Development of Science Learning Media Based on Augmented Reality Book with Problem Based Learning Model to Improve Learning Outcomes of Third Grade Students

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Abstract: This research was conducted based on the findings of problems in the field, one of which is the learning outcomes of students in science learning are still low compared to other learning. The purpose of this study was to determine the development, feasibility, and effectiveness of Augmented Reality Book learning media as a science learning media on water cycle material in elementary schools. The method used is R & D (Research & Development), and the development model used is the ADDIE model. The results of research and development are obtained from the results of feasibility trials and the results of usage trials. From media experts get a percentage of 91.67% with a very feasible category and from material experts get a percentage of 90.38% with a very feasible category. The results of the small group usage trial obtained an average posttest of 81.30 with an average pretest value of 54. While the results of the large group usage trial obtained an average posttest of 79.18 with an average pretest value of 50.27. With an increase in learning outcomes in the moderate category of 61% in small groups, while in large groups there was an increase in learning outcomes in the moderate category of 58%. So it can be concluded that AR-Book-based science learning media on water cycle material effectively improves student learning outcomes. For this reason, researchers hope that there is support for more complete learning facilities so that the application of using the media is more effective and more efficient.

Keywords: Augmented Reality Book; Learning media; Learning outcomes

Introduction

One of the efforts in building a quality Indonesian society is to improve the quality of education. Education can help students recognize their potential and develop their potential. As per Article 1 paragraph (1) of Law of the Republic of Indonesia Number 20 of 2003 concerning the National Education System, education is defined as a deliberate and organized endeavor to establish a learning environment and learning process where students actively develop their potential to possess religious and spiritual strength, self-control, intelligence, noble character, personality, and skills required by themselves, society, nation, and state. So that through an education, students gain knowledge and skills to develop their potential.

The current era is one filled with rapid technological advances. In order to assist people acquire the abilities and information required to meet the challenges of the future, education must be well-prepared in this day and age (Hidayat et al., 2023). This is in line with the research statement (Al-Ansi et al., 2023) which states that "Along with the rapid development and maturity of technology, more and

more educational applications appear in the learning process". Given how quickly technology has advanced, it stands to reason that learning material should make use of it. This is consistent with study findings that emphasize the need for educator's at all educational levels to be able to adjust to digital teaching practices. Every instructor and student must also become proficient in the usage of a range of online tools utilized in distant learning (Fajri et al., 2024).

Learning media is something that is used by educators to channel a message, attention, stimulate students' minds so that the information provided can be conveyed properly (Ariyani et al., 2021). The use of learning media is effective in improving a learning process and results. The existence of learning media in delivering a material will attract the attention of students, especially elementary school students. One of the learning media that is in accordance with the Water Cycle material of grade III Elementary School is by using an Augmanted Reality (AR) based learning media. This is in line with the results of research which states that Augmented Reality technology is able to divert students' attention (Santos et al., 2016).

Augmented Reality is a learning media in the form of technology that acts as a realization of virtual world objects into the real world in the form of two or three-dimensional displays (Setyawan et al., 2019). Augmented Reality is also an integration of virtual objects that are designed as if they are in the real world so that users can interact with these objects (Widiasih, Zakirman, & Ekawati, 2023). Augmented reality (AR) integrates the digital world with the real world, giving users a real-time experience (Sharma et al., 2022). Thus, AR technology is the right media to increase students' learning motivation, especially elementary school students so that they get a better learning experience. This statement is also in line with the results of research from (Drljević et al., 2024) which suggests that the use of AR technology in exploring real-world classes can enhance interesting learning experiences for students.

In addition to using learning media, researchers also combine products by using the Problem Based Learning learning model to create more effective learning. Problem Based Learning (PBL) is a learning method that allows students to learn through solving realistic contextual problems. Based on the results of research (Isbah et al., 2024), The problem-based learning (PBL) learning approach, in conjunction with PhET Simulation, has a positive impact on sixth-grade students' HOTS regarding electrical circuit information. This is also in line with the results of research which states that "The Problem Based Learning model can effectively increase student motivation to learn"(Wijnia et al., 2024). In addition, Problem Based Learning is the

right solution in measuring students' different levels of understanding (Gijbels et al., 2005).

Natural Science learning is one of the subjects included in the elementary school curriculum structure. In learning Natural Sciences, students can develop their knowledge through scientific methods or experiments. Science is a human effort in understanding the universe through observations and appropriate methods and is clearly explained with a reasoning so as to get an explanation or conclusion (Wibowo et al., 2022). The science of the water cycle for life is one of the elementary school science subjects that deals heavily with issues of daily living and social issues in society for which science provides a solution. Controversies around human actions that harm the environment and compromise the sustainability of the water cycle, such as forest fires, land expansion, and environmental restrictions, are issues pertaining to water cycle material. Since these are open-ended problems, students must be able to think critically in order to come up with answers. In order to reach the proper conclusions, students who have a solid understanding of the water cycle content will be able to apply their knowledge to difficulties based on the socioscientific problems that are presented (Septianita et al., 2023). PBL is a useful tool for coming up with solutions for dealing with the effects that human activity has on environmental harm like flooding.

Some previous research that has touched on the use of Augmented Reality is the implementation of augmented reality regarding the introduction of planets and celestial bodies. Through the results of his research (Iskandar et al., 2022), Augmented Reality media on the introduction of planets and celestial bodies learning science obtained results from both group tests by getting an average score of 95.5% with the category "Very Good" or media feasible and suitable for use. In the results of his research (Şimşek et al., 2023) which uses Augmented Reality-based text. The post-test results showed that the overall comprehension score of the experimental group was much higher than that of the control group. In this case, augmented reality-based text can contribute greatly to students' reading comprehension performance. This is also in line with the statement of the results of his research (Wang et al., 2023) which states that in testing two groups, dominant students are more active in discussing by applying AR media so that AR media is very influential in increasing student learning activeness (Pandita et al., 2023; Radianti et al., 2020).

In addition, research conducted by Latif et al. (2023) on the introduction of the solar system using AR applications. Through the Virtual Planetarium, children can interact with the sun or planets and get information so that children can understand more about the solar system. Based on the results of the needs analysis

conducted by researchers on third grade students of Beringin 02 State Elementary School, it was found that 28 students needed online-based learning media, this was evidenced by the results of student responses in filling out a questionnaire which showed 100% of students needed online-based learning media. Based on the results of direct interviews, the homeroom teacher III stated that there were still problems experienced by students in the water cycle material. This is evidenced in the theme 3 subtheme 4 learning 5 material, namely the change in the form of objects in the process of rain or the water cycle as evidenced by the scores of students who are below the KKM, which is 28 students said to be incomplete. This problem occurs because students still do not understand the water cycle material.

The lack of student roles is due to the learning process on water cycle material has not used special media tools or props. In addition, another problem is that teachers are still less competent in making creative learning media in accordance with the demands of the development of the world of education. This also supports the statement in his research (Nikou et al., 2023) which states that AR technology does have many advantages in the field of education, but there are difficulties in adjusting technological developments in the field of education, namely the lack of teacher competence in technology to integrate it into learning practices.

Based on the essence of the background above, the purpose of this study is to develop AR-Book-based science learning media on water cycle material, to determine the feasibility of AR-Book-based science learning media on water cycle material, and to determine the effectiveness in improving the learning outcomes of third grade students of SD Negeri Beringin 02. The results of this study are expected to have a positive impact on the implementation of further learning through the application of AR-Book-based learning media.

Method

Research and development (Research and Development) is the type of research that will be conducted, and ADDIE is the development model of choice. The five steps of the ADDIE method-based research and development strategy are analysis, design, development, implementation, and evaluation (Adji et al., 2023). Initial analysis, which comprises needs analysis (including user-aspects, curriculum suitability, and reinforcement using literature studies), product design, which entails developing products based on needs analysis findings, product development, which includes expert assessment activities, implementation, which involves small- and large-scale trials, and

evaluation, which is the final step in assessing research products, are the first steps in the ADDIE development model (Widiasih, Zakirman, & Ekawati, 2023). The research flow can be seen in Figure 1.
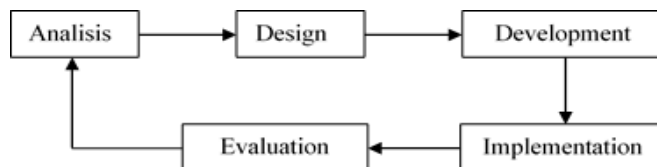

Figure 1. Steps of the ADDIE research and development model

Research is being done to build an AR-Book-based science learning media for grade III SD students that covers the water cycle. Additionally, lecturers who are authorities in their domains will test the AR-Book learning materials. In addition, there are also teachers and students as respondents regarding the AR-Book learning media developed. This trial was conducted to determine the feasibility of the learning media developed. Huang et al. (2021) states that the material feasibility assessment in the AR-Book learning tool is reviewed from the aspects of: Content Feasibility; includes suitability for competence, suitability for needs, correctness of substance and benefits; Language, including readability, clarity of information, conformity with language rules, and language effectiveness; Presentation, including the order of presentation, motivation and attractiveness, and completeness of information, and relevance to everyday life.

Meanwhile, in accordance with references from Risdianto et al. (2022), the media feasibility assessment is reviewed from the aspects of: Suitability; suitability with Core Competencies, basic competencies, learning objectives, and the level of development of students; Display; readability of writing, readability of images, quality of animation, suitability of color and typography, clarity of media content, and attractiveness of media; Presentation; the media is presented in a practical, flexible, and durable manner. Each expert provides validation or assessment of the feasibility of media and AR-Book media prototypes of the water cycle. The following are the criteria for processing data on product feasibility assessments :

Table 1. Product Feasibility Assessment Criteria

Percentage	Eligibility Criteria
85% - 100%	Very Decent
69% - 84%	Feasible
53% - 68%	Decent Enough
37% - 52%	Less Feasible
20% - 36%	Not Feasible

Result and Discussion

Using the five stages of the ADDIE research model analysis, design, development, implementation, and evaluation researchers created an AR-Book learning medium. The study's findings look at a number of topics, including as the creation of AR-Book-based science learning resources, the viability of creating AR-Book resources on the water cycle, and the outcomes of efficacy tests carried out on SDN Beringin 02 third-graders.

Results of AR-Book Based Science Learning Media Development

The first stage is the analysis stage. At this stage the researcher analyzes why a product needs to be developed at SD Negeri Beringin 02 based on several problems that occur in the field. Based on the results of observations and interviews conducted, for class III and class VI still use the 2013 curriculum, while the rest have implemented an independent curriculum. Because class III is still using the 2013 curriculum, science learning is in the content of Indonesian language lessons. So that several problems were found, namely learning media that did not support the learning process so that students paid less attention, the PBL learning model with the lecture method used by the teacher still did not attract students' attention, there was no IT-based learning media development, lack of facilities and infrastructure in displaying IT-based learning media, and the learning outcomes of Indonesian language content students were still low compared to other learning content.

Based on the results of the analysis of teacher needs through questionnaires, it shows that teachers have conducted science learning in accordance with learning objectives, material, and fun learning, but students still have difficulty in understanding the material studied, students need to have a good understanding of science learning but students' learning resources in science learning have not supported. Although the teacher has used media in learning, the learning media has not met the needs of the water cycle material. Meanwhile, the results of the analysis of student needs show that science learning is fun and so far students can understand it but some students still find science lessons difficult. Although science learning has used interesting media, students need new media to learn about the water cycle material. The second stage is the design stage. At this stage the researcher begins to design the initial framework of the product to be made by paying attention to the problems and needs found in the field at the analysis stage. In this design stage, researchers also choose software or applications that will be used to create AR-Book learning media, namely the assemblr EDU application.

With the help of the software Assemblr Edu, students may access interactive, 3D learning materials based on augmented reality covering a range of subjects from elementary school to high school (Majid et al., 2023). Researchers chose this application based on various factors including features, animations, instructions for use, and costs. This AR-Book media is a learning media used in the form of technology that acts as a realization of virtual world objects into the real world in the form of three-dimensional displays (Kamiana et al., 2019). This learning media contains class III water cycle material, which is packaged in a book display that contains a barcode of Augmented Reality media objects so that students can see objects in a three-dimensional display like the real world.

The next stage is the development stage. The product developed by researchers is AR-Book-based science learning media with Problem Based Learning model. AR-Book is a combination of ordinary books with AR technology (Lee et al., 2020). The form of Augmented Reality media development refers to the results of previous research, namely the results of Iskandar and Mayarni's research entitled "Development of Augmented Reality Media on the Introduction of Planets and Celestial Bodies for Elementary School Science Learning". So that researchers want to develop the results of the study to be more effective to be applied by elementary school students. The results of previous studies were packaged using non-print media and only printed scans of the AR barcode, while the researcher packaged the product using printed media in the form of a book in which there was already a barcode of augmented reality. In addition, the media developed by researchers has also been equipped with the syntax of the learning model applied (Mizumoto et al., 2023).

Then, for the application of making augmentd reality objects from previous studies using the Unity 3D application and making it quite difficult while researchers make augmented reality objects using the assemblr EDU application because the application has provided interesting objects in accordance with the material to be created. The comparison of products developed can be seen in the picture in table 2.

Thus, the results of the development of AR-Book-based science learning media with the Problem Based Learning model developed by researchers consist of a cover, preface, instructions for using AR-Book, table of contents, book identity, concept map, meeting material 1 and 2, Basic Competencies, indicators, learning objectives, syntax of the Problem Based Learning model, AR barcode of each material, evaluation questions, conclusions, bibliography, and author biography.

Table 2. Comparison of Augmented Reality Media Products

Product Results from Previous Research	Results of Product Development by Researchers

AR media cover

AR-Book media cover

AR media 3D object display

AR-Book media 3D object display

Feasibility Results of AR-Book Based Science Learning Media

After the product is successfully developed, the next step is to test the feasibility of the media by means of product validation. Design or product validation is carried out after making the initial product. The validation that researchers do is done with two kinds, namely design validation by media experts, and material content validation with material experts.

Stage 1 media feasibility assessment was validated by material expert lecturers, namely expert lecturers in the field of Natural Sciences (IPA). The material expert

lecturer on this water cycle AR-Book media was validated by Mrs. Aldina Eka Adriani, S.Pd., M.Pd. as a lecturer in the Department of Elementary School Teacher Education, FIPP UNNES. The material feasibility assessment uses a questionnaire assessment instrument with 13 indicator items in 3 aspects of assessment including aspects of material feasibility, aspects of material presentation, and aspects of material language. The recapitulation of the material expert's assessment of the water cycle AR-Book media is shown in table 3 as follows.

Table 3. Results of Feasibility Assessment by Material Experts

Numbering	Assessed Aspect	Total Items	Item Score	Maximum Score	Acquisition Score
1.	Aspects of material feasibility	5	4	20	18
2.	Material presentation aspect	4	4	16	14
3.	Language aspect of the material	4	4	16	15
Total Score				52	47
Percentage					90.38%
Score Category					Very Feasible

The results of the AR-Book media validation assessment by the material expert lecturer received a total score of 47 out of 52 with a percentage of 90.38% including in the "Very Feasible" classification. This shows that the water cycle AR-Book media developed is in accordance with the feasibility assessment aspects and

the material contained in this water cycle AR-Book learning media is very good so that the media can be used in research.

Stage 2 media feasibility assessment is validated by media expert lecturers, namely expert lecturers in the field of Media or Educational Technology. The media

expert lecturer on this water cycle AR-Book media was validated by Mr. Dr. Deni Setiawan, S.Sn., M.Hum. as a lecturer in the Department of Elementary School Teacher Education, FIPP UNNES. Media feasibility assessment using a questionnaire assessment instrument with 12 indicator items in 3 aspects of assessment including suitability aspects, display aspects, and presentation aspects. The results of the recapitulation of the media expert's assessment of the water cycle AR-Book media are in table 8 as follows.

Table 4. Results of Feasibility Assessment by Media Experts

Numbering	Assessed Aspect	Total Items	Item Score	Maximum Score	Acquisition Score
1.	Aspects of suitability	4	4	16	16
2	Display aspect	4	4	16	14
3	Presentation aspect	4	4	16	14
Total Score				48	44
Percentage					91.67%
Score Category					Very Feasible

The results of the AR-Book media validation assessment by media expert lecturers received a total score of 44 out of 48 with a percentage of 91.67% including in the "Very Feasible" classification. This shows that the developed water cycle AR-Book media is in accordance with the feasibility assessment aspects and AR-Book media is very adequate as a learning medium so that the media can be used in research.

Results of Testing the Effectiveness of AR-Book-Based Science Learning Media

Implementation is the fourth step. At this point, the third grade pupils at SDN Beringin 02 are taught using the augmented reality book media that has been created.

Researchers conducted small group and large group trials. The small group trial involved 6 students from class 3 of SDN Beringin 02 with 2 students each taken with high ability categories, 2 students with medium ability, 2 students with low ability in learning activities as respondents. Products that have been tested in small groups are then tested widely or in large groups. This trial involved 22 3rd grade students of SDN Beringin 02. The trial was conducted to find out the response to the product developed. From the response questionnaire data obtained from small group and large group trials in class 3 SD Negeri Beringin 02 can be seen from table 5.

The data obtained by researchers are in the form of pretest and posttest results. Both results were analyzed and tested first with a normality test. The response analysis assessment of the water cycle AR-Book media was carried out by third grade elementary school students and teachers in small groups. In the teacher's response, 10 statements were presented. A total of 6 statements received a score of 5 and the remaining 4 statements received a score of 4. The total percentage of the assessment conducted by the teacher on the water cycle AR-Book media is 92% so that it gets a very feasible category. In the student response questionnaire there are 13 statements presented. Of the 13 statements, 5 statements got the lowest percentage of 83.3%, while the remaining 8 statements got a percentage of 100%. The average percentage of student assessment of the water cycle AR-Book media in the small-scale trial is 93.5% so that it gets a very feasible category.

Table 5. Test Assessment Results Before and After Product Use

Numbering	Test Subject	Pre-Test	Post-Test
1.	Small group trial	54	81.30
2.	Large group trial	50.27	79.18

Next is the normality test. The purpose of conducting a normality test on the pretest and postest results of third grade students of SDN Beringin 02 is to determine whether the data is normally distributed or not normally distributed. In this study, researchers tested the normality of the pretest and posttest results of small groups and large groups. To measure the data normality test, researchers were assisted by SPSS 22 software with the results in table 6 and table 7 as follows.

Table 6. Normality Test Results on Small Group Trials

						Tests of Normality
	Kolmogorov-Smirnov[a]					Shapiro-Wil
	Statistic	df	Sig.	Statistic	df	Sig.
Pretest	.163	6	.200*	.981	6	.958
Postest	.113	6	.200*	.999	6	1.00

*. This is a lower bound of the true significance.
a. Lilliefors Significance Correction

Table 7. Normality Test Results on Large Group Trials

	Kolmogorov-Smirnov[a]			Tests of Normality Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Pretest	.168	22	.110	.963	22	.542
Posttest	.186	22	.047	.955	22	.388

a. Lilliefors Significance Correction

After being tested using SPSS, it can be seen in the normality test table in each group there are two types of normality. Because the sample used by researchers is less than 50, in this case only the Shapiro-Wilk normality test is used by researchers. Based on the results of the small group normality test in table 6, the Shapiro-Wilk column shows the results for the pretest obtained a significance value (Sig.) of 0.958 and for the posttest obtained a significance value (Sig.) of 1.00. Data can be said to be normally distributed if the significance value obtained is more than 0.05. Based on the data that has been obtained, it can be concluded that the data from the small group pretest and posttest results are normally distributed. While the results of the large group normality test in table 7, in the Shapiro-Wilk column show the results for the pretest obtained a significance value (Sig.) of 0.542 and for the postest obtained a significance value (Sig.) of 0.388. Data can be said to be normally distributed if the significance value obtained is more than 0.05. Based on the data that has been obtained, it can be concluded that the data from the pretest and posttest results of the large group are also normally distributed.

The next test is the Paired Sample t-test Pretest and Postest. The pretest and posttest average difference test was conducted with the aim of testing the hypothesis of using AR-Book media to improve the learning outcomes of third grade students of SDN Beringin 02. The effectiveness of using AR-Book media can be seen from the significant average difference between the initial knowledge score before using the water cycle AR-Book media (pretest score) and the knowledge score after using the water cycle AR-Book media (posttest score). The calculation of this average difference uses the paired sample t-test formula. The following are the results of the paired sample t-test test that has been carried out.

Table 8. Small Group Paired Sample t-Test Results

				Paired Sample Test				
				Paired Differences				
				95% Confidence Interval of the Difference				
	Mean	Std. Deviation	Std. Error Mean	Lower	Upper	t	df	Sig. (2-tailed)
Pair 1 Pretest - Postest	-28.90	10.33	2.20	-33.486	-24.332	-13.13	21	.000

Table 9. Large Group Paired Sample t-Test Results

				Paired Sample Test				
				Paired Differences				
				95% Confidence Interval of the Difference				
	Mean	Std. Deviation	Std. Error Mean	Lower	Upper	t	df	Sig. (2-tailed)
Pair 1 Pretest - Postest	-27.333	5.785	2.36	-33.40	-21.26	-11.57	5	.000

Table 8's small group paired sample t-test findings indicate a Sig. (2-tailed) of 0.000 ≤ 0.05. There is a significant difference between the learning outcomes in the pretest and posttest data if the value of Sig. (2-tailed) ≤ 0.05. In contrast, there is no significant difference between the learning outcomes in the pretest and posttest data if the Sig. (2-tailed) > 0.05. Thus, it can be said that the pretest and posttest results from the small group trial show a substantial change in the learning outcomes of the water cycle.

Table 9 displays the results of the large group paired sample t-test, which yielded a 2-tailed Sig value of 0.000 ≤ 0.05. There is a significant difference between the learning outcomes in the pretest and posttest data if the value of Sig. (2-tailed) ≤ 0.05. In contrast, there is no significant difference between the learning outcomes in the pretest and posttest data if the Sig. (2-tailed) > 0.05. Thus, it can be said that the pretest and posttest results from the large group trial show a substantial change in the learning outcomes of the water cycle.

To determine the increase in water cycle learning outcomes after using AR-Book media, researchers used the N-gain test. The values that have been obtained from the pretest and posttest results are data that will be analyzed using the N-gain formula, to determine the average increase in student learning outcomes. The difference between the maximum and pretest scores and the difference between the pretest and posttest scores yields the N-gain test. Tables 10 and 11 below display the N-gain test findings.

Table 10. Small Group N-gain Test Results

				Descriptive Statistics	
	N	Minimum	Maximum	Mean	Std. Deviation
ngain_skor	6	1	1	.61	.064
ngain_persen	6	53	71	60.98	6.41
Valid N (listwise)	6				

Table 11. Large Group N-gain Test Results

				Descriptive Statistics	
	N	Minimum	Maximum	Mean	Std. Deviation
ngain_skor	22	.27	.87	.5830	.17604
ngain_persen	22	27.03	86.67	58.2955	17.60412
Valid N (listwise)	22				

Based on the results of the small group n-gain test in table 10, it was found that by using AR-Book media for the water cycle in class III students of SDN Beringin 02 with a total of 6 students, there was an increase in learning outcomes of 0.61 with a moderate category. With the difference between the average posttest score and the average pretest score of the small group is 27.20.

Based on the results of the large group n-gain test in table 11, the results show that by using the AR-Book media for the water cycle in grade III students of SDN Beringin 02 with a total of 22 students, there is an increase in learning outcomes of 0.58 with a moderate category. With the difference between the average posttest score and the average pretest score of the large group is 17.

Evaluation is the sixth step. The viability of the developed media is assessed in this examination. To ascertain and quantify the viability of learning media, a development evaluation was conducted by lecturers with expertise in both materials and media. SDN Beringin 02, produces, distributes, and utilizes the development's outcomes.

Discussion
Development of Augmented Reality Learning Media Book
Researchers created AR-Book-based science learning materials using a problem-based learning

approach. An AR-Book combines traditional books with augmented reality technology (Lee et al., 2020; Tomi et al., 2013). Researchers developed AR-Book learning media using the Assemblr EDU application. The relatively simple Assemblr Edu program can offer more efficient learning chances with capabilities that are comprehensive enough to learn (Efendi et al., 2023). Using the Problem Based Learning learning approach will improve the effectiveness of AR-Book media application in the classroom. Students can learn by solving real-world contextual problems through the use of problem-based learning (PBL). According to study findings, sixth-grade students' HOTS on electrical circuit content are positively impacted by the Problem-Based Learning (PBL) learning paradigm with the help of PhET Simulation.

The form of Augmented Reality media development refers to the results of previous research, namely the results of Iskandar and Mayarni's research entitled "Development of Augmented Reality Media on the Introduction of Planets and Celestial Bodies for Elementary School Science Learning" (Iskandar et al., 2022). So that researchers want to develop the results of these studies to be more effective to be applied by elementary school students. Thus, the results of the development of AR-Book-based science learning media with the Problem Based Learning model developed by researchers consist of a cover, preface, instructions for using AR-Book, table of contents, book identity, concept map, meeting material 1 and 2, Basic Competencies, indicators, learning objectives, syntax of the Problem Based Learning model, AR barcode of each material, evaluation questions, conclusions, bibliography, and author biography.

Water cycle AR-Book media has several advantages, including making students more interested in learning or motivating students to learn about the water cycle. The water cycle AR-Book media can also be used by students without teacher assistance because it is designed to stimulate students' curiosity. In addition, the water cycle AR-Book media is also quite effective as a supporting medium for water cycle learning. In the water cycle AR-Book media, there is a barcode scan from assemblr EDU so that students can see objects in 3-dimensional form and students can feel the real sensation of the media. Another advantage is that the water cycle AR-Book media contains interestingly designed material, student activities, practice questions, and evaluation questions for students to measure their ability or understanding of the material after reading the material in the water cycle AR-Book media.

Besides having advantages, the water cycle AR-Book media also has disadvantages. Among them is the water cycle AR-Book media for accessing 3-dimensional objects must use a stable internet network. The login and

installation process also takes a long time so that the teacher must also be able to conducive students, the majority of whom have impatient characters. Another drawback is that the three-dimensional object for the display of the description of the material cannot be edited to be larger and more legible so that the operation must be zoomed first. Although using ivory paper type if not stored properly or exposed to water then the media can be damaged.

Feasibility of Learning Media Augmented Reality Book

Based on the results of research conducted by Listiyani et al. (2021), an average percentage of 78% was acquired from media experts during the feasibility test of augmented reality flashcard media, indicating good credentials. Meanwhile, the results of the feasibility assessment from media experts developed by researchers received a very feasible category with a percentage of 91.67%. This shows that the developed water cycle AR-Book media is in accordance with the feasibility assessment aspects and AR-Book media is very adequate as a learning medium so that the media can be used in research. This is consistent with the claim that educational media can improve students' learning processes, which should raise the quality of learning results attained (Khasanah et al., 2022). The results of the feasibility assessment of the material experts developed by the researchers received a very feasible category with a percentage of 90.38%. This shows that the water cycle AR-Book media developed is in accordance with the feasibility assessment aspects and AR-Book media is very adequate as a learning medium so that the media can be used in research. The findings of previous studies, which indicate that choosing the content to be included in learning media is one of the processes that need to be taken into consideration when creating learning media, support this (Mustaqim, 2017).

Effectiveness of AR-Book Media in Improving Learning Outcomes of Third Grade Students of SDN Beringin 02

In order for the selected learning media to be appropriate, there are several factors that are considered in the selection of learning media. The factors in question include: objectivity, effectiveness, and efficiency of using learning media (Mardhiah et al., 2018). The use of learning media is effective in improving a learning process and results (Muhamad et al., 2023). One of the media innovations that can be used in the process of teaching and learning activities is augmented reality-based media. AR media can increase student learning motivation so that student learning outcomes increase. Iskandar and Mayarni in their research (Maleke et al., 2018) stated that "Augmented Reality Media on the introduction of planets and celestial bodies of science learning obtained results from both group tests by

getting an average score of 95.50% with the category 'Very Good' or media feasible and suitable for use". Other research results state "there is a significant difference between before and after using AR media. In other words, students understand the material more easily after being treated with AR media on the concept of eye optics." (Widiasih, Zakirman, Ekawati, et al., 2023).

In the small group test, the average student pretest score was 54 and the average student posttest score was 81.3.After using AR-Book media using the Problem Based Learning (PBL) model, there was an increase of 61%.At first, there were 5 students who did not meet the minimum completeness criteria, after using AR-Book media using the Problem Based Learning (PBL) model, there were no students who scored below the KKM (70). In connection with the results of data processing with the N-gain test of small-scale product trials, the results showed that by using AR-Book media for the water cycle in class III students of SDN Beringin 02 with a total of 6 students increased learning outcomes by 0.61 or can be interpreted as moderate.

In the large group test, the average student pretest results were 54 and the average student posttest results were 50.27. After using AR-Book media using the Problem Based Learning (PBL) model, there was an increase of 58%.At first, there were 21 students who did not meet the minimum completeness criteria, after using AR-Book media using the Problem Based Learning (PBL) model, the number of students who were not complete decreased to 9 students.In connection with the results of data processing with the N-gain test of large-scale product trials, the results showed that by using the AR-Book media for the water cycle in third grade students of SDN Beringin 02 with a total of 22 students increased learning outcomes by 0.58 or can be interpreted as moderate.

Based on the explanation above, it can be concluded that AR-Book-based science learning media using the cc (Kustyarini et al., 2020), that the creative use of learning media can increase the effectiveness and efficiency of learning so that learning objectives can be achieved.

Conclusion

The results obtained show that AR-Book learning media received very feasible qualifications from material experts and media experts, from teachers (practitioners) and students. In addition, the results of data analysis show that AR-Book learning media can improve student learning outcomes. It is concluded that AR-Book-based science learning media has a good impact on the learning process in the classroom regarding water cycle material. With this media, it can increase students' understanding of the process of rain

or the water cycle, not only that it can improve student learning outcomes much better in class III SDN Beringin 02.

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Author Contributions

Conceptualization, methodology, validation, formal analysis, investigation, .resources; S.; data curation, writing—original draft preparation, writing—review and editing, visualization, I. A. All authors have read and agreed to the published version of the manuscript.

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Conflicts of Interest

No conflict interest.

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