PILLAR OF PHYSICS EDUCATION
Vol. 19 (4), 2026, page.391-400
ISSN (Print) : 2337-9618
ISSN (Online) : 2684-8880

THE EFFECT OF USING CONTEXT-BASED INSTRUCTIONAL VIDEOS ON STUDENTS' PROBLEM-SOLVING SKILLS IN THE TOPIC OF MOMENTUM AND IMPULSE

Aditya Saputra[1], Desnita[1*], Festiyed[1], Selma Riyasni[1]

[1] *Department of Physics, Universitas Negeri Padang, Jl. Prof. Dr. Hamka Air Tawar Padang 25131, Indonesia*
Corresponding author. Email:desnita@fmipa.unp.ac.id

ABSTRACT

Problem-solving skills are crucial in 21st-century learning. However, preliminary test results at Padang State High School 7 indicate that these skills are still not optimal, particularly in the stage of evaluating solutions. This study aims to analyze differences in students' problem-solving abilities between the use of context-based instructional videos and conventional instructional videos on the topics of momentum and impulse. This study employed a quantitative approach using a quasi-experimental method and a control group design without a pre-test. The sample consisted of 78 11th-grade students in Phase F, with 39 students each in the experimental and control groups. Both groups participated in instruction using the Problem-Based Learning (PBL) model, while the type of video served as the treatment variable. Data were collected through an essay test based on Polya's four stages of problem-solving and analyzed using descriptive statistics, normality tests, homogeneity tests, and an independent samples t-test at a significance level of 0.05. The results showed that the average score for the experimental group was 72.18 and 65.77 for the control group. The t-test results showed a significant difference of 0.042 ($p < 0.05$) with a Cohen's d effect size of 0.47 (moderate category). Thus, the group that used context-based instructional videos demonstrated higher problem-solving skills compared to the group that used instructional videos

Keywords : Problem-Solving Skills, Momentum and Impulse, Problem-Based Learning, Context-Based Instructional Videos

Pillar of Physics Education is licensed under a Creative Commons Attribution ShareAlike 4.0 International License.

I. INTRODUCTION

Problem-solving skills are one of the key competencies in 21st-century learning that need to be developed in physics education. These skills are not only related to conceptual mastery but also encompass the ability to identify relevant information, determine problem-solving strategies, apply appropriate concepts, and evaluate the results obtained. Therefore, physics education must provide students with opportunities to engage in meaningful problem-solving processes related to real-world situations. The development of these skills is also in line with educational demands that promote higher-order thinking skills (HOTS) [1].

One framework that can be used to analyze students' problem-solving abilities is Polya's stages, which include understanding the problem, formulating a solution plan, implementing the plan, and checking the results [2]. These four stages provide an overview of the process students go through when solving problems. These stages have also been used to analyze students' problem-solving abilities in the field of mechanics [3]. In physics instruction, these stages are relevant because students need to understand the situation presented, identify physical quantities and the relationships between concepts, select the appropriate equations or strategies, and verify that the results are consistent with the conditions of the problem. Therefore, problem-solving skills need to be developed through learning activities that help students connect the information in a problem with relevant physics concepts.

One approach that has the potential to support this process is contextual learning—that is, learning that connects subject matter to real-life situations or experiences relevant to students' lives. Through this approach, concepts are not only presented in the form of definitions and equations but are also linked to phenomena that

can be observed and understood. In physics instruction, presenting real-world contexts can help students identify key information in a problem and understand the relevance of the concepts they are learning [4][5]. Thus, context-based learning has the potential to support problem-solving, although its effectiveness still needs to be tested through empirical research.

Based on preliminary observations and interviews at Padang State High School No. 7, the Problem-Based Learning (PBL) model has been implemented in physics instruction. However, some students still struggle to understand the problems and relate the available information to the appropriate physics concepts, as was also reported in the unit on momentum and impulse [6]. Preliminary findings also indicate that students' ability to reevaluate their answers still needs to be developed. This situation highlights the need for instructional support that can help students understand the context of the problems more concretely. Therefore, the use of instructional media that presents real-world phenomena is one alternative that needs to be explored to support physics learning.

The topics of momentum and impulse are among the physics concepts that can be related to various phenomena in everyday life, such as collisions between objects, the use of airbags in vehicles, and motion and collisions in sports. To understand these phenomena, students need to connect the characteristics of these situations with the concepts of momentum, impulse, and changes in momentum. If instruction focuses only on presenting equations and calculations, students may have difficulty identifying the relationship between these phenomena and the concepts used to solve problems. This difficulty may stem from students' misunderstandings of momentum and impulse [7]. Therefore, presenting contextual phenomena through teaching media can be one way to support students' understanding of problems related to momentum and impulse.

Context-based instructional videos can be used to present real-world phenomena related to physics concepts. According to multimedia learning theory, the presentation of information through a carefully designed combination of words and images can support the learning process by helping students construct mental representations of the material being studied. Meanwhile, the situational learning perspective emphasizes the importance of context in understanding knowledge and its application in specific situations. In the context of problem-solving, videos depicting contextual phenomena have the potential to help students understand the problem situation before identifying relevant concepts and strategies to solve it [8]. However, these benefits depend on the appropriateness of the video content, the quality of its presentation, and its relevance to learning activities.

In this study, context-based instructional videos were used as a supporting medium in the Problem-Based Learning (PBL) model. PBL serves as a learning framework that facilitates students in identifying problems, conducting investigations, discussing information, and developing solutions. Videos were used to present the context of phenomena related to the problem being studied, while student worksheets (LKPD) were used to guide student activities [9]. To compare the types of media in a more targeted manner, both groups received instruction using the PBL model and the same learning materials; the difference in treatment lay in the type of video used—context-based instructional videos for the experimental group and standard instructional videos as a comparison for the control group.

A number of previous studies have examined the use of instructional videos, context-based learning, and problem-solving skills. Other studies have also examined the use of videos in teaching momentum and impulse [10][11]. In the same field of study, the application of context-based and problem-based learning models has also been reported to influence students' physics problem-solving skills [4]. Furthermore, video-supported problem-based learning tools have been reported to be effective in fostering students' problem-solving skills [12]. These findings indicate that the use of videos and context in physics instruction is not an entirely new concept [13][14]. The effectiveness of PBL on physics problem-solving skills has also been summarized in a meta-analysis [15]. However, the findings of previous studies cannot directly explain whether context-based instructional videos yield different problem-solving skill outcomes compared to conventional instructional videos when both are used within the same PBL framework for the topics of momentum and impulse. Therefore, this study focuses on comparing these two types of videos, rather than comparing the PBL model with other instructional models.

Based on the discussion above, this study aims to analyze the effect of using context-based instructional videos compared to conventional instructional videos on students' problem-solving skills related to the topics of momentum and impulse. Both groups participated in instruction using the PBL model; therefore, the comparison focused on the type of instructional video used. The research hypotheses are formulated as follows. H_0: There is no significant difference in students' problem-solving skills between the group using context-based instructional videos and the group using conventional instructional videos in PBL instruction on the topics of momentum and impulse. H_a: There is a significant difference in students' problem-solving skills between the group using context-based instructional videos and the group using conventional instructional videos in PBL instruction on the topics of momentum and impulse.

II. METHOD

Research Design

This study employed a quantitative approach using a quasi-experimental research method. The design used was a control group design with a post-treatment-only test [16], involving two pre-existing classes. This design was chosen because the researcher did not randomly assign individual students to the experimental and control groups. This study aims to analyze differences in students' problem-solving abilities based on the use of two types of instructional videos: context-based instructional videos and conventional instructional videos. Both groups participated in learning using the Problem-Based Learning (PBL) model, while the difference in treatment lay in the type of instructional video used. The PBL model was implemented as a teaching framework to ensure that learning activities proceeded in a structured manner, while worksheets were used as a guide for student learning activities. Thus, the focus of this study was on the differences in the use of instructional videos, not on testing the effectiveness of the PBL model or the worksheets. The research design is presented as follows:

Table 1. Posttest-Only Control Group Design

Group	Treatment	Posttest
Eksperimental	X_1	O_1
Control	X_2	O_2

Source: [16]

Notes: Note: X_1 = learning using context-based instructional videos; X_2 = learning using standard instructional videos; O_1 and O_2 = measurements of students' problem-solving abilities through final tests in each group.

Research Population and Sample

This study was conducted at Padang State High School No. 7 on the topics of momentum and impulse. The study was carried out during the odd semester of the 2026/2027 academic year. The study population consisted of all students in Class XI F at Padang State High School 7. Each Class XI had 39 students. The study sample consisted of Class XI F1 as the experimental group and Class XI F2 as the control group, each with 39 students, resulting in a total sample size of 78 students.

The sample was selected using purposive sampling, taking into account the similarity of teaching staff and information regarding students' prior knowledge. Initial data showed that the average score for Class XI F1 was 41.60, for Class XI F2 was 40.01, and for Class XI F4 was 46.30. This data was used as an initial consideration in class selection. However, the descriptive similarity of these average scores is not sufficient to statistically prove the equivalence of initial abilities. Since this study used existing classes and did not include a pretest for the main sample as part of the research outcome measurement design, potential differences in initial abilities must be considered when interpreting the results. If initial ability data were available.

Research Variables and Treatment

The independent variable in this study was the use of context-based instructional videos, with conventional instructional videos serving as the control group. The dependent variable was students' problem-solving skills related to the concepts of momentum and impulse. This study compared the learning outcomes of the two groups to determine whether there were differences in problem-solving skills after students participated in instruction using different types of videos.

The experimental group used context-based instructional videos designed to link the concepts of momentum and impulse to students' real-life experiences and everyday phenomena (such as vehicle collision simulations, the use of airbags, and sports activities). These videos, developed by a research team led by Desnita in 2020, have been validated by experts. The use of these videos aims to help students analyze cases, connect physical phenomena to theory, and develop higher-order thinking skills (HOTS) in problem-solving. The control group used standard instructional videos sourced from YouTube. These comparison videos present general material on momentum and impulse and focus on the problem-orientation stage without deeply linking everyday phenomena to a systematic problem-solving framework. In both groups, instruction was conducted using the Mass-Based Learning model.

Research Instrument

Data on students' problem-solving abilities were collected through a written essay-type test designed based on Polya's four stages of problem-solving. Initially, the instrument consisted of 32 test items. The quality of the instrument was assessed through two validation stages, namely: 1). Content Validity: Conducted by expert validators to assess the alignment of test items with the indicators of momentum and impulse, as well as Polya's problem-solving construct. The assessment results were calculated using Aiken's V coefficient. 2). Empirical

Validity: The 32 test items that had been validated by the experts were pilot-tested on students outside the main sample. Empirical validity was calculated using the product-moment correlation [17]. Test items meeting the criterion of a calculated r value > the table r value were considered valid and used as the final test instrument (posttest). Scoring of open-ended responses was based on a rubric aligned with Polya's four stages. The rubric, scoring ranges, number of items at each stage, and results of inter-rater reliability testing must be described in accordance with the applied assessment procedures. If conducted, analyses of item difficulty and discriminative power are also reported to provide information on the quality of the instrument.

Data Analysis Technique

The main data collection was conducted by administering a final test to the experimental and control groups after the entire learning process was completed. Both groups completed the same assessment instrument under equivalent procedures and time allocations. The final test was used to measure students' problem-solving skills after participating in instruction using different instructional videos. The data obtained were then processed and analyzed to compare problem-solving skills between the group that used context-based instructional videos and the group that used conventional instructional videos.

The data were analyzed using descriptive and inferential statistics. Descriptive statistics were used to describe the number of students, mean scores, standard deviations, and the distribution of final test scores in the experimental and control groups. Analysis was also conducted based on Polya's four stages to identify patterns in students' problem-solving abilities at each stage. Prior to hypothesis testing, a normality test was conducted using the Shapiro–Wilk test, and a test for homogeneity of variances was conducted using Levene's test. The normality test was used to evaluate the distribution of scores in each group, while the test for homogeneity of variances was used to check for equality of variances between the two groups.

If the assumptions of the analysis were met, the difference in the mean problem-solving ability between the two groups was tested using

III. RESULTS AND DISCUSSION

Result

The validity of the problem-solving ability test instrument was assessed in two stages: content validity testing by experts and empirical validity testing through field testing. The results of the expert evaluation, using Aiken's V coefficient for the 32 test items designed, showed values ranging from 0.73 to 0.78. These values met the content validity criteria (V > 0.60), so all 32 test items were considered content-valid and suitable for empirical testing. Subsequently, all 32 test items were field-tested. The results of the correlation analysis showed that 20 items were deemed valid (calculated r-values > table r-values), while 12 items were deemed invalid (and were discarded). These 20 valid items were then used as the final test instrument (posttest). Details of the empirical validity test results for all 32 items are presented in Table 2.

Table 2. Item Validity

Item No	Validity	Criteria
1	0,713	Valid
2	0,651	Valid
3	0,674	Valid
4	0,658	Valid
5	0,123	Invalid
6	0,725	Valid
7	0,735	Valid
8	0,291	Invalid
9	0,114	Invalid
10	0,671	Valid
11	0,671	Valid
12	-0,14	Invalid
13	0,187	Invalid
14	0,004	Invalid
15	0,829	Valid
16	0,651	Valid
17	0,243	Invalid
18	0,243	Invalid
19	0,716	Valid
20	0,654	Valid

Item No	Validity	Criteria
21	0,664	Valid
22	0,644	Valid
23	0,148	Invalid
24	0,753	Valid
25	0,623	Valid
26	0,295	Invalid
27	0,624	Valid
28	0,742	Valid
29	0,651	Valid
30	0,198	Invalid
31	0,689	Valid
32	0,290	Invalid

The experts' assessment and empirical testing provided different information regarding the quality of the instrument. Expert judgment was used to evaluate the alignment of item content with the indicators and constructs being measured, whereas empirical testing evaluated the relationship between item scores and the total test score based on the responses of the field-trial participants. Therefore, items that met the content validity criteria did not necessarily meet the empirical validity criteria. However, the causes of invalidity for each item cannot be determined solely from the correlation coefficients; they require examination of item characteristics, scoring rubrics, and field-trial participants' responses.

Instrument Reliability

The reliability of the instrument was analyzed using Cronbach's alpha for the 20 test items used in this study. The test results showed a Cronbach's alpha. Thus, the instrument meets the reliability criteria for use in collecting data on students' problem-solving skills. The reliability test results are presented in Table 3.

Table 3. Item Reliabily Test

Reliability Statistics	
Cronbach's Alpha	N of Items
.947	20

Based on Table 3, the instrument yielded a Cronbach's alpha coefficient of 0.947 for its 20 items. This value indicates that the instrument has high internal consistency and excellent reliability. Therefore, the instrument is considered reliable and suitable for collecting data on students' problem-solving skills.

Descriptive Statistics of Problem-Solving Skills

After the instruments were developed, a final test was administered to the experimental and control groups. Both groups participated in instruction using the Problem-Based Learning (PBL) model and the same worksheets. The difference in treatment lay in the type of instructional video used. The experimental group used context-based instructional videos, while the control group used standard instructional videos as a comparison. Descriptive statistics for both groups are presented in Table 4.

Table 4. Descriptive Statistic of Problem-Solving Skills

Group Statistics					
	Results	N	Mean	Std. Deviation	Std. Error Mean
Value	Posttest Experimental Class	39	72.18	14.086	2.256
	Posttest Control Class	39	65.77	13.206	2.115

Based on Table 4, the experimental group achieved an average score of 72.18, which was higher than the control group's average score of 65.77. The difference of 6.41 points indicates that, descriptively, students in the experimental group demonstrated better problem-solving performance. In addition, the experimental group had a standard deviation of 14.086, compared to 13.206 in the control group, indicating slightly greater variation in student scores in the experimental group. However, further statistical analysis is needed to determine whether this difference in mean scores is statistically significant.

Descriptive analysis was also conducted based on Polya's four stages of problem-solving. The results showed that the experimental group scored higher than the control group at all stages. At the problem-understanding stage, the experimental group scored 75.00, while the control group scored 69.97. At the planning stage, the scores for each group were 71.63 and 67.54, respectively. In the "plan implementation" stage, the experimental group scored 73.17, while the control group scored 63.83. Meanwhile, in the "evaluation" stage, the experimental group scored 68.97 and the control group scored 60.26. These results are presented in Figure 1.

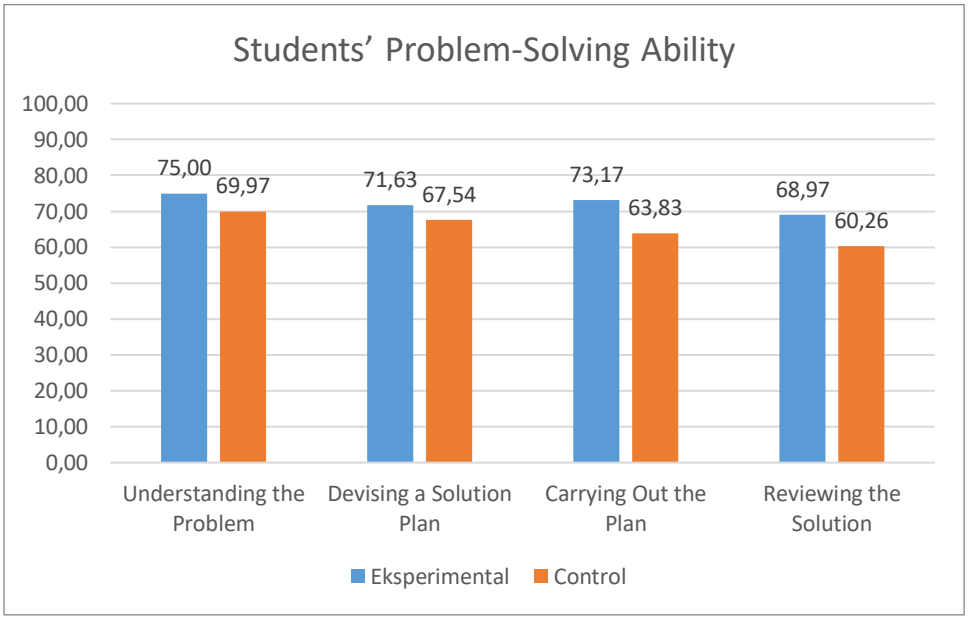


Figure 1. Students' Problem-Solving Ability Based on Polya's Stages

The results presented in Figure 1 show that the experimental group performed better than the control group in all four stages of Polya's problem-solving framework. The largest difference was observed in the plan execution stage, with a difference of 9.34 points, followed by the evaluation stage, with a difference of 8.71 points. The differences in the "understanding the problem" and "formulating a plan" stages were 5.03 and 4.09 points, respectively. These findings suggest that the use of context-based instructional videos in PBL is associated with better descriptive performance at each stage of problem-solving, particularly in applying problem-solving strategies and evaluating solutions. However, these descriptive results alone are not sufficient to establish a cause-and-effect relationship at each stage individually.

Prerequisite Assumption Tests

A normality test was conducted using the Shapiro–Wilk test to determine the distribution of post-test scores in each group. The results of this test are presented in Table 5.

Table 5. Posttest Normality Test Results

Group	N	Shapiro-Wilk	Sig.	Information
Experiment	39	0,958	0,156	Normal
Control	39	0,960	0,182	Normal

Based on Table 5, the Shapiro–Wilk test yielded a p-value of 0.156 for the experimental group and 0.182 for the control group. Both values exceed the significance level of 0.05, indicating that the final test scores for both groups are normally distributed. Therefore, the assumption of normality is met, and the analysis can proceed to the next stage of statistical testing.

Next, a homogeneity test was conducted using Levene's test to evaluate the equality of variances between the two groups. The results of this test are presented in Table 6.

Table 6. Posttest Homogeneity Test Results

Kelompok	N	F	Sig.	Information
Experiment	39	0,084	0,773	Homogen
Control	39	0,084	0,773	

Based on Table 6, Levene's test yielded an F-value of 0.084 and a p-value of 0.773. Since the p-value is greater than 0.05, the variances of the experimental and control groups can be considered homogeneous. Therefore, the assumption of homogeneity is met, and an independent samples t-test can be conducted to test for differences in students' post-test scores between the two groups.

Hypothesis Testing

Hypothesis testing was conducted using an independent samples t-test to determine whether there was a difference in problem-solving ability between the group that used context-based instructional videos and the group that used standard instructional videos. The test results showed a t-value of 2.073, degrees of freedom (df) of 76, and a two-tailed significance level of 0.042. Since this significance level is less than 0.05, there is a statistically significant difference between the two groups. The results of the hypothesis testing are presented in Table 7.

Table 7. Independent Samples t-Test Results

		Independent Samples Test							
		T-hitung	**T-tabel**	**df**	**Sig. (2-tailed)**	**Mean Difference**	**Std. Error Difference**	**95% Confidence Interval of the Difference**	
								Lower	**Upper**
Posttest Values	Equal variances assumed	2,073	1,991	76	0,042	6.410	3.092	.252	12.568
	Equal variances not assumed	2,073	1,991	75.686	0,042	6.410	3.092	.252	12.568

Based on Table 7, the independent-samples t-test yielded a t-value of 2.073, which exceeds the critical t-value of 1.991, with 76 degrees of freedom and a significance level of 0.042 ($p < 0.05$). The mean difference between the two groups is 6.410 points, with a 95% confidence interval ranging from 0.252 to 12.568. These results indicate a statistically significant difference in students' problem-solving abilities between the experimental and control groups. Combined with the higher post-test average scores in the experimental group, these findings suggest that students who learned using context-based instructional videos achieved better problem-solving performance than those who used standard instructional videos.

In addition to statistical significance, the effect size was calculated using Cohen's d to describe the magnitude of the difference between the two groups. A Cohen's d value of 0.47 falls into the moderate category based on Cohen's interpretation conventions. These results indicate a difference in problem-solving ability with a moderate effect size. However, these results must be interpreted with caution because the significance value is relatively close to the 0.05 threshold, and this study involved only one class in each treatment condition.

Discussion

The results of the study indicate a difference in problem-solving ability between the experimental group and the control group after both groups received instruction using the Problem-Based Learning (PBL) model with different video media. The experimental group achieved an average final test score of 72.18, while the control group scored 65.77. The results of the independent samples t-test showed a significance value of 0.042 ($p < 0.05$), indicating a statistically significant difference between the two groups. A Cohen's d value of 0.47 indicates a moderate effect size. These results indicate that the use of context-based instructional videos in PBL is associated with higher problem-solving achievement compared to instructional videos that provide a comparative overview of the topics of momentum and impulse. These findings are consistent with research on momentum and impulse that reported higher learning outcomes in groups using video game-based media in discovery learning [18]. The effect of context-based videos on problem-solving skills and learning outcomes has also been studied in other subjects [13][5].

This difference in achievement must be understood by considering the characteristics of the treatment in both groups. Both groups received the same PBL model and worksheets, so students in both groups went through the same stages: problem orientation, investigation, discussion, solution development, and evaluation. The difference in treatment lay in the video media used. The experimental group used contextual learning videos that presented everyday phenomena (such as vehicle collisions and airbags) related to the concepts of momentum and impulse, while the control group used standard educational videos sourced from YouTube as a comparison. Therefore, the differences in problem-solving performance can be discussed based on the characteristics of the video media within the same learning environment.

Further descriptive analysis was conducted to examine student performance across the four stages of Polya's problem-solving model. In the "understanding the problem" stage, the experimental group scored 75.00, while the control group scored 69.97. This stage requires students to identify known information, determine what is being asked, and understand the relationships among the information presented in the problem. The higher achievement of the experimental group indicates that students were better able to identify key elements in the given problem. This aligns with the principles of multimedia learning, which state that the appropriate presentation of words and images helps students construct mental representations of the material being studied [19]. Presenting phenomena through contextual videos provides a cognitive bridge for students to translate the problem text into easily understandable real-world situations. Thus, the information in the problems is not only received in the form of text or mathematical symbols but can also be linked to phenomena observed through the videos.

In the problem-solving devising a solution plan stage, the experimental group scored 71.63, while the control group scored 67.54. This stage relates to students' ability to identify relevant physics concepts or principles, select the appropriate equations, and design solution steps based on the information they have understood. The higher performance of the experimental group can be attributed to the connection between the phenomena shown in the video and the concepts of momentum and impulse. The real-life context depicted in the video provided a starting point for students to relate these phenomena to the physics concepts needed to solve the problem. This finding is consistent with reports that integrating context with PBL in the topics of momentum and impulse supports physics problem-solving skills [4]. When students understand this relationship, they have a clearer foundation for identifying the concepts, equations, and strategies to use.

During the carrying out the plan stage, the experimental group scored 73.17, while the control group scored 63.83. This stage required students to apply physics concepts and principles, use the appropriate equations, perform calculations, and apply problem-solving strategies systematically. The higher score of the experimental group can be attributed to the understanding they had developed in the previous stage. After gaining an understanding of the phenomenon through the video and identifying relevant concepts, students were able to use that information as a basis for applying equations and carrying out problem-solving steps. Consistent with the findings in [20][21], the implementation of the PBL model with structured learning materials supports the improvement of students' problem-solving skills.

In the reviewing the solution stage, the experimental group scored 68.97, while the control group scored 60.26. This phase required students to reevaluate their steps and solutions and assess their relevance to the given problem. These scores can be linked to the context of the phenomenon that students have been observing since the beginning of the lesson. The contextual video illustrates the physical conditions underlying the problem, thereby providing a reference point for students as they evaluate their results. Students can not only check the accuracy of their calculations but also consider whether their solutions align with the physical conditions depicted. This stage still requires additional support; therefore, the activity of re-evaluating calculation results and unit consistency can be reinforced through reflective questions in a worksheet guided by the teacher. The use of context in physics learning can help students connect concepts to more meaningful situations [5]. In the context of problem-solving, these visual experiences can be revisited as students reflect on their problem-solving processes and outcomes.

This pattern indicates a correlation between the characteristics of context-based instructional videos and Polya's stages of problem-solving. Videos provide a visual experience and contextualize phenomena; PBL provides a problem-based learning structure; and worksheets help guide students in organizing information and solving problems. These three components work together in a single learning sequence, while the main difference between the experimental and control groups lies in the characteristics of the videos used. However, the research results do not indicate that the videos are the sole factor determining problem-solving ability. Both groups received the same PBL and worksheets; therefore, the improvement in problem-solving ability should be understood as the result of the overall learning process, with the videos serving as one component of the treatment. The difference in achievement between the two groups indicates that the contextual characteristics of the videos can provide additional support in the process of understanding phenomena, connecting concepts, applying strategies, and evaluating solution outcomes.

Overall, the experimental group achieved an average score of 72.18 on the final test, which was higher than the control group's score of 65.77; the results of the independent samples t-test showed a p-value of 0.042 ($p < 0.05$) and a Cohen's d of 0.47, indicating a moderate effect size. These results suggest that the use of context-based instructional videos in PBL is associated with higher problem-solving achievement on the topics of momentum and impulse. Higher performance across all stages of Polya's model suggests that contextual video support is associated not only with understanding the context of the problem but also with the processes of planning, executing, and evaluating problem-solving. These findings are consistent with research on momentum and impulse, which reported higher learning outcomes in groups that used video game-based media in discovery learning [18].

IV. CONCLUSION

Based on the research findings, there was a significant difference in students' problem-solving abilities between the group that participated in Problem-Based Learning (PBL) supported by contextual instructional videos and the group that participated in PBL supported by comparative instructional videos on the topics of momentum and impulse (with a t-value of 2.073 and a p-value of 0.042). The experimental group achieved a higher average problem-solving ability than the control group, with a moderate effect size (d = 0.47). Descriptively, the experimental group also demonstrated higher achievement across all four stages of Polya's problem-solving model. However, differences at each stage were not statistically tested; therefore, these differences cannot be concluded as significant at each stage. Thus, context-based instructional videos have the potential to serve as an alternative supporting medium in PBL instruction for the topics of momentum and impulse.

This study has limitations, namely the use of a "posttest-only" control group design and the fact that it involved only two classes from a single school; consequently, students' initial abilities were not assessed via a pretest, so the generalizability of the study's findings must be interpreted with caution. Furthermore, each group was represented by only one class. Future research is recommended to use both pretests and posttests, involve more classes from various schools, consider random assignment where possible, and conduct instruction over a longer period to obtain stronger evidence regarding the effectiveness of context-based instructional videos on students' problem-solving skills.

ACKNOWLEDGMENT

The author would like to thank Padang State High School No. 7 for granting permission and providing support throughout the research process. Thanks are also extended to the physics teachers and students who participated and assisted in the research data collection process. The author would also like to thank the academic advisor and the faculty members in the Department of Physics Education, Faculty of Mathematics and Natural Sciences, Padang State University, for their guidance, direction, and feedback provided throughout the research process. Finally, the author would like to thank all parties who provided assistance and support, both directly and indirectly, so that this research could be successfully completed.

REFERENCES

[1] A. Jayadi, D. H. Putri, And H. Johan, "Identifikasi Pembekalan Keterampilan Abad 21 Pada Aspek Keterampilan Pemecahan Masalah Siswa Sma Kota Bengkulu Dalam Mata Pelajaran Fisika Agung," *J. Kumparan Fis.*, Vol. 3, No. 1, Pp. 25–32, 2020, Doi: 10.33369/Jkf.3.1.25-32.

[2] G. Polya, *How To Solve It*. Usa: Princeton University Press, 1957.

[3] K. Suartini, A. Tjalla, And Mahdiyah, "The Influence Of Students Self-Efficacy On Classic Mechanics Problem Solving Ability With The Polya Model," *Jotalp J. Teach. Learn. Phys.*, Vol. 8, No. 1, Pp. 48–53, 2023, Doi: 10.15575/Jotalp.V8i1.23356.

[4] Yuberti, S. Latifah, A. Saregar, Misbah, A. Anugrah, And K. Jermsittiparsert, "Approaching Problem-Solving Skills Of Momentum And Impulse Phenomena Using Context And Problem-Based Learning," *Eur. J. Educ. Res.*, Vol. 8, No. 4, Pp. 1217–1227, 2019, Doi: 10.12973/Eu-Jer.8.4.1217.

[5] A. R. Sari, S. Gummah, B. A. Sukroyanti, And H. Habibi, "The Effect Of Contextual Teaching And Learning Model Assisted By Video On Students' Learning Outcomes And Motivation," *Lensa J. Kependidikan Fis.*, Vol. 12, No. 2, Pp. 197–211, 2024, Doi: 10.33394/J- Lkf.V12i2.13313.

[6] T. Adianto And M. A. Rusli, "Analysis Of Student's Difficulties In Solving Physics Problem: Im- Pulse And Momentum Topics," *Unnes Sci. Educ.*, Vol. 10, No. 1, Pp. 24–33, 2021, Doi: 10.15294/Usej.V10i1.41517.

[7] I. Kaniawati, G. Triyani, A. Danawan, I. Suyana, A. Samsudin, And E. Suhendi, "Implementation Of Interactive Conceptual Instruction (Ici) With Computer Simulation : Impact Of Students ' Misconceptions On Momentum And Impulse Material," Vol. 10, Pp. 1–17, 2021, Doi: 10.24042/Jipfalbiruni.V10i1.8375.

[8] E. K. Sitinjak, "Penggunaan Video Pembelajaran Untuk Meningkatkan Kemampuan Pemecahan Masalah Fisika," Vol. 6, No. 1, Pp. 19–25, 2022, Doi: 10.23887/Jppp.V6i1.45006.

[9] H. Choeriyah, D. Yulianti, And I. Yulianti, "Pengembangan Lembar Kerja Siswa (Lks) Fisika Berbasis Problem Based Learning Untuk Meningkatkan Kemampuan Pemecahan Masalah," *Unnes Phys. Educ. J.*, Vol. 10, No. 1, 2021, Doi: 10.15294/Upej.V10i1.46756.

[10] A. Doyan, I. Putri, M. Taufik, And Susilawati, "Practicality Of Physics Learning Tools Using Blended

Learning Model With Video Assistance On Momentum And Impulse Materials To Improve Problem Solving Ability Of Students," *J. Sci. Sci. Educ.*, 2022, Doi: 10.29303/Jossed.V3i2.2575.

[11] I. Putri, M. Taufik, And Susilawati, "Validitas Perangkat Pembelajaran Model Blended Learning Berbantuan Video Pada Materi Momentum Dan Impuls Untuk Meningkatkan Kemampuan Pemecahan Masalah," *J. Ilm. Pendidik. Fis.*, Vol. 7, Pp. 1071–1077, 2022, Doi: 10.29303/Jipp.V7i3.650.

[12] F. Rahmana, L. Muliyadi, Kosim, And Susilawati, "Practicality Of Problem-Based Physics Learning Tools With Video Assistance To Improve Problem- Solving Ability Of Students," *J. Sci. Sci. Educ.*, 2022, Doi: 10.29303/Jossed.V3i1.1614.

[13] H. Tamrin And Desnita, "The Effect Of Using Context-Based Learning Videos On Global Warming Materials On Students' Problem-Solving Skills," *Phys. Educ. Res. J.*, Vol. 5, No. 1, Pp. 21–28, 2023, Doi: 10.21580/Perj.2023.5.1.13082.

[14] S. Hamida And Desnita, "The Validity Of Contextual-Based Physics Learning Videos To Improve Students ' 4c Skills," *Int. J. Progress. Sci. Technol.*, Vol. 25, No. 2, Pp. 175–184, 2021, Doi: 10.52155/Ijpsat.V25.2.2843.

[15] R. Siregar, W. S. Dewi, A. Putra, And Hidayati, "The Effect Of Problem-Based Learning Model On Students ' Physics Problem Solving Ability : A Meta-Analysis," *J. Penelit. Pendidik. Ipa*, Vol. 9, No. 4, Pp. 2103–2109, 2023, Doi: 10.29303/Jppipa.V9i4.3291 ©.

[16] Sugiyono, *Metode Penelitian Kuantitatif, Kualitatif, Dan R & D*. Bandung: Alfabeta Bandung, 2017.

[17] H. Retnawati, *Analisis Kuantitatif Instrumen Penelitian (Panduan Peneliti, Mahasiswa, Dan Psikometrian) Pengembangan*. Yogyakarta: Paranama Publishing, Yogyakarta, 2016.

[18] M. Nurkhojin, A. H. Odja, T. J. Buhungo, R. Uloli, Mursalin, And C. S. Payu, "The Effectiveness Of The Discovery Learning Model Assisted By Video Games To Improve Student Learning Outcomes On The Concept Of Momentum And Impulse In High School," *Phys. Educ. Res. J.*, Vol. 4, No. 2, Pp. 57–62, 2022, Doi: 10.21580/Perj.2022.4.2.12781.

[19] F. Rahmana, Susilawati, And Kosim, "The Effectiveness Of Video-Assisted Problem-Based Physics Learning Devices To Improve Students ' Problem-Solving Ability On Elasticity Materials," *J. Penelit. Pendidik. Ipa*, Vol. 7, No. Special Issue, Pp. 362–330, 2021, Doi: 10.29303/Jppipa.V7ispecialissue.1237.

[20] T. I. W. Diana And Suliyanah, "The Implementation Of Problem Based Learning Model : An Effort In Upgrading Students ' Problem-Solving Skills," *Junral Pendidik. Fis.*, Vol. 10, No. 2, Pp. 123–129, 2022, Doi: 10.26618/Jpf.V10i2.7187.

[21] W. A. Aripin, H. Sahidu, And M. Makhrus, "Efektivitas Perangkat Pembelajaran Fisika Berbasis Model Problem Based Learning Untuk Meningkatkan Kemampuan Pemecahan Masalah Dan Kemampuan Berpikir Kritis Peserta Didik," *J. Penelit. Dan Pembelajaran Fis. Indones.*, Vol. 3, No. 1, Pp. 19–23, 2021, Doi: 10.29303/Jppfi.V3i1.120.