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Wordwall Integration in the CTL Model to Improve Students' Interest and Cognitive Abilities in Education for Sustainable Development

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Abstract

In this study, Wordwall-assisted technology is used within the framework of Contextual Teaching and Learning to promote sustainable education. This study aims to analyze the use of Wordwall technology in CTL to enhance students' interest and comprehension. This study employs a quantitative approach using a quasi-experimental nonequivalent control group design involving two classes. The method serves as a function. The real issue is the cement and gravel. The research participants included 36 students from each class, and data was collected using questionnaires along with pretest and posttest assessments. The data analysis involved checking for normality, checking for equal variances, and performing independent sample t-tests using IBM SPSS Statistics 27 software. The results showed that students in the experimental class had an average learning interest of 65.47, which was higher than the 61.36 in the control class, and this difference was statistically significant with a value less than 0.05. In addition, students' thinking skills improved a lot, going from 59.58 to 83.75 in the experimental class, which shows that using interactive tools like Wordwall can really boost interest and understanding, helping with education for Sustainable Development.

[Dalam penelitian ini, teknologi yang didukung Wordwall digunakan dalam kerangka Pengajaran dan Pembelajaran Kontekstual (CTL) untuk mendorong pendidikan berkelanjutan. Penelitian ini bertujuan untuk menganalisis penggunaan teknologi Wordwall dalam CTL guna meningkatkan minat dan pemahaman siswa. Penelitian ini menggunakan pendekatan kuantitatif dengan desain quasi-eksperimental kelompok kontrol tidak setara yang melibatkan dua kelas. Metode ini berfungsi sebagai fungsi. Masalah sebenarnya adalah semen dan kerikil. Peserta penelitian terdiri dari 36 siswa dari masing-masing kelas, dan data dikumpulkan menggunakan kuesioner serta penilaian pretest dan posttest. Analisis data melibatkan pengujian normalitas, pengujian kesamaan varians, dan pelaksanaan uji t sampel independen menggunakan perangkat lunak IBM SPSS Statistics 27. Hasil menunjukkan bahwa siswa di kelas eksperimen memiliki rata-rata minat belajar sebesar 65,47, yang lebih tinggi daripada 61,36 di kelas kontrol, dan perbedaan ini secara statistik signifikan dengan nilai kurang dari 0,05. Selain itu, keterampilan berpikir siswa meningkat secara signifikan, dari 59,58 menjadi 83,75 di kelas eksperimen, yang menunjukkan bahwa penggunaan alat interaktif seperti Wordwall benar-benar dapat meningkatkan minat dan pemahaman, serta mendukung pendidikan untuk Pembangunan Berkelanjutan.] © The Authors.

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1. Introduction

Education serves as the primary basis for developing skilled human resources, enabling them to tackle increasingly intricate global issues. In today's context, education emphasizes not merely the transfer of knowledge, but also the cultivation of critical, creative, and adaptive thinking abilities. Sustainable Development Education is a significant approach as it highlights the importance of understanding environmental, social, and economic sustainability in daily life [1]. However, the implementation of learning in schools still uses conventional methods that are centered on teachers, so that students are less active in the learning process. This condition causes low interest in learning and students' cognitive abilities, so more effective and relevant learning innovations are needed.

The development of digital technology provides a great opportunity to enhance the standard of education in the modern era. Digital interactive technology is able to create more interactive, adaptive learning, and is able to provide direct feedback to students. One of the learning media that can be used is Wordwall, which provides a variety of educational game-based activities. The use of new technologies in learning allows students to engage in enjoyable practical activities to learn effectively [2]. Moreover, the incorporation of technology into education can greatly enhance student motivation and involvement. Findings from earlier studies indicate that incorporating interactive digital technology into the learning model positively influences students' cognitive, emotional, and psychomotor skills[3].

One of the learning models is the Contextual Teaching and Learning Model, which is an approach that emphasizes the relationship between learning materials and students' real lives. This approach allows students to understand concepts more deeply as they relate to everyday experiences [4], [5]. When the CTL model is combined with digital media, the learning process becomes more interesting and meaningful [6]. Students not only receive information passively, but also actively engage in the learning process. This has a positive impact on increasing students' interest in learning and cognitive abilities. Thus, the integration of CTL and digital technology becomes an effective strategy in modern learning.

The application of the right learning model and the use of digital technology are also important factors in improving the quality of learning [7]. In the current digital age, information and communication technology is advancing swiftly and offers significant prospects in the field of education. The utilization of learning media based on digital technology can assist educators in delivering content in a more engaging, interactive, and comprehensible way for students, while enhancing motivation and interest in education, as it offers a more diverse and enjoyable learning experience[8]. One of the digital platforms that can be integrated into learning is Wordwall. Wordwall is a web-based digital learning medium that allows teachers to create various interactive activities such as quizzes, word games, card matching, puzzles, and various other forms of educational exercises. The use of this media has been proven to be able to increase students' enthusiasm and participation in the learning process, so that understanding of concepts and learning outcomes increases significantly [9].

Previous studies generally examined the use of the Contextual Teaching and Learning (CTL) model or Wordwall media separately, and were more frequently applied in subjects such as Mathematics, Science, and Language learning. Research that integrates both approaches in Economics learning remains limited. In addition, earlier studies mostly focused only on one aspect of learning outcomes, such as learning interest or academic achievement, so they have not comprehensively measured both affective and cognitive aspects simultaneously.

Therefore, this study offers novelty by integrating the CTL learning model with Wordwall digital media in Economics learning, especially on market price material. This study not only investigates students' learning interest as an affective aspect, but also examines students' cognitive abilities as an academic aspect simultaneously. Through this integration, learning is expected to become more contextual, interactive, and meaningful for students. Furthermore, this research supports the implementation of Education for Sustainable Development by encouraging the use of digital innovation to improve learning quality and prepare students to face future challenges.

This study is innovative as it combines the CTL learning model with Wordwall digital media for economic education, based on findings from multiple references. It is anticipated that this approach will serve as a viable solution for enhancing the quality of economic education. This method allows students to grasp economic concepts not just in theory, but also to recognize their ties to real life and to leverage technology as an enjoyable and significant way of learning. Earlier research has demonstrated that the integration of innovative learning models with digital technology positively affects students' learning processes and results [4]. According to the description provided, this

research seeks to assess the impact of utilizing interactive digital wordwall technology on enhancing students' engagement and comprehension in economics classes.

2. Method

This research employs a quantitative method featuring a quasi-experimental design with a nonequivalent control group. This design was selected as it enabled researchers to track alterations in the measured variables after the intervention was given to one group, by comparing them with other groups that did not undergo similar treatment, without complete randomization of participants [10]. This study was conducted between February 2 and February 25, 2026, at MAN 1 Tulungagung. The research participants included two classes: class X-I served as the experimental group, while class X-J functioned as the control group, with each class comprising 36 students. The experimental group underwent economic learning treatment utilizing the CTL model combined with Wordwall digital media, whereas the control group implemented the CTL model without incorporating digital technology. [11]. The flow of this research is presented in the following image:

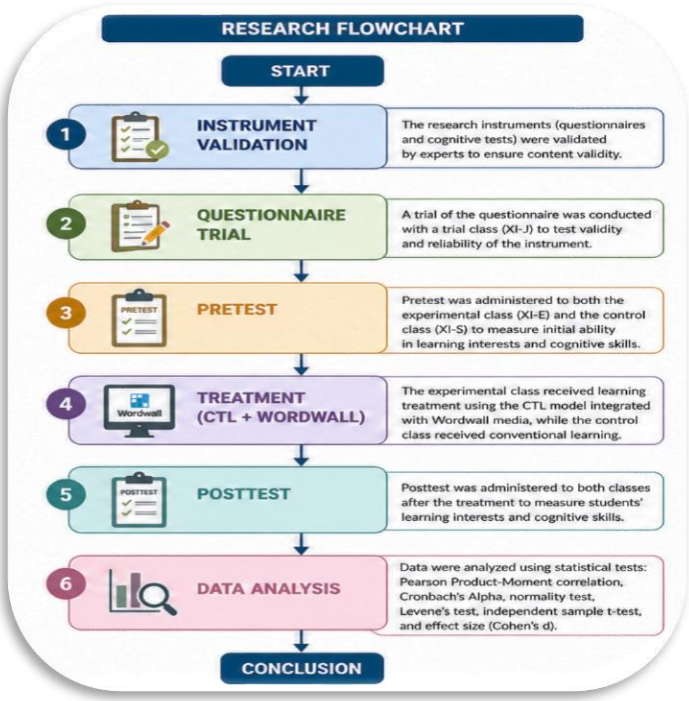

Figure 1: Research Flowchart of the Quas Exspermental Study

Figure 1 illustrates the research flow of the quasi-experimental study used in this research. The study began with the instrument validation stage, where the questionnaires and cognitive tests were validated by experts to ensure the content validity of the instruments [12]. After that, a questionnaire trial was conducted in a trial class to determine the validity and reliability of the research instruments.

The next stage was the pretest, which was administered to both the experimental and control classes to measure students' initial learning interest and cognitive abilities. Furthermore, during the treatment stage, the experimental class received learning activities using the Contextual Teaching and Learning (CTL) model integrated with Wordwall media, while the control class received conventional learning without digital media integration [13].

After the treatment process was completed, a posttest was conducted to measure students' improvement in learning interest and cognitive abilities. The collected data were then analyzed in the data analysis stage using statistical tests, including Pearson Product-Moment validity test, Cronbach's Alpha reliability test, normality test, homogeneity test, Independent Sample t-test, and Cohen's d effect size analysis. Finally, the research concluded with the interpretation and conclusion of the study findings. The syntax in this learning is as follows.

Figure 2. Concept Map of CTL Syntax ntegrated With Wordwall

Figure 2 presents the concept map of the Contextual Teaching and Learning (CTL) syntax integrated with Wordwall media. The first stage is constructivism, where students build their understanding based on prior knowledge and real-life experiences [14]. The second stage is inquiry, in which students investigate and explore information or solutions to learning problems through learning activities and Wordwall media [15]. The next stage is questioning, where both teachers and students engage in question-and-answer activities to deepen conceptual understanding.

In the learning community stage, students work collaboratively in groups to discuss ideas and solve problems together [16]. The following stage is modeling, where teachers or students provide demonstrations, examples, or learning models to support students' understanding of the material. Next, in the reflection stage, students reflect on what they have learned and evaluate their learning experiences [17]. The final stage is authentic assessment, where students' learning interest and cognitive abilities are assessed through tasks and Wordwall-based activities. The integration of Wordwall into the CTL syntax creates a more interactive and engaging learning environment that enhances students' participation and learning outcomes [18].

3. Results

Results from analyzing learning interest data collected via questionnaires revealed that students in the experimental class, who utilized the CTL learning model supported by Wordwall media, exhibited a higher average learning interest score compared to the control class that employed traditional learning methods [19]. The mean score for learning interest in the experimental class was 65.47, compared to 61.36 in the control class. The findings indicate that using the CTL model with Wordwall media positively influences students' interest in learning.

In the cognitive ability variable, the pretest scores for the two groups were quite similar, with the experimental class averaging 59.58 and the control class averaging 58.61. Following the treatment, both classes experienced an improvement in learning outcomes. The mean posttest score for the experimental group was 83.75, whereas the control group scored 70.42. Significant advancements in experimental groups indicated that CTL models supported by Wordwall were more efficient in enhancing students' cognitive skills.

According to the outcomes of the partial test (t-test), the significance value for the learning interest variable was 0.004 < 0.05, resulting in the rejection of H_0 and the acceptance of H_1. In the cognitive ability variable, the significance level is 0.000 < 0.05, thus H_0 is dismissed, and H_2 is accepted. The outcome of the effect size evaluation applying Cohen's formula d indicated a value of 0.70 (medium

category) for the learning interest variable, and a value of 0.944 (high category) for the cognitive ability variable.

The desire to learn is one of the internal elements that significantly influences the effectiveness of the learning process. Students with a strong interest in learning tend to engage more actively in educational activities, show greater diligence in completing assignments, and grasp the material taught by the teacher more rapidly.[20]. Therefore, teachers need to use learning strategies and models that are able to arouse and increase students' interest in learning optimally.

Table 1. Descriptive Statistics of Student Learning Interest Score

Groups	N	Red	Std. Deviation	Std. Error Mean
Experiments	36	65.47	6.509	1.085
Controls	36	61.36	5.139	0.856

Table 2. T Test Statistics

Remarks	T	Df	Sig. (2-tailed)	Mean Difference	Std. Error Difference
Equal variances assumed	2.974	70	0.004	4.111	1.382
Equal variances not assumed	2.974	66.423	0.004	4.111	1.382

Source : Research data that has been processed, 2026

Based on the findings of the research, the mean score for learning interest in the experimental group was 65. 47, compared to a score of 61. 36 in the control group. This variation indicates that the use of the CTL model along with Wordwall media has a more favorable effect on students' interest in learning. The CTL model refers to an educational strategy that links content with students' everyday experiences, making the learning experience feel more relevant and significant (Johnson, 2002; Trianto, 2010). When learners can connect the ideas studied to their personal experiences, their curiosity and enthusiasm for the material inevitably grow. According to the results of the statistical analysis, the significance level was found to be 0. 004.

Cognitive ability is an important aspect of learning, which includes the ability of students to understand, remember, apply, analyze, evaluate, and create knowledge from the material studied [21]. Good cognitive abilities will help students achieve optimal learning outcomes. Therefore, teachers need to apply learning models and strategies that can encourage the development of students' thinking skills in a holistic and in-depth manner [22].

Table 3. Descriptive Statistics of Student Posttest Scores

Groups	N	Red	Std. Deviation	Std. Error Mean
Experiment	36	83.75	11.975	1.996
Control	36	70.42	15.963	2.661

Table 4. T Test Statistics

Remarks	T	Df	Sig. (2-tailed)	Mean Difference	Std. Error Difference
Equal variances assumed	4.009	70	0.000	13.333	3.326
Equal variances not assumed	4.009	64.917	0.000	13.333	3.326

Source: Research data that has been processed, 2026

Based on the findings from the research, during the pretest phase, both groups displayed fairly equal starting skills (experiment: 59. 58; control: 58. 61). Following the intervention, the experimental group showed a much greater improvement, achieving an average posttest score of 83. 75, while the control group only reached 70. 42. This enhancement indicates that the CTL model used with Wordwall media effectively boosts students' thinking skills.

According to the t-test results, the significance value found was 0. 000, which is less than 0. 05. Therefore, it can be determined that the null hypothesis (H_0) is not supported, while the alternative hypothesis (H_2) is confirmed. This indicates a notable impact from employing the CTL learning model alongside Wordwall media on students' cognitive skills. In essence, this learning approach has been shown to significantly enhance students' critical thinking abilities compared to traditional teaching methods used before. The analysis of effect size computed through Cohen's d yielded a value of 0. 944, categorizing it as large. This effect size indicates that the CTL learning framework with Wordwall

media strongly influences students' cognitive development. The integration of this learning model with Wordwall media plays a vital role in advancing students' thinking skills when grasping educational content.

The enhancement of thinking abilities in the experimental group is also reflected in their enthusiasm and involvement during lessons. Students showed greater participation in discussions, responded to questions, and completed a variety of tasks facilitated through Wordwall media. These engaging learning exercises encourage students to think critically and gain a deeper understanding of the concepts being taught.

The findings of this research align with educational theory, which posits that the learning experience improves when students take an active role in their education. Learning that incorporates real-world contexts and interactive media aids students in comprehending the material more effectively, making the concepts taught easier to process and retain. Thus, the implementation of CTL models with the support of Wordwall media not only enhances student engagement in the learning journey but also significantly boosts their cognitive functions. process but also significantly improves students' cognitive abilities [23].

From this explanation, it can be concluded that the use of the Contextual Teaching and Learning (CTL) learning model supported by Wordwall media has a significant impact on students' cognitive abilities. This learning model helps create a more fun, interactive, and meaningful learning process, so that students can understand the subject matter better. Therefore, the use of CTL models integrated with digital learning media such as Wordwall can be an alternative effective learning strategy in improving students' cognitive abilities, especially in market price materials in class X.

Based on the findings of the research, the Contextual Teaching and Learning (CTL) model that incorporates Wordwall media has been shown to influence the interest in learning and cognitive skills of grade X students at MAN 1 Tulungagung. This aligns with the idea that contextual learning links academic content to real-life situations, making students more engaged and eager to learn.

The T-Independent Sample test results for the learning interest variable indicated a significance value (Sig. 2-tailed) of 0. 004, which is less than 0. 05. Consequently, the null hypothesis (H_0) is dismissed, while the alternative hypothesis (H_1) is accepted. On average, the experimental class demonstrated a learning interest level of 65. 47, surpassing the control class's average of 61. 36. Additionally, the effect size test yielded Cohen's value of d = 0. 70, categorizing it as medium, with an influence percentage of 76%. The application of the CTL model, supported by Wordwall, has proven quite effective in boosting students' engagement in learning. Students' interest is essential in determining their level of activity during lessons. Using interactive Wordwall media can enhance students' engagement as it introduces enjoyable, game-based learning experiences.

The t-test results on the cognitive ability variable reflected a significance value of 0. 000, which is lower than 0. 05. Thus, the null hypothesis (H_0) is rejected, and the alternative hypothesis (H_1) holds. The average posttest score for the experimental class was 83. 75, higher than the control class, which had an average of 70. 42. When looking at the pretest scores, the experimental class showed an improvement from 59. 58 to 83. 75, while the control class progressed from 58. 61 to 70. 00. This indicates that the cognitive ability in the experimental class improved more significantly than in the control class. Furthermore, the effect size value of 0. 944 falls into the high category with an influence percentage of 82%. Activity-focused learning such as CTL can facilitate a deeper and better understanding of concepts for students.

In conclusion, the study suggests that the CTL learning model with Wordwall media not only enhances students' interest in learning but also markedly boosts their cognitive abilities. Students who engage with enthusiasm in their learning tend to be more diligent, focused, and motivated during classes, which contributes to better cognitive learning outcomes. Additionally, employing learning media can clarify material explanations and enhance academic results. Therefore, the CTL approach using Wordwall presents an effective method for learning and improving the educational quality concerning market price topics.

4. Discussion

This research outlines how the Contextual Teaching Learning (CTL) model, supported by Wordwall media, affects students' interest and cognitive skills regarding market price subjects in class X at MAN 1 Tulungagung. The information collected was derived from a survey on learning interests and exam results reflecting students' cognitive abilities. Subsequent statistical evaluations led to the following findings.

4.1. The Influence of the Contextual Teaching Learning (CTL) Model Enhanced by Wordwall Media on X Grade Students' Engagement in Market Price Topics at MAN 1 Tulungagung

The findings of this study demonstrate that the implementation of the Contextual Teaching and Learning (CTL) model integrated with Wordwall media significantly improved students' learning interest in market price material. Based on the results of the independent sample t-test, the Sig. (2-tailed) value was 0.004, which is lower than the significance level of 0.05. Therefore, the null hypothesis (H0) was rejected and the alternative hypothesis (H1) was accepted. In addition, the experimental class obtained a higher mean score of learning interest (65.47) compared to the control class (61.36). This result indicates that students who learned through the CTL model assisted by Wordwall showed greater enthusiasm and engagement during the learning process than students who experienced conventional learning methods.

The increase in students' learning interest can be explained through the characteristics of the CTL learning model itself. CTL emphasizes the connection between learning materials and students' real-life experiences, enabling students to perceive the relevance and usefulness of the subject matter in daily life. In the context of market price material, students were encouraged to relate economic concepts to actual market conditions surrounding them. This contextual approach made the learning process more meaningful and reduced students' boredom during classroom activities.

Furthermore, the integration of Wordwall media contributed significantly to students' motivation and participation. Wordwall provides interactive quiz-based activities that create a more enjoyable and competitive learning atmosphere. Students became more active in answering questions, discussing concepts, and participating in classroom interactions. The use of digital learning media also stimulated students' curiosity and concentration because the activities were presented in an attractive visual format. These findings are consistent with Slameto's theory, which explains that indicators of learning interest include feelings of enjoyment, attention, curiosity, and active participation in learning activities [24].

The findings also reveal that students in the experimental class demonstrated better classroom engagement than those in the control class. During the implementation of CTL assisted by Wordwall, students were more willing to ask questions, express opinions, and collaborate with peers. In contrast, students in the conventional learning class tended to be more passive because the learning activities relied heavily on teacher explanations without interactive digital support. This difference confirms that innovative and technology-based learning models are capable of increasing students' active involvement in the learning process.

In addition, these findings support previous studies indicating that the integration of CTL and interactive media positively affects students' learning interest [25].The consistency between this study and prior research strengthens the argument that contextual and technology-assisted learning can create a more student-centered learning environment. Therefore, the CTL model assisted by Wordwall can be considered an effective strategy for improving students' learning interest in Economics subjects, particularly in market price material.

4.2. The Effect of the Contextual Teaching Learning (CTL) Model Assisted by Wordwall Media on Students' Cognitive Abilities in Class X Market Price Materials at MAN 1 Tulungagung

The results of this study indicate that the CTL learning model integrated with Wordwall media significantly improved students' cognitive abilities. Based on the independent sample t-test analysis, the Sig. (2-tailed) value was 0.000, which is smaller than 0.05. Therefore, the null hypothesis (H0) was rejected and the alternative hypothesis (H1) was accepted. The experimental class achieved a higher average score (85.75) than the control class (70.42), showing a substantial difference of 15.33 points. This finding demonstrates that students who learned through the CTL model assisted by Wordwall achieved better cognitive learning outcomes than those who learned through conventional methods.

The improvement in cognitive ability occurred because the CTL model encourages students to actively construct knowledge through real-life problem-solving activities. Students were not only required to memorize concepts but also to analyze, apply, and evaluate economic problems related to market price phenomena. Through inquiry and discussion activities, students developed higher-order thinking skills that are essential in cognitive learning development.

The use of Wordwall media also played an important role in strengthening students' understanding of concepts. Interactive quizzes and game-based activities provided immediate feedback that helped students identify their mistakes and improve their comprehension. The visual and interactive features of Wordwall made abstract economic concepts easier to understand, thereby

increasing students' retention of learning material. This condition explains why students in the experimental class showed significantly better post-test results.

These findings are closely related to the theory proposed by Anderson and Krathwohl, which states that cognitive ability includes remembering, understanding, applying, analyzing, evaluating, and creating [26]. Through the CTL learning stages, students were involved in various learning activities that stimulated these cognitive processes. Likewise, Gagné emphasizes that cognitive ability develops when students actively use thinking strategies to solve problems and understand concepts [27].In this study, the combination of contextual learning and interactive media successfully created a learning environment that supported intellectual development.

Moreover, classroom observations during the learning process showed that students in the experimental class were more enthusiastic and focused during lessons. Students were actively involved in group discussions, interactive quizzes, and problem-solving activities. This active participation contributed to deeper conceptual understanding compared to students in the control class, who mainly relied on teacher-centered explanations. Therefore, the integration of Wordwall into the CTL learning model not only increased students' motivation but also improved the quality of their cognitive learning processes.

The results of this study are also consistent with previous research conducted by Umi Nur Chofifah, which found that the CTL learning model assisted by digital media significantly improved students' learning outcomes. The similarity of findings indicates that integrating contextual learning with interactive digital media can effectively enhance students' cognitive achievement across different subjects and educational contexts.

4.3. The Effect of the Contextual Teaching Learning (CTL) Learning Model Assisted by Wordwall Media on Students' Interest and Cognitive Ability in Class X Market Price Material at MAN 1 Tulungagung

The findings of this study reveal that the CTL learning model assisted by Wordwall media had a meaningful impact on both students' learning interest and cognitive ability simultaneously. Based on the effect size analysis using Cohen's d, the effect size value for learning interest was 0.70, which falls into the medium category, while the effect size value for cognitive ability was 0.944, categorized as high. These results indicate that the implementation of the CTL model integrated with Wordwall not only produced statistically significant differences but also generated substantial practical effects in classroom learning.

The medium effect on learning interest suggests that the integration of interactive and contextual learning activities successfully increased students' enthusiasm, attention, and participation in learning activities. Students became more motivated because the learning process was presented in a more engaging and enjoyable manner. Meanwhile, the high effect on cognitive ability demonstrates that the CTL model assisted by Wordwall was highly effective in improving students' understanding and mastery of market price concepts.

The difference in average scores between the experimental and control classes further strengthens these findings. The experimental class achieved higher average scores in both learning interest (65.47 compared to 61.36) and cognitive ability (85.75 compared to 70.42). These differences indicate that students who experienced contextual and technology-assisted learning performed better academically and emotionally than students who participated in conventional learning environments.

The success of this learning model can also be explained through the combination of contextual learning principles and digital media integration. CTL encourages students to connect theoretical knowledge with real-life situations, while Wordwall creates an interactive and student-centered learning environment. The combination of these two elements enabled students to become more active, collaborative, and confident during the learning process. Consequently, students were able to understand concepts more effectively and maintain higher learning motivation.

In addition, these findings support previous studies stating that contextual learning approaches integrated with interactive digital media produce strong educational impacts and improve students' learning experiences [28]. The results of this study confirm that innovative learning strategies are essential in modern education, particularly in Economics learning at the Madrasah Aliyah level. Therefore, the CTL learning model assisted by Wordwall media can be recommended as an innovative, effective, and student-centered learning approach that not only enhances students' cognitive achievement but also increases their interest and engagement in learning activities.

5. Conclusion

This research indicates that incorporating digital interactive technology via Wordwall media into the CTL learning model can significantly enhance students' learning interest and cognitive skills. Learning transforms into a more engaging, captivating experience that enhances student participation in the educational process. The study's findings indicate that technology usage greatly benefits student learning results. Moreover, incorporating technology into education helps facilitate Education for Sustainable Development as it cultivates skills pertinent to future demands. Consequently, it is recommended that educators employ digital interactive technology in education to continuously enhance the quality of learning.

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