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Development of a Water Cycle E-module Assisted by a Flipbook Application for 5th Grade Elementary School Students

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Abstract: This study aims to develop a water cycle E-module assisted by the Flipflop for fifth grade elementary school students. The use of technology not only provides flexibility during the learning process but also fosters active participation and enhances student interactivity, thereby creating a more meaningful learning experience. The research method used is research and development (R&D) with ADDIE model (Analysis, Design, Development, Implementation, Evaluation). The data collection techniques used in this study were observation, interviews, and questionnaires. Data collection instruments consist of observation sheets, interview guidelines, and student response questionnaires. The results of the study showed that the developed water cycle e-module was valid and practical to use. The research results from media experts obtained a percentage of 94.2% and material experts 98.5% which fell into the very valid category. Furthermore, in terms of practicality, the teacher obtained a result of 88.2% in the very practical category and when the small-scale trial obtained a percentage of 73.2% in the practical category and the limited-scale trial obtained a percentage of 80.7% in the practical category.

Keywords: E-module, Water Cycle, Fifth Grade Elementary School

Abstrak: Penelitian ini bertujuan untuk mengembangkan E-modul siklus air berbantuan aplikasi Flipbook bagi siswa kelas 5 Sekolah Dasar. Penggunaan teknologi tidak sekedar memberi fleksibilitas selama pembelajaran berlangsung, namun juga mendorong partisipasi aktif serta memperkuat interaktivitas siswa sehingga menciptakan pengalaman belajar yang lebih bermakna. Metode penelitian yang digunakan adalah penelitian pengembangan (Research and Development/R&D) dengan model ADDIE (Analysis, Design, Development, Implementation, Evaluation). Teknik pengumpulan data yang digunakan dalam penelitian ini adalah observasi, wawancara, dan angket. Instrumen pengumpulan data terdiri dari lembar observasi, pedoman wawancara, dan angket respon siswa. Hasil penelitian menunjukkan e-modul siklus air yang dikembangkan valid dan praktis untuk digunakan. Hasil penelitian dari ahli media memperoleh prosentase 94,2% dan ahli materi 98,5% yang masuk ketegori sangat valid. Selanjutnya untuk kepraktisan ditinjau dari segi guru memperoleh hasil 88,2% masuk kategori sangat praktis dan ketika uji coba skala kecil memperoleh prosentase 73,2% masuk kategori praktis serta uji coba skala terbatas memperoleh prosentase 80,7% masuk kategori praktis.

Kata Kunci: E-modul, Siklus Air, Kelas 5 Sekolah Dasar

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INTRODUCTION

Entering the 21st century, teachers are now required to master technology as one of the key approaches in instruction. This indicates the need for digital or electronic-based resources during learning to enhance effectiveness and efficiency in educational management. Technology serves not only as a field of knowledge but also as a source of information and diverse learning resources that support the educational process. Lestari (2018) states that the implementation of technology in learning includes its use as a learning resource, an administrative tool, and instructional media. Appropriate application of technology, combined with active and constructivist learning approaches, can make learning more engaging, enjoyable, and effective for students. The use of e-modules is one effort to improve the quality of education. Utilizing e-modules allows students to learn flexibly, interactively, and encourages active participation during the learning process. This is supported by research from Manzil & Anas Thohir (2022), which demonstrates that e-modules are highly effective for use in modern education. These findings align with needs analysis results, indicating that technology-integrated learning can increase student motivation and facilitate comprehension of the material presented.

Based on interviews conducted at three elementary schools—SD Negeri Banjaragung 3, SD Negeri Tebel 2, and SD Negeri Pakel 3—several challenges in the educational process were identified. A key issue is the suboptimal use of technological advancements in supporting instructional delivery. Observations conducted on April 30, 2024, involving three teachers from three elementary schools in Bareng District with varying educational report card outcomes, revealed stagnant performance data in 2024, indicating a need for improvement. According to the educational report card, while teachers have implemented learning media such as the water cycle module, literacy outcomes remain suboptimal, necessitating the development of technology-enhanced modules. This has resulted in students' limited understanding of the water cycle process and low learning outcomes, particularly in this topic. Therefore, educational innovation is required to improve student achievement.

The development of a Flipbook-assisted e-module on the water cycle for fifth-grade elementary students is essential for several reasons related to educational innovation and technological advancement. Flipbook-assisted e-modules can enhance student engagement in learning. Technology-based learning tends to attract greater student interest compared to conventional methods. Interactive applications stimulate students to actively comprehend the material, especially in topics requiring visualization. Huang et al. (2020) emphasize the importance of interactive educational technology in increasing student engagement.

The integration of technology in learning significantly enhances the quality of the teaching process. Among various available applications, Flipbook stands out for its ability to provide simulations and animations that help students visualize real-world phenomena such as the water cycle, facilitating their understanding of abstract concepts. Zawacki-Richter & Jung (2023) highlight the importance of visualization in science education and how technology can aid in comprehending complex concepts. The water cycle is one such topic that requires clear visualization for student understanding, making Flipbook-assisted e-modules a valuable tool.

In terms of developing digital literacy, the use of Flipbook in e-modules not only helps students learn about the water cycle but also fosters digital literacy skills, which are increasingly important in the information age. Digital literacy enables students to effectively access, understand, and utilize information through technology. As noted by Erwin & Mohammed (2022), mastery of digital technology is crucial for enhancing both learning quality and students' digital literacy skills. Through the development of a Flipbook-assisted e-module on the water cycle, this research aims to improve the

quality of elementary education. Previous studies, such as those by Awwaliyah et al. (2021), have demonstrated that Flipbook-based e-modules enhance student motivation. Similarly, Safitri et al. (2021) found that such e-modules improve student independence, while Utari et al. (2023) showed they foster creative thinking skills. By adopting the latest educational technology, this study contributes significantly to the development of engaging and effective digital-age learning methods. The goal of this research and development is to create a valid and practical product for fifth-grade elementary students, specifically for the water cycle topic.

RESEARCH METHODS

This study applies the Research and Development (R&D) approach with the ADDIE model (Analysis, Design, Development, Implementation, Evaluation) to develop a Flipbook-assisted e-module on the water cycle. The Analysis phase involved: (1) needs analysis of water cycle learning in fifth-grade classrooms, (2) literature review, and (3) analysis of student characteristics and technological readiness. The Design phase focused on creating an interactive e-module structure with attention to readability, visual design, and pedagogical elements, which were validated through consultations with supervisors. The Development phase utilized Flipbook software to integrate multimedia and interactive content. During Implementation, the e-module was tested with fifth-grade students to assess its effectiveness. The Evaluation phase collected feedback from students, teachers, and subject/media experts to refine the final product.

Data were collected through interviews, questionnaires, and classroom observations. Material experts evaluated content validity based on: (1) material accuracy, (2) assessment quality, and (3) language clarity. Media experts assessed: (1) interface design, (2) content completeness, and (3) color scheme. The study involved fifth-grade elementary students as the population, with 5 students in small-scale trials (representing low, medium, and high ability levels) and 15 students in limited trials. One teacher participated as an interviewee. Data analysis combined descriptive statistics (for questionnaire responses) and qualitative analysis (for interviews and observations).

Descriptive and qualitative analyses were applied in this research and development. Descriptive analysis was used to analyze questionnaire data describing student responses to the e-module. Qualitative analysis, meanwhile, analyzed teacher interview data and observation results to provide further insight into the implementation and impact of the e-module on learning. After the product was developed to determine its validity, it was validated by subject matter and media experts. The following are the product validity categories.

Table 1. Product Validity Criteria

Value Range	Criteria
85,01% - 100%	Very Valid
70,01% - 85%	Valid
55,01% - 70%	Quite Valid
37,01% - 55%	Less Valid
20% - 37%	Not Valid

In this study, the validity value of the product being developed was determined to be at least in the "Valid" category. Meanwhile, the practicality of the product being developed was determined through teacher and student responses. The following are the practicality categories for the product being developed.

Table 2. Product Practicality Criteria

Value Range	Criteria
85,01% - 100%	Very Practical
70,01% - 85%	Practical
55,01% - 70%	Quite Practical
37,01% - 55%	Not Practical
20% - 37%	Not Practical

During research and development, products are not only evaluated for validity but also for practicality. In this study, the practicality score was determined to be at least in the "Practical" category.

RESULTS AND DISCUSSION

The first stage of this research was analysis. The first step was a needs analysis. A questionnaire administered to students to determine their needs revealed that 72.4% of students had never used electronic modules. Furthermore, 96.6% of students required engaging learning media rich in images, videos, and animations. This was reinforced by interviews, which revealed that teachers never used a variety of learning resources. The learning process was dominated by textbooks. The next step was a literature review, examining the depth of the material related to the water cycle taught in fifth-grade elementary school. The researchers then analyzed the characteristics of fifth-grade students. The analysis revealed that each topic taught to students in the concrete operational phase needed to be visually presented. This facilitated students' understanding of abstract objects or symbols.

The second stage was design. The design of the developed product was based on the results of a preliminary study, including interviews and a student questionnaire. The developed product was an e-module that was engaging for students and easy to use anywhere and anytime. The steps in the design phase are: a) creating the e-module design, b) preparing materials, exercises and assignments, c) collecting and creating backgrounds, covers, and layouts, d) developing the module feasibility assessment instrument. After completing the second phase, the third phase is development.

The third phase is development. In this phase, the researcher develops the e-module based on the previously developed design. After development, the researcher assesses the product's validity before implementation. The validity of the water cycle e-module being developed is determined by two experts: a media expert and a material expert. The water cycle e-module is considered valid if it meets the predetermined criteria, namely, obtaining a minimum score in the "Valid" category. The table below presents the results of the validation conducted by media experts in their respective fields.

Table 3. Media Expert Validation Results

Aspect	Item	Percentage	Total Percentage
Effective and Efficient	3	86,6%	94,2%
Reliable and Simplicity of Operation	2	100%	
Visual Communication	9	91,1%	
Balance	3	93,3%	
Integration	3	100%	

Table 3 illustrates that the assessment obtained from media experts will be reviewed through 5 assessment aspects: Effectiveness and Efficiency obtained a percentage of 86.6% which is included in

the very valid category, Reliability & Simplicity of Operation obtained a percentage of 100% which is included in the very valid category, Visual Communication obtained a percentage of 91.1% which is included in the very valid category, Balance obtained a percentage of 93.3% which is included in the very valid category, and Integration obtained a percentage of 100% which is included in the very valid category. Thus, the total percentage obtained from media experts is 94.2% which is included in the very valid category. From the data obtained, it can be said that the product being developed, namely the water cycle e-module, is valid for use. This shows that media experts have provided a recommendation that the currently developed product can be tested in the learning process for students and teachers. After conducting validation with media experts in their respective fields, researchers also conducted revisions or improvements to the currently developed product. These improvements and revisions were tailored to the suggestions and comments provided by the media experts regarding the product being developed, ensuring it was ready for use in trials with students and teachers. Furthermore, the research and development conducted to determine the product's validity was measured not only by media experts but also by subject matter experts. The following presents the results of the validation by subject matter experts in their respective fields.

Table 4. Results of Material Expert Validation

Aspect	Item	Percentage	Total Percentage
Content Suitability	2	100%	98,5%
Material Accuracy	4	100%	
Learning Support Materials	4	100%	
Compliance with Laws and Regulations	2	90%	
Presentation Techniques	2	100%	
Learning Presentation	3	100%	
Completeness of Presentation	2	100%	

Table 4 explains that the assessment obtained from the material experts will be reviewed through 7 assessment aspects, namely the Content Feasibility obtained a content feasibility percentage of 100% which is classified as very valid, the Accuracy of the material obtained a percentage of 100% which is classified as very valid, the Supporting learning materials obtained a percentage of 100% which is classified as very valid, Compliance with laws and regulations obtained a percentage of 90% which is included in the very valid category, Presentation techniques obtained a percentage of 100% which is classified as very valid, Learning presentation obtained a percentage of 100% which is classified as very valid, and Completeness of presentation obtained a feasibility percentage of 100% which is classified as very valid. So that the validation by the material experts obtained a total of 98.5% of the overall aspects. In addition, in table 4 it can be seen that of the 7 assessment aspects, 6 of them obtained a percentage of 100%. This demonstrates that the material experts recommended that the currently developed product, the water cycle e-module, be piloted on students during the learning process.

After validating the product with the material experts, the next step was for the researchers to make improvements or revisions in line with the comments and suggestions provided. This was done to further refine the developed product and ensure its usability, both in terms of design and content. During the research and development of the water cycle e-module, the researchers not only reviewed its validity but also its practicality, as assessed by teachers and students during the learning process. The following are the results obtained to determine the practicality of the product for teachers.

Table 5. Practical Results by Teachers

Aspect	Item	Percentage	Total Percentage
Material Aspect	9	88,8%	88,2%
Language Aspect	5	88%	
Presentation Aspect	3	86,6%	
Media's Effect on Learning Strategies	5	88%	
Overall Appearance Aspect	2	90%	

Table 5 illustrates that the assessment obtained from the teacher will be reviewed through 5 assessment aspects, namely the Material Aspect, the Media Effect Aspect on Learning Strategies, the Language Aspect, the Presentation Aspect, and the Overall Appearance Aspect. The results received based on table 5 above are related to the Material Aspect, which has a percentage of 88.8%, which is classified as very practical criteria, the same thing is seen in the Language Aspect, which has the same percentage, namely 88%, which is classified as very practical criteria, the Presentation Aspect has a percentage of 80%, which is classified as very practical criteria, for the Media Effect Aspect on Learning Strategies, which has a percentage of 88%, which is classified as very practical criteria, and for the Benefits Aspect, which has a percentage of 86.6%, which is classified as very practical criteria and for the Overall Appearance Aspect, which has a total percentage of 88.2%. This means that the product being developed is classified as "very practical" for use during learning. In addition to teacher reviews, the developed product was also tested on students. Two trials were conducted with students: a small-scale trial and a limited-scale trial. The following are the results obtained from the small-scale trial with fifth-grade elementary school students.

Table 6. Small-Scale Student Response Results

Aspect	Item	Percentage	Total Percentage
Content Aspects of Presented Material	7	69,1%	73,2%
Ease of Access	4	73%	
Clarity of Message Conveyed	9	77,5%	

Table 6 illustrates that the assessment obtained from the initial responses by 5 students who provided responses for 3 assessment aspects including the Content Aspect of the Presented Material, Clarity of the Message Conveyed, and Ease of Access. Based on the aspects presented in the table, the student responses for the Content Aspect of the Presented Material obtained a percentage of 69.1% in the fairly practical category, for Ease of Access obtained a percentage of 73% in the practical category, the Clarity of the Message Conveyed aspect obtained a percentage of 77.5% in the practical category. From the data obtained, the total aspect was obtained, namely 73.2%, which is included in the practical category. Therefore, in this trial there were several improvements to the content of the presented material and the clarity of the message conveyed, from the results of the responses there were several contents or contents that according to students were not yet understood and made it difficult to understand, so that the product being developed was carried out changes or revisions in the kenimaster video in certain parts. The results of this revision will then be followed up with a trial in the next stage, a limited-scale trial, after product improvements based on student feedback. The following are the results of the limited-scale trial.

Table 7. Limited Scale Student Response Results

Aspect	Item	Percentage	Total Percentage
Content Aspects of Presented Material	7	80,3%	80,7%
Ease of Access	4	80,9%	
Clarity of Message Conveyed	9	81,1%	

Table 7 shows the assessment results for the responses of 15 students who provided feedback on three assessment aspects: Content of the Presented Material, Ease of Access, and Clarity of the Conveyed Message. Based on the aspects listed in the table, student responses for Content of the Presented Material were 80.3%, falling within the practical category. Ease of Access was 80.9%, and Clarity of the Conveyed Message was 81.1%, falling within the practical category. The data obtained yielded a total of 80.7%, which can be categorized as "very practical."

After conducting a small-scale, limited trial, the product being developed, the water cycle e-module, will be revised based on field findings. Revisions and improvements will be made to various aspects of both the design and content of the e-module. This will ensure that the developed e-module is further refined in terms of design and content, meeting the needs of the field. The use of e-modules can help students engage in independent learning activities. In line with this, (Ibrahim & Yusuf, 2019) stated that knowledge cannot be directly transferred from teacher to student; instead, students must actively seek, process, apply, and construct information independently.

This research aims to develop an e-module on the water cycle using the Flipbook application, which is expected to improve student understanding. The features contained in the e-module are expected to assist and facilitate student learning. The development of the e-module on the water cycle is complemented by elements such as engaging images, videos, moving animations, and exciting games. These engaging features in the e-module can attract students to learn (A et al., 2020). As part of an educational technology approach, this e-module utilizes interactive media to enable students to be more active during the learning process. Research results (Ramadhani & Fitria, 2021) show that the use of e-modules supported by the Flipbook application has a positive impact on understanding the concept of the water cycle and motivates students to continue learning through fun and more interactive methods. In line with this statement, (Zaharah et al., 2017) revealed that the interactive nature of e-modules during learning facilitates student understanding.

Based on the research results, the use of e-modules supported by the Flipbook application can improve student understanding of the water cycle. The use of interactive media such as the Flipbook application allows students to learn in more fun and engaging ways, as multimedia features such as images, animations, and voice narration make complex concepts easier to grasp. Similarly, (Munawaroh et al., 2019a) stated that one learning medium deemed efficient and effective for application during learning is e-modules. Teaching students about the water cycle will certainly be challenging if they have to observe it directly. Therefore, learning resources are needed that can facilitate students' learning. This statement is supported by (Lusidawaty et al., 2020), who revealed that in fifth-grade elementary school students need intermediaries to better understand the material. Research conducted by (Januarti et al., 2023) shows that the use of e-modules during learning can help students improve conceptual understanding. The attractive design of e-modules can attract students' attention. The e-module development for the water cycle is complemented by visuals and various audio materials, making it easier for students to learn abstract material. (Ferdianto et al., 2019) revealed that utilizing e-modules during learning can increase motivation and enhance student learning. This finding is further supported by research (Mahzuardi et al., 2024), which states that the use of e-modules during learning can increase student enthusiasm.

The use of e-modules during learning has a positive impact on fifth-grade elementary school students. Research (Munawaroh et al., 2019b) shows that e-modules can attract students' interest in reading, and the ease of use of e-modules can increase students' interest in continuing learning. This is supported by research (Yuningsih, 2022), which reveals that the use of technology-based teaching materials is considered to facilitate the delivery of learning materials and is more engaging for students. The use of e-modules in flexible learning can facilitate student learning because they can learn anywhere and anytime. This is supported by (Yuningsih, 2022), who stated that teaching materials in the form of electronic modules are considered capable of providing innovation during the learning process. This research was limited to fifth-grade elementary school students. Furthermore, the e-module assisted by flipbooks is also limited to the water cycle material. Furthermore, the developed product can only be used or connected if there is an internet connection. So the e-module that was developed cannot be used offline.

CONCLUSIONS AND RECOMMENDATIONS

In the research and development of the water cycle e-module product with the help of flipbooks, a valid and practical product was produced to be used by students in grade 5 of elementary school in learning. The results of the study showed that the validity test by media experts obtained a percentage of 94.2% and material experts 98.5% so it is classified as very valid. Furthermore, for practicality by teachers obtained a score of 88.2% so it is classified as very practical and by students when small-scale trials of 73.2% included in the category of quite practical and when limited-scale trials of 80.7% included in the category of practical. The suggestions that can be conveyed by the researcher for further researchers are to develop e-modules on other materials and grade levels not limited only to the water cycle material in grade 5 of elementary school. In addition, suggestions are also submitted to policy makers to provide support in the form of adequate suggestions and infrastructure such as ICT devices, as well as a stable internet network so that learning can take place more optimally.

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