Validity and Practicality of the E-Book Science Model RADEC (Read-Answer-Discuss-Explain-Create) to Improve the 4C Skills of Students

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Abstract: Quality human resources are the main goal of a nation's ability to compete. The demands of the 21st century also require quality human resources. Therefore, learning resources are needed that support students' 4C skills. The purpose of this research is to develop learning resources in the form of science e-books that have been tested for validity and practicality. The type of research used is research and development, using the ADDIE development model. In the ADDIE development model, there are five stages, including analysis, design, development, implementation, and evaluation. The validity of the Science E-Book uses the Aiken's V scale, and the practicality of the Science E-Book uses the Likert scale. Based on the results of the data analysis conducted, the validity and practicality results were obtained as follows. The results of e-book validity tests by experts were obtained at 0.88. The results of the teacher's practicality were obtained at 89.25%, and the results of the students' practicality were obtained at 88%. So it can be concluded that the RADEC model-based science e-book (Read-Answer-Discuss-Explain-Create) is valid and practical to use in science learning and to improve the 4C skills of junior high school students.

Keywords: RADEC model; Science e-book; 4C Skills

Introduction

The presence of the industrial revolution 4.0 era has affected many fields, namely industry, education, and technology (Ananda et al., 2023). The 21st century is also a century characterized by the rapid development of science and technology. As a result, all aspects of life have progressed and accelerated, which is characterized by the merging of space and time factors due to the use of technology (Risma et al., 2021). Due to advances in science and technology, the world is changing rapidly, as evidenced by environmental problems or technological advances (Mulyana et al., 2023). In the current 21st century, education is expected to be able to keep up with the times in the field of science which is very rapid. Since technology, science, and talents have advanced so much in the 21st century (Akmal et al., 2023).

The 21st century demands that learning be able to produce students who have various skills (Yulkifli, 2019). Quality human resources are the main goal of a nation's ability to compete. The 21st century requires students to have 4C skills (Husniyah, 2023). 4C skills such as the ability to think critically, communicate, collaborate, think creatively, and have technological literacy (Azmi et al., 2023). 4C skills (critical thinking, communication, collaboration, and creativity) that students have to be able to follow the progress, especially at field of science (Nuri et al., 2023). Critical thinking is not necessarily attached to someone from birth. However, critical thinking skills can be developed through students' direct experience in dealing with problems (Adhelacahya et al., 2023).

The demands and challenges that exist in the 21st century have an impact on changes in the learning patterns that exist in Indonesian education. Various efforts have been made by the government to meet the

demands of the 21st century, such as making improvements to education standards, including teacher and education personnel standards, facilities and infrastructure standards, management standards, financing standards, and implementing the School Literacy Movement (GLS) program. In addition, the most important thing is to make changes and develop the curriculum. The current curriculum guides learners to master 21st century skills (Ministry of Education and Culture, 2017).

Skills that should be prepared by learners to face the demands of the 21st century, one of which is the 4C skills consisting of critical thinking, creativity, cooperation, and communication skills (Hosman, 2014). 4C skills are needed by learners to face 21st century learning challenges. Based on the journal review, it is found that the 4C skills, one of which is the critical thinking skills of students, are low. This can be seen from PISA data from 2018, which states that Indonesia's education ranking is ranked 72 out of 78 countries (OECD, 2019). This illustrates that the thinking skills of Indonesian students are still in the low category (Yuliantil, 2022).

The Covid-19 pandemic has also had a significant impact on the education system in Indonesia. Several schools have been affected by the pandemic. A global disease outbreak that requires digital transformation where distance or online learning is an option for overcoming these problems (Dewi, 2022). This sudden situation requires quick adjustment by teachers and students. Online learning conducted during the pandemic is not effective; this can be seen from the very low learning outcomes of students (Chairunnisa, 2022). Based on the results of observations that have been made in several junior high schools in the district of fifty cities, several problems were found. The first problem can be seen from the questionnaire determining the characteristics of students in 'the' learning interest, where it is found that students' interest in learning science is still low, at 68%. The second problem is that the monotonous learning process makes students feel bored, which has an impact on the learning process that occurs in the classroom.

The third problem is that the use of technology in several junior high schools in the district of fifty cities has not been implemented in the science learning process. Learning models that are still not effectively applied in schools. The fourth problem is that the learning resources in schools are not yet varied. In schools that were observed using learning resources in the form of LKS. The fifth problem is that 21st century skills, such as 4C skills, have not been implemented optimally in schools. Whereas 4C skills are one of the skills required in the current curriculum.

Based on the problems stated, a solution is sought to solve the problem. One of the efforts that can be made to improve 4C skills is by using electronic learning materials based on learning models. These students' skills can be developed with the help of teachers through a learning process that uses a learning model that can support the creation of these 4C skills, namely the RADEC (Read, Answer, Discuss, Explain, Create) learning model (Fhilrizki et al., 2022).

This RADEC model follows the development of current education-based technology, where the learning resources are books and other sources such as the internet that are easily accessible to students (Pratama et al., 2019). This RADEC (Read-Answer-Discuss-Explain-Create) learning model is intended to improve the quality of learning processes and outcomes in situations and conditions in Indonesia (Martinopa, 2023). The RADEC learning model is integrated into electronic learning materials in the form of e-books. An e-book is one of the interactive teaching materials that can be used by students (Hidayat et al., 2017). The RADEC development model (Read, Answer, Discuss, Explain, and Create) was developed to address the problem of the low quality of student learning processes and outcomes in improving students' high-order thinking skills (Fauziah et al., 2023).

One type of teaching material that can be developed in the current digitalization era is an electronic book (e-book) (Sumka et al., 2023). E-books developed must be able to improve students' 4c skills (Fitriadi et al., 2022). E-books have the advantage that they can be used anytime and anywhere online (Jin, 2014). E-books can be used by students for independent learning (Rafli et al., 2019). E-books can be designed to be as interesting as possible to foster students' interest in learning (Afriwardani, 2023). Digital book media based on Flip PDF Professional is a publication of writing, images, video or sound in an electronic system that is useful for obtaining information for updating traditional paper books using digital flipping and can insert information on various types of facilities, namely sound, animation, writing, video (Putri et al., 2022). E-books are designed to make it easier for students in the learning process, especially science learning (Damayanti et al., 2020).

Teaching materials designed in the form of e-books that can improve students' 4C skills contain learning materials, discussion activities, and experimental activities. The RADEC learning model has several advantages, including being able to train students' 4C skills, fostering students' interest in reading, and being centered on students (Sopandi et al., 2021). Based on the description above, the researcher is interested in conducting research related to electronic teaching materials. So a science e-book based on the RADEC (Read-Answer-Discuss-Explain-Create) model was

developed to improve the 4C skills of junior high school students. The science e-book will be tested for validity and practicality.

Method

In this study, the type of research used is research and development, using the ADDIE development model. In the ADDIE development model there are five stages, including analysis, design, development, implementation, and evaluation. The product produced in this study is a science e-book based on the RADEC learning model, which has been tested for validity. The stages of the ADDIE development model, can be seen in Figure 1.
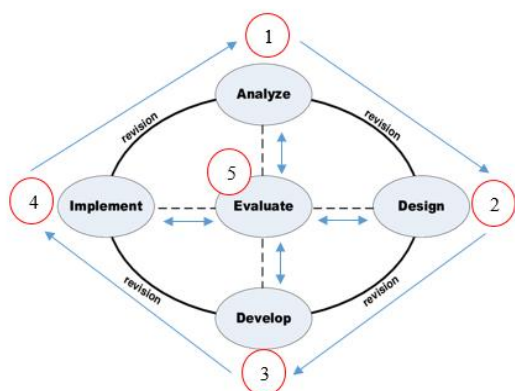
Figure 1. Stages of the ADDIE development model

The first stage of this research is analysis. This stage is very important to do first by identifying possible problems that may occur. At this stage, an analysis is carried out related to the characteristics of students, the needs of students and teachers, and the analysis of learning resources used in learning. The second stage is design. In the research conducted at this stage, the design of the E-Book display and variations in the presentation of E-Book material will be carried out in accordance with the results of the analysis carried out at the previous stage. The product design stage is very necessary in research so that the product in the form of an e-book that is developed looks attractive to students and creates learning that is interesting, fun, effective, and motivates students to learn.

The third stage is product development. At this stage of development, the material and work steps in the e-book are developed so that they are coherent, interesting, and able to improve the 4C skills of students. At this stage, the product in the form of an e-book is designed in accordance with e-book development procedures in general but is designed to be as attractive as possible so that it can be used by students in their learning. At this stage, we will produce a product in the form of an e-book based on the RADEC learning model.

After the fourth stage of development, namely the application stage, at this stage, a validity test is carried out by experts. Every product that will be tested must be validated first and declared valid (Yulkifli, 2022). The equation used to determine the validity test is Aiken's V.

$$V = \frac{\Sigma s}{[n(c-1)]} \qquad (1)$$

Description:
S   =   r - lo
Lo =   the lowest validity assessment number (in this case = 1)
c   =   the highest validity assessment number (in this case = 5)
R   =   the number given by the validator
n   =   number of validators
The following is a table of product validity criteria.

Table 1. Product Validity Criteria (Azwar, 2015)

Aiken's Mean Score	Category
≥ 0.60	Valid
≤ 0.60	Invalid

After the validity test is carried out, a valid product is obtained, so it can be tested. But if the product is not valid, then the product revision is carried out to meet the valid criteria (Septiani et al., 2021). Furthermore, if it has been declared valid, it will be implemented in the intended school. At this stage, we will see whether the products that have been developed can improve the 4C skills of junior high school students. At this stage, the practicality test is also carried out by teachers and students. The following is an equation for testing the practicality of the Science e-book.

$$NP = \frac{R}{SM} \times 100\% \qquad (2)$$

Description:
NP   = Percent value sought
R   = Score acquisition
SM   = Maximum score
The following is a table of criteria for the practicality of Science E-Books.

Table 2. Criteria for Authenticity of Science E-Books

Interval	Category
86 – 100%	Very Practical
76 – 85%	Practical
60 – 75%	Moderately Practical
55 – 59%	Less Practical
< 54%	Not Practical

The last stage is evaluation. The evaluation stage is carried out at all stages of the ADDIE development model. The evaluation stage is carried out after the

analysis, design, development, and implementation stages to get the maximum product.

Result and Discussion

Based on the results of observations made of students and teachers, electronic teaching materials based on learning models that can improve students' 4C skills are developed. In schools where observations have been made, it has been found that the materials they use are still in the form of printed teaching materials and have not been integrated with learning models. So that researchers are interested in developing electronic teaching materials in the form of science E-Books based on the RADEC (Read-Answer-Discuss-Explain-Create) model to improve students' 21st century skills. The following is the design of a RADEC model-based science e-book to improve the 4C skills of junior high school students that has been designed and tested for validity and practicality.
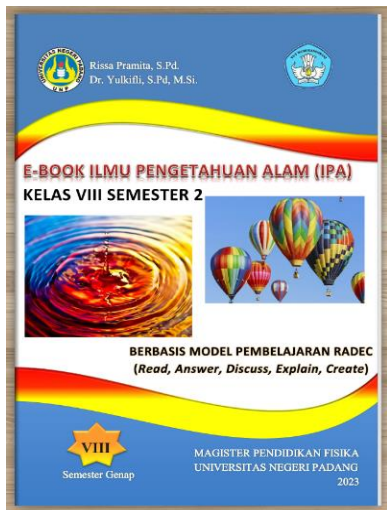

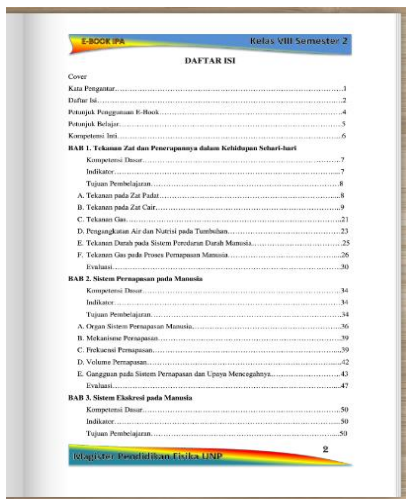**Figure 2.** Display of science e-book cover

Figure 3. Contents in the Science E-Book

Figure 2 is the cover view of the Science e-book. In this cover section, there is the author's name, images related to the material, agencies that develop it, and other information. In Figure 3, there is a table of contents. The table of contents makes it easier for students and teachers to find the learning material they want to aim for. So that teachers and students do not find it difficult to find learning material.
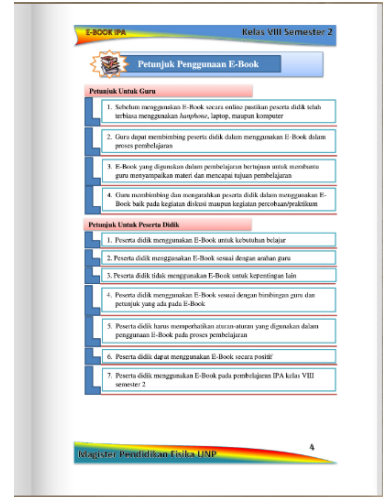

Figure 4. Instructions for using the science e-book

In Figure 4, there are instructions for using the Science E-Book. These instructions are made to assist students and teachers in operating electronic teaching materials and facilitate the learning process.
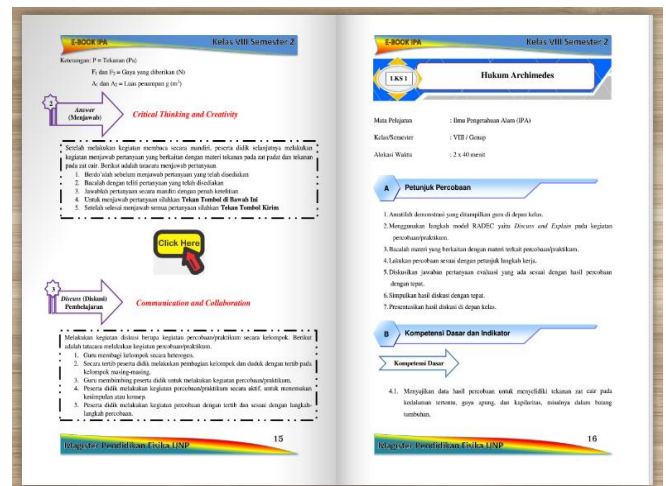

Figure 5. RADEC model syntax in science e-books

In Figure 5, there is a RADEC learning model syntax. The syntax of the learning model is contained in the learning material and practicum. The e-book contains all the syntax of the learning model that can train students' 4C skills and guide the implementation of the desired learning process.
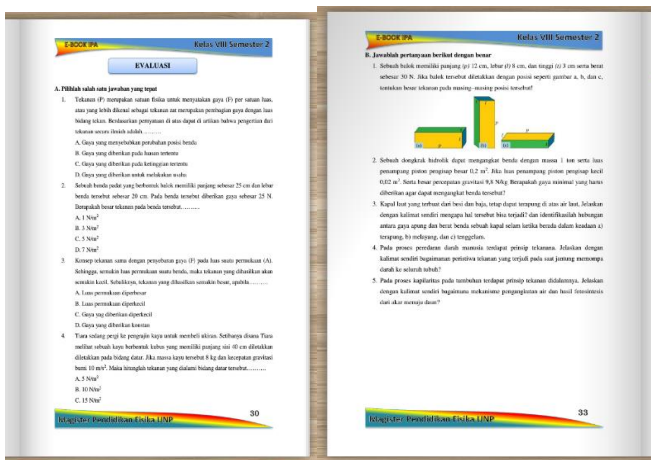
Figure 6. Evaluation on the science e-book

Figure 6 is an evaluation. In the evaluation section, there are objective questions and essays. This part is done at the end of learning and is used to determine the critical and creative thinking skills of students.
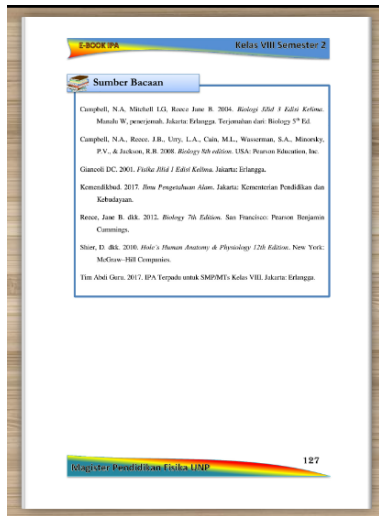

Figure 7. Reference to the science e-book

In Figure 7, there is a list of references used in the Science E-Book. The reference list contains the sources used in the development of E-Book IPA.

The results of the science E-Book based on the RADEC model measured are the validity and practicality values. The validity value of the RADEC model-based science e-book is obtained from validation by experts in the form of physics education lecturers at Padang State University (UNP). The practicality value of the RADEC model-based science e-book is obtained from the practicality test conducted by teachers and students of SMPN 1 Pangkalan Koto Baru.

Results of Validity Test by Experts

Before conducting the validity test of the RADEC model-based science e-book, the validity test of the research instruments used was first carried out. The

validation and practicality questionnaire sheets have been tested for validity first. So that the validity and practicality assessment questionnaire can be used in research.

On the validation questionnaire sheet, there are several assessment components. The first component is the substance of the material. This component contains the truth of the material, currentness, material coverage, and readability. The second component is learning design. This component contains the title, KI and KD, indicators and learning objectives, learning model steps, evaluation, and references. The third component is visual appearance. This component contains the appearance, font size, videos and images, and illustrations. The fourth component is software utilization. This component contains the media used, interactiveness, and originality.

The validation of the science e-book based on the RADEC model was carried out by experts. In the validation questionnaire sheet, there are several aspects that are assessed, including the substance of the material in the science e-book, learning design, visual appearance, and software utilization. The results of the validity value of the Science e-book can be seen in Table 3.

Table 3. Science E-Book Validity Results

Component	Final Score	Description
Material Substance	0.90	Valid
Learning Design	0.85	Valid
Visual Display	0.88	Valid
Software Utilization	0.91	Valid
Average	0.88	Valid

Based on Table 3, it can be seen that the RADEC model-based science e-book is declared valid with a final score of 0.88. This result is obtained from the final results on the four components of the assessment. The results of e-module validation are part of the validity indicators to obtain validation results in accordance with predetermined indicators (Kurniawan et al., 2021). In this developed e-module, there are four validation indicators based on the ICT teaching material development guide from Kemdikbud 2010, which consist of indicators of material substance, communication display, learning design, and software usage.

The RADEC model-based science e-book has been tested for validity and declared valid. This validity test was conducted by three experts. So that the RADEC model-based science e-book can be used in learning science in class VIII junior high school semester 2.

After validation and revision of the product based on suggestions and comments from validators, the next stage is to conduct research. This research was

conducted at a junior high school, namely SMPN 1 Pangkalan Koto Baru District, Fifty City Regency. These results are in accordance with the results of research (Rachmawati et al., 2021) that a research product will be said to be valid if the product is useful for the curriculum. So that research will be carried out at the intended school.

Practicality Test Results by Teachers and Learners

The RADEC model-based science E-Book practicality test was conducted on teachers and students. Teachers and learners will use the science e-book in their learning. After use, students and teachers will assess the practicality of the science e-book through a practicality questionnaire. The practicality test of the Science e-book was assessed by the science teacher. On the teacher's practicality questionnaire sheet, there are several components that are assessed, including usability, ease of use, attractiveness, and efficiency. The results of the science e-book practicality score by the teacher can be seen in Table 4.

Table 4. Results of E-Book IPA Practicality by Teachers

Component	Final Score	Description
Usability	88%	Practical
Ease of use	86.36%	Practical
Attractiveness	91.25%	Practical
Efficiency	91,.5%	Practical
Average	89.25%	Practical

Based on Table 4, the results of the analysis of the practicality test by teachers on the science e-book. The average value of practicality among teachers is 89.25%. It can be concluded that the RADEC model-based science e-book is practically used in science learning. After the practicality test by the teacher, the next practicality test was carried out by students. In the questionnaire sheet for the practicality of students, there are several components that are assessed, including usability, ease of use, attractiveness, and efficiency. The results of the practical value of the science e-book for students can be seen in Table 5.

Table 5. Results of the Practicality of E-Book IPA by Learners

Component	Final Score	Description
Usability	85%	Practical
Ease of use	88%	Practical
Attractiveness	88%	Practical
Efficiency	91%	Practical
Average	88%	Practical

Based on Table 5, the results of the analysis of the practicality test by students on the Science E-Book. The average value of practicality among students is 88%. It can be concluded that the RADEC model-based science e-book is practically used in science learning. The results of the practicality test by teachers and students have an average value above 0.6; this shows that the RADEC model-based science E-Book is practical to use in science learning and to improve students' 4C skills. From the results of the validity and practicality analysis, it can be concluded that the RADEC model-based science e-book (Read-Answer-Discuss-Explain-Create) can be used for science learning and to improve the 4C skills of junior high school students. So that teachers and students can use science e-books in learning that uses technology, in accordance with the demands of 21st-century skills.

Conclusion

Based on the results of validation and practitioners conducted in this study, data were obtained, and data processing and analysis were carried out. The conclusion obtained from the validation results is that the RADEC model-based science e-book is declared valid. This can be seen from the analysis of the validation results, with a final value of validity of 0.88. So that the RADEC model-based science e-book is declared valid by experts. The conclusion obtained from the results of the teacher's practicality test is that the Science E-Book is declared practical, with a final score of 89,25%. The conclusion drawn from the results of the practicality of the students is 88% with a practical description. The final conclusion in this study is that the science e-book based on the RADEC (Read-Answer-Discuss-Explain-Create) model is valid and practical to use in science learning and to improve the 4C skills of junior high school students.

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