

Development of E-Modules Based on Read-Answer-Discuss-Explain and Create (RADEC) Assisted by 3D Pageflip Professional on the Theme 6 Subtheme 1 "Temperature and Heat"

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Abstract: The study aims to develop Read-answer-discuss-explain and create (RADEC) based teaching materials with the help of 3D Pageflip Professional on the theme 6 subtheme 1 "temperature and heat" in grade 5 of elementary school. Based on preliminary study data through interviews that SDN 17 Kampung Baru, SDN 07 Kampung Jawa II, SDN 04 Rawang Pariaman city settlements that the use of less attractive printed teaching materials and materials that do not match the characteristics and environment of students. This development research uses the ADDIE model and uses instruments questionnaires, tests and observation sheets. Where after conducting research involving five validators for the validation aspect, three teachers and students in three schools for the practicality aspect, and fifth graders at three schools to test effectiveness. Obtained results of teaching materials are in the category of very validity, teaching material is in the class of very practicality, and the effectiveness of teaching materials is very effective.

Keywords: Effectiveness; Practicality; Read-answer-discuss-explain and create (RADEC); Validity; 3D pageflip professional application

Introduction

Education is simply the conscious effort a person makes to make the process of change for the better, such as change in behavior and change from ignorance to more knowledge. According to Anaelka (2018), education should be aligned with the latest technological developments and knowledge in accordance with human needs in order for them to be better in their lives. Education in Indonesia needs to take into account the needs of the 21st century, not only academic knowledge but more leading to high innovation and creativity that follows the development of technology to be able to compete in the global world.

The focus of the field of education in the era of the Industrial Revolution 4.0 is known as 4C: creativity, critical thinking, communication and collaboration. Indonesian education is demanded to be able to equip

students with skills in this era namely skills that are capable of creative and innovative, communication skills and collaborative critical thinking and problem-solving. Problem solving is a complex process that requires students to coordinate experience, knowledge, understanding, and intuition for students according to (Huang et al., 2020). Therefore, it requires the skills and soft skills of the teacher to meet the needs of students according to the development of the times. According to (Murkatik et al., 2020) teachers are obliged to carry out educational development and develop creative learning materials and use information and communication technologies to communicate and develop themselves.

Users of technology are highly demanded in learning to make quality learning. According to Desyandri et al. (2021) the development of technology has interfered in all matters of life so that teachers need digital media to realize meaningful learning for

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students. The learning process used to use only teaching materials provided by teachers, now we see a wide variety of interesting content not only providing existing texts but there are also various animations, videos, images and audio that help students in learning. The use of creative, innovative teaching materials will be an attraction in learning thus supporting the process of delivering more quality materials. According to Wijaya et al. (2020), teaching materials need to be supported by learning methods and is an interrelated aspect.

The choice of a specific learning method will affect the type of teaching material to be used, although various other aspects should be taken into account when using the teaching materials in learning, among other things, the learning objectives, learning background, learning styles, tasks and responses that students expect after completion of learning, as well as student characteristics. A teaching material is a guide for students in learning activities that contain teaching materials, research activities based on concepts, science activities, information, and examples of application of science in everyday life according to (Fahmi et al., 2022). But in general in the field, many of the teaching materials in the form of package books that have been used these years are very monotonous and not updated with existing technological developments. According to (R. Amini & Usmeldi, 2020) Teaching materials are text-only and not interactive so students get bored in learning quickly.

Based on the results of preliminary studies at 3 primary schools in the Central Park district on Monday-Saturday (20-21) June 2022, data from observations and interviews with class teachers and students of class V SDN 18 Kp were obtained. SDN 04 Rawang, SDN 07 Kp. Java II, the city of Paraman. It was found that the learning process is still conventional with the use of lecturing methods that are centered on teachers and teaching materials that are limited only to existing thematic books and have been used for years so that it will be less updated with existing technologies as well as not in accordance with the characteristics and environment of students. Students are only focused on gaining knowledge from teachers alone without taking advantage of the evolving technology. Learning is focused on one direction only because the printed textbooks used today are not interactive so that it makes it difficult for students to focus on the learning process as well as quickly get bored in reading and understanding the learning material so that the child's learning outcomes become low. The printed teaching materials and learning methods with lectures make the lack of enthusiasm and monotony of the pupils to the characteristics of elementary school pupils who want real, creative and innovative things. Other technology-based tools such as laptops and tablets, school wifi,

infocus and learning applications are also less used in the learning process that will make it easier for teachers

One very convenient solution for implementing its use is Radec-based teaching materials with the help of the 3D Pageflip Professional application. In line with Taqwa et al. (2019) books in the form of applications are in demand by students because making the learning look more attractive and flexible is able to solve the difficulties of learning visualization. This teaching material is shaped in the application so that students can open or file the teaching materials anywhere easily, considering the current situation and conditions that most use technology-based learning, because it has the advantages of other learning materials development applications. 3D display will be able to motivate learning in the classroom. According to Tilova et al. (2022). The ideal teaching materials are interesting and can motivate students to learn with the sentences used in the teaching material should be structured in a simple, short, clear, and effective way, so that it is easier for students to understand the learning material and supported by the presence of text, images/animation, audio and video that can clarify the content of the material so as to increase interest and reduce the boredom of students in learning.

3D Pageflip Professional is an educational technology that will make it easier for students to understand the material and learning process. According to Sholichin et al. (2022) 3D Pageflip Professional is a top-notch program that is specifically used to display material in the form of a 3D-shaped electronic book that can be reversed like a real book, equipped with audio, images, moving animations and videos. In addition, the 3D Pageflip Professional application can also be used on computers or with smartphones so that students can get teaching materials specifically when learning is done anywhere. The teaching materials using this application will be more meaningful and intuitive with the application of Radec model oriented according to the 2013 curriculum.

According to Pratama et al. (2019) this Radec model follows the development of technology based on today's education, where the learning resources are books and other resources such as the Internet are easily accessible to students. Therefore, this Radec model is perfectly suitable for implementation in learning processes that leverage technology such as the use of teaching materials using the 3D Pageflip Professional application. Several previous studies showed the suitability of this RADEC Read-Answer-Discuss-Explain-and Create learning model to improve the quality of learning processes and outcomes in situations and conditions in Indonesia. The first model introduced by Sopandi (2019) is a learning model that uses its stages as the name of the model itself, namely Read or read, Answer or answer,

Discuss or discuss, Explain or explain and Create or create. According to Pratama et al. (2020) Radec is the answer to the misconception of teachers to the innovative learning model, in addition to its easy syntax, this model does not take long in its implementation. This model can improve the quality of learning outcomes, such as the understanding of concepts that fit the context of Indonesia to build critical thinking skills of elementary school students.

Method

This type of research is called research and development, (R&D). According to Sugiyono (2020) research methods used to research so as to produce new products, and then test the effectiveness of these products. The developmental research used in this study adapted the ADDIE procedure. According to Kurnia et al. (2019) the ADDIE model can be used in various forms of product development in education, one of which is the development of educational materials. The ADDIE model starts with analysis, design, development, implementation, and evaluation.

At the analysis stage, the researcher performs observations and analyses of the student's needs. Further, at the design stage, the data obtained from observation and analysis is used as a guide to create the design of teaching materials that correspond to the needs of educators and learners. According to Magdalena et al. (2020) at the development stage, the products that have already been designed have been developed again into a unity so that they can be used by educators and students in the learning process. At the implementation stage, the researchers tested the product that had been developed to the students. According to Kurnia et al. (2020) at the evaluation stage, the researcher evaluates the test results and improves the product according to the evaluations carried out. The subjects of the experiment conducted in this study were students of the V-class Basic School in the Central Pariaman district of the City of Pariaman, namely SDN 17 New Village, SDN 07 Java Village II, SDN 04 Rawang.

Data collection activities in this study used instrument validity sheets, teacher and student response questionnaire sheet, and questions to test the effectiveness of teaching materials. According to Mutiaramses et al. (2022) the validation activities carried out in this study use the instrument validity sheet to measure the validity of the educational material that has been developed. Where the validity sheet of this instrument will be given to five validators who have expertise in their respective fields, such as 3 validators in the material/complete division, 1 validator for the language part, and 1 validator for product design. This validation activity applies the following equation 1.

$$R = \frac{\sum_{i=1}^n v_{ij}}{nm} \times 100 \quad (1)$$

Information: R = Average assessment results from practitioners (experts), v_{ij} = The value of the assessment results of the j experts/practitioners against criteria i , n = Number of experts who judged, m = Number of criteria assessed. The procedure used when determining the level of validity of the product created is based on table 1.

Table 1. Category Determination Level Validity (Hendriani et al., 2023)

Range	Category	Description of Product Review
81-100	Very valid	Not revised
61-80	Valid	Not revised
41-60	Quite valid	Revisions
21-40	less valid	Revisions
0-20	Not valid	Revisions

From the description of the table above, it can be stated that the material teaching is valid if it reaches an average number of $\geq 61-80$. While testing the practicality through the teacher's questionnaire sheet and the student's questionnaire sheet, using equation 2.

$$NA = \frac{PS}{SM} \times 100 \% \quad (2)$$

Information: NA = Final Score, PS = Score Obtained, SM = Score Maximum.

The procedure used in determining the level of practicality of the product made is based on table 2. From the description of the table 2, it can be stated that the material teaching is said to be practical if it reaches an average number of $\geq 61 - 80$.

Table 2. Category Determination Level Practicality (Hendriani et al., 2023)

Range	Category
81-100	Very practical
61-80	Practically
41-60	Quite practical
21-40	Less practical
0-20	Not practical

Test the effectiveness of the teaching materials developed by the researchers focusing on the cognitive aspects so that in determining these teaching materials, it is effectively seen from the achievement of the values obtained by students according to (Eviyanti et al., 2022). If many students get scores above the minimum learning completeness, then this teaching material is said to be effective. For SDN 07 Kp. Jawa II, SDN 04 Rawang, SDN 17 Kp. Baru has a minimum learning completeness standard of 70. To find students' cognitive scores

obtained from giving questions related to the material in the teaching material, use equation 3.

$$KB = \frac{T}{T_t} \times 100 \% \quad (3)$$

Information: KB = Mastery learning, T = the number of scores obtained by students, T_t = Total score.

Result and Discussion

To answer the problem formula in accordance with previous observations and interviews, this development research was carried out in three basic schools in the city of Pariaman namely: SDN 07 kampung Jawa II, SDN 04 Rawang, dan SDN 17 Kampung Baru. Learning materials using the Read-Answer-Discuss-Explain-and Create (RADEC) learning model will help students increase motivation and interest in the learning process, as well as this teaching material will also help the application 3D Pageflip Professional will attract student interest so that learning is more meaningful and students are able to delve into the material. Learning using learning models and applications that are updated with technology will help children gain a good learning experience. In line with (Džanić & Pejić, 2016) Unvariable and tending to be monotonous learning processes cause students to lose learning experience and poor student understanding of the concepts taught.

These three research schools have sufficient qualifications to use technology-based teaching materials, but are not fully utilized. Technology-based teaching materials using the steps of the RADEC model in the design with the front page of the teaching material can be seen in Figure 1, where the design of the front pages of this learning material is made in such a way to depict the material to be delivered and close to the child's environment in the western Sumatra so that it can attract the attention of students. in harmony with (Risda Amini & Usmeldi, 2020) stated that learning that is close to the child's daily environment will make it easier for children to absorb more meaningful learning.

Once the teaching material was developed on the theme 6 sub-theme 1 on temperature and calories, the next step of this Study included testing validity and practicality. For validity tests, which are carried out on RADEC-based teaching materials based on the 3D Pageflip Professional application in grade IV elementary school, conducted by staff who are experts in their respective fields, namely four lecturers at the UNP educational faculty and one educational practitioner. A practitioner who is a qualified teacher with a master's degree in education. The qualifications assessed on this teaching material cover several aspects, including

language usability, material content validity, and design validity.



Figure 1. Teaching material covers

Every aspect of language, material and design validity has several statement points according to that aspect. The results of the validity assessment on the language proficiency test used can be seen in Table 3, which has four aspects:

Table 3. Linguistic aspect validation

Aspect	Validity Value	Description
Readability of information on text teaching materials	83.00	Very Valid
straightforward language	78.00	Valid
Conformity with the rules of language	78.00	Valid
Use language effectively and efficiently	80.00	Valid
Average	79.75	Valid

From table 3, showing the validity of language aspects by experts consisting of 4 assessment indicators, the average value of language validity is 79.75, where this figure is included in the valid category. For each indicator language aspect is in the category valid and very valid in the range 78.00-83.00. In addition, the validity assessment associated with the content validation of the material can be seen in Table 4, which contains 4 indicators of aspects:

Table 4. Material Aspects Validation

Aspect	Validity Value	Description
Components of teaching materials	85.00	Very Valid
The feasibility of the material in teaching materials	85.00	Very Valid
arrangement of teaching materials	89.00	Very Valid
Evaluation of teaching materials	78.00	Valid
Average	84.25	Very Valid

Based on the table 4, is related to the validity of content that contains 4 aspects of assessment. The obtained average value for content validity assessment is 84.25 which belongs to the very valid category. For

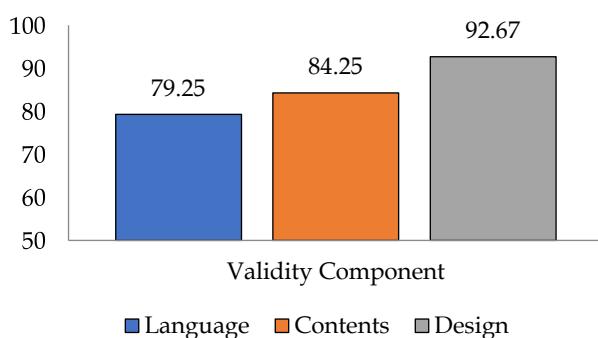
each indicator the material content aspects are in the category valid and very valid in the range 78.00-89.00. In addition, the validity of the assessment associated with design validation can be seen in Table 5 which contains 4 aspects of the indicators:

Table 5. Design Aspects Validation

Aspect	Validity Value	Description
The size of the book	89.00	Very Valid
Book cover design	100.00	Very Valid
Book content design	89.00	Very Valid
Average	92.67	Very Valid

Based on the table 5, is related to the validity of design that contains 3 aspects of assessment. The obtained average value for design validity assessment is 92.67 which belongs to the very valid category. For each indicator the material content aspects are in the category valid and very valid in the range 89.00-100.00.

After the analysis of validity assessment aspects on the three aspects of the value, then to determine the average value of the validity of the teaching materials based on RADEC supported 3D Pageflip Professional in Class V Elementary School can be done by looking for the average of the third aspects starting from the language aspects, content materials, and design can be seen in Figure 2.

**Figure 2.** Validation average score

Based on Figure 2, it can be seen that the average value of each aspect in the assessment of the validity of teaching materials is in the range of 79.25 to 92.67, which if calculated the average severity of the aspects of validity is 85.39. Based on the average value of the three aspects of validity of teaching materials based on RADEC supported by 3D Pageflip Professional in Class V Elementary Schools are in a very valid validity category.

Design of teaching materials according to the needs of teachers, curriculum and student characteristics. According to Ardianti et al., (2021) which stated that the appropriate teaching material is the teaching materials

whose content corresponds to the core competence and basic competence in learning, there is the relevance of language and its design is interesting for students. Based on the results of the validation carried out by the validator, the product of the educational materials made is one of the teaching materials that can be used as a reference or alternative teaching material for educational practitioners in particular in class V of elementary school.

Then a practical test of the designed teaching materials was carried out using two instruments: teacher questionnaire sheets and student questionnaire sheets according (Komalasari et al., 2019). teacher practicality questionnaire sheets were given to three teachers in three schools to provide feedback on the teaching materials developed. In line with that, a practicality test was also carried out with student practicality questionnaire sheets at the three schools to find out students' responses to the teaching materials that had been developed. The average results of product practicality questionnaire sheets by teachers in three schools can be seen in table 6.

From table 6, it can be interpreted that the average practicality questionnaire results by teachers in three schools get an average score of 87.22, based on this number the practicality value is classified into the very practical category.

At the same time, the average results of product practicality questionnaire sheets by students in three schools can be seen in table 7. From the table 7, it can be concluded that the average performance of practicality by students in the three schools obtained an average score of 86.15 based on the figure practicality values are classified into the very practical category. From the table 7, it can be concluded that the average performance of practicality by students in the three schools obtained an average score of 86.15 based on the figure practicality values are classified into the very practical category. According to (Lestari, Alberida, & Rahmi, 2018) product development is said to be practical if it includes ease of use, language and materials clear and simple, efficiency of learning time, attractiveness and usefulness.

After the practicality test phase is completed, the next step is to test the effectiveness of the teaching materials developed by involving 68 students. This effectiveness testing mechanism is by giving questions designed in such a way by considering the category of HOT's questions to students regarding the materials contained in the developed teaching materials. The number of questions is as many as 25 multiple-choice questions and five questions in the form of descriptions. The following is the cumulative result of 68 students who have worked on these questions.

Table 6. Teacher Response Questionnaire

Aspect	Practicality Value	Description
Placement of animations, image illustrations, and other supporting objects under the order in which the material is displayed	90.00	Very Practical
The teacher quickly understands the presentation of sentences	90.00	Very Practical
Teaching materials make it easier for teachers to teach or deliver learning materials to students	85.00	Practical
The instructions in the developed teaching materials	80.00	Practical
Teaching materials can make it easier for teachers	90.00	Very Practical
Teaching materials designed according to student needs	90.00	Very Practical
RADEC learning helps teachers provide a fun learning experience for students	90.00	Very Practical
Teaching materials can be used as a source of data for assessment in the learning process	80.00	Practical
The use of teaching materials can assist teachers	90.00	Very Practical
Average	87.22	Very Practical

Table 7. Student's Response Questionnaire

Aspect	Practicality Value	Description
Display The teaching materials used in learning activities make me (students) interested in participating in the learning process	85.29	Practical
The linkage of the learning materials in the teaching materials is close to my life environment (students)	84.93	Practical
The working instructions in the teaching materials used in the learning process can be clearly understood	83.46	Practical
Animation or illustrative images that exist in teaching materials can expand the material knowledge that I (students) have	87.50	Very Practical
The teaching materials used can make me (the student) active in the learning process	89.71	Very Practical
The teaching materials used in the learning process make me (students) enthusiastic about working on projects that follow the learning materials.	90.07	Very Practical
The teaching materials used in the learning process make it easy for me (students) to understand the learning materials	88.24	Very Practical
Teaching materials with RADEC models used in the learning process make it easy for me (students) to understand the learning materials	86.76	Very Practical
The exercises in the teaching materials used in the learning process can help me (students) understand the material well.	87.87	Very Practical
Are there any obstacles that you face when using this book creator application-based teaching material	77.75	Practical
Average	86.15	Very Practical

Table 8. Cumulative Score Students

Name of Elementry School	Average	Minimum learning mastery	Description
SDN 07 Kp. Jawa II	88.18	70.00	Very Good
SDN 04 Rawang	89.00	70.00	Very Good
SDN 17 Kp. Baru	88.78	70.00	Very Good
Total			Good
Average	88.65		

Based on the table above, the teaching materials used in the three schools through the effectiveness test showed promising results, namely the average value of the three schools was above 70, it is 88.78, which was included in the excellent category and could be applied in the learning process.

Read-Answer-Discuss-Explain- and Create (RADEC) based teaching materials with the help of the 3D Pageflip Professional application for students of Grade V of Elementary School are developed by considering many things and through several

refinements and evaluations and testing by various experts. Theme material 6 subthene 1 "temperature and heat" through the validity and practicality process by teachers and students so that this product becomes an answer or alternative teaching material according to the characteristics and environment of the child.

Conclusion

Based on the research that has been carried out, namely the development of Read-answer-discuss-explain and create (RADEC) based teaching materials with the help of 3D Pageflip Professional on the theme 6 subthene 1 "temperature and heat" in the 5th grade of elementary school, it can be concluded that the product is valid, practical and effective. Average validity results carried out by expert validators indicate that the teaching material belongs to a highly valid validity category, while the average results of practicality by teachers and students, stated that the teaching materials

are in the category of highly practical practicality and from the average student learning outcomes stated teaching materials are very effective.

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Author Contributions

Conceptualization, data curation, funding acquisition, methodology, visualization, writing-original draft by lindri martinopa and writing-review & editing by Risda amini.

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Conflicts of Interests

No conflicts of interest.

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