

## Development of Water Pop-Up Book Media with a Scientific Approach: Efforts to Increase Elementary Students' Scientific Literacy

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### Abstract

This research develops the water pop-up book media with a scientific approach. The purposes of this study were to describe the development of the water pop-up book media and to test the effectiveness of the media in increasing scientific literacy. The research method used was 4D research and development with the Define, Design, Development, and Dissemination stages. Limited trial subjects consisted of 20 students, and product trials consisted of 60 students. The results of the study showed that the media based on the feasibility assessment by experts and the readability test were included in the excellent category. The use of Pop-Up Book media is effective. This can be seen from the results of learning by using literacy-based questions in the pretest and posttest, which got an average difference of 16.08. The results of the t-test obtained an average increase of 0.448, which were included in the medium criteria, so the pop-up book media with a scientific approach was very valid and effective when used in learning.

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## INTRODUCTION

Science in education must continue to develop along with curriculum updates and learning tools. Development is a field of educational technology that is carried out to solve learning problems related to needs analysis findings. The use of technology is primarily intended to facilitate work in one's daily life (Junaidi, 2019).

Learning was a transfer of knowledge to students which aims to increase knowledge and improve student behavior (Ananda, 2019). Changes in experience can be in the form of knowledge, understanding, attitudes, and skills obtained directly from experience. While learning is the effort of each individual to change behavior in the form of knowledge, skills, and positive attitudes and values. The Implementation of classroom learning is a process of interaction between teachers and students (Jinhui & Yu, 2022). In the process of this interaction, students will experience change if they want to learn to change themselves for the better.

Use of exciting and interactive learning media will help students understand learning well so that students experience meaningful learning (Bina et al., 2021). Ramadhani et al. (2021) also added that a teacher's lack of self-confidence also causes the teacher's unskilled use of technology. Learning objectives will be achieved if the teacher can confidently use learning media.

To achieve a process that was suitable to learning objectives, learning media can assist teachers in delivering material (Pusparani, 2017). Learning media can be used in the teaching and learning process to convey messages or information to attract students' attention and interest in learning. Besides helping to improve the delivery of information to students, learning media can also make the teaching and learning process more enjoyable.

Learning media was a medium capable of displaying events that occur over a long time and can be presented quickly. In the use of learning media, it was hoped that it can provide

more concrete learning experiences for students, and can increase student activity in learning, for example, namely interactive computer learning media (Candra, 2020)

Learning media is essential for the teacher to pay attention to if you want maximum learning results. Educational media includes tools used to physically transmit the contents of educational material, such as tapes, books, camcorders, VCRs, pictures or photos, documentaries or general films, graphics, television, and computers (Novita et al., 2019).

An example if proper use of media based on student characteristics, is the use of media to increase student literacy, useful Pop Up Book media. The accuracy of the media used will determine the success of learning.

According to Sri (2017) a pop-up book is a book that, when opened, has an interesting spatial effect and visualizes the story in such a way that it can be extended into several parts. Pop-up books are considered attractive to students because they can present visuals by folding, moving, and forming to surprise and amaze students when they open each page (Masturah et al., 2017).

Umm, et al. (2019) said that the advantage of pop-up books is the development of innovative learning, thereby increasing teacher creativity and becoming an effective learning environment. In addition, the advantages of pop-up books as a learning environment are (1) a sense of responsibility for the books given, encouraging students to care for and appreciate the books they have; (2) developing students' imagination; (3) developing students' creative power; (4) providing accurate shape recognition information interactively; (5) fostering students' interest in reading from an early age.

Based on this, learning by using pop-up books gives a whole meaning to students, as reflected in the various themes available in engaging learning media, wrapped in thematic learning. Thematic learning combines several learning materials with several learning materials into one, then packaged into a theme. Several subjects are applied to combine

overlapping concepts, attitudes, and skills that merge into one (Ermayani et al., 2022).

In thematic learning, there are principles of implementing learning, namely the teacher's skills as a class manager, both individually and in groups, so that the learning atmosphere can be conducive so that the learning process in class runs smoothly.

Thematic learning also used a scientific approach which can also be called a scientific approach, in which the meaning of basic concepts that inspire or underlie the design of teaching methods apply scientific or real nature (Kerti, 2018). The scientific approach was part of the pedagogical approach to implementing learning. With this approach, learning will be fun.

The scientific approach is student-centered learning, not the teacher one. The teacher is only a facilitator. The scientific approach contains a learning process designed, so students experience active learning through stages.

The implementation of this scientific approach will touch on three main domains, namely cognitive (knowledge), affective (attitude), and psychomotor (skills) (Wanojaleni, 2021). With this learning, the learning outcomes will produce creative and innovative students and strengthen integrated attitudes, skills, and knowledge.

Before carrying out the teaching and learning activities that the teacher will deliver, the teacher should give directions to students to carry out literacy, as stated in the government's literacy program (Maghfiroh et al., 2021). So that when learning takes place, students will understand what will be learned, and there is a question-and-answer process in the activity.

Literacy includes the cognitive (knowledge) and psychomotor (skills) that students need to acquire, understand, analyze, evaluate information, express thoughts, and feelings, generate ideas and opinions, build relationships with others and interact with school and extracurricular activities. Heru and Yuliani (2020) also put forward another opinion regarding the term literacy in the context of the

school literacy movement, namely the ability to access, use, and understand something intelligently through various activities, including seeing, listening, reading, writing, and speaking.

In the process of self-learning, literacy is usually carried out before learning. The teacher gives time for students to read books for 15 minutes to read the reading books brought by students. Then the teacher gives a picture that stimulates students' knowledge to make a piece of writing, from which the writing will be posted on the GELIS (School Literacy Movement) tree. Therefore, this literacy is critical when applied.

Literacy itself is not only for students at school but is helpful for society. In its implementation, literacy can be carried out at school, in the family environment, or even more broadly, in the community. So this literacy is suitable if done.

Observation activities had been carried out in two elementary schools, SD Negeri 1 Kecomberan and SDIT Akmal Sabila. In this observation activity on finding data on learning Theme 8, Our Friendly Environment, the teacher only used media pictures and science kits. However, the available pictures and learning media kits must match the material, including old kits in poor condition. So the available media is not appropriate to the curriculum applied by the school, and the media images were appropriate but did not attract students' attention.

Then the Class V students were given a survey in the form of a questionnaire to prove that they needed alternative media that were interesting and relevant to students' needs. The questionnaire results showed that students were interested when learning and used engaging media that made it easier to understand the material.

Based on these problems, developing an image media that can convey the material well is necessary. The media concept to be developed is Pop Up Book media on Water with a Scientific Approach. This Pop-Up Book media has the advantage of doing activities such as opening, folding, and shifting parts of the pop-up book and playing with students' fine motor skills so

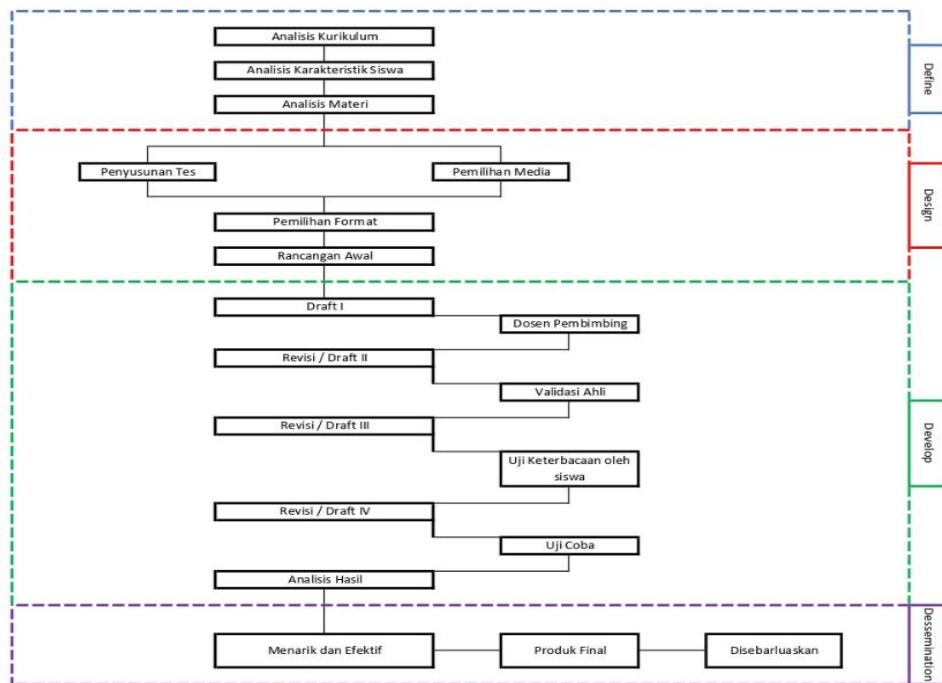
that it can be a memorable experience for students. This activity will give an impression to students that the material is easy to digest in memory when using it. According to Safri et al. (2017), pop-up books are books with moving parts or 3-dimensional elements and provide visualization of exciting stories, starting from displaying images that can move when the page is opened.

Based on the description above, a research on the Development of Water Pop Up Book Media with a Scientific Approach to Increase Elementary School Students' Scientific Literacy was carried out. The purposes of this research were to describes the development of the water pop-up book media and to test the effectiveness of the media in increasing scientific literacy.

This research helped increase knowledge about the development of learning practices in Theme 8, Our Friend's Environment, which focuses on learning resources that support the learning process.

**METHOD**

The research method used was the research and development method. Every research and development activity must have stages that must be carried out. The research process used the stages of the 4D development model (Amali et al., 2019). The development of Pop Up Book Media in this study has the steps shown in Figure 1.



**Figure 1.** Research and Development Procedures

The development research procedure was seen from the 4D steps. Define contained the determination of a media product to be developed, along with its specifications. Design contained the product design that has been determined; this was adjusted to some of the analysis results from the previous stage. In The development, including an initial draft of was designed the pop-up book media. As attractive

as possible to motivate students to read and study it. Dissemination was the final stage, in which the finished media was disseminated and implemented to measure student learning development (Arifin, 2022).

The data types used in this study were qualitative and quantitative, the purpose and function of which determine the type of research to measure the level of validity, effectiveness,

and student response, so that this research and development product can be categorized as a good product (Widiyana et al., 2019). The qualitative data were obtained from input and suggestions from several experts who were analyzed, in addition to describing the data in the form of specific spoken or written words. Meanwhile, quantitative data was obtained from expert validation, readability, tests, and results of student questionnaires through trials conducted, which qualitative data would later analyze.

This study's data sources were teachers and fifth-grade students at SDIT Akmala Sabila Cirebon and SD Negeri 1 Kecomberan, expert validation, and researchers. The aim is to determine the need for media development, the feasibility of the media, and the effectiveness of the pop-up book media in learning Theme 8.

The test subjects were divided into two, namely, the product validity test subjects and the target trial subjects. The subject of product validity trials can be seen from expert validation and media readability trials conducted at Kecomberan 1 Public Elementary School. As for the subject of product trials, the effectiveness of the media used in the learning process can be seen from the process and learning outcomes. The trial design used in this study was One Group pretest and posttest. One group pretest-

posttest is designed to consist of one predetermined group. This design was also tested twice, namely before the researcher gave the treatment, commonly called the pretest, and after the treatment was called the posttest. The trial design pattern can be seen in Table 1 as follows:

**Table 1.** Trial Design

Pre-test	Treat	Post-test
O <sub>1</sub>	X	O <sub>2</sub>

This test design was carried out twice before and after being given treatment. The test conducted before getting the treatment is called the pretest (O<sub>1</sub>). After the pretest was carried out, the writer gave treatment in the form of learning on theme 8 using learning media (X). In the final stage, he gave post-test questions (O<sub>2</sub>).

Yuana and Aminy (2019) argue that data collection was an essential and most important job in research. In this development research, there were data collection techniques, namely interviews, expert validation questionnaires (media experts, linguists, media experts, and student response questionnaires), teacher and student observation sheets, documentation, and learning achievement tests.

## RESULTS AND DISCUSSION

The discussion on the results of the development research conducted by the researcher is in the form of the pop-up book media. The pop-up book media was developed because teachers still needed companion books as learning media and limited learning support books.

Pop-up book media was developed using a 4D development model. This 4D model is a development model that can be used to develop learning tools, including teaching materials (Kurniawan & Dewi, 2017).

The primary consideration for selecting the 4D model is that each step of the development procedure is explained in detail,

what the researcher will do when developing a product in the form of teaching materials, books, or other teaching materials.

There are three stages at the definition stage (define): curriculum analysis, student characteristics analysis, and Material Analysis (Sari & Wardani, 2021). On curriculum analysis, it can be seen that SDIT Akmala Sabila Cirebon and SD Negeri 1 Kecomberan use the 2013 curriculum. Analysis of student characteristics in developing student competencies in learning Theme 8 students are more pleased with the material presented with exciting pictures such as pop-up book media. Students are more motivated by learning to use the water pop-up book media. Material analysis was carried out to determine relevant material in media

development, such as this media taking the theme of Water by KD IPA 3.8 Indonesian Language 3.8 PPKn 3.3 and SBdP 4.3, which both discuss Water.

At the design stage, this was done by designing media components in class V Theme 8, Our Friend's Environment. The design stages were described, namely, (1) Preparation of the criteria test, which is necessary because it compiles the test format used as an evaluation tool for the media, (2) selection of instructional media to determine what media are by the characteristics of students, (3) format selection determines the format of the learning device that is the media being developed, and (4) initial design, namely the initial activity of making media.

The process of making the pop-up book media includes, (1) determining KI and KD as well as learning indicators that are appropriate to the media, (2) collecting various information related to the material to be discussed, namely material about Water, (3) searching for pictures and other references to support the material, (4) making an initial design regarding were to write the material and the layout of the image to be used through Coral Draw X7, (5) making an attractive background so that the media looks better, (6) designing media which contains information and train students' motor skills, (7) after that, designing the contents, front cover

and back cover with exciting color variations and images, and (8) saving and printing them to be used as initial drafts.

The pop-up book media will look more attractive because it combines text and images, in which there is a barcode scanner that can be scanned and will display a video explaining the page; this can be seen in Figure 2. This media was designed using the Coral application draw X7 to highlight good colors and pictures. When transferring knowledge, students can master the content of the material and motivate students to learn. The media specifications can be seen in Table 2.



Figure 2. Media Pop Up Book

Table 2. Media Specifications

Format	Information
Form	Media Pop Up Book
Paper Type	doff laminated Ivory 260 paper, Corel X7 layout
Size	19 x 23.5 cm
Margins	1.5 cm
Font Type	Contents use century gothic and chapter titles use best in class
Number of Pages	23 Pages (cover, contents, and back cover)

The next stage is the development stage. Suppose the media has been designed and printed. In that case, the next step is to carry out the validation stage of assessing the feasibility of

the media by experts consisting of media experts, linguists, and material experts. The validators assessed the media designs made and then be assessed by media experts. The coverage

of the content of the material by material experts, as well as the language used in the media, were assessed by linguists. Media assessment and expert advice was used to improve the media so that the media is said to be suitable for use. After implementing improvements according to the results of the assessment and input from media experts, a small-scale trial will be carried out on the student readability test.

Then a team of media experts, linguists, and material experts carried out the media evaluation validation stage. The validator evaluated the media design, which is evaluated directly by the media expert, the coverage of the material by the material expert, and the linguist evaluated the language used in the media. The results of the media evaluation and suggestions from the expert group were then used to improve the media. After making the necessary improvements based on the evaluation results and suggestions from a group of media experts, they conducted a small-scale test, namely the student readability test. Each expert consisted of

3 validators, such as media validation consists of 3 validators, material validation consists of 3 validators, and language validation consists of 3 validators, so the total number consists of 9 expert validators.

This student readability test aimed to see how far students understand the questions with the gap test. This readability test involved 20 students from class V SD Negeri 1 Kecomberan as respondents. After all the results have been found and processed, the next step is to conduct product trials at SDIT Akmalia Sabila Cirebon.

This product trial aimed to determine the effectiveness of the media in learning with the one-group pretest-posttest model that is applied. Based on the experimental results, researchers measure student learning outcomes on the pre-test and post-test and compare them in such a way as to determine the effectiveness of the media. The trial of this product was carried out at SDIT Akmalia Sabila with 60 students as test subjects. The results of the media eligibility were obtained from the results of the expert validation assessment as shown in Table 3.

**Table 3.** Assessment Results by Pop Up Book Validation

Validators	Percentage
Media	98%
Theory	93%
Language	93%
Validation Average	94%
Category	Perfect

Based on table 3 will be explained as follows. The results of media experts' research were conducted to test the feasibility of presenting water's pop-up book media. There are three indicators, namely, aspects of physical attractiveness, aspects of appearance, and aspects of media content design. The overall validation results of three media experts get a total score of 294 with a percentage of 98%, which is classified as a very valid criterion. With some input and suggestions from media experts, such as pictures taken from the Internet, it is better to write down the source or link so that the researcher adds several aspects to the media being developed.

The results of the assessment by material experts get a total score of 280 with a percentage of 93%, which is included in the very valid criteria. There are three assessment indicators: content quality, implementation, and visual appearance. The assessment results by language experts obtained a score of from three language experts 277 with a percentage of 93%, which is included in the very valid criteria. The language assessment indicators cover six aspects: straightforward, communicative, diagnostic, and interactive, conformity with student development, Indonesian language rules, and use of terms, symbols, or icons—some input

from language experts, such as adding projects related to the material taken.

Based on the percentage obtained from the validity test of the pop-up book media from the three experts, 94%, if converted to the existing criteria, the pop-up book media is said to be very valid and can be used.

Media feasibility can also be seen in the student readability test. Readability test to determine the overall level of students' readability regardless of capacity or cognitive ability. The subject of this readability test was selected from 20 students of class V SD Negeri 1 Kecomberan. The selection of 20 subjects was based on high, medium, and low abilities. This is done to know the legibility level validly for all student abilities because it is intended for students regardless of cognitive capacity or ability.

This readability test uses a type of gap test. The gap test itself is included in the cloze test technique. The Cloze Test technique is a reading practice technique given to students. Students

are told to read the paragraph, after which they are given the exact text again, but certain words or keywords are omitted and replaced with lines. In this legibility test activity, students are given media and asked to read one discourse in about 15 minutes; then, students are given a gap test sheet, with students filling in sentences with words or fields that match the blank parts of the text. Checking this readability test uses matching answers, meaning the student's answers are adjusted to the words in the water pop-up book media. Furthermore, the readability test results were compared with the answer keys and scoring guidelines that had been prepared previously.

The readability test results were used to measure the validity of the fifth-grade students. The researcher could continue with the product trial activities if the readability test results were valid. The results of the readability test can be seen in Table 4 as follows.

**Table 4.** Recapitulation of Readability Test Results

Number	Score	Percentage
1	17	85%
2	17	85%
3	17	85%
4	17	85%
5	18	90%
6	18	90%
7	18	90%
8	18	90%
9	18	90%
10	18	90%
11	18	90%
12	18	90%
13	18	90%
14	18	90%
15	18	90%
16	19	95%
17	20	100%
18	20	100%
19	20	100%
20	20	100%
Average		90%
Criteria		Perfect



Based on the average readability test percentage results, as shown in Table 4, which 20 students conducted, the average percentage was 90%. The readability level of water's pop-up book media is in the high category because the reader understands the content of the reading. The results of the average percentage can also be concluded that the readability test on water's pop-up book media can be very valid.

So the results of the feasibility research on the product development of the water pop-up book media, reviewed from expert validation, are included in the perfect category. Regarding the readability test, they are included in the perfect category, so it can be concluded that the media is feasible to use.

After carrying out the media feasibility test with expert validation values and readability tests, proceed to the product test stage, which was carried out at SDIT Akmala Sabila Cirebon

with 60 students as research subjects. In the product trial, the researcher obtained pretest and posttest data for normality, N-gain, homogeneity, and t-tests to answer the research hypothesis and student responses to the water pop-up book media.

Before carrying out the product trial, the researcher gave pretest questions to students first, so they could find out to what extent they answered the questions correctly. After the pretest results are obtained, the researcher will provide treatment and explain the material and overall guidance according to the learning device. Furthermore, the researcher gave posttest questions after giving treatment to students to measure the extent to which students knew the material the teacher had explained. The learning outcomes from the pretest and posttest scores can be seen in Table 5 below.

**Table 5.** Recapitulation of Student Learning Outcomes

Activity	Average	Number of Completed students	Total Students	Mastery Learning
Pre-test	64,17	18	60	30%
Post-test	80,25	50	60	83%
Average Difference	16,08			

Table 5 shows students' learning outcomes in class V SDIT Akmala Sabila Cirebon; when the pre-test and post-test questions were filled with types of literacy questions, the pre-test average was 64.17, and the post-test average was 80.25. Therefore, the average difference value is 16.08. As many as 18 out of 60 students experienced an increase in their learning ability when taking the pre-test with a percentage of 30%, and several 50 students out of 60 students experienced an increase in learning completeness when working on the post-test questions, with a percentage of 83%. The data shows that the learning material on the water in Theme 8 at SDIT Akmala Sabila Cirebon on the type of literacy questions has changed after and before applying the water pop-up book media.

Furthermore, in analyzing the data that will be used after the pre-test and post-test results

are obtained, a normality test will be carried out using the Shapiro-Wilk test formula in the calculations. In calculating the hypothesis,  $H_0$  is accepted if  $\text{sig} > 0.050$ , so the data is said to be normally distributed. At the same time,  $H_0$  is rejected if  $\text{sig} < 0.050$ , so the data is said to be not normally distributed.

The significance of the values in the Shapiro-Wilk table shows  $\text{sig} > 0.050$  for both the pre-test and post-test values. The pre-test results showed a sig value of 0.077, and the post-test value showed a sig value of 0.053. So the data is known to have a normal distribution of pre-test and post-test results, so the statistics used are parametric.

If the pre-test and post-test values are known, then the next research step is to test the difference between the means by conducting a two-tailed t-test (paired-sample t-test). The effectiveness of the Water pop-up book media in

the water cycle material and its benefits can be seen by the average pre-test and post-test scores. It is obtained sig from the calculation of the t-test with the paired sample t-test on the SPSS 26 application. Sig (2tailed)), which is 0.000. From these results, sig. (2tailed) <0.05, there is a significant difference between the pre-test and post-test scores as learning outcomes.

Conversely, if sig. (2tailed) > 0.05, there is no significant difference between the pre-test and post-test results. It can be seen from the results of

the t-test that the value of sig. (2tailed) <0.05 can be concluded that there is a significant difference between the values of the pre-test and post-test results.

After completing the t-test, the researcher conducted the N-Gain test to determine whether the average value had increased. The N-Gain shows an increase in the average student learning outcomes on water and its use after using the pop-up book media. Water is listed in Table 6 below.

**Table 6.** Average Increase Test Results (N-Gain)

Category	Score
Pret-est	64.17
Post-test	80.25
Average Difference	16.08
N-Gain Class	0.448
Category	Medium

Based on the N-Gain test in table 6, it can be seen that there has been an increase of 0.448, where the average difference is 16.08, which is included in the medium category. Based on the N-gain results on the results of student strokes, the effectiveness of the Water pop-up book media in water cycle material and its benefits can be used as the right media solution for teachers to convey material to students.

Regarding empirical studies, this research is supported by other research by Dewanti et al. (2018) revealed that the results of the students' pre-test and post-test showed a difference in the average scores before and after using the media, namely 55.625 and 82.5. From the results of the students' pre-test and post-test, an average increase in the quality of the final results was obtained by 26.875%, which means that the media is effective for students because it is seen in student learning outcomes. Using the KKM 70 reference, 13 students did not complete the pre-test, while in the post-test, no students did. This shows that this Pop-Up Book media helps students understand the material where I live.

Then in the research conducted by Khoiriyah and Sari (2018) that the effectiveness of the Pop-Up Book media was obtained through the results of individual students'

written tests for Science subjects at SDN 3 Junjung with a KKM score of 75. The data obtained in this study had an average score out of 28 students at SDN 3 Junjung, which was 95.3. So the use of Pop-Up Book media that has been developed is also effective for student learning outcomes. Therefore, applying Pop-Up Book learning media can make student learning outcomes effective.

Research conducted by Widyasari and Putri (2019) indicates that the average student learning outcomes after using Palembang culture-based Scrapbook media obtain an average value of 11.06 on a small scale, while the average on a large scale is 11.16. Based on the average N-Gain score, the media is effectively used in learning.

As quoted by Aqib (2018: 49), Edgar Dale's conical description of the theoretical basis of media use explains that direct experience will give the impression that students will get the whole, not a different and more significant idea and the information contained therein, which which is an experience that engages all of his senses. The Water pop-up book media provides students with direct experience with water circulation material and its benefits. In this way, students can understand the content of the

material being taught and how it affects learning outcomes.

The final stage in the 4D research and development design is dissemination. The activity promotes the pop-up book media so that users accept it, both individuals and a group (Herdiati, 2021). The researcher conducted limited dissemination by introducing and giving the pop-up book media to students and schools in the Talun sub-district, according to the KKG. According to Ibnu and Sutrusno (2020) who said that at this dissemination stage, in the context of developing teaching materials such as the pop-up book media through distribution in limited quantities. This distribution was carried out to obtain a response or feedback on the pop-up book media that had been developed.

## CONCLUSION

Based on the results of research on developing water pop-up book media with a scientific approach, it can be concluded that using the 4D development model with the stages of define, design, development, and dissemination. This media is also different from other media where a barcode scanner can be scanned and displays an explanatory video. Pop Up Book Media which was developed based on the feasibility assessment by experts obtained an average percentage value of 94%, included in the perfect category, and in terms of user validation (readability test), obtained an average percentage value of 90%, included in the same category valid. The results of learning to use literacy questions on the pre-test and post-test, with an average difference of 16.08. The results of these values are then tested for the average difference by calculating the t-test giving an average increase of 0.448, which is included in the medium criteria.

skill indicators after being the intervention is in the Excellent Development (BSB)category

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