Jurnal Pijar MIPA
https://jurnalfkip.unram.ac.id/index.php/JPM

ISSN 1907-1744 (Print)
ISSN 2460-1500 (Online)

Development of SIAIR Interactive Media Assisted with Songs to Improve Learning Outcomes on Water Cycle Material in Elementary School

Yulina Sri Rahayu*, Putri Yanuarita Sutikno

Elementary School Teacher Education, Faculty of Education and Psychology, Universitas Negeri Semarang, Semarang, Indonesia
*e-mail: yulinasrirahayu@students.unnes.ac.id

Received: May 23, 2025. Accepted: June 9, 2025. Published: June 29, 2025

Abstract: Students' understanding of the water cycle material is still relatively low, which is caused by the limited learning media used. This has an impact on the low learning outcomes of students. This study aims to develop interactive media SIAIR assisted by songs to improve student learning outcomes on water cycle material. The novelty of this media lies in the integration of songs with various interactive digital media components, such as text, animated videos, simulation games, and digital comics, which are adapted to the thinking ability of elementary school students. This research uses the R&D method with the ADDIE model, which includes analysis, design, development, implementation, and evaluation. The research subjects consisted of 41 fifth-grade elementary school students. Data collection techniques through test techniques in the form of pretests and posttests, as well as non-test techniques in the form of observation, interviews, documentation, and questionnaires. The data obtained were then analyzed through product assessment, normality test, paired samples t-test, and N-Gain test. The results showed that the song-assisted SIAIR interactive media was very feasible, with a score of 93% from media experts and 94% from material experts. This media is also considered practical by students and teachers, with a practicality level of 97.78% from small groups, 96.56% from large groups, and 100% from teachers. In addition, the effectiveness of the media in improving learning outcomes has been proven empirically. Based on the paired samples t-test, the small group showed a significance value (2-tailed) of 0.001 and N-Gain of 0.5398 with a moderate category. Then, the large group obtained a significance value (2-tailed) of 0.000 and N-Gain of 0.5617 with a moderate category. Based on the results of this study, it can be concluded that SIAIR interactive media assisted by songs is a feasible, practical, and effective learning innovation to improve student learning outcomes on water cycle material.

Keywords: Interactive Media; Learning Outcomes; SIAIR; Song; Water Cycle.

Introduction

Merdeka Curriculum is a curriculum that is currently applied at the primary school level as a reference in the learning process. This curriculum is designed to push education in Indonesia towards a quality equivalent to developed countries, by offering learners the opportunity to choose a learning path based on their interests and potential [1]. This approach allows learners to explore their abilities optimally, so that the learning process takes place more effectively. One of the prominent characteristics in the implementation of Merdeka Curriculum at the primary school level is the merging of science and social studies subjects into one integrated subject called Natural and Social Sciences (IPAS) [2]. The purpose of combining these two disciplines is to prepare students to manage the natural and social environment in one unit [3]. IPAS is a field of science that discusses the life of living and non-living things in nature, as well as the role of humans as individuals and social beings in relation to the surrounding environment [4]. IPAS learning is able to attract students' attention to various phenomena that occur around them [5], thus encouraging them to understand the natural universe and its impact on human life on earth [6].

IPAS learning contains material about the water cycle, which discusses the series of processes that occur in the water cycle. Because it is abstract and consists of a series of processes, this material is difficult to understand if only taught verbally, which has an impact on student learning outcomes. This statement is in line with research [7], water cycle material is quite difficult material because there is a process of particle changes that occur in the earth's atmosphere that are not directly visible to the human senses, which affects how well students understand the material. This problem also occurs at SDN Tambakagung. Based on the results of pre-research collected through observations and interviews with fifth-grade teachers, students have difficulty understanding water cycle material because the process cannot be witnessed directly and is abstract. When presenting the material, the teacher only explains verbally and uses the package book as a learning tool. In addition, students are less motivated and tend to be inactive during learning activities because the learning process is not equipped with interesting and interactive media. Teachers also stated that there is still a lack of learning resources, and they lack the expertise to create technology-based interactive media that can teach complex topics such as the water cycle. The absence of interesting media also affects students' learning motivation, causing students to be less interested in learning. [8] confirms that low learning motivation has the potential to reduce student achievement, thus impacting the effectiveness of the

How to Cite:
Y. S. Rahayu and P. Y. Sutikno, "Development of SIAIR Interactive Media Assisted with Songs to Improve Learning Outcomes on Water Cycle Material in Elementary School", *J. Pijar.MIPA*, vol. 20, no. 4, pp. 669–680, Jun. 2025. https://doi.org/10.29303/jpm.v20i4.9128

learning process. This is also reflected in the data on the learning outcomes of fifth-grade students at SDN Tambakagung, where 61% or 25 out of 41 students obtained formative scores below the minimum KKTP limit of 70. Meanwhile, only 39% or 16 students managed to reach or exceed the value standard.

Based on the problems previously described, the utilization of learning media is seen as a potential strategy in encouraging the improvement of students' academic achievement. Similar emphasis is conveyed by [9] which states that learning media plays a crucial role in optimizing the achievement of learning objectives. One form of media that has been proven to show its effectiveness is interactive media. This finding is reinforced by research results from [10] which shows that the implementation of interactive media in learning has a real impact on improving student learning outcomes at the elementary school level. This type of media can facilitate students' understanding of abstract material through visualization, simulation, and activities that require active participation in the learning process [11]. In line with technological developments, teachers are also required to be more creative in designing learning media and utilizing them optimally to be in line with the times [12]. Therefore, the researcher created SIAIR, an interactive media assisted by songs specifically designed to help students improve learning outcomes.

This interactive media was developed using Lectora Inspire. Lectora Inspire is a software that allows users to create learning materials in various forms of multimedia. Compared to PowerPoint, the program offers features such as audio, video, animation, and integration with more advanced internet technologies, all of which contribute effectively to the learning process [13]. Lectora Inspire is used as a container to package the water cycle materials, which consist of various interactive digital media components, such as text, animated videos, simulation games, songs, and digital comics. Among these various components, songs are utilized as the main component in SIAIR interactive media. Song media has an important role in the world of education, especially for elementary school students [14]. This song was chosen because the language is simple and the rhythm is fun, according to elementary school students who learn while playing [15]. In the learning process, song media can be used by turning learning material into song lyrics, which can then be sung by students [16]. Song media is used to increase the thinking power of students because it can help recall the material presented by the teacher [17]. In addition, by presenting the material in a fun and memorable way, song media can increase learners' enthusiasm for learning and strengthen their understanding of a series of complex processes, such as the water cycle. Although song media has advantages in the audio aspect, it is less effective in conveying material visually. Therefore, the researcher sought to integrate it with animated videos that have a strong role in visually representing the material, especially for topics related to process sequences, such as the water cycle.

Most previous research tends to develop only one form of learning media, which ultimately limits the variety of approaches in delivering the material and does not reach the various learning styles of students. Some studies have developed animated videos as learning media [18], [19], and [20]. Other studies have developed educational games [21] and [22], while the use of songs as learning media has also been investigated in previous studies [23]. Digital comics were also developed in several previous studies [24] and [25]. Therefore, song-assisted SIAIR interactive media is a new breakthrough in the development of learning media that integrates various interactive digital media components, such as text, animated videos, simulation games, songs, and digital comics into a single interactive media unit.

This approach provides an opportunity for learners to experience a more enjoyable and meaningful learning process while being in tune with their individual learning styles. These conditions ultimately contribute to improving learners' learning outcomes. The song-assisted SIAIR interactive media not only presents unique and interesting content, but can also help learners to better understand the complex water cycle material. With a presentation that adapts to the characteristics and needs of elementary school children, this media is expected to have a positive impact on improving their learning outcomes.

Research Methods

This research adopts the R&D method, which is a method that not only aims to create new products, but also evaluates the effectiveness of these products in achieving learning objectives [26]. The product developed in the form of interactive media, SIAIR, is assisted by songs specifically designed to improve students' understanding of the concept of the water cycle. The development process is carried out by following the stages in the ADDIE model, which consists of analysis, design, development, implementation and evaluation. This model was chosen because of its advantages in organizing a systematic and flexible workflow, allowing for continuous improvement at each stage of development.

The analysis stage is the first step taken by researchers to identify problems through pre-research activities, such as observation, interviews, and documentation. The findings from this pre-study were used as the basis for preparing a needs analysis, which was then formulated in the form of a questionnaire for teachers and students. The questionnaire contains a number of plan options that will be used as guidelines in developing learning media.

At the design stage, before designing learning media, researchers first compiled teaching modules as a basis for developing interactive media. Furthermore, the researcher made a media design that would be made by looking at the media presentation components. The media design made by researchers is in the form of a storyboard that describes the flow of material presentation, visual appearance, narration, and interaction that will be displayed in the media. This storyboard is the main reference in the development process, so that the media produced is in accordance with the learning objectives and characteristics of students.

At the development stage, the storyboard that has been prepared at the design stage is developed into an interactive learning media product. The development process began with the creation of song-assisted SIAIR interactive media, which was designed using several digital

platforms. Lectora Inspire was used as the main platform to integrate all material components about the water cycle. The media components packaged in this product include text, animated videos, simulation games, songs, and digital comics, all of which are arranged in an integrated manner to suit the learning characteristics of elementary school students.

The implementation stage is the product testing stage in the field. The product in question is SIAIR interactive media assisted by songs. After validation by experts and revisions have been made, the media will be implemented or tested in classroom learning. The trial process is carried out in two stages, namely testing in small groups first, followed by testing in large groups.

The evaluation stage involves reviewing the data from the pretest, posttest, and student and teacher response questionnaires, which are used as indicators in measuring the feasibility, practicality, and effectiveness aspects. The results of the analysis became a foothold in concluding that the media had reached the criteria for readiness to be implemented without requiring further improvement.

This research was conducted at SDN Tambakagung in the 2024/2025 academic year, involving 41 fifth-grade students as subjects. Research data were obtained from various sources, namely students, teachers, and experts. Data collection used test and non-test techniques. The test technique includes giving individual pretest and posttest questions as a formative evaluation. While non-test techniques include observation, interviews, documentation, and questionnaires. All data collected was thoroughly analyzed to develop quality products, focusing on aspects of feasibility, practicality, and effectiveness.

Data processing in this study was carried out through a descriptive, qualitative, and quantitative approach, which was complemented by an inferential statistical analysis approach to strengthen the overall interpretation of the findings. Qualitative descriptive research focused on collecting and understanding opinions and suggestions from experts, teachers, and learners through questionnaires related to SIAIR interactive media assisted by songs. Quantitative descriptive research aims to obtain assessment scores from experts, teachers, and students on the developed media. The inferential statistics to test the effectiveness of SIAIR interactive media assisted by songs through normality tests, then a paired samples t-test, and followed by calculating the N-Gain value as a measure of increased learning outcomes.

This research includes two forms of data analysis of the products developed, namely the analysis of the feasibility aspects of the media and the analysis of the responses of students and teachers. The assessment of the feasibility of SIAIR interactive media assisted by songs was carried out by media experts and material experts. The assessment process uses the formula according to [27] which is as follows:

$$\mathrm{NP} = \frac{\mathrm{R}}{\mathrm{SM}} \mathrm{x}\ 100$$

Information:
NP = Percentage value of feasibility
R = Raw score obtained
SM = Maximum score in the questionnaire

The results of the feasibility assessment percentage are then converted into criteria according to [27] which are presented as follows:

Table 1. Expert validation eligibility criteria

Percentage	Criteria
81% - 100%	Very Feasible
61% - 80%	Worth
41% - 60%	Decent Enough
21% - 40%	Less Feasible
0% - 20%	Very Unfit

After the product feasibility test, the researchers then collected questionnaire responses from students and teachers regarding the products produced. The questionnaire data on the responses of students and teachers can be measured using the formula according to [27], which is as follows.

$$\mathrm{NP} = \frac{\mathrm{R}}{\mathrm{SM}} \mathrm{x}\ 100$$

Information:
NP = Percentage value of feasibility
R = Raw score obtained
SM = Maximum score in the questionnaire

The results of the percentage of responses from students and teachers are then converted into criteria according to [27] which are presented as follows:

Table 2. Criteria for the feasibility of questionnaire responses from students and teachers

Percentage	Criteria
81% - 100%	Very Feasible
61% - 80%	Worth
41% - 60%	Decent Enough
21% - 40%	Less Feasible
0% - 20%	Very Unfit

Then, the first step in data processing begins by conducting a normality test on pretest and posttest scores to assess whether the distribution of data follows a normal distribution pattern [28]. Normality criteria are met if the significance value is greater than 0.05. Conversely, if the significance value is smaller than 0.05, it indicates that the data is not normally distributed [29]. After the data meet the normal distribution criteria, the next step is the paired samples t-test to test the difference in pretest and posttest averages, and calculate the increase in pretest and posttest averages with the N-Gain test. In paired samples t-test testing, if the significance value (2-tailed) shows a number smaller than 0.05, then the null hypothesis is rejected and the alternative hypothesis is accepted, which indicates a significant difference between the pretest and posttest results. Conversely, if the significance value (2-tailed) is greater than 0.05, then the null hypothesis is accepted and the alternative hypothesis is rejected, which means that there is no significant difference between the pretest and posttest results. Furthermore, to find out the average increase in the pretest and posttest scores of students, the N-Gain test is used, which is calculated based on the formula from [30].

$$\text{N-Gain} = \frac{\text{skor posttest} - \text{skor pretest}}{\text{skor maksimal} - \text{skor pretest}}$$

The results of the calculation are then determined based on the criteria set by [30] which are presented as follows:

Table 3. N-Gain score criteria

N-Gain Value	Criteria
N-Gain ≥ 0.70	High
0.30 < N-Gain < 0.70	Medium
N-Gain ≤ 0.30	Low

Results and Discussion

This development research successfully developed a song-assisted SIAIR interactive media to support the delivery of water cycle materials. This media was created with the main purpose of improving students' learning outcomes, especially in topics related to the water cycle. The development process was carried out by following the stages in the ADDIE model. The series of results from each stage of the development that has been carried out by researchers is presented as follows.

Analysis Stage

In this stage, researchers conducted pre-research in class V SDN Tambakagung through observation, interviews, and documentation. The results of the pre-research activities show that students have difficulty in understanding the concept of the water cycle because the nature of the material is abstract and cannot be observed directly in everyday life. When delivering the material, the teacher only explains verbally and uses the textbook as a learning tool. In addition, students are less motivated and tend to be inactive during learning activities because the learning process is not equipped with interesting and interactive media. Teachers also stated that there is still a lack of learning resources, and they lack the expertise to create technology-based interactive media that can teach complex topics such as the water cycle. The absence of interesting media also affects students' learning motivation, causing students to be less interested in learning. This has an impact on the low learning outcomes of students. [8] corroborates this by stating that poor learning motivation can reduce student learning outcomes, so that the learning process becomes less optimal.

The results of the pre-study were used to create indicators of questions that would be included in the questionnaire for the needs of interactive SIAIR media assisted by songs. This questionnaire is given to teachers and learners to find out what kind of media they need in learning. Information from this questionnaire will help researchers in designing media that suits the needs of teachers and students. Based on the recapitulation of the results of the teacher and learner needs questionnaire, it is known that they want learning media that is interesting, easy to use, and in accordance with the material. In addition, both teachers and learners welcome the use of songs and various interactive digital media components, such as text, animated videos, simulation games, and digital comics in learning media because they are considered to help understand the material more interestingly and in a more fun way.

Design Stage

In this stage, before designing learning media, researchers first compiled teaching modules as the basis for developing interactive media. This teaching module is prepared by referring to the learning outcomes, learning objectives, and subject matter that will be delivered through the media. The material to be delivered through the media is focused on the meaning of the water cycle, the stages of the water cycle, the importance of the water cycle for life, and efforts to maintain water availability. After the teaching module was compiled, the researcher designed the learning media design by paying attention to the media presentation components and the suitability of the material to be presented. All materials are packaged in an integrated manner, but the emphasis of the material remains on the six main stages of the water cycle, such as evaporation, transpiration, condensation, precipitation, infiltration, and runoff.

Then, researchers designed song lyrics, which became an important component in the media. It aims to strengthen learners' understanding through a fun musical approach in explaining the precipitation stage. Meanwhile, other stages, such as evaporation, were designed using character-based narrative animation videos, and transpiration was designed using conceptual visual animation videos. Then, researchers also designed simulation games to explain the material in the condensation stage, as well as infiltration and runoff through storylines in digital comics. The media design made by researchers was outlined in the form of a storyboard. The preparation of the storyboard aims to ensure that the flow of material delivery runs systematically, is interesting, and is easily understood by students before being developed into the actual interactive media form.

Development Stage

The development stage is the process of implementing the song-assisted SIAIR interactive media design that has been compiled at the design stage. The design that has been formulated previously becomes the main guideline in the media-making process. This process begins with creating an initial media display using the Canva Pro platform as a first step towards developing a complete and ready-to-test media. Furthermore, the developed display was processed and integrated into the Lectora Inspire platform as the main container for combining various interactive digital media components. These components include text, animated videos, simulation games, songs, and digital comics that have previously been designed and adapted to the water cycle material. The following is the initial appearance of the song-assisted SIAIR interactive media.

Figure 1 shows the initial appearance of the song-assisted SIAIR interactive media. The song-assisted SIAIR interactive media is designed with bright colors and easy-to-read fonts that are tailored to the needs of teachers and learners. This page displays the name of the media, learning

materials, and the intended class to facilitate identification of media content.

Figure 1. Initial media display

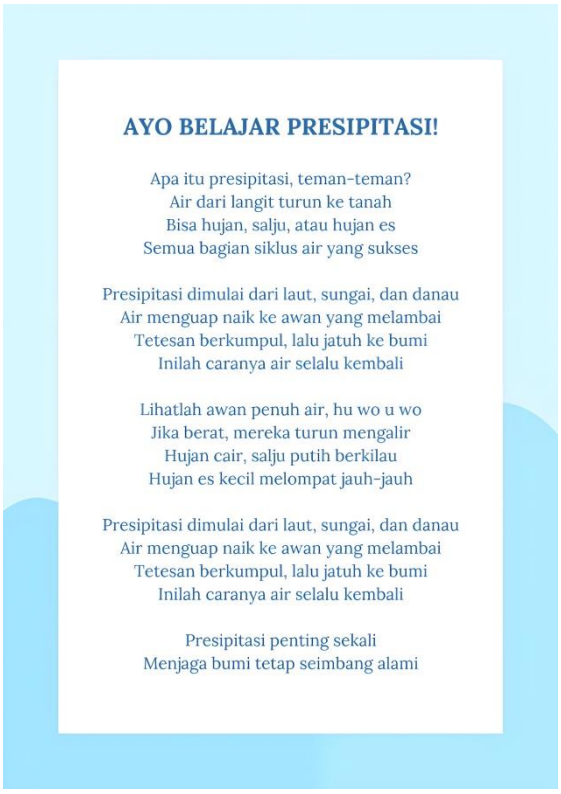

Figure 2. Lyrics to the song "Ayo Belajar Presipitasi!"

The researcher developed original song lyrics as part of the learning media. The song lyrics are shown in Figure 2 and are the result of the researcher's creation, both in terms of writing lyrics and music arrangement, without adapting the work of others. The song was created with a fun and memorable approach to facilitate learners' understanding of the concept of precipitation. In the process of composing the song and processing the musical accompaniment, the researcher used several supporting applications, such as the Guitar Pro 5 application to compose the melody and arrangement of the song, and Cakewalk by BandLab to add sound effects and adjust the audio quality. Then, researchers used BandLab to record sound with the musical accompaniment that had been made.

Figure 3 shows the song display of the song-assisted SIAIR interactive media. After the song media was developed, researchers tried to combine it with animated videos that have a strong role in representing material visually, especially for topics related to a process, such as precipitation. The animated video developed was made using Canva Pro to create moving visuals that illustrate the process of precipitation events, and CapCut was used as a tool to edit background sounds and set synchronization between lyrics and music.

Figure 3. Song display

Figure 4. Video display of character-based narrative animation

Figure 5. Conceptual visual animation video display

After completing the song, the researchers then proceeded to develop an animated video that serves to strengthen the delivery of material on other stages of the water cycle. This animation video includes two forms, namely character-based narrative animation videos, such as in the evaporation stage, which presents the sun and water characters (Figure 4), and conceptual visual animation videos that display scientific processes, such as the transpiration stage, illustratively without using characters (Figure 5). The animated videos developed were also created using Canva Pro to create moving visuals that illustrate the process of evaporation and transpiration. In this animation, dialogue between characters and explanatory text are inserted to facilitate students' understanding of the process shown. The editing process was done using CapCut, which was used to add background sound and adjust the duration of the visual display with the flow of dialogue and explanations in the video. Both types

of animation are designed to help learners understand the material in an audio-visual way, with an approach that suits the characteristics of elementary school-age children.

Figure 6. Simulation game view

Figure 6 shows the appearance of the simulation game at the condensation stage. At this stage, the game was created using the Scratch platform by presenting an interactive mechanism where learners can raise or lower the temperature. When the temperature is lowered, water vapor turns into water droplets, and when the temperature is raised, condensation does not occur. This simulation game aims to help learners understand the concept of condensation through a fun and educational gaming experience.

Figure 7. Digital comic display

Figure 7 shows the digital comic designed by the researcher to explain the material on the infiltration and runoff stages in the water cycle. This comic was developed using Canva Pro, by raising the main character in the form of water droplets that have an adventure along the surface of the ground until they enter the ground. Through the visualization of stories in digital comics, students are invited to understand the process of infiltration and runoff in an interesting and easy-to-understand way.

Figure 8 displays material on the importance of the water cycle for life, while Figure 9 displays material on efforts to maintain the availability of water delivered in the form of narrative text without illustrations. This delivery is focused on describing information in writing without using illustrations, so that students are expected to understand the material through reading comprehension.

Figure 8. Material display of the importance of the water cycle for life

Figure 9. Material display of the efforts to maintain water availability

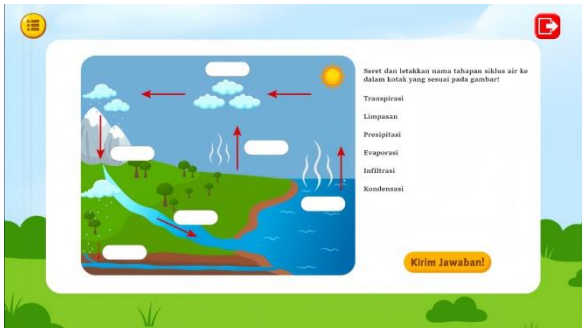

Figure 10. Drag and drop quiz display

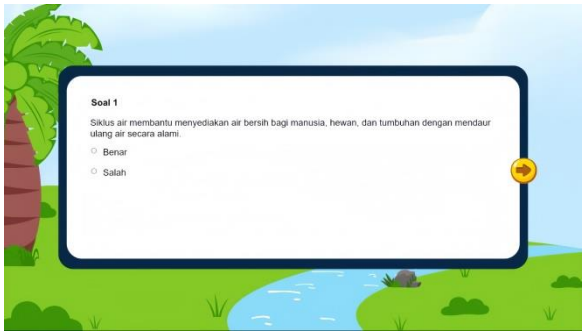

Figure 11. True or false quiz display

Figure 12. Multiple choice quiz display

In the song-assisted SIAIR interactive media, several types of quizzes are available according to the submaterial created using the Lectora Inspire application. The quiz on understanding and stages of the water cycle is presented in the form of drag and drop (Figure 10), the quiz on the importance of the water cycle for life is presented in the form of true or false (Figure 11), and the quiz on efforts to maintain water availability is presented in the form of multiple choice (Figure 12). These quizzes are used to measure the extent of students' understanding of the material that has been presented. In doing the quiz, there will be feedback that automatically provides a response when students answer right or wrong, so they can immediately know the results and understand where the error occurred. After the learners have finished working on the quiz, the total score will appear.

After the song-assisted SIAIR interactive media has been developed, the next step is to publish the media in HTML format. Files in HTML format are then uploaded and hosted through the itch.io platform so that they can be easily accessed by users, both teachers and students. The use of the itch.io platform as a hosting medium was chosen because it supports the HTML5 format and allows the distribution of interactive media widely and easily accessible through various devices.

After the song-assisted SIAIR interactive media development process is complete, the feasibility test is carried out by providing validation questionnaires to media experts and material experts. The validation process is carried out to assess the feasibility of media and learning materials before being applied to students. At this stage, researchers also obtained constructive input and suggestions to improve the developed media. The results of the feasibility assessment conducted by experts are presented in the following table.

Table 4. Expert validation test results

Eligibility Aspects	Percentage Score	Criteria
Media	93%	Very Feasible
Material	94%	Very Feasible

The developed media have paid attention to various interactive digital media components such as text, animated videos, simulation games, songs, and digital comics in harmony and support each other. Learning media design has also been adapted to the characteristics of students in the form of selecting the right background, color, font, and font size. Based on Table 4, the results of media expert validation show that SIAIR interactive media assisted by songs obtained a score of 93% with a very feasible category. This finding indicates that the song-assisted SIAIR interactive media has met the eligibility standards from the media side, according to the media expert's assessment. These results are in line with research [31] which states that song-based learning media developed through the Canva platform is rated very feasible by media experts, so it has met the validation standards of media experts.

The elements in the interactive digital media components used aim to increase the attractiveness and involvement of learners in the learning process. The importance of integrating multimedia elements is reinforced by the findings of [32], the presentation of material through interactive multimedia can be combined with interesting and simple ideas to attract learners' attention in the learning process. Another study by [33] also shows that good visual design, including a balance of shape, size, color, font, and attractive background, contributes to the effectiveness and practicality of learning media. Thus, the selection of appropriate media elements and visual design in accordance with the characteristics of learners is an important factor in creating learning media that are not only technically feasible but also practical and attractive for use at the primary school level.

SIAIR interactive media assisted by songs has also fulfilled the aspect of material suitability, which is reflected in the close relationship between learning outcomes, learning objectives, and the content of the material presented. Based on the results of the material expert validation in Table 4, this media obtained a score of 94% with a very feasible category. The score reflects a high level of compatibility between the media and learning materials, as well as with the learning outcomes and objectives that have been set. This finding is in line with research [34] which emphasizes that the main principle in selecting learning media is its relevance to learning objectives and teaching materials, as well as suitability to the level of development of students. Therefore, in the process of developing learning media, it is important to make learning outcomes and objectives the main reference. This is so that the media developed is not only appropriate in substance, but also able to have a positive influence on the learning process and outcomes of students.

Implementation Stage

The implementation stage is a process in which products that have been validated with very feasible criteria by experts are tested in the field. This trial was conducted in two stages, namely, small groups and large groups. The small group trial involved 9 students who were heterogeneously selected based on the level of learning achievement. Meanwhile, the large group trial involved 32 learners. The trial was conducted through three main stages. In the initial stage, all learners were given 25 multiple-choice questions as a pretest to assess their level of understanding before learning began. Furthermore, learning was carried out at meetings I and II, where the teacher shared the SIAIR interactive media link with the help of songs and explained the learning material using the developed media. The use of SIAIR interactive media assisted by songs in classroom learning activities is carried out in groups by utilizing the laptop facilities provided by the school. After the learning activities, students were asked to do a posttest consisting of 25 multiple-choice questions and fill out a response questionnaire on the use of interactive media SIAIR assisted by songs. In addition, researchers also distributed a similar questionnaire to teachers to obtain views from the educator's side regarding the developed media.

Referring to the data in Table 5, it can be concluded that the responses of students and teachers to the application of SIAIR interactive media assisted by songs show very positive results. In the small group trial, the percentage of responses reached 97.78% and in the large

group reached 96.56%. The teacher's response showed a perfect score of 100%. This shows that SIAIR interactive media assisted by songs can be well received by users and can make a positive contribution in supporting learning activities in the classroom. Research by [35] states that the use of interactive media can improve students' concept understanding through an attractive visual presentation. Therefore, this media is not only practical to use by students and teachers, but also effective in creating meaningful learning experiences for students.

Table 5. Results of questionnaire responses from students and teachers

Subject	Percentage Score	Criteria
Small Group	97.78%	Very Feasible
Large Group	96.56%	Very Feasible
Teacher	100%	Very Feasible

The effectiveness of the media in this development research is obtained through a comparison of pretest and posttest results given to students. SIAIR interactive media assisted by songs proved to have high attractiveness and was able to improve students' learning outcomes. This is reflected in the implementation of trials in small and large groups, which showed an increase in students' interest and understanding of the learning material. In the small group, the average pretest score of 55.56 increased to 80.89 in the posttest, showing an increase of 25.33 points. While in the large group, there was an increase from an average pretest of 58.50 to 81.75 at posttest, an increase of 23.25 points. Based on the findings collected, it can be concluded that the use of SIAIR interactive media assisted by songs significantly contributes to improving the quality of students' learning achievements.

Table 6. Small group normality test results

	Shapiro-Wilk		
	Statistic	df	Sig.
Pretest	.884	9	.172
Posttest	.951	9	.696

Table 7. Large group normality test results

	Shapiro-Wilk		
	Statistic	df	Sig.
Pretest	.958	32	.239
Posttest	.939	32	.069

After the pretest and posttest data are obtained, the next step is to conduct a normality test to determine whether the data are normally distributed or not. The results of this test are an important reference in choosing the right statistical analysis method to use in the next stage of analysis. The normality test was carried out using SPSS version 24 software with the Shapiro-Wilk formula, because the number of samples analyzed was less than 50 respondents. The test results in Table 6 show that the small group had a pretest significance value of 0.172 and a posttest of 0.696. Meanwhile, the results in Table 7 show that the large group obtained a pretest significance value of 0.239 and a posttest of 0.069. Based on these results, all significance values are greater than 0.05, indicating that the pretest and posttest data from both groups are normally distributed.

Table 8. Small group paired samples t-test results

	Mean	t	df	Sig. (2-tailed)
Pretest - Posttest	-25.333	-4.947	8	.001

Table 9. Large group paired samples t-test results

	Mean	t	df	Sig. (2-tailed)
Pretest - Posttest	-23.250	-16.515	31	.000

After obtaining certainty that the data is normally distributed, the next stage of analysis is directed at conducting a paired samples t-test to trace any significant differences related to learning outcomes before and after the application of SIAIR interactive media assisted by songs. In Table 8, the significance value (2-tailed) for the small group is recorded at 0.001, while Table 9 shows a figure of 0.000 for the large group. Since both values are smaller than 0.05, H_0 is rejected and H_a is accepted. It can be interpreted that there is a significant difference in learning outcomes before and after the use of SIAIR interactive media assisted by songs.

Table 10. Small group N-Gain test results

	N	Min	Max	Mean	Std. Deviation
N-Gain Score	9	.17	.67	.5398	.15260
N-Gain Percent	9	16.67	66.67	53.9755	15.26000
Valid N (listwise)	9				

Table 11. Large group N-Gain test results

	N	Min	Max	Mean	Std. Deviation
N-Gain Score	32	.13	1.00	.5617	.15583
N-Gain Percent	32	12.50	100.00	56.1745	15.58336
Valid N (listwise)	32				

To measure how much the students' learning outcomes improved from before to after the learning process, the N-Gain calculation was analyzed. Table 10 shows that the small group obtained an N-Gain value of 0.5398, while Table 11 shows the large group with an N-Gain value of 0.5617. Both values are in the range between 0.30 to 0.70, which indicates that the increase in learning outcomes in both groups is in the moderate category. This finding indicates that the application of SIAIR interactive media assisted by songs contributes positively to increasing students' understanding in learning water cycle material. These results support research [36] which reveals that the proper utilization of learning media by teachers can make it easier for students to understand concepts, thus having implications for improving optimal learning outcomes.

Evaluation Stage

At this stage, the data collected includes the results of pretests and posttests done by students, as well as response questionnaires that have been filled out by students and teachers. Referring to the overall results obtained, it can be concluded that the SIAIR interactive media assisted by songs shows feasibility, practicality, and effectiveness in supporting the learning process of water cycle material. This evaluation also shows that the media have met the expected quality standards, so it does not require further revision or improvement before being applied more widely in the learning process.

The development of song-assisted SIAIR interactive media is in line with the characteristics of students at the elementary school level, who are still in the concrete operational cognitive development phase. Referring to the theory of cognitive development, children at elementary school age do not yet have the ability to think abstractly and still need the help of concrete media to understand learning concepts [37]. Song-assisted SIAIR interactive media is needed to bridge these cognitive limitations by integrating text, animated videos, simulation games, songs, and digital comics into one unit. This is reinforced by [38] which states that the use of interactive media has a significant impact on improving understanding of science concepts. SIAIR interactive media assisted by songs provides a learning experience that is in line with the various learning styles of students, such as visual, auditory, and kinesthetic, and is able to meet their cognitive and emotional needs. Research results [39] support this finding, that interactive and engaging technology-based media can adjust to the diversity of learning styles. This condition makes learning activities not only fun, but also able to increase the effectiveness in strengthening learners' understanding.

The song-assisted SIAIR interactive media was developed to learn the concept of the water cycle through a multimodal approach, combining text, animated videos, simulation games, songs, and digital comics in one media unit. The role of songs in SIAIR interactive media is one of the key factors for successful learning. The song, which is an important component in this media, is specifically designed to convey scientific concepts with a musical approach. This strategy aims to create a learning experience that is fun, easy to understand, and more memorable for elementary school students. The use of songs in learning activities can act as a medium for delivering material, where the learning content is packaged in the form of song lyrics [40]. Through interesting rhythms and melodies, songs are able to convey concepts more easily accepted by students, while stimulating emotional aspects that support the learning process.

Develop media in the form of animated videos that are visually and auditory effective, but do not provide interactive experiences that optimally involve kinesthetic aspects [18], [19], and [20]. Meanwhile, develop educational games that can increase learners' kinesthetic involvement, but do not include song or video components that can strengthen learners' understanding and memory. [21] [22]. Develops songs as learning media, but is still limited to the auditory aspect, so it has not been able to reach visual and kinesthetic learning styles as a whole [23]. As for the development of digital comic-based media, such as those conducted by [24] and [25] , they show potential in delivering material in a narrative and interesting way, but have not been integrated with other media such as audio or in-depth direct interaction.

Therefore, this study has an advantage over previous studies because it presents a song-assisted SIAIR interactive media that integrates various interactive digital media components, such as text, animated videos, simulation games, songs, and digital comics in one unit. This approach reaches various learning styles of learners and creates a fun and meaningful learning experience. In addition, other advantages of this media lie in its attractiveness in increasing students' interest and learning outcomes, ease of access for teachers and students, and its practicality to be used both in the elementary school environment and at home.

Given the absence of previous research that specifically develops learning media with integrative models such as SIAIR interactive media assisted by songs, the results of this study can be an important contribution and new reference in the development of innovative and adaptive learning media to the needs of students. The main contribution of this research lies in the learning media products produced, which not only function as teaching aids but also as alternative learning resources that can enrich learning activities.

However, the scope of this research is still limited to the subject of Natural and Social Sciences (IPAS), with the scope of the water cycle material. Therefore, further research is expected to develop and adapt SIAIR interactive media assisted by songs for other materials that are more diverse, both in the scope of subjects and levels of education. The implication of this research shows that SIAIR interactive media assisted by songs can be used as an effective and applicable alternative for teachers in supporting meaningful, fun, and interactive learning processes in the classroom.

Conclusion

Based on the results of research on the development of SIAIR interactive media assisted by songs on water cycle material, it can be concluded that SIAIR interactive media assisted by songs is proven to be feasible, practical, and effective in learning water cycle material in elementary schools. The song-assisted SIAIR interactive media has been developed and validated through a feasibility assessment by media experts and material experts, which shows that this media is in the very feasible category. The media feasibility assessment obtained a score of 93%, while the material feasibility obtained a score of 94%. In terms of practicality, this media received positive responses from students and teachers indicating that the media is easy to understand and use in learning. The percentage of practicality reached 97.78% in the small group trial, 96.56% in the large group and 100% based on teacher assessment. This indicates that the media is very practical to use at school and at home. The use of SIAIR interactive media assisted by songs is also effective for improving student learning outcomes in the cognitive domain. By using the paired samples t-test and N-Gain test, the results for the small group trial obtained a significance value (2-tailed) of 0.001 and N-Gain of 0.5398 (medium category).

Then, for the large group trial, the significance value (2-tailed) was 0.000 and the N-Gain was 0.5617 (medium category). Thus, the song-assisted SIAIR interactive media is declared feasible, practical, and effective as a means of supporting water cycle learning at the elementary school level.

Author's Contribution

This research is the result of a collaboration between Yulina Sri Rahayu as the first author and Putri Yanuarita Sutikno as the second author. The first author played an active role in all stages of the research, from problem formulation, data collection and analysis, to the preparation of scientific articles. The second author contributed to providing guidance from the planning stage, helping to clarify the direction of the research, providing input on the content of the theory and methodology, and guiding in editing the content of the article to conform to the rules of scientific writing. This collaboration is carried out gradually and continuously so that the results of the research can be scientifically accounted for and useful for the world of education.

Acknowledgements

With great respect, the author expresses her deep gratitude to Dr. Putri Yanuarita Sutikno, S.Pd., M.Sn, as the supervisor for all forms of guidance, motivation, and direction that are very meaningful during the process of preparing and conducting research until the completion of this article. The author also expresses his gratitude to the Head of SDN Tambakagung for the opportunity and permission given to conduct research at the school. Sincere gratitude is also addressed to the teachers who have provided support during the research, as well as to all students of SDN Tambakagung who took an active role in the research process. All the support, cooperation, and involvement of various parties have enabled this research to be carried out smoothly and produced very useful findings.

References

[1] Y. S. Putri and M. Arsanti, "Kurikulum Merdeka Sebagai Upaya Pemulihan Pembelajaran," *Pros. Semin. Nas. Sultan Agung*, vol. 4, no. November, pp. 21–26, 2022, [Online]. Available: https://jurnal.unissula.ac.id/index.php/sendiksa/article/view/27269

[2] N. M. I. Ikhsani and I. A. Alfiansyah, "Persepsi Guru Terkait Implementasi Kurikulum Merdeka di Sekolah Dasar Pada Mata Pelajaran IPAS," *J. Elem. Edukasia*, vol. 6, no. 4, pp. 1597–1608, 2023, doi: 10.31949/jee.v6i4.7132.

[3] D. Meylovia and Alfin Julianto, "Inovasi Pembelajaran IPAS pada Kurikulum Merdeka Belajar di SDN 25 Bengkulu Selatan," *J. Pendidik. Islam Al-Affan*, vol. 4, no. 1, pp. 84–91, 2023, doi: 10.69775/jpia.v4i1.128.

[4] I. Azzahra, Aan Nurhasanah, and Eli Hermawati, "Implementasi Kurikulum Merdeka Pada Pembelajaran IPAS di SDN 4 Purwawinangun," *Didakt. J. Ilm. PGSD STKIP Subang*, vol. 9, no. 2, pp. 6230–6238, 2023, doi: 10.36989/didaktik.v9i2.1270.

[5] O. Asmaul Husnah, A. Fitriani, F. Patricya, and T. Putri Handayani, "https://bajangjournal.com/index.php/JPDSH Analisis Materi Ips Dalam Pembelajaran Ipas Kurikulum Merdeka Di Sekolah Dasar," *JPDSH J. Pendidik. Dasar Dan Sos. Hum.*, vol. 3, no. 1, pp. 57–64, 2023, [Online]. Available: https://bajangjournal.com/index.php/JPDSH

[6] A. N. I. M. A. W. Septiana, "Analisis Kritis Materi Ips Dalam Pembelajaran Ipas Kurikulum Merdeka Di Sekolah Dasar," *Ilm. Pendidik. Guru Sekol. Dasar*, vol. 1, no. 1, pp. 43–54, 2023, [Online]. Available: file:///C:/Users/hp/Downloads/3479-7788-1-PB (2).pdf

[7] N. D. Afifah, A. Widiyono, and S. N. C. Attalina, "Pengembangan Media Diorama Siklus Air Untuk Meningkatkan Hasil Belajar IPAdi Sekolah Dasar," *J. Pendidik. dan Konseling*, vol. 4, no. 3, pp. 528–533, 2022, [Online]. Available: https://journal.universitaspahlawan.ac.id/index.php/jpdk/article/view/4374/2974

[8] M. P. Sudewiputri and I. M. A. Dharma, "Model Pembelajaran Numbered Heads Together (NHT) Terhadap Motivasi dan Hasil Belajar IPA," *J. Pedagog. dan Pembelajaran*, vol. 4, no. 3, p. 427, 2021, doi: 10.23887/jp2.v4i2.38900.

[9] B. Budiyono, "Inovasi Pemanfaatan Teknologi Sebagai Media Pembelajaran di Era Revolusi 4.0," *J. Kependidikan J. Has. Penelit. dan Kaji. Kepustakaan di Bid. Pendidikan, Pengajaran dan Pembelajaran*, vol. 6, no. 2, p. 300, 2020, doi: 10.33394/jk.v6i2.2475.

[10] A. M. Dian Nur Septiyawati Putri, Fitriah Islamiah, Tyara Andini, "Analisis Pengaruh Pembelajaran Menggunakan Media Interaktif Terhadap Hasil Pembelajaran Siswa Sekolah Dasar," *Pendidik. Dasar Dan Sos. Hum.*, vol. 2, no. 2, p. 367, 2022.

[11] A. S. O. Fiani, N. A. Wibowo, Y. A. A. Andoyo, and N. Rofisian, "Penerapan Media Pembelajaran Interaktif Berbasis Multimedia Untuk Meningkatkan Pemahaman Konsep Matematika Peserta Didik Sekolah Dasar," vol. 2, no. 3, pp. 999–1003, 2024.

[12] M. L. Hamzah, Ambiyar, F. Rizal, W. Simatupang, D. Irfan, and Refdinal, "Development of Augmented Reality Application for Learning Computer Network Device," *Int. J. Interact. Mob. Technol.*, vol. 15, no. 12, pp. 47–64, 2021, doi: 10.3991/ijim.v15i12.21993.

[13] Y. Otoluwa, S. Eraku, and D. Yusuf, "Pengembangan Media Pembelajaran Berbasis Lectora Inspire Yang Diintegrasikan Dengan Camtasia Studio Pada Mata Pelajaran Geografi Materi Sistem Informasi Geografi," *Jambura Geo Educ. J.*, vol. 1, no. 1, pp. 01–08, 2019, doi: 10.34312/jgej.v1i1.4041.

[14] U. Najia and P. Y. Sutikno, "Virtual Field Trips Borobudur Temple Assisted With Songs In Stimulating Writing Skills Of Descriptive Texts," vol. 12, no. 4, pp. 1991–2003, 2024.

[15] G. Prananda, R. Saputra, and R. Zuhar, "JURNAL IKA VOL 8 No. 2," *Ika Ikat. Alumni Pgsd Unars*, vol. 8, no. 2, pp. 304–314, 2020.

[16] N. Fatmawati and E. Novena, "Bernyanyi Lagu Pembelajaran Bagi Siswa Kelas V Sd Jolosutro Siklus 1," vol. 2, no. 2, pp. 92–104, 2022.

[17] A. N. Tania, D. A. Uswatun, and A. Sutisnawati, "Pengaruh Media Lagu terhadap Kemampuan Kognitif Siswa dalam Pembelajaran IPA di Sekolah Dasar," *J. Pendidik. Dasar Flobamorata*, vol. 4, no. 2, pp. 625–632, 2023, doi: 10.51494/jpdf.v4i2.946.

[18] G. P. P. Hapsari and Z. Zulherman, "Pengembangan Media Video Animasi Berbasis Aplikasi Canva untuk Meningkatkan Motivasi dan Prestasi Belajar Siswa," *J. Basicedu*, vol. 5, no. 4, pp. 2384–2394, 2021, doi: 10.31004/basicedu.v5i4.1237.

[19] J. G. Melinda and Y. Yermiandhoko, "Pengembangan Media Video Animasi Mata Pelajaran Ipa Materi Siklus Air Untuk Siswa Kelas V SD," *Jpgsd*, vol. 09, no. 05, pp. 1–10, 2017, [Online]. Available: https://ejournal.unesa.ac.id/index.php/jurnal-penelitian-pgsd/article/view/40535

[20] S. Suryaman and Y. Suryanti, "Pengembangan Media Video Animasi Berbasis Plotagon Dan Capcut Untuk Meningkatkan Hasil Belajar Kognitif Siswa Kelas Ii Sekolah Dasar," *J. Cakrawala Pendas*, vol. 8, no. 3, pp. 841–850, 2022, doi: 10.31949/jcp.v8i3.2575.

[21] N. S. Afdoli, A. H. Madjdi, and K. Khamdun, "Pengembangan Game Edukasi Materi Siklus Air Bagi Siswa Kelas V Sekolah Dasar," *JIIP - J. Ilm. Ilmu Pendidik.*, vol. 6, no. 7, pp. 4743–4750, 2023, doi: 10.54371/jiip.v6i7.1896.

[22] S. N. Hidayah and T. Prasetyo, "Pengembangan Media Game Edukasi Tematik Berbasis Web Wordwall Berpadukan Classroom untuk Meningkatkan Hasil Belajar Siswa Kelas 4 Sekolah Dasar," *JIIP - J. Ilm. Ilmu Pendidik.*, vol. 5, no. 7, pp. 2632–2635, 2022, doi: 10.54371/jiip.v5i7.732.

[23] R. Wulandari and Y. Setiawan, "Pengembangan Media Lagu Mabar Dalam Mata Pelajaran Matematika Kelas 1 Sekolah Dasar Untuk Meningkatkan Kemampuan Problem Solving Peserta Didik," *J. Educ. FKIP UNMA*, vol. 10, no. 2, pp. 545–552, 2024, doi: 10.31949/educatio.v10i2.8449.

[24] A. S. Fitri, A. N. Aeni, and R. G. Nugraha, "Pengembangan Komik Digital Untuk Meningkatkan Hasil Belajar Pada Materi Nilai-Nilai Pancasila Siswa Kelas IV Sekolah Dasar," *Al-Madrasah J. Pendidik. Madrasah Ibtidaiyah*, vol. 7, no. 1, p. 220, 2023, doi: 10.35931/am.v7i1.1756.

[25] Satriana, S. Syamsuri, and M. Akhir, "Pengembangan Media Codibook (Learning Comic Berbasis Digital Book) Untuk Meningkatkan Hasil Belajar Bahasa Indonesia Siswa Sekolah Dasar," vol. 08, pp. 1–23, 2023, [Online]. Available: https://journal.unpas.ac.id/index.php/pendas/article/view/10342

[26] Sugiyono, Metode Penelitian Pendidikan Pendekatan Kuantitatif, Kualitatif, dan R&D. Bandung: Alfabeta, 2016

[27] N. Purwanto, Prinsip-prinsip dan Teknik Evaluasi Pengajaran, vol. 10. Bandung: PT Remaja Rosdakarya, 2019

[28] A. A. Kurniawan, N. D. Rahmawati, and K. Dian, "Pengaruh Media Pembelajaran Interaktif Canva terhadap Hasil Belajar IPAS pada Peserta Didik Kelas IV Sekolah Dasar," *J. Inovasi, Eval. dan Pengemb. Pembelajaran*, vol. 4, no. 2, pp. 179–187, 2024, doi: 10.54371/jiepp.v4i2.466.

[29] S. Ismail, "Pengaruh Penggunaan Model Pembelajaran Berbasis Proyek 'Project Based Learning' Terhadap Hasil Belajar Fisika Peserta Didik Kelas X IPA SMA Negeri 35 Halmahera Selatan Pada Konsep Gerak Lurus"," *J. Ilm. Wahana Pendidik.*, vol. 8, no. 5, pp. 256–269, 2022, doi: 10.5281/zenodo.6466594.

[30] K. E. Lestari and M. R. Yudhanegara, Penelitian Pendidikan Matematika. Bandung: Refika Aditama, 2018

[31] B. C. An-Nisa and P. Y. Sutikno, "Development of Song Media Assisted with Canva To Improve the Acrostic Poetry Writing Skills," *Edunesia J. Ilm. Pendidik.*, vol. 5, no. 3, pp. 1330–1351, 2024, doi: 10.51276/edu.v5i3.1004.

[32] Arman Berkat Cristian Waruwu and Debora Sitinjak, "Penggunaan Multimedia Interaktif dalam Meningkatkan Minat Belajar Siswa pada Pembelajaran Kimia," *J. Pendidik. Mipa*, vol. 12, no. 2, pp. 298–305, 2022, doi: 10.37630/jpm.v12i2.589.

[33] K. T. Sidarta and T. N. H. Yunianta, "Pengembangan Kartu Domano (Domino Matematika Trigono) Sebagai Media Pembelajaran Pada Matakuliah Trigonometri," *Sch. J. Pendidik. dan Kebud.*, vol. 9, no. 1, pp. 62–75, 2019, doi: 10.24246/j.js.2019.v9.i1.p62-75.

[34] M. Miftah, "Landasan Konseptual Pemanfaatan Media Pembelajaran Berbasis TIK," *Edu Cendikia J. Ilm. Kependidikan*, vol. 2, no. 01, pp. 25–31, 2022, doi: 10.47709/educendikia.v2i01.1425.

[35] P. Manurung, "Multimedia Interaktif Sebagai Media Pembelajaran Pada Masa Pandemi Covid 19," pp. 1–12.

[36] Y. D. Lestari, "Pentingnya Media Pembelajaran dalam Meningkatkan Hasil Belajar di Sekolah Dasar," *Lentera J. Ilm. Kependidikan*, vol. 16, no. 1, pp. 73–80, 2023, doi: 10.52217/lentera.v16i1.1081.

[37] N. Putu, N. Wirantini, I. G. Astawan, and I. G. Margunayasa, "Media Pembelajaran berbasis Multimedia Interaktif pada Topik Siklus Air," vol. 10, no. 1, pp. 42–51, 2022.

[38] Lindawati, M. Arsyad, and Khaeruddin, "Pengaruh Multimedia Interaktif (BSD MIPA) Terhadap Pemahaman Konsep IPA Peserta Didik Kelas VII SMPN 1 Gilireng Kabupaten Wajo," *Omega J. Ilmu Pendidik. Dan Sains Fis.*, vol. 2, no. 1, pp. 31–44, 2023, [Online]. Available: http://journal.unpacti.ac.id/index.php/approach/article/view/644%0Ahttp://journal.unpacti.ac.id/index.php/approach/article/download/644/487

[39] F. Nurbadriyah, P. Darmawan, M. Albertina, and K. Wardani, "Penggunaan Media Pembelajaran Wordwall Untuk Memenuhi Target Kurikulum," vol. 4, no. 11, pp. 2020–2025, 2024, doi:

10.17977/um064v4i112024p1091-1096.
[40] A. T. Nandadewi and M. Fathurrahman, “Pengembangan Media Lagu Edukasi Berbasis Google Sites untuk Meningkatkan Hasil Belajar Materi Wujud Zat dan Perubahannya Mupel IPAS Kelas IV SD Muhammadiyah Legokkalong Pekalongan,” vol. 09, 2024.