3 SMA Negeri 8 Gowa. Jurnal Pendidikan Fisika, 8(3), 310-318.

Bayne, S. (2015). What's The Matter With 'Technology-Enhanced Learning'? Learning, Media And Technology, 40(1). Https://Doi.Org/10.1080/17439884.2014.915851

Bancong, H., & Song, J. (2018). Do physics textbooks present the ideas of thought experiments?: A case in Indonesia. Jurnal Pendidikan IPA Indonesia, 7(1), 25-33.

Bancong, H., Putra, D. P., & Nurazmi, N. (2021). The purposes of students in conducting thought experiments while solving physics problem. In AIP Conference Proceedings (Vol. 2330, No. 1). AIP Publishing.
Bancong, H., Sultan, A. D., Subaer, S., & Muris, M. (2019). The development of physics teaching aids to demonstrate the intensity of blackbody radiation as a function of temperature. Jurnal Pendidikan Fisika, 7(1), 9-18.
Bulfin, S. , J. N. F. , & B. C. (2015). Critical Perspectives On Technology And Education. Springer.
Carrier Michael, N. A. (2017). Empowering Teachers For The Digital Futurewhat Do 21st-Century Teachers Need? (1st Edition). Routledge.
De Freitas, S., & Oliver, M. (2005). Does E-Learning Policy Drive Change In Higher Education?: A Case Study Relating Models Of Organisational Change To E-Learning Implementation. Journal Of Higher Education Policy And Management, 27(1). Https://Doi.Org/10.1080/13600800500046255
Fahmi, N., Nurlina, N., & Sulfasyah, S. (2022). Development of scientific literacy-based modules to improve IPA class IV learning outcomes. Jurnal Pembangunan Pendidikan: Fondasi dan Aplikasi, 10(2).
Gregory, S., & Bannister-Tyrrell, M. (2017). Digital Learner Presence And Online Teaching Tools: Higher Cognitive Requirements Of Online Learners For Effective Learning. Research And Practice In Technology Enhanced Learning, 12(1). Https://Doi.Org/10.1186/S41039-017-0059-3
Hsu, L. (2016). Examining Efl Teachers' Technological Pedagogical Content Knowledge And The Adoption Of Mobile-Assisted Language Learning: A Partial Least Square Approach. Computer Assisted Language Learning, 29(8). Https://Doi.Org/10.1080/09588221.2016.1278024
Kirner, T. G., Reis, F. M. V., & Kirner, C. (2012). Development Of An Interactive Book With Augmented Reality For Teaching And Learning Geometric Shapes. Iberian Conference On Information Systems And Technologies, Cisti.
Marisda, D. H., & Ma'Ruf, M. (2021). Situation analysis of mathematical physics learning with online learning during the COVID-19 pandemic. In Journal of Physics: Conference Series (Vol. 1806, No. 1, p. 012034). IOP Publishing.
Marisda, D. H., Rahmawati, R., Ma'ruf, M. R., & Bancong, H. (2023). Preliminary research on the development of digital hypercontent modules in mathematical physics subjects. In AIP Conference Proceedings (Vol. 2540, No. 1). AIP Publishing.
Marisda, D. H., Handayani, Y., Riskawati, R., Sultan, A. D., Hasin, A., Nurazmi, N., & Samsi, A. N. (2022). Development Assessment of Thinking Skills Interpretation, Analysis, and Inference Prospective Physics Teacher. Kasuari: Physics Education Journal (KPEJ), 5(1), 33-41.
Ma'Ruf, M., Marisda, D. H., & Handayani, Y. (2019). The basic physical program based on education model online assisted by alfa media to increase creative thinking skills. In Journal of Physics: Conference Series (Vol. 1157, No. 3, p. 032068). IOP Publishing.
Ma'Ruf, M., Handayani, Y., Marisda, D. H., & Riskawati, R. (2020). The needs analysis of basic physics learning devices based on hybrid learning. In Journal of Physics: Conference Series (Vol. 1422, No. 1, p. 012029). IOP Publishing.
Maruf, M., & Dhiqfaini Sultan, A. (2023). Analysis of The Use of Interactive Multimedia Android Thermodynamics to Reduce Student Misconceptions. European Online Journal of Natural and Social Sciences, 12(1), pp-213.
Maruf, M. (2020). How To Result Of Guided Inquiry Learning Physics Model On The Concept Of Static Fluid. Journal of Teaching and Learning Physics, 5(1), 41-47.

Munro, M. (2018). The Complicity Of Digital Technologies In The Marketisation Of Uk Higher Education: Exploring The Implications Of A Critical Discourse Analysis Of Thirteen National Digital Teaching And Learning Strategies. International Journal Of Educational Technology In Higher Education, 15(1). Https://Doi.Org/10.1186/S41239-018-0093-2

Nurlina, N., Lestari, R. A., & Riskawati, R. (2020). Application of learning models conceptual understanding procedures by using experimental methods on understanding physics concepts of students. In Journal of Physics: Conference Series (Vol. 1572, No. 1, p. 012009). IOP Publishing.

Nurlina, N., Marisda, D. H., Riskawati, R., Sultan, A. D., Sukmawati, S., & Akram, A. (2022). Assessment on Digitalization of Basic Physics Courses: Need Analysis on the Use of Digital-based Assessment. Jurnal Pendidikan IPA Indonesia, 11(4).

Nurlina, N. (2019). The Implementation of Guided Discovery Learning Model Based on Experiments toward Science Process Skills. Jurnal Pendidikan Fisika, 7(2), 129-139.

Paige, K., Zeegers, Y., Lloyd, D., & Roetman, P. (2016). Researching The Effectiveness Of A Science Professional Learning Programme Using A Proposed Curriculum Framework For Schools: A Case Study. International Journal Of Science And Mathematics Education, 14(1). Https://Doi.Org/10.1007/S10763-014-9569-2

Sultan, A. D., Ma'ruf, M. R., Kurniawan, R., Nurfadillah, N., Ariani, A., & Hasbi Assidiq, M. (2023). Design and Analysis of the Basic Physics Practicum Model Based on the Higher Order Thinking Laboratory as a Model for 21st Century Learning Practicum. European Online Journal of Natural and Social Sciences, 12(2), pp-233.

Sultan, A. D. (2021). Effectiveness of Basic Physics Practicum in Determining Gravity Acceleration Based on Virtual Mobile Observatory. Kasuari: Physics Education Journal (KPEJ), 4(1), 13-20.