



MEASURING THE EFFECT OF PROBLEM BASED LEARNING WITH INSTRUCTIONAL VIDEO ON PRIMARY SCHOOL STUDENTS' PROBLEM-SOLVING SKILLS DEVELOPMENT

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Abstract

This study aims to analyse the efficacy of instructional video through problem-based learning model in developing problem-solving skills among primary school students. This research integrated in video instructional material related to statistics topics "data collection and data presentation" to improve student problem-solving skills. Quasi Post-

test-only system experiment was used to achieve this study's goal. The model was introduced in three primary public schools in Banda Aceh, Indonesia, involving 163 grade 5 students. A post-examination test was administered after treatment. Independent t-test findings indicate a substantial mean difference between the control group and the experimental group with a significant level below 0.05. Accordingly, integrating classroom video collaboration with problem-based learning model helps students strengthen their understanding of statistics subject and enhance their problem-solving skills. Thus, these findings suggest that PBL with instructional video is more successful than traditional teaching method to boost problem-solving ability among primary school students.

Keywords: *Problem Based Learning, Problem Solving Skills, Primary School Student*

A. Introduction

Students' difficulties in solving mathematical problems among primary school students are well documented (Kramarski et al., 2002)(Stein & Burchartz, 2006). Many students, lower as well as higher achievers, face difficulties in solving authentic tasks (Kramarski et al., 2002). The difficulties are raised at all stages of the solution process from the very first stage of understanding what the problem is all about, through planning the solution process and selecting appropriate strategies, to reflecting on the solution and deciding whether or not it makes sense. This problem also faces by Indonesian students. The results of TIMSS and PISA studies showed that Indonesian students' problem- solving skills are in the lower levels (Stacey, 2005).

Problem based learning (PBL) is considered as one of the effective strategies contribute to the development of students cognitive and metacognitive thinking skills such problem solving (Weshah, 1997). The first development of PBL was carried out by Howard Barowws in Macmaster University Canada which used to improve medical college students' ability to think and to deal with medical problems in different setting and environment. Currently, it has been used worldwide in many disciplines and school curricula.

(Weshah, 1997) (1997:262) defined PBL as "methodology that situated learning in complex and meaningful problems that are framed in authentic context". The aim of this approach is to motivate students by asking them to solve authentic problems, to promote collaboration and problem-solving skill that are needed for students' future live (Jun & Minwha, 2011). Through problem-based learning, group of students are required to solve a carefully constructed problem. The problem basically contains a daily world issues or conditions that are needed of solutions. The student learning activities in this model is to

work collaboratively to solve these problems and to make hypothesis the phenomena by discussing and describing them in terms of underlying process, principle, or mechanism. As students actively and socially construct knowledge, instructors allow them to handle more complex and difficult cases (Weshah, 1997).

PBL has unique features that make it an effective learning method. One justification of using PBL is that developing students' strategy which is applying learned knowledge to problem solving. (Yu et al., 2014) found that problem-based learning produced better long-term retention, skill development, and satisfaction of students and teachers than those in traditional instruction.

On the other side, a considerable body of research literature has shown that multimedia resources can help children improve higher-order mathematical thinking [7], for example, video is a rich environment that elicits reflection on mathematics and problem solving. Appropriate video design provides unique opportunities for experimentation and innovative problem solving. It can also help students make visually tangible change from studying an abstract term. Video as a part of classroom instruction has long been studied in many topics [1][8][9]. Educators recognized the ability of audio-visual materials to catch learners' attention, increase their enthusiasm, and improve learning. Researchers who incorporated video to promote student learning used many different terms such as video-based teaching, video-based learning, classroom video, and instructional video. For example, [1] found that classroom video provides students with a rich learning atmosphere and enhances students' ability to absorb and retain presented content.

Many research literatures recorded several pedagogical strengths of video. These involve presenting knowledge in a coherent and appealing manner and showing facts and specifics that are difficult to describe by text or static photograph [10], making the complexities of teaching and learning processes noticeable and making systematic observation available from various perspectives [11]; attracting students' interest, growing motivation, improving learning and engaging students. Using video will contribute to better learning outcomes. It supports various learning styles, particularly visual learners. This indicates that video may be an important factor in teaching mathematics for primary students, where their cognitive growth is predominantly concrete. Hence, primary school teachers are encouraged to regularly use video in their everyday classroom teaching.

With regard to these PBL model and video potential, it is suggested that PBL with instructional video may be used to resolve some of the mathematics education issues in Indonesia specially to develop problem-solving skills for students. Moreover, Indonesia's analysis of implementing PBL model with video in primary mathematics classroom is still limited. Therefore, this study tries to address the following research questions, "What is the impact of PBL model with instructional video in enhancing problem-solving skills of primary students? Students' response to mathematical problem-solving was examined to assess the model's effectiveness in enhancing student ability.

B. Method

This study employed quasi experiment with control group post-test design by teaching mathematics to fifth-grade students in order to answer the research question proposed by this study. Two types of groups were created, namely experimental group and control group. The instructional video was especially developed for this study to function as a treatment for the experimental group. Thus, the teaching procedures conducted for this study is the experimental group used the video-based instruction within problem-based learning model and the control group used traditional method (with direct instruction approach).

A.1. Participants

This study was conducted in three public primary schools in Banda Aceh, Indonesia. Two classes were selected from each school, one assigned as an experimental group and another one as control group. A total of 163 grade 5th students, ranged from 28-32 students in each group, participated in the study voluntarily.

A.2. Experimental design

The quasi experiment was carried out in October 2018. Complete experiments took about three weeks: in the first week students did the pre-test, in the second week the experimental group worked to solve mathematical problem the assistance of video-based instruction and the third week students did again the test. In experimental group, instructional video and PBL approach were used, while in the control group, traditional mathematics teaching methods was used as a teaching method. The same mathematics topic (statistics) was delivered in all groups, but the learning activities were organized in accordance with proposed approached. Teaching experiment was conducted by teachers from each selected school after being trained through 3-days workshop which conducted by researchers. In that workshop, teachers were informed about the experimental

process and trained on how to employ such approach. This was conducted to assure that all group from each school accept the same teaching process followed the experimental procedure proposed by researchers. The procedures of video-based instruction and PBL Model adopted from (Pendidikan, 2020) can be seen from Table 1. In addition, all teaching instruments such as lesson plan, instructional video, student's worksheet and tests were provided by research to be used by teachers during the teaching process.

Table 1. The syntax of PBL with instructional Video at the experimental group

Teacher's activity	Student's activities
<p>Phase 1: Orienting student to problems</p> <ul style="list-style-type: none"> • Teacher starts the lesson through apperception and giving motivation • Teacher plays the video which contain of learning outcomes, learning objectives, contents and mathematical problems related to statistics subject. 	<ul style="list-style-type: none"> • Students are reminded about previous lesson topic and are motivated by trying to understand the learning objectives, taking into account the direction of learning process and the skill of problem solving presented by teachers • Student watch video and follow the instruction as required by video
<p>Phase 2: Organizing student to learn</p> <ul style="list-style-type: none"> • Teacher divides students into heterogeneous groups (4-5 students) and • Teacher distributes student worksheet which contain non routine mathematical problems to be solved by students collaboratively 	<ul style="list-style-type: none"> • Students gather in heterogeneous group (4-5 students) to solve non-routine mathematical problems administered through student worksheet. • Students work collaboratively to solve the give problems.
<p>Phase 3: Guiding individual or group investigation</p> <p>Teacher guide students in solving mathematics problems provided within student worksheet</p>	<ul style="list-style-type: none"> • The activities of student in solving non-routine mathematical problem in worksheet as an effort to train problems solving skills in the learning process as follow: <ul style="list-style-type: none"> ✓ Student understand the problems by identifying what are known and unknown about the problem ✓ Student select appropriate mathematical formula/concepts to solve problem ✓ Implementing concepts/formula to solve problem ✓ Evaluate the results whether correct and not by giving the explanation
<p>Phase 4: Developing and presenting the results</p>	

Teacher's activity	Student's activities
Teacher guides student to present their results of given mathematical problem to classical or another group	Students prepare their responses to be presented in front of classes and let their peer group to question or to give suggestions
Phase 5: Analyzing and evaluating the process	
<ul style="list-style-type: none"> Teacher guides students to evaluate processes and outcomes in the skill of problem solving Teachers provide follow-up tasks for individual students 	<ul style="list-style-type: none"> Students evaluate the processes and outcomes in their skills of problem solving All students obtain and undertake follow-up task outside of the school hours

A.3. Data collection instruments

The instruments used in this research was posttest. The post-test was a paper-based pencil test namely problem-solving essay test (PBET) consisting of 2 items with duration to complete is 35 minutes. The instruments were constructed by researchers, and validated by the instructional experts from several universities in Banda Aceh. The PBET covered 4 indicators: understand the problem, devise plan, carried out the plan, and look back (Irwanto et al., 2018).

A.4. Data analysis

Posttest's student responses were corrected by scoring rubrics and entered to SPSS. To ensure the reliability of the test instruments, they were evaluated according to alpha criteria for each participating class. According to (Creswell, 2009), a value greater than 0.6 for Cronbach's alpha suggests that the test applied is appropriate to identify students based on the material provided. In addition, these instruments were closely checked by each teacher whose classes participated to confirm both the validity of pedagogical material and its usefulness in assessing knowledge acquired. Independent t-testing was conducted to compare mean between two classes, calculating their substantial differences. SPSS 20 performed these analyzes.

C. Results and Discussion

A.5. Descriptive data

The descriptive statistics of students' response are presented in the following Table 2.

Table 2. Descriptive data

Descriptive data	Control Group	Experimental Group
N	82	81
Mean	42,99	62,22
Std. Error of Mean	2,631	3,617

Descriptive data	Control Group	Experimental Group
Median	40,00	82,50
Mode	38	90
Std. Deviation	23,82	32,55
Variance	567,81	1059,68
Range	83	90
Minimum	0	0
Maximum	83	90
Sum	3525	5040

A.6. The effectiveness of pbl with instructional video

With SPSS 20, post-test data gathered from teaching experiment analyzed with independent t-test technique to measure the significance mean difference. This was conducted to assess the effect of learning instruction with video developed by researchers. The results of independent t-test are provided in the following table 3.

Table 3. Independent t-test results

Group	n	Mean	SD	t	df	Sig (2-tailed)
Experiment	81	62.22	32.55	-4.308	162	0.000
Control	82	42.99	23.82			

As can be seen in Table 3, when students of the study group and control group post-test scores were analyzed, it was found that the mean of post-test scores taken by students of the treatment group was 62,22 and the valued figure of students of the control group was 42,99. It can be shown that a 19.23-point gap between groups means a p value is less than 0.05. Moreover, there was a substantial difference ($t(162) = -4.308, p < 0.05$) between the experimental group and the control group from the outcome of independent t-test study. This result indicates that the video-instructed PBL model plays a role in increasing problem-solving skills.

The data revealed that experimental group was better than control group as they tended to display better problem-solving skills. One explanation the group was more able to solve mathematical problem because they were prepared to solve the problem visualized with video instruction. At the beginning of the class, students were introduced to a dilemma. They were inspired to explore the known unknown problem. Students used their previous experiences and expertise when collecting information, preparing their strategies, when investigating the problem. It's useful as learning causes problems. Moreover, this model helps students to gain new information by answering the problems to be solved instead of memorizing the formula [15]. This is consistent with previous studies reported [14].

D. Conclusion

This research aimed to establish the impact of problem-based video instruction learning on primary student problem-solving skills. It was found that the treatment using the PBL model with instructional video is more effective than the control group using conventional teaching methods. When the experimental and control group's post-test score was compared, it was found that the increase in the experimental group is significantly high shows that this group's video model is more effective than conventional methods. This finding addresses the research problems proposed at the start of the research. It can be argued from this analysis that the PBL community used the video instruction more efficiently, showed stronger mathematical problem-solving skills such as understanding problems, preparing the way to solve problems, carrying out the strategy and assessing the solution.

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