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Research Article

The Effect of Contextual Teaching and Learning (CTL) Assisted by Audiovisual Media on Students' Cognitive Achievement and Learning Interest in Colloid Topics

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ABSTRACT

This study investigated the effect of the Contextual Teaching and Learning (CTL) instructional model supported by audiovisual media on students' cognitive achievement and learning interest in the colloid topic at SMA Negeri 1 Syamtalira during the 2024/2025 academic year. A quantitative approach employing a quasi-experimental method with a non-equivalent control group design was adopted. The participants were selected through purposive sampling, consisting of 29 students from class XI IPAS 8 as the experimental group and 30 students from class XI IPAS 7 as the control group. Data were collected using a cognitive achievement test and a learning interest questionnaire. Statistical analysis was conducted using an independent samples t-test. The findings revealed that students taught using the CTL model integrated with audiovisual media demonstrated significantly higher cognitive achievement and learning interest than those taught using the Discovery Learning model. The experimental group achieved a higher mean posttest score (79.31) compared to the control group (63.78). In addition, the average learning interest score of the experimental group reached 84% (very high category), while the control group obtained 78% (high category). The t-test results showed a Sig. (2-tailed) value of 0.000 (< 0.05), indicating a statistically significant effect of the CTL model supported by audiovisual media on students' cognitive achievement and learning interest in colloid learning.

Keywords: Contextual Teaching And Learning; Audiovisual Media; Cognitive Achievement; Learning Interest; Colloid

1. INTRODUCTION

Self-efficacy is judgement of a person to his capabilities to plan and implement the action to reach certain goals (Mukhid, 2009). In an academic context, self-efficacy reflects how confident students are in performing specific tasks (Perez & Ye, 2013). Self-efficacy plays a role in academic motivation and learning motivation (especially students' ability to manage their learning activities), and resistance to learning (Zimmerman, 2000). Self-efficacy has three dimensions that are magnitude, the level of task difficulty a person believes she can attain; strength, the conviction regarding magnitude as strong or weak; and generality, the degree to which the expectation is generalized across situations (Lunenburg, 2011). The magnitude dimension refers to the difficulty level of the task that a person believes he or she can accomplish. That is, the students' self-confidence toward their abilities in accomplishing various tasks at different levels of difficulty. The strength dimension refers to the resilience and persistence of students in accomplishing various tasks. Meanwhile, the generality dimension refers to students' beliefs about their abilities in accomplishing certain tasks as well as on a broader range of activities and situations.

Learning is a process that leads to behavioral and skill development through experience and practice, rather than changes resulting from biological growth or maturation. In educational contexts, learning is understood as an improvement in behavior and the acquisition of new skills, which reflects the enhancement of psychological functions underlying individual performance (Suarim & Neviyarni, 2021). Within the teaching learning process, teachers play a crucial role in ensuring that learning objectives are effectively achieved and that instructional content is meaningfully understood by students (Yestiani & Zahwa, 2020). Therefore, instructional practices must be well designed and implemented with high quality to optimize student learning outcomes.

Learning outcomes represent students' overall achievements after participating in instructional activities, encompassing cognitive, affective, and psychomotor domains (Andriani & Rasto, 2019). Among these domains, cognitive ability is a primary indicator used to assess academic achievement in the Indonesian education system (Lukman & Ulfa, 2020). The cognitive domain involves mental processes such as understanding concepts, processing information, and applying knowledge in

various contexts (Harapan et al., 2024). In addition to cognitive ability, students' learning interest is recognized as an important internal factor that significantly influences learning outcomes.

Learning interest refers to a sense of attraction and enjoyment toward learning activities that arises intrinsically without external pressure. It reflects a psychological relationship between students and the learning content, which in turn affects motivation and engagement (Afriani et al., 2020). Students with high learning interest tend to demonstrate sustained attention, enjoyment in learning activities, active participation, and consistent involvement throughout the learning process (Furqon, 2024).Teaching practices were predominantly teacher-centered, relying heavily on lecture-based methods, which limited student participation. As a result, students experienced difficulties in understanding chemical concepts, as reflected in low examination scores that did not meet the minimum mastery criteria (KKTP). Furthermore, instructional materials were rarely connected to real-life contexts, and the use of learning media was minimal, with instruction largely dependent on textbooks.

Chemistry is often perceived by students as a difficult subject due to its abstract concepts, complex theories, and the need to master formulas and calculations (Rahmi. et al., 2021). This perception was reinforced by interviews with a chemistry teacher at SMA Negeri 1 Syamtalira Bayu, who indicated that the theoretical and computational nature of chemistry presents significant challenges for students. These conditions highlight the need for innovative instructional strategies that can enhance students' cognitive achievement and learning interest.

One instructional approach that addresses these challenges is the Contextual Teaching and Learning (CTL) model. CTL emphasizes the connection between learning materials and students' real-life experiences, enabling students to construct knowledge in a meaningful and relevant manner (Syaifuddin et al., 2021). Through CTL, students are encouraged to apply classroom knowledge to real-world situations within their social and cultural environments (Juniwati & Sari, 2019). The CTL model is characterized by seven core components: constructivism, inquiry, questioning, learning community, modeling, reflection, and authentic assessment (Rahmah & Ermawati, 2021). Previous studies suggest that CTL promotes active learning and meaningful engagement by positioning students as active participants rather than passive recipients of information (Waruwu et al., 2022). In addition to instructional models, the integration of appropriate learning media plays a vital role in enhancing instructional effectiveness. Audiovisual media, which combine visual and auditory elements such as images, videos, and presentations, can facilitate students' understanding of abstract concepts and create a more engaging learning environment (Abdullah & Maryati, 2019; Kahsay et al., 2024). The use of audiovisual media has been shown to increase students' comfort and interest during learning activities, thereby supporting improvements in cognitive performance and learning motivation (Irwan & Hasnawi, 2021). Although previous studies have examined the effectiveness of the CTL model and audiovisual media separately, empirical evidence regarding their combined implementation in chemistry learning particularly on colloid topics at the senior high school level remains limited. Therefore, this study aims to investigate the effect of the Contextual Teaching and Learning (CTL) model assisted by audiovisual media on students' cognitive achievement and learning interest in colloid learning among eleventh-grade students.

2. RESEARCH METHOD

This study employed a quasi-experimental research design using a nonequivalent control group design, which involved two groups: an experimental group and a control group. The experimental group was taught using the Contextual Teaching and Learning (CTL) model assisted by audiovisual media, while the control group received instruction through the Discovery Learning model.

Table 1. Research Design

Group	Pre-test	Treatments	Post-test
Experimental	CALI1	Contextual Teaching and Learning (CTL) model assisted by audiovisual media	CALI2
Control	CALI1	Discovery Learning	CALI2

The research was conducted at SMA Negeri 1 Syamtalira Bayu during the even semester of the 2024/2025 academic year. The population of this study consisted of all eleventh-grade students, totaling 247 students. The sample was selected using a purposive sampling technique, as only two classes at the eleventh-grade level were enrolled in the chemistry specialization. Accordingly, class XI IPAS 8 (29 students) was assigned as the experimental group, and class XI IPAS 7 (30 students) served as the control group.

The independent variable in this study was the CTL instructional model supported by audiovisual media, while the dependent variables were students' cognitive achievement and learning interest. Data were collected using a multiple-choice cognitive test to measure students' cognitive achievement and a learning interest questionnaire to assess students' learning interest. Both instruments were administered before and after the instructional intervention.

Data analysis procedures included the Shapiro–Wilk test to examine data normality, the Levene's test to assess variance homogeneity, and hypothesis testing using an independent samples t-test to determine the significance of differences between the experimental and control groups.

3. RESULTS AND DISCUSSION

3.1 Results

The quantitative analysis compared pretest and posttest cognitive scores, as well as pre- and post-intervention learning interest between the CTL (Contextual Teaching and Learning) experimental group and a Discovery Learning control group. Initially, both groups demonstrated low baseline knowledge of colloid chemistry: the experimental class mean pretest score was only 29.89, while the control class mean was 25.33 (out of 100). After the instructional intervention, the experimental group's posttest mean rose to 79.31, whereas the control group's posttest mean was 63.78. This pattern suggests that while both classes improved, the CTL audiovisual approach yielded substantially larger cognitive gains.

Contextual Teaching and Learning engages students through real-world tasks and active participation, rather than rote memorization (Reddy & Revathy, 2024). In this study, the CTL-based method emphasized observation, discussion, and hands-on experimentation, prompting students to connect colloid concepts with familiar phenomena. Such constructivist strategies make abstract chemistry content more concrete and meaningful. As Hudson and Whisler (2007) note, CTL promotes "authentic learning" by helping students form connections between knowledge and context. These pedagogical features likely contributed to the experimental group's superior performance.

Prior to hypothesis testing, the data met necessary assumptions. Shapiro–Wilk tests for both groups on the pretest, posttest, and interest measures all yielded p-values greater than .05, indicating normal distributions. Levene's test likewise confirmed equal variances across groups ($p > .05$). Given these results, independent-samples t-tests were conducted on the posttest and post-intervention interest scores. The t-test for cognitive achievement showed a highly significant difference: the experimental group's posttest mean was about 15.85 points higher than the control's ($t(57) = 4.798$, $p < .001$). Thus, the observed improvement in the CTL class was statistically robust

As illustrated in **Figure 1**, the CTL-assisted class exhibited a dramatic gain in cognitive scores compared to the control class. The nearly identical starting levels (both ~30 on the pretest) gave way to a large gap after instruction: 79.31 versus 63.78. The significant t-test indicates this gap is not due to chance. Pedagogically, these results suggest that the CTL framework augmented by engaging audiovisual materials deepened student understanding of colloid chemistry much more than the Discovery Learning approach. The roughly 16-point difference in mean scores underscores the practical impact of this method on learning outcomes.

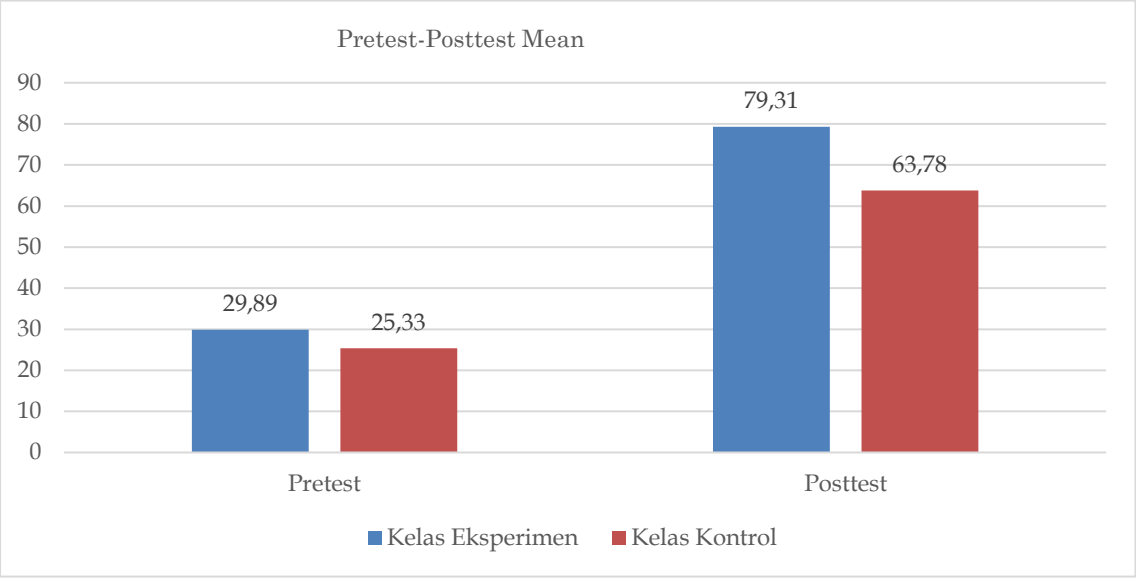

Figure 1. Pretest-Posttest Mean Cognitive Achievement

These findings align with prior research showing that contextualized, multimedia teaching enhances student learning. Audio-visual media, including interactive multimedia and instructional videos, have proven effective in enhancing student engagement and understanding of complex subject matter. Furthermore, the implementation of audio-visual tools at the secondary school level has been shown to improve classroom learning quality, sustain high levels of student interest, and promote active participation throughout the learning process. In our study, the experimental students' higher scores likely

reflect not only improved content knowledge but also enhanced motivation: when learners see real-world relevance in lessons, they tend to invest more effort and achieve better outcomes. Overall, this supports the notion that CTL–audiovisual instruction produces deeper learning than a pure discovery-based approach (Syamsuddin. et al, 2025).

Table 2. Pretest and Posttest Results of Students' Learning Interest

Aspect	Control		Experiment	
	Pretest	Postets	Pretest	Postets
Enjoyment	61%	83%	66%	85%
Interest in the material	62%	79%	63%	89%
Involvement	58%	76%	53%	83%
Diligence and discipline	53%	73%	41%	78%

Student interest in learning was assessed with a four-point Likert questionnaire across four indicators: enjoyment, interest in the material, involvement, and diligence/discipline. Table 2 illustrate the proportion of students at each interest level before and after instruction. Before the intervention, both groups reported generally high interest in chemistry, with no large differences between classes. For instance, about 66% of the experimental class and 61% of the control class reported feeling "happy" about learning the topic, and roughly 63% versus 62% reported being genuinely interested; involvement and diligence were somewhat lower (around 41–58%) but comparable across groups. In short, initial interest profiles were similar for both groups.

After instruction, all interest measures increased, and the CTL group consistently led the control group. The experimental class attained higher "very high" ratings across all categories: for example, post-intervention enjoyment was 85% (very high) vs. 83%, involvement was 83% vs. 76%, and diligence was 78% vs. 73% (experimental vs. control). The greatest difference was in the general interest indicator (89% vs. 79%). A t-test on the post-intervention interest scores confirmed this effect: $t(57) = 6.483$, $p < .001$ (mean difference = 3.749). These results indicate that the CTL–audiovisual treatment more effectively stimulated student interest.

Pedagogically, this heightened interest is explained by the CTL approach's emphasis on relevance and experience. By framing chemistry topics in real-life contexts and involving students actively, CTL makes learning more engaging and meaningful[1]. In addition, the use of audiovisual media can captivate students' attention: vivid images, motion, and sound in instructional videos stimulate multiple senses and break monotony. Studies employing experimental methods have shown that the use of audiovisual resources leads to notable gains in student learning outcomes. Learners also expressed favorable views toward these media, suggesting improvements in their study routines and overall academic achievement (Magadán-Díaz, et, al 2021). In short, the CTL–audiovisual combination created a learning environment in which students were both curious and motivated.

Overall, the findings are consistent with educational theory and prior studies linking CTL to higher motivation and achievement. CTL engages students by connecting newly introduced concepts with their prior knowledge and real-life experiences, thereby enabling them to grasp how the material applies in practical situations (Rao, et al , 2023). Relating learning material to real-world situations can strengthen students' involvement in the learning process and increase their motivation Rich audiovisual media further reinforce this by making abstract phenomena concrete and engaging students' senses. The converging evidence of higher test scores and greater reported interest suggests a synergistic effect: engaged, motivated learners achieve better outcomes.

3.2 Discussion

The results of the study indicate that the application of the Contextual Teaching and Learning (CTL) model assisted by audiovisual media significantly enhances students' cognitive achievement and learning interest on the topic of colloids. The difference in average posttest scores between the experimental and control groups 79.31 and 63.78, respectively—demonstrates a better conceptual understanding achieved through the CTL approach. These findings suggest that the integration of contextual learning with audiovisual media can make abstract chemistry concepts more concrete and easier for students to comprehend.

This study is in line with the findings of Sari and Gummah (2024), who stated that the CTL model supported by video media has proven effective in improving student learning outcomes and motivation. In the context of colloid learning, activities such as observing real-life phenomena, group discussions, and simple experiments encouraged students to connect the subject matter with real-world experiences. This reinforces the CTL principle, which emphasizes the importance of linking academic content to everyday life. The implementation of this strategy is further supported by Carracedo (2025), who emphasized that a contextual approach enriched by dynamic visualizations can enhance both cognitive and affective learning dimensions.

An increase in students' learning interest was also evident from the questionnaire results, which included four main indicators: enjoyment, interest in the material, engagement, and discipline/persistence. All indicators showed improvement in the experimental group compared to the control group. This is supported by the findings of Siregar and Hasratuddin (2025), who found that the use of instructional videos within the CTL model significantly boosted student motivation and engagement. Audiovisual media enables the presentation of content in visually and auditorily stimulating ways, helping to reduce boredom and increase student focus during the learning process.

Furthermore, these findings are reinforced by the study of Fadillah et al. (2017), which demonstrated the effectiveness of a CTL model assisted by concept mapping media in improving learning outcomes on colloid systems. Although different types of media were used, the CTL principle remained the key factor in encouraging active engagement and strengthening conceptual understanding. Audiovisual media in chemistry learning plays a crucial role in representing phenomena that cannot be observed directly, such as colloidal particles, thus supporting the development of deeper understanding. Overall, the combination of contextual approaches and audiovisual media creates a more meaningful and engaging learning environment for students. These findings are consistent with constructivist theory, which posits that learning is more effective when students actively build their knowledge through direct experience. Therefore, the implementation of the CTL model integrated with audiovisual media is widely recommended, especially for science topics that are abstract and complex in nature, in order to improve learning outcomes and foster sustained interest and motivation among students.

4. CONCLUSION

The implementation of the Contextual Teaching and Learning (CTL) model supported by audiovisual media was proven to have a positive effect on students' cognitive achievement. This was evidenced by a significant difference in cognitive test results between the experimental and control groups. The average posttest score of students in the experimental group reached 79.31, while the control group only obtained an average of 63.78. In addition, the CTL model assisted by audiovisual media also had a significant impact on enhancing students' learning interest. The post-intervention questionnaire results showed that learning interest in the experimental class reached 84% (categorized as very high), whereas the control class achieved only 78% (categorized as high). The use of audiovisual media helped create an interactive, engaging, and non-monotonous learning environment, thereby encouraging active student participation. The results of the Independent Samples Test indicated a significance value (Sig. 2-tailed) of 0.000 (< 0.005), which means that the alternative hypothesis (H_a) is accepted and the null hypothesis (H_0) is rejected. Therefore, it can be concluded that the use of the CTL model supported by audiovisual media had a significant effect on the cognitive achievement and learning interest of eleventh-grade students in the topic of colloids.

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