The Positive Impact of the Problem-Based Learning Model Assisted by Audio Visual Media on the Science Knowledge Competency

Ni Kadek Sri Astuti[1*], Gusti Ngurah Sastra Agustika[2*], I Komang Ngurah Wiyasa[3] (iD)

[1,2,3] Pendidikan Dasar, Universitas Pendidikan Ganesha, Singaraja, Indonesia

A B S T R A K

Banyaknya kekurangan siswa dalam memahami materi pembelajaran IPA yang disebabkan oleh penggunaan komponen pembelajaran yang kurang optimal. Tujuan penelitian ini adalah untuk menganalisis pengaruh model pembelajaran problem based learning berbantuan media audio visual terhadap kompetensi pengetahuan IPA kelas V SD. Penelitian ini merupakan penelitian eksperimen semu dengan rancangan penelitian non equivalent control group design. Populasi pada penelitian ini adalah siswa kelas V. Sampel dalam penelitian ini ditentukan dengan teknik cluster random sampling. Sampel dalam penelitian ini adalah siswa kelas V SD. Data pada penelitian ini dikumpulkan dengan menggunakan metode tes dalam bentuk pilihan ganda. Data yang telah dikumpulkan selanjutnya dianalisis dengan menggunakan teknik analisis statistik deskriptif dan teknik analisis statistik inferensial uji-t. Hasil analisis uji-t diperoleh t_{hitung} =8,413 dan t_{tabel} =4,027 dengan taraf signifikansi 5%. Hasil perhitungan tersebut menunjukkan bahwa $t_{hitung} > t_{tabel}$, sehingga H_0 ditolak dan H_1 diterima. Maka dari itu, dapat disimpulkan bahwa terdapat pengaruh yang signifikan model pembelajaran problem based learning berbantuan media audio visual terhadap kompetensi pengetahuan IPA siswa kelas V SD. Implikasi dari penelitian ini adalah untuk meningkatkan kompetensi pengetahuan IPA siswa.

A B S T R A C T

The number of students who need to improve in understanding science learning material is caused by using less than optimal learning components. This study aimed to analyze the effect of the problem-based learning model assisted by audio-visual media on the competence of science knowledge in fifth-grade elementary school. This research is a quasi-experimental study with a non-equivalent control group design. The population in this study was fifth-grade students. The sample in this study was determined by cluster random sampling technique. The sample in this study was fifth-grade elementary school students. Data in this study were collected using the multiple-choice test method. The collected data were then analyzed using descriptive and t-test inferential statistical analysis techniques. The results of the t-test analysis obtained $_{count}$ = 8.413 and $_{table}$ = 4.027 with a significance level of 5%. These calculations show that $t_{count} > t_{table}$, so H_0 is rejected, and H_1 is accepted. Therefore, the problem-based learning model assisted by audio-visual media significantly influences the science knowledge competence of fifth-grade elementary school students. The implication of this research is to improve students' science knowledge competence.

1. INTRODUCTION

Education, in general, is one measure of a nation's progress. All matters related to education must be considered carefully and studied in depth. One of these things is an education system that can make a nation intelligent. Education is an effort to improve human dignity and demand to produce higher human qualities to guarantee the implementation and continuity of development (Nurabadi et al., 2021; Wangid et al., 2020). Education is a system with a broad scope and is a means to improve a person's self-quality (Muhtar & Dallyono, 2020; Perdana et al., 2020). As this education system develops, education is readjusted to the circumstances and conditions of society and the surrounding environment (Diningrat et al., 2020; Sutarni et al., 2021). Education certainly has a main and very important goal. Education aims to

Corresponding author
E-mail addresses: kadekastuti9969@email.com (Ni Kadek Sri Astuti)

improve self-quality and optimally develop one's potential, interests and talents to be useful in life. Of course, in running an education system, guidelines are needed that are used as guidance or instructions to carry out good educational systematics. Therefore, the curriculum is used as a guide in carrying out this education. Currently, the curriculum continues to be updated to improve the flow of education. Providing adequate facilities and infrastructure strongly supports curriculum renewal through developments in science and technology (Garad et al., 2021; Hudha et al., 2021).

We all know technology plays a very important role in today's developments. This, of course, has a huge impact on every aspect of life, especially education. The presence of technology in the field of education has had a very helpful impact on educators in creating learning flows that are interesting, innovative, and, of course, efficient to implement. Learning that utilizes technology-based facilities is certainly very good and appropriate for optimizing the learning process. Many technology-based learning facilities, such as technology-based learning media, can be developed now. Learning media are tools or facilities that can effectively support the implementation of the learning process (Afandi et al., 2021; Zuhairoh & Rosadi, 2020). This learning media certainly helps teachers carry out the learning process and increases students' learning activities so that they can understand the learning material better. Technology-based learning media is a breakthrough in responding to current developments in education.

In elementary school, students' learning will be more effective if they can apply technology-based learning media. Technology-based learning media is a tool that utilizes technology and can provide concrete information to achieve the expected learning goals (Efendi & Nurjanah, 2019; Wibowo & Dg Matona, 2019). Technology-based learning media applied in the learning process must, of course, be selected well according to the learning objectives to be achieved by students. Audio-visual learning media is one of the appropriate learning media for teachers to use in implementing learning with students, especially elementary school students. Audio-visual learning media is a learning media that can bring out sound and image elements in conveying information or messages (Rahmawati & Ramadan, 2021; Ramadhani & Hanggara, 2019). Audio-visual learning media is certainly very suitable for providing students with an understanding of the material. This is because students are very motivated by learning media that combines elements of sound and images. Hence, their imagination increases, and they can understand the material or information conveyed using audio-visual learning media. It is hoped that the application of audio-visual learning media will improve students' understanding of concepts and the material and curriculum applicable at the school (Mumpuni & Nurpratiwiningsih, 2018; Ritonga et al., 2020).

However, in reality, the current learning process in schools still needs the use of learning media that supports the implementation of the learning process. Based on observation activities carried out at SD Negeri 2 Sesetan together with the school, namely Mr. Ida Bagus Nyoman Artawa, S.Pd as the Principal of SD Negeri 2 Sesetan as well as several fifth-grade teachers at SD Negeri 2 Sesetan, the observation results were obtained that when implementation of the learning process, there are still many students who do not understand learning, especially science subjects. This is due to using learning models and media that could be more optimal and classified as conventional, resulting in a learning atmosphere that does not increase students' interest in learning, and the class atmosphere becomes unpleasant. This kind of learning system influences reducing students' science knowledge competency. The problems found from the results of observations and interviews became obstacles for teachers at SD Negeri 2 Sesetan in implementing the science learning process. With the problems found, of course, solutions are needed to overcome them. The solution that can be given is to apply appropriate learning models and media by adjusting them to the student's characteristics and the material being taught. Applying learning models and media that suit students' characteristics will certainly increase students' interest in learning and increase students' science knowledge competency so that learning objectives can be achieved optimally.

It is widely known in education that various learning models are appropriate for teachers to apply in the learning process. A learning model is a method or technique used to systematically present learning material to improve students' understanding and achieve the expected goals (Hashim et al., 2020; Pramana & Suarjana, 2019). Based on the problems found, a learning model suitable for improving science knowledge competency can be determined, namely the problem-based learning (PBL) learning model. The problem-based learning model is a student-centered learning strategy that requires students to be skilled and sensitive to collaboratively solving problems in their real social environment (Narmaditya et al., 2018; Perdana et al., 2020). The problem-based learning model is appropriate for teaching students about science learning material related to global phenomena in the surrounding environment, focusing on problem-solving. The problem-based learning model can be combined with learning media that is appropriate and appropriate to the application of the problem-based learning model, such as audio-visual media. Solving problems with the help of audio-visual media will provide students with a deeper understanding.

Applying the problem-based learning model assisted by audio-visual media is also a renewal in the learning process, where learning media conveys information with a combination of images and sound that can attract students' attention. Everything, such as learning materials, images, and video designs, is packaged well and effectively to be shown to students. The application of the problem-based learning model based on audio-visual media is supported by findings from other research, such as the problem-based learning model, which helps readers choose an appropriate learning model and can attract students' interest in learning (Narmaditya et al., 2018 Tapilouw et al., 2017). The problem-based learning model is also quite effective in improving student learning outcomes (Saputro et al., 2021; Sueb & Damayanti, 2021). Therefore, it is necessary to research to analyze the influence of the problem-based learning model assisted by audio-visual media on the science knowledge competency of fifth-grade elementary schools.

2. METHOD

This research was carried out at SD Negeri 2 Sesetan, which has state status and is located at Jl. Raya Sesetan No. 264, Sesetan, South Denpasar. This research was carried out from November 2022 to February 2023, calculated as 3 months. When conducting the research, the treatment was given 6 times to the experimental group and 6 times to the control group. The provision of treatment has also been adjusted to the timing of the research, which has been well-designed. The type of research used is quantitative research, with a quasi-experimental design. A quasi-experimental design has a control group that cannot fully control external variables influencing the research results (Pamungkas & Koeswanti, 2022; Sidiq et al., 2021). There are limitations in observing students' behavior and understanding when outside school, so a quasi-experimental design is used (Suhartono et al., 2019; Widiana et al., 2021). The selection of a quasi-experimental design is also by the selection of the research design to be used, where the research design used in this research is a non-equivalent control group design. The research design can be seen in Figure 1.

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Figure 1. Non Equivalent Control Group Design Research Design
Modified from (Wicaksana et al., 2020)

The non-equivalent control group design was used to compare research subjects, namely, the study group that received treatment using the problem-based learning model assisted by audio-visual media as an experimental class with the study group that did not use the problem-based learning model assisted by audio-visual media as a control class. Population is a general area of objects or subjects with certain characteristics and characteristics studied, and conclusions can be drawn (Cofré et al., 2018; Perdana et al., 2020). Another thing expressed by population is a collection of data that identifies phenomena (Fitri & Agusfitriani, 2018; Maspika & Kurniawan, 2019). The population in this study were all fifth-grade students at SD Negeri 2 Sesetan, which consisted of 5 classes with a total population in this study of 110 people. The population is chosen randomly with the condition that the population must be equal and analyzed using One Way Analysis of Variance (Anova A). However, the data is first assumed to come from a normally distributed and homogeneous population before carrying out an equality test. A sample can be used if the large population affects researchers with limited energy and time to research all subjects. The sample is part of the number and characteristics possessed by a population (Putra et al., 2018; Sutiarso et al., 2018). A sample is a data collection representing subjects in a relatively large population (Heliawati et al., 2022; Syukri et al., 2018).

The cluster random sampling technique can be used to determine the sample. The cluster random sampling technique is based on clusters/groups by lottery (Hujjatusnaini et al., 2022; Pertiwi et al., 2019). This technique was used because the individuals used as research subjects had already formed class groups, so they should have been better individuals was not good (Ertikanto et al., 2018; Jampel et al., 2018). Therefore, the only things that can be selected randomly are classes or groups. Classes were chosen as they had been formed without intervention by researchers and no randomization of individuals because the possibility of influences from the condition of students knowing that they were involved in the experiment could be reduced so that this research truly describes the influence of the treatment given to each class in State Elementary Schools 2 Sesetan. The samples obtained in this research were fifth-

grade students at SD Negeri 2 Sesetan, where 26 VD students were in the experimental class, and 28 VC students were in the control class.

The data collected in this research is science knowledge competency data of students who study using the problem-based learning model assisted by audio-visual media. Data was collected using a method, namely the test method. The test method objectively measures a person's behavior and can be described using a scale or numbers (Fitriyana et al., 2020; Sukmanasa et al., 2020). Generally, this test method is widely used to measure cognitive realms or domains. The test method is adapted to the data collected in this research, science knowledge competency data for fifth-grade students at SD Negeri 2 Sesetan for the 2022/2023 academic year. In this study, researchers carried out two tests: a test before treatment using a problem-based learning model assisted by audio-visual media (pre-test) and a test after treatment using a problem-based learning model assisted by audio-visual media (post-test).

3. RESULT AND DISCUSSION

Result

The data analyzed in this research is the science knowledge competency of fifth-grade students in the experimental and control groups at SD Negeri 2 Sesetan for the 2022/2023 academic year. The data analysis results in this research describe the average, standard deviation, and variance of the students' science knowledge competency data collected. This research has obtained data: post-test science knowledge competency data in the experimental group and post-test science knowledge competency data in the control group. A recapitulation of the results of post-test descriptive statistical data analysis in the experimental and control groups can be presented in Table 1 and Table 2.

Table 1. Recapitulation of Post-Test Data Results for Science Knowledge Competency in the Experimental Group

Statistic	Science Knowledge Competency
Mean	81.15
Standard Deviation	6.37
Variance	40.61

Table 2. Recapitulation of Post-Test Data Results for Control Group Science Knowledge Competency

Statistic	Science Knowledge Competency
Mean	73.96
Standard Deviation	6.40
Variance	41.07

Based on the results of data analysis in Table 1 and Table 2, it can be explained that the data results in the experimental group show the mean (average) value in the post-test results of the experimental group after being given treatment using the problem-based learning model assisted by audio-visual media. The results were 81.15, with a standard deviation of 6.37 and a variance of 40.61. For the post-test results of the control group after treatment using the problem-based learning model assisted by audio-visual media, the mean (average) result was 73.96 with a standard deviation of 6.40 and a variance of 41.07. Comparing the results of the analysis of the experimental group post-test data and the control group post-test data shown, a conclusion can be drawn where there are differences obtained from the results of the mean (average), standard deviation and variance data in the group post-test scores. Experimental and post-test control group.

After knowing the results of the post-test in the experimental group and control group, data analysis can be continued by carrying out a t-test and formulating a hypothesis at the final stage. Before carrying out data analysis in the t-test, a prerequisite test can be carried out first: to analyze the data distribution normality test and variance homogeneity test to determine whether the data obtained is normally distributed and homogeneous. This study's normality test for data distribution was conducted on students' science knowledge competency data in the experimental and control groups. The data distribution normality test aims to determine whether each group's data distribution of mathematics knowledge competency scores is normally distributed so that appropriate data analysis techniques can be determined (Efendi & Nurjanah, 2019; Mamat et al., 2018). A recapitulation of the normality test results for the distribution of pre-test and post-test data in the experimental and control groups is presented in Table 3.

Table 3. Recapitulation of Data Distribution Normality Test Results

No.	Science Knowledge Competency Data Group	Maximum Value	Table Values	Conclusion
1	Experiment	0.188	0.256	Normal
2	Control	0.166	0.250	Normal

Obtaining the normality distribution test results in the table above shows that the experimental and control groups' pre-test and post-test data results were declared to be normally distributed. From these results, a variance homogeneity test can be continued. The purpose of carrying out this homogeneity of variance test is to determine whether there are differences in hypothesis testing caused by variance between groups and not caused by differences within groups. A recapitulation of the homogeneity of variance test results for the pre-test and post-test for the experimental and control groups can be presented in Table 4.

Table 4. Recapitulation of Variance Homogeneity Test Results

No.	Science Knowledge Competency Data	F_{count}	F_{table}	Conclusion
1	Pre-test experimental and control groups	1.44	1.94	Homogeneous
2	Post-test of experimental and control groups	1.44	1.94	Homogeneous

The results of the homogeneity of variance test in the table above show that the pre-test and post-test data of the experimental and control groups were declared homogeneous. The data results from the data distribution normality test and the variance homogeneity test that have been obtained show that the data is normally distributed and homogeneous, so it can be continued to carry out data analysis by carrying out a t-test. A recapitulation of the t-test results can be presented in Table 5.

Table 5. Recapitulation of t-test Calculation Results

No.	Sample Group	N	X	Variance	dk	F_{count}	F_{table}
1	Experimental Class	26	82.50	28.50	52	8.413	2.006
2	Control Class	28	73.96	41.07			

Based on the t-test data in the table above, it can be concluded that the results of the analysis of the t-test results obtained tcount = 8.413 and for a significance level of 5% with dk = (26 + 28 - 2) = 52, ttable = 2.006. With the criteria $t_{count} > t_{table}$, namely t_{count} = 8.413 > t_{table} = 4.072, it can be stated that H_0 is rejected and H_1 is accepted. So, from these results, it can be concluded that there is a significant difference in the mastery of science knowledge competencies in the group of students who were taught using the problem-based learning model assisted by audio-visual media with the group of students who were not taught using the problem-based learning model assisted by audio-visual media in fifth-grade students. SD Negeri 2 Sesetan 2022/2023 academic year.

Discussion

This research aims to analyze the effect of implementing the problem-based learning model assisted by audio-visual media on fifth-grade students at SD Negeri 2 Sesetan for the 2022/2023 academic year. Based on the results of data analysis previously obtained, it can be concluded that there is a significant difference in the mastery of science knowledge competencies in the group of students who were taught using the problem-based learning model assisted by audio-visual media and the group of students who were not taught using the problem-based learning model assisted by audio-visual media for fifth-grade students at SD Negeri 2 Sesetan for the 2022/2023 academic year. The differences in the science knowledge competencies of students in the experimental group and the control group show that the application of learning models and media is very influential. In the experimental class, a problem-based learning model assisted by audio-visual media is implemented, which influences the learning process effectively, invites students to be active, and can increase students' science knowledge competency. Meanwhile, in the control class, which did not apply the problem-based learning model assisted by audio-visual media in the learning process, the impact on learning could have been more exciting, carried out optimally, and could not increase students' science knowledge competency. The existence of these significant differences can conclude that the application of the problem-based learning model assisted by audio-visual media is very appropriate to be used in the learning process because the application of this model can invite students to be active in the learning process and can increase students' interest in learning so that the learning material is delivered can be understood well.

The problem-based learning model assisted by audio-visual media can increase students' interest in learning by inviting students to solve the problems given and teaching students to find solutions to overcome these problems (Purwaningsih et al., 2020; Syawaludin et al., 2019). Applying the problem-based learning model assisted by audio-visual media allows students to implement their experiences to solve problems and influence student learning outcomes. The problem-based learning model assisted by audio-visual media can improve students' problem-solving abilities and better assess their problem-solving abilities (Hadibarata & Rubiyatno, 2019; Wati & Widiansyah, 2020). There are advantages to implementing the problem-based learning model assisted by audio-visual media, including (1) challenging students' abilities and inviting students to discover new knowledge, (2) increasing students' motivation and learning activities, (3) helping students in transferring knowledge, (4)) helps students to develop new knowledge, (5) encourages students to carry out their evaluation of both the results and the learning process, (6) develops students' ability to think critically, and (7) makes it easier for students to master the concepts studied to solve problems world (Parno et al., 2020; Ratini et al., 2018). So, from the explanation above, applying the problem-based learning model assisted by audio-visual media in the learning process can generate new desires and interests, motivate and stimulate learning activities, and psychologically influence students. Using audio-visual learning media will also greatly help the effectiveness of the learning process and delivery of messages and lesson content per curriculum demands (Akhdinirwanto et al., 2020; Zaki et al., 2020).

Several relevant studies support and strengthen the findings in this research, namely the results that the problem-based learning model helps readers choose an appropriate learning model and can attract students' interest in learning. This is proven by the average result obtained from the analyzed data, namely 21.3. The minimum increase in learning outcomes is 8.9, and the maximum increase is up to 83.3. Then, from the previous average data and the average after using the problem-based learning model, there was a significant change of 30%. Thus, using the problem-based learning model can improve student learning outcomes (Ertikanto et al., 2018; Sumardjoko, 2018). This is because the problem-based learning model effectively improves student learning outcomes. Research findings support that the problem-based learning model positively influences fifth-grade integrated thematic learning outcomes in Theme 2, Sub Theme 2, PB 1, 2, and 5, implemented in the Hamka Cluster, Sijunjung Regency. This can be seen from the results obtained tcount > ttable, 2.33 > 2.024. The tcount > ttable value shows that the two classes' learning outcomes in integrated thematic learning are significantly different. Audio-visual media also has a good influence on making students learn independently because clear concepts facilitate it, and examples in the video have been adapted to material related to the student's daily environment (Safura et al., 2018; Sunyono & Meristin, 2018). Apart from that, the design of this audio-visual media uses logical steps by applying a contextual approach to create a pleasant learning atmosphere (Narmaditya et al., 2018; Sueb & Damayanti, 2021). Learning activities using audio-visual media at SD N Kedung Baruk I/275 Rungkut Surabaya experienced increased learning activities and student learning outcomes. Students become more enthusiastic and active in learning; the average student score has increased (Meilinda et al., 2017; Rusydiyah et al., 2021).

This research reveals that applying the problem-based learning model assisted by audio-visual media significantly positively impacts fifth-grade students' mastery of science knowledge competencies at SD Negeri 2 Sesetan. However, several limitations need to be considered. First, this research only focused on one school and class, so the results must be cautiously generalized. Second, other aspects, such as the application of the learning model to other subjects and different grade levels, have yet to be considered, so further research must be conducted to evaluate its applicability as a whole. However, the advantages of this learning model are very clear. Using problem-based learning assisted by audio-visual media can increase students' interest, motivation and involvement in learning and help them develop problem-solving and critical-thinking skills. The implication of this research is the importance of paying attention to the role of technology in increasing the effectiveness of learning, as well as the need for further development of the application of this learning model in a broader educational context. Thus, this research enriches educational literature and provides new views on innovative and effective learning methods.

From several relevant studies, it can be concluded that the problem-based learning model assisted by audio-visual media has the advantage of inviting students to be active in the learning process, increasing students' interest in learning, making the learning process effective, and being able to increase students' science knowledge competency. It also becomes easier for teachers to explain learning material by applying this learning model combined with appropriate audio-visual media to optimize the implementation of the learning process. This research aims to increase students' science knowledge competency and activeness in learning so that it takes place optimally.

4. CONCLUSION

Based on the results of the research described previously, a conclusion can be drawn that there is a significant difference in the mastery of science knowledge competencies in the group of students who were taught using the problem-based learning model assisted by audio-visual media and the group of students who were not taught using the problem-based learning model assisted by media audio-visual for fifth-grade students at SD Negeri 2 Sesetan for the 2022/2023 academic year. The problem-based learning model assisted by audio-visual media can encourage students to be active in the learning process, increase students' interest in learning, make the learning process effective, and increase students' science knowledge competency. The use of audio-visual learning media will also greatly help the effectiveness of the learning process and the delivery of messages and lesson content by curriculum demands. The advice that can be given is that the results of this research can be widely known and used as a reference by other researchers and the general public to develop broad insight. The problem-based learning model assisted by audio-visual media can also be applied well by teachers and schools to design innovative learning processes and optimize the achievement of the expected learning goals.

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