# The Influence of CTL on Students' Ability to Understand Science Concepts

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**Abstract:** This study examines the effect of the Contextual Teaching and Learning (CTL) model on the science concept comprehension of fifth-grade students at SDN 88 Singkawang. The study used a quantitative approach with a quasi-experimental design and purposive sampling technique. The sample consisted of 44 students (22 students in the experimental class and 22 students in the control class). The research instruments included a concept comprehension test in the form of multiple-choice questions and a questionnaire on students' responses to the application of CTL in the experimental class. Data analysis was performed using an independent t-test. The results showed a significant difference between the experimental and control classes (t = 6.341; t-table = 2.080) and a large effect size (d = 1.5), indicating a substantial effect of the CTL model on improving students' science concept comprehension. These findings provide empirical evidence that contextual and active learning through CTL can improve abstract concept comprehension at the primary school level. The practical implication is a recommendation for teachers to integrate the CTL approach into the planning and implementation of science learning; theoretically, this study strengthens the empirical basis for the effectiveness of CTL in the context of primary education.

**Keyword:** CTL; concept understanding ability; science

## Introduction

Previous studies have shown that CTL can improve conceptual understanding in various subjects, including science. However, most of these studies were conducted in urban schools or schools with relatively adequate learning facilities. This raises the question of whether CTL can also have a significant impact in elementary schools in other areas with different characteristics, such as SDN 88 Singkawang , North Singkawang District. Therefore, the objective of this investigation is to ascertain the impact of the CTL model on the conceptual comprehension of science among elementary school students at SDN 88 Singkawang.

Primary schools currently still face various obstacles (Gumilar, 2023; Utami et al., 2025), particularly in science education, mainly because the learning process tends to be teacher-centred and focuses largely on basic cognitive aspects such as memorisation and rote learning (Sukowati & Harjono, 2023). This situation causes students to have difficulty understanding abstract concepts in science, making it easy for them to forget these concepts after learning (Aningsih & Wolosah, 2020; Erina Susanti et al., 2021). This condition highlights the importance of a learning strategy that can help students build a more meaningful understanding of concepts (Aen & Kuswendi, 2020).

Conceptual understanding is at the core of science learning (Rahmawati et al., 2023) because it is related to the ability to explain concepts in one's own words and apply them in everyday life (Meilin & Afriyah, 2024). Mastery of concepts in primary school is an important foundation for the continuity of science learning at the next level (Nasriyanti et al., 2021). However, a number of studies show that primary school students' understanding of science concepts is still low, which is influenced by the abstract nature of science material and limited contextual learning experiences (Maulina et al., 2024; Putu Swistiyawati & Indrayani, 2024; Sahra et al., 2025).

Contextual Teaching and Learning (CTL) has been widely reported to be effective in helping students understand abstract concepts through learning experiences that are relevant to real-life contexts (Andini & Suhartyaningsih, 2025; Efriyani & Aryani, 2024; Lestari & Suryani, 2021; Pebrianti & Nana Sutarna, 2024). This model has also been proven to improve students' learning outcomes and scientific skills (Nuraini et al., 2024; Saputra, 2021). However, most CTL studies have been conducted in schools with relatively adequate learning facilities and located in urban areas. This raises the question of whether CTL is also effective in schools with different characteristics, such as SDN 88 Singkawang, which is located in an area with varying learning conditions. Therefore, this study aims to measure the effect of the CTL model on the science concept understanding of fifth-grade students at SDN 88 Singkawang.

## Methods

This study employed a quantitative approach and a quasi-experimental design. It employed a non-equivalent control group design. The subjects were all 44 fifth-grade students at SDN 88 Singkawang, divided into two classes. Class selection was conducted using purposive sampling. The instrument consisted of a 14-item multiple-choice test structured around seven indicators of science concept understanding: interpreting, exemplifying, classifying, summarizing, concluding, comparing, and explaining. Each indicator was represented by two items. The instrument was validated by three expert validators, and all items were found valid. Reliability was tested using Excel, yielding a coefficient of 0.89, categorized as high. The experimental class received instruction using the treatment model, while the control class learned conventionally. Both classes received the same material and time allocation. A pretest was administered before the treatment, and a posttest after all learning sessions were completed. Data were analyzed using independent samples t-tests and effect size calculations.

## Results And Discussion

### Results

**Table 1.** Normality Test

| Class | $X^2_{Count}$ | $X^2_{Table}$ | Conclusion |
|---|---|---|---|
| Control | 2,894 | 32,671 | Normal |
| Experiment | 0,522 | 32,671 | Normal |

**Table 2.** Homogeneity Test

| Class Control | Varians | | Fcount | $F_{Table}$ | Conclusion |
|---|---|---|---|---|---|
| | Pre-test | Post-test | | | |
| | 222,61 | 286,62 | 1,00 | 4,35 | Homogen |
| **Class Experiment** | **Varians** | | **Fcount** | **$F_{Table}$** | **Conclusion** |
| | Pre-test | Post-test | | | |
| | 223,29 | 75,48 | 0,26 | 4,35 | Homogen |

From the table above, the calculation results for the control class show that Fcount=1.00 < Ftable=4.35, indicating that H0 is accepted, which means the data are homogeneous. In the experimental class, the obtained value of Fcount=0.26 < Ftable=4.35 also leads to the acceptance of H0, suggesting that the data in the experimental class are homogeneous as well.

**Table 3.** Independent t-test

| Class | N | t-count | t-table |
|---|---|---|---|
| Control Class | 22 | 6,341 | 2,080 |
| Experimental Class | 22 | | |

Based on the results of the two-sample t-test calculations, it shows that the calculated t is 6.341 and the t-table is 2.080 because the calculated t > t table, then Ha is accepted, which means there is a difference in students' understanding of science concepts between the control and experimental classes.

**Table 4.** Effect size calculation result

The contextual learning model influences fifth-grade students' ability to understand science concepts; data analysis was conducted using Cohen's test., which showed that the Effect Size value obtained was 1.5. Table 4 shows the results of the effect size calculations.

| Information | Results |
|---|---|
| Average | 25.73 |
| Standard Deviation | 17.3 |
| Effect size | 1.5 |
| Criteria | Tall |
| Conclusion | These findings confirm that the application of the CTL model serves as a key factor in strengthening elementary students' mastery of scientific concepts |

Based on Table 4, it is known that the Effect Size value of 1.5 is included in the high category, because it is in the criteria of Effect Size > 0.8. This finding indicates that the application of the Contextual Teaching and Learning (CTL) learning model has a strong influence on improving the ability to understand science concepts in grade V students of SDN 88 Singkawang.

**Discussion**

The CTL approach has been proven to improve students' conceptual understanding and learning outcomes in mathematics (Trimurtini et al., 2020), strengthen reading and literacy skills in English language learning (Usman et al., 2019), and even encourage active participation and critical thinking in thematic learning and other subjects (Desnita et al., 2022). The results of the study show that the understanding of science concepts among students in the experimental class who learned using the CTL model was higher than that of the control class who used direct learning. The difference was not only statistically significant but also showed a high degree of influence, thus strengthening the argument that CTL is effective when applied in the context of science learning in primary schools. This proves that CTL also has a strong influence not only in science lessons but also across other subjects.

These findings are in line with the research by (Dewi et al., 2021) that the application of CTL in science learning has an impact in the form of an increase in students' science concept comprehension scores. Theoretically, CTL enables the process of connecting abstract concepts with real experiences, making information easier to understand and retain. This will make it easier for students to understand abstract material (Nuraini et al., 2024; Rimayanti et al., 2023).

In this study, during two meetings, students were involved in observing, trying, discussing, and connecting the material to their daily lives. These activities provided space for students to construct their own understanding, so that the increase in post-test scores became something that could be explained logically. This approach has

been proven effective in building deep understanding, as confirmed by (Salsabilla et al., 2023; Supriyanto & Syafi'ah, 2022) that conceptual understanding does not only mean knowing, but also the ability to explain and apply it in real life. Students who use the CTL approach to learning may become more engaged (Yuwandra & Arnawa, 2020). The character of CTL itself focuses on the process rather than the result (Adirilany et al., 2023; Erni et al., 2020). These findings are in line with various previous studies, but the context of SDN 88 Singkawang provides a new variation because the characteristics of the students, learning resources, and classroom dynamics are different from previous studies.

The high effect size can also be influenced by several factors. Abstract material makes a contextual approach more relevant, so that the impact appears stronger. In addition, limited variation in methods in the control class can widen the difference in learning outcomes between groups. In the control class, teachers still dominate. Teachers who only teach as usual, focusing on the teacher and one-way communication, make students look bored (Erni et al., 2020; Herlina, 2020) and tend to have difficulty understanding the material because during the learning process, there is no connection to everyday life.

This opinion is reinforced by (Rozali et al., 2022), who reveal that teacher-centred learning is becoming a problem in the world of education because it has an impact on the decline in the quality of education for students. (Safrihady et al., 2021) also emphasise that complete control by teachers and overly rapid delivery of material can cause students to lose focus. These factors are important to consider in the interpretation process, as the results depend not only on the learning model but also on the conditions of the comparison class.

It should be acknowledged that there are several limitations to this study. The relatively short number of meetings and the scope of the study, which only covered one school, limit the generalisation of the findings. Variations in teachers' abilities to implement CTL and differences in student characteristics also have the potential to influence the results. Therefore, further research with more diverse contexts and samples is needed to strengthen these findings.

## Conclusion

The results of this study indicate that the CTL model significantly impacts students' understanding of science concepts. An independent t-test indicated a significant difference between the control and experimental classes. Furthermore, an effect size of 1.5 indicates a strong influence of the CTL model. These findings confirm that CTL can help students understand abstract concepts through contextual and meaningful learning experiences.

This study suggests that teachers can improve students' understanding of science concepts by consistently applying contextual learning syntax in science instruction. Future research could examine the application of CTL at different grade

levels, in other subjects, or with a broader sample size to strengthen the existing findings. This study has limitations due to its quasi-experimental design, sample size, and single-school location, which require careful consideration when interpreting the results.

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