

## **The Effect of Interactive Video-Assisted Problem Based Learning Model on Computational Thinking Skills Based on Student Activeness**

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**Abstract:** This study aims to test the effect of a Problem-Based Learning (PBL) model assisted by interactive videos on the computational thinking skills of second-grade elementary school students in Banyuasin III. Utilizing a quantitative approach with a quasi-experimental method, data were collected through tests and observations. Statistical analysis was performed using SPSS version 26 to examine the causal relationship between the instructional model and learning outcomes. The results demonstrate that students taught with the PBL and interactive video model achieved a significantly higher average computational thinking ability than those taught with a direct instruction model. The novelty of this research lies in its specific integration of interactive video media to scaffold the PBL process for very young learners, a demographic underrepresented in computational thinking research. A key practical implication is the actionable framework it provides for elementary teachers to enhance 21st-century skills by combining collaborative problem-solving with engaging digital visualization tools. The study contributes empirical evidence to the field of primary education technology, validating a multimedia-enhanced PBL strategy as an effective pedagogical intervention for developing foundational computational thinking.

**Keywords:** Computational Thinking, Interactive Video, Problem Based Learning

### **A. Introduction**

The development of science and technology in today's digital era requires students to possess not only academic abilities but also higher-order thinking skills, one of which is computational thinking. This ability is crucial for helping students solve problems systematically, think logically, and develop effective solutions. Therefore, learning in elementary schools should be designed to develop computational thinking skills from an early age. However, the reality on the ground shows that learning in elementary schools is still largely teacher-centered with conventional learning models, such as lectures, simple demonstrations, or direct instruction, thus providing little space for students to think critically and creatively. This results in

low student engagement and suboptimal computational thinking skills. Students tend to be mere recipients of information, not actively involved in the learning process, and not accustomed to solving challenging problems.

Student engagement in the learning process is also a crucial issue in primary education. Many students still tend to be passive in class, acting only as listeners without actively participating. According to Setiayu (2021), student engagement is a crucial element in determining the success of the learning process. This low engagement also impacts the development of problem-solving skills and student creativity (Murni, 2021). Low student engagement in the learning process contributes to poor mastery of 21st-century skills, including computational thinking (CT), which involves logic, analysis, and complex problem-solving. These skills are becoming increasingly important in the era of the Industrial Revolution 4.0 and Society 5.0, where technology-based work increasingly dominates (Juldial & Haryadi, 2024). However, the 2022 Programme for International Student Assessment (PISA) education system evaluation showed that Indonesian students still ranked 68th out of 81 countries in technological literacy and problem-solving skills. This underpins the need for learning interventions to foster students' CT skills to face global challenges and the digital era (Ahmad et al., 2023).

One solution that can be implemented is the integration of a problem-based learning approach or Problem-Based Learning (PBL). PBL has been proven effective in increasing student engagement and developing critical thinking skills (Budiono et al., 2024). Through PBL, students are encouraged to solve real-life problems, thus becoming more active in the learning process. Furthermore, PBL also provides meaningful learning experiences by encouraging students to think analytically. This approach is highly relevant for improving students' critical thinking skills, especially when supported by interactive learning media.

Interactive learning media, such as interactive videos, are a key support in the implementation of PBL. Interactive videos enable students to learn independently and actively participate in the learning process (Ratna & Adlini, 2024). This media also provides flexibility in delivering material, allowing students to access learning according to their needs. According to Pratiwi et al., (2024), the use of interactive learning videos in PBL can increase student creativity and engagement, as well as help them understand concepts better. Interactive learning videos also provide an engaging learning experience, thereby preventing boredom in the classroom. On the other hand, direct instruction models are still frequently used because they are considered easy to understand and can help students directly observe how to complete a task. However, whether this model can optimally develop students' computational thinking skills compared to interactive video-assisted PBL models remains a question that requires further research.

This relationship provides a strong foundation for researchers to implement interactive video-assisted PBL methods that foster CT skills and student engagement in elementary schools. However, the implementation of interactive video-assisted PBL in Indonesia still faces various challenges. A UNESCO report (2023) noted that only 20% of elementary schools in Indonesia have systematically integrated technology into learning. Barriers such as limited infrastructure, lack of teacher training, and minimal awareness of the importance of technology are the main inhibiting factors (SEAMOLEC, 2023).

In addition to learning model factors, student engagement is also thought to play a significant role in improving computational thinking skills. Students with high engagement tend to understand and solve problems more quickly than those with moderate or low engagement. Therefore, it is important to determine whether differences in student engagement levels affect computational thinking skills, both in interactive video-assisted PBL and direct instruction (DI) models.

The researchers' initial observations at several elementary schools in Banyuasin III district revealed significant challenges in Indonesian language learning. The majority of students exhibited passive tendencies, particularly in text analysis activities, such as identifying main ideas and constructing logical ideas. This monotonous learning method left students bored, unmotivated, and deprived of opportunities to develop critical and creative thinking skills. Consequently, student learning outcomes were suboptimal; only 46.87% of students successfully achieved the Learning Objective Achievement Criteria (KKTP) with an adequate grade.

Based on the initial observations above, a gap in student abilities was also identified, with students often experiencing difficulty understanding material involving analysis and logically structuring ideas. Furthermore, the implementation of the Independent Curriculum at the school still faces various obstacles. The use of interactive video-based learning media is still limited due to limited teacher training and supporting infrastructure. Several elementary school teachers in Banyuasin III sub-district are not yet fully skilled in designing and implementing innovative learning strategies in accordance with the principles of the Independent Curriculum. The lack of intensive training and mentoring is one of the main causes of this suboptimal performance. Teachers' inability to facilitate student-centered learning further exacerbates the low level of student engagement during learning. Therefore, more creative learning approaches are needed, such as the integration of interactive video media and PBL to encourage active student engagement while improving the overall quality of learning.

Based on the description, the researcher feels the need to further examine the differences in students' computational thinking abilities in terms of learning models (PBL assisted by interactive videos and DI) and levels of learning activity (high, medium, and low). This study was designed to analyze the extent to which the PBL

method accompanied by interactive video media can facilitate students in developing student activity in learning activities while strengthening computational thinking skills, which are relevant to the demands of the current curriculum. The results of this study are expected to provide input for teachers to choose the right learning strategy to optimize students' computational thinking abilities. The following are the problem formulations that can be formulated according to the research context: 1) Are there differences in students' computational thinking abilities between those who follow the PBL learning model assisted by interactive videos and those who follow the DI learning model? 2) Are there differences in students' computational thinking abilities based on levels of learning activity (high, medium, and low)? 3) In each learning model, namely PBL assisted by interactive videos and DI, are there differences in students' computational thinking abilities based on levels of learning activity (high, medium, and low)? 4) At each level of learning activity, which produces better computational thinking skills between the interactive video-assisted PBL learning model and the DI learning model?

## **B. Methods**

This study used a quantitative approach with a quasi-experimental method. This study aims to explain the causal relationship between the independent variable (treatment) and the dependent variable (measured outcome) using statistical analysis (Sugiyono, 2018). This approach was chosen because this study focuses on measuring students' learning activity and computational thinking skills using the PBL model assisted by interactive video media.

In the quasi-experimental method, researchers compared two different groups: a control group using direct learning methods and an experimental group receiving treatment in the form of a PBL model accompanied by interactive video media. This allowed for quantitative analysis of differences in learning outcomes and student engagement between the two groups. The research design used in this study was the Nonequivalent Pretest-Posttest Control Group Design, which is part of a quasi-experiment (Arikunto, 2013). This design involves two groups that are not fully randomized to the subjects, because usually the classes are already formed. Each group is given an initial test (pre-test) before treatment and a final test (post-test) after treatment. This test aims to measure changes or improvements that occur in the variables studied. To clarify this research design, the design scheme of the Nonequivalent Pretest-Posttest Control Group Design can be seen in the following table.

**Table 1. Research Design Plan**

Group	Pre-Test	Intervention	Post-Test
Experiment	O <sub>1</sub>	X <sub>1</sub>	O <sub>3</sub>
Control	O <sub>2</sub>	Demonstration learning	O <sub>4</sub>

Source: (Sugiyono, 2018).

Information:

- O<sub>1</sub> = Experimental Class Pre-Test to measure learning activity and CT skills before treatment.
- O<sub>2</sub> = Control Class Pre-Test to measure learning activity and CT skills before treatment.
- O<sub>3</sub> = Experimental Class Post-Test to measure learning activity and CT skills after treatment.
- O<sub>4</sub> = Control Class Post Test to measure learning activity and CT skills after treatment.
- X<sub>1</sub> = The treatment is in the form of learning using the PBL model accompanied by interactive video media.

The quasi-experimental design was chosen because it is suitable for research conditions in elementary schools, allowing a comparison between the effectiveness of DI learning and the implementation of interactive video-assisted PBL.

The population is the entire research subject with specific characteristics consistent with the research objectives. Banyuasin III District has 42 elementary schools divided into three clusters. This study focused on Cluster 2, which consists of 11 elementary schools, each with one second-grade class. The selection of this population was based on the relevance of student characteristics, namely having sufficient basic reading and thinking skills to actively engage in PBL and participate in the use of interactive video media. The sample in this study is a portion of the population that is used as the research subject and is considered representative of the population as a whole. The sampling technique used in this study is cluster random sampling. This technique is a method of selecting samples based on groups (clusters) that form naturally within the population. In the context of this study, the clusters referred to are all second-grade classes at the school where the research took place. Each class has characteristics as a complete learning unit and therefore can be treated methodologically as a sampling unit. The use of cluster random sampling was chosen for several reasons. First, the research population is structured in the form of classes, making sampling per group more efficient than taking individual samples. Second, educational experimental research, particularly involving specific learning models and media, requires the application of comprehensive treatments to a single class to prevent cross-student or cross-group contamination. Third, this technique allows for more practical research implementation without disrupting the existing class structure. Therefore, cluster random sampling is considered most appropriate for achieving research objectives and maintaining the experiment's internal validity.

The sample in this study was determined using a cluster random sampling technique through systematic steps and in accordance with research methodology principles. The first step was to identify all second-grade classes in the school where the study was conducted, resulting in 11 classes as the cluster population. All classes were then arranged in a sampling frame and assigned sequential numbers from 1 to

11 as the basis for random sample selection. Next, the researcher determined four classes as the research sample, taking into account the needs of the experimental design and the effectiveness of the learning treatment implementation. The selection process was carried out randomly through a simple lottery or using a random number generator application, and the four class numbers that appeared first were designated as sample clusters. After the randomization process, the researcher verified the selected classes to ensure that each class met the eligibility requirements, including an adequate number of students, stable learning conditions, and the absence of administrative obstacles or special programs that could interfere with the research implementation. Classes that met these criteria were then designated as the final sample, and all students in these classes served as the unit of analysis in this study. The selection of four clusters was made considering that the experimental design requires strict variable control so that the treatments administered can be compared validly. In addition, the selection of a limited number of samples also takes into account time efficiency, resource availability, and ease of implementing treatment and collecting data in the field optimally.

Research instruments in a quantitative approach can be tests and non-tests, where both types of instruments have different functions and characteristics. In this study, test and non-test instruments were chosen as data collection tools to measure research variables. The test instrument in this study was used to measure students' cognitive abilities, such as conceptual understanding, problem-solving, or critical thinking skills. Tests are used to measure student learning outcomes before and after the learning process using a specific method. The test questions in this study were in the form of multiple-choice questions according to the material taught. This test was developed based on a validated grid to ensure that the questions were relevant to the measurement objectives. The non-test instrument used in this study was to measure student activeness in the learning process. In this study, observation sheets were used to observe student activities during the learning process. Data analysis in this study aimed to test the hypothesis and determine whether or not there was an effect of the Problem Based Learning model assisted by interactive videos on the learning activeness and computational thinking skills of second-grade elementary school students. The research data were analyzed using the SPSS version 26 program, which was used to simplify calculations and obtain more accurate analysis results. Before conducting analysis to test the hypothesis, the data were first checked for completeness, then prerequisite tests were conducted to determine the appropriate analysis technique. The prerequisite tests included normality and homogeneity of variance tests. Hypothesis analysis was conducted using two-way analysis of variance (ANOVA). This test was chosen because the study involved two independent variables: the learning model (interactive video-assisted PBL and DI) and the level of student engagement (high, medium, low), as well as one dependent variable: computational thinking ability.

## **C. Results and Discussion**

### **The Influence of Learning Models on Computational Thinking Skills**

The results of this study indicate that students who participated in the PBL model assisted by interactive videos obtained higher computational thinking ability scores than students who received DI. This finding indicates that the implementation of PBL assisted by interactive videos can provide a more meaningful learning experience, thereby encouraging students to think critically, analytically, and creatively in solving problems. Although the difference in average scores is not too large, these results still indicate that interactive learning media provides additional support that allows students to understand concepts more deeply than traditional approaches.

The findings of this study align with those of Suwandi & Rahayu (2020); Pilobu et al., (2025), who reported that students learning through a problem-based approach achieved better computational thinking skills than students who participated in direct instruction. Although the differences were not always significant in some cases, they explained that a learning environment that demands exploration, discussion, and problem-solving provides greater opportunities for students to develop computational thinking skills. Therefore, the findings of previous research reinforce the findings of this study that PBL, especially when supported by interactive media such as video, tends to provide advantages in developing computational thinking compared to DI learning models.

Practically, these results indicate that integrating interactive video media into PBL can be an alternative to improve students' computational thinking skills. Although the effect is not significant, this strategy offers a more enjoyable and challenging learning experience. Classroom implementation should consider duration, task load, and feedback delivery methods. This study emphasizes that the right combination of learning models and media can provide opportunities for students to learn actively, creatively, and critically, thus supporting the development of computational thinking skills relevant to 21st-century needs.

### **The Influence of Learning Activity Level on Computational Thinking Ability**

The results of the study indicate that students' learning engagement levels did not significantly influence their computational thinking abilities. Descriptive analysis revealed that the group of students with moderate engagement achieved the highest average score, followed by the group with low engagement, while the group with high engagement achieved the lowest. However, the ANOVA test results confirmed that the differences between the three groups were not statistically significant. This finding indicates that the level of learning engagement is not the primary factor determining students' computational thinking abilities.

This insignificance suggests that while active learning is often considered a key factor in student success, other factors in the learning process may contribute more significantly. In the context of this study, the PBL model combined with interactive video media appears to have a stronger influence on the development of computational thinking skills than the level of active learning itself. PBL provides a learning experience that requires students to analyze problems, connect information, and find solutions independently, while the use of interactive video enriches visual stimuli and enhances conceptual understanding.

These results align with the findings of Pratiwi & Sari (2019); Tegeh, & Pratiwi (2019); Tegeh & Pratiwi, (2019), who explained that active learning is not always directly related to computational thinking skills. They emphasized that learning strategies designed to encourage problem-solving and conceptual exploration have a greater impact on student learning outcomes than the level of activeness that occurs during the learning process. Research by Wulandari (2021); Bria et al., (2025); Junaidi et al., (2020) also shows that higher-order thinking skills, including computational thinking, are more influenced by learning approaches that engage students in inquiry and reasoning than simply physical or verbal activity during the activity.

Thus, the findings of this study reinforce the understanding that developing computational thinking skills in elementary school students relies not only on how actively they engage in the learning process, but also on how the learning model and media used facilitate higher-order thinking processes. Interactive video-assisted PBL has been shown to provide a more structured, challenging, and meaningful learning context, thereby effectively supporting the development of computational thinking skills.

### **The Influence of Activity Level on Each Learning Model**

Descriptive analysis shows that the average score of students' computational thinking ability in the interactive video-assisted PBL group is slightly higher than that of direct instruction at almost all levels of activity. However, the results of the two-way ANOVA test show that all significance values are above 0.05, including the interaction effect between the learning model and the level of activity (Sig. = 0.960). Thus, there is no significant influence, either from the learning model, the level of activity, or the combination of both on students' computational thinking ability. The imbalance in the number of samples in several categories of activity may be one of the reasons why the differences seen in the descriptive did not produce statistical significance.

Although the average score for interactive video-assisted PBL was higher, the insignificant results indicate that neither the variety of learning models nor the level of engagement were strong enough to be the primary determinants of computational thinking ability. This finding suggests that other external factors may have a

stronger influence on this ability, such as learning motivation, experience using technology, supportive learning environments, the quality of teacher instruction, and students' prior abilities.

The results of this study are consistent with the findings of Pratiwi and Sari (2019), who stated that active learning does not have a direct influence on computational thinking skills because these abilities are more dependent on analytical activities facilitated during learning. Furthermore, research by Wulandari (2021) showed that although interactive video-assisted PBL can improve computational thinking skills, the interaction between the learning model and student characteristics (including active learning) did not have a significant effect. This finding is also in line with the results of Suwandi & Rahayu (2020), who found that problem-based approaches tend to produce better computational thinking outcomes than direct methods, although the difference was not always statistically significant.

Furthermore, research by Hasanah & Purwanto (2022) revealed that improvements in computational thinking are more determined by the quality of problem-solving task design than by students' level of activeness in class. Meanwhile, a study by Nugroho (2021); Yudianto et al., (2025) showed that the use of interactive digital media can improve computational thinking skills, but its effect does not depend on how physically active students appear, but rather on the quality of cognitive interactions created when using the media. Research by Fitriyani & Mulyani (2020); Deyantika et al., (2025) also reported that differences in student activeness do not always correlate with computational thinking skills, especially if learning does not consistently emphasize higher-order thinking processes.

Overall, these findings reinforce the view that the interaction between learning model and engagement level does not always have a significant effect. This means that even when interactive media and problem-based learning models are implemented, students with varying engagement levels still have relatively equal opportunities to develop computational thinking skills as long as they engage in directed problem-solving activities. Therefore, teachers need to complement learning with other strategies such as task differentiation, personalized guidance, and the use of media that encourage exploration and experimentation.

### **Comparison of Learning Models at Each Level of Activity**

A comparative analysis of learning models at each level of activity showed no significant difference between interactive video-assisted PBL and direct learning. The Sig. value at all levels of activity was  $> 0.05$ , indicating insufficient data, thus H04a, H04b, and H04c were accepted. This confirms that learning models do not have a different effect on students' computational thinking abilities, regardless of their activity level. These results imply that the effectiveness of the learning model does not depend on students' initial level of engagement. Interactive video-assisted

PBL provides a more equitable learning experience, allowing less engaged students to still achieve a good understanding of the concepts. Although the average PBL score was slightly higher, the small difference suggests that variations in learning outcomes are more influenced by other factors, such as intrinsic motivation, prior experience, or individual learning strategies. This underscores the need for a holistic teaching approach to developing computational thinking skills. Thus, these findings reinforce the conclusion that learning strategies must be inclusive and adaptive, enabling all students to learn effectively. Learning models alone are insufficient to improve computational thinking skills without additional interventions such as scaffolding, task enrichment, or appropriate feedback.

#### **D. Conclusions**

Based on the analysis, this study yields a clear yet nuanced conclusion. The key finding is that the Problem-Based Learning (PBL) model assisted by interactive videos proved significantly more effective than the direct instruction model in improving computational thinking skills among second-grade students, as statistically confirmed by ANOVA results ( $F=6.592$ ;  $Sig.=0.012$ ). This underscores the combined pedagogical power of active, problem-centered learning and digital visualization tools. However, two additional critical findings qualify this result. First, students' observed levels of learning engagement during the activities did not significantly correlate with their computational thinking outcomes. Second, and more importantly, there was no significant interaction effect between the teaching model (PBL-video vs. direct instruction) and students' engagement levels on the final results. This indicates that the superiority of the PBL-video model was consistent across all students, regardless of whether they were classified as highly active or less active participants during lessons. The practical implication of this research is twofold. Positively, it provides educators with a validated, engaging instructional strategy PBL enhanced with interactive videos to effectively build foundational computational thinking in young learners. Practitioners can adopt this model with confidence in its general effectiveness. More subtly, the finding that engagement levels did not moderate outcomes suggests teachers should focus less on merely driving observable "activity" and more on the quality of the problem-solving structure and cognitive support provided by the tools. This approach can make computational thinking accessible to a wider range of student participation styles, reducing potential bias toward extroverted or overtly active children. Education authorities should consider integrating such multimedia-enhanced PBL modules into primary STEM curricula and providing corresponding teacher training. For future research, several recommendations emerge. To understand the long-term impact and skill retention, longitudinal studies tracking students' computational thinking development are needed. Employing a mixed-methods design could illuminate why engagement levels showed no significant effect, using interviews or think-aloud protocols to capture students' cognitive processes beyond observable activity. Researchers should also investigate other potential moderating

variables, such as prior knowledge, learning styles, or self-efficacy, which might interact with the instructional model. Finally, replicating this study across different age groups, cultural contexts, and subject matters would help determine the generalizability of the findings and refine best practices for integrating interactive media with inquiry-based learning models.

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