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Improving Students' Reading Comprehension by Using Integrated Multimedia in MAN 1 Bandar Lampung

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ABSTRACT: This study examined the impact of integrated multimedia instruction on students' reading comprehension achievement compared with the traditional print-based instruction. This research applied a quasi-experimental design involving two groups: experimental and control. In this experiment, there were 38 students assigned to the experimental group and 37 in the control group from 12th graders at MAN 1 Bandar Lampung. The experimental group received instruction that integrated text, picture, audio, video, and an interactive quiz in a single web post, whereas the control group used print-based instruction. Pre-test results showed relatively equal initial abilities with mean scores of 62.7 and 60.0 respectively for the experimental and control group, $t = 0.697$, $p = 0.488$. In comparison, after treatment, the average post-test score in the experimental group is remarkably higher at 83.3, while that of the control group is a mere 70.3, with $t = 6.784$; p-value $= 4.38 \times 10^{-9}$. This confirms that integrated multimedia instruction significantly improves students' reading comprehension as compared to the print-based one. Integrating multiple media into a single web post tends to be more effective in bringing improvement to students' reading achievement. This finding gives educators valued information on how to better use multimedia tools in order to improve reading instruction outcomes.

KEYWORDS: Educational Technology, Integrated Multimedia Instruction, Multimedia Learning, Print-Based Instruction, Reading Comprehension.

INTRODUCTION

Reading is one of the fundamental skills in the academic and personal development of students. According to Anderson et al. (1985), reading is vital in knowledge acquisition, critical thinking development, and exposing oneself to a variety of ideas that form a foundation for lifelong learning. Despite this fact, Indonesian students' reading ability remains alarmingly low. Based on the result of PISA 2022, students of Indonesia aged 15 years obtained an average score of 359 points in reading literacy, far behind the average of OECD countries with 476 points, which put Indonesia among countries with the worst performance. Meanwhile, the National Reading Index reported an interest in public reading of 59.92 in 2021 from 55.74 in 2020. While this indicates slight improvement, it also underlines the continued challenges in fostering literacy development. These results mark pressing concerns that need to be addressed regarding the continued lack of reading comprehension among Indonesian students.

This struggle in reading comprehension emanates from a number of factors, which include but are not limited to: insufficient exposure to interesting instructional materials and inappropriate use of strategy in developing critical reading. These insufficiencies mostly left the students unprepared in tackling the key aspects in reading. In fact, Rizqon et al., 2021, indicated in their study that 52% of the senior high school students encountered difficulties with regard to vocabulary problems and 43.2% experienced deficiencies in the background knowledge pertinent to the text in the course of reading in English. Traditional teaching, especially print-based teaching, does not easily accommodate the rapidly changing contexts, or encourage dynamic discussions and shared constructions, either between learners or between the learner and the text, that might meet such challenges. Such instruction may be out of tune with modern notions of appropriate teaching and fail to scaffold effectively the increasingly complex needs for which instruction is designed to enable reading comprehension gains. Such an approach needs to be modernized in attempts to improve reading comprehension attainment and ensure the ability to meet knowledge demands through school and beyond.

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Integrated multimedia instruction, on the other hand, promises to provide an alternative that bypasses many of the above-mentioned problems. Incorporating text, pictures, audio, video, and interactive quizzes, multimedia instruction offers a more dynamic and engaging learning environment that better caters to students' needs. According to Mayer's Cognitive Theory of Multimedia Learning (2005), the use of multiple sensory channels promotes deeper comprehension because of reduced cognitive overload. Cognitive overload occurs when learners process too much information at once or use inefficient methods to understand, for instance, a text. Integrated multimedia instruction is based on this theory in that information is presented through different yet complementary media, where each medium reinforces and enriches the others to enhance understanding. By spreading the cognitive load across the senses, multimedia tools lower mental strain often required by reliance on a single mode of delivery, such as text alone. It frees students to make sense of the material rather than trying to work with the delivery format. The combination of visual, auditory, and interactive elements makes the learning experience engaging and immersive, capturing students' attention and maintaining their interest.

This can be made possible, for instance, a reading text supported with visuals and audio narration could engage both visual and auditory senses for better comprehension. Videos provide dynamic context and visualization of abstract ideas, while interactive quizzes activate tactile engagement and cognitive processing. Such a combination of multimedia, interactive tools, and formative feedback tackles many traditional instruction limitations, enhancing learners' comprehension and retention and making learning more fun and effective.

Further, the dual advantages of multimedia enhancing both cognitive processing and motivation are brought out by Moreno's 2005 Cognitive-Affective Theory of Learning with Media. Interactive features, like quizzes and animations, make students more involved in their studies and turn learning into a less tedious process; it holds their attention longer. Combined, these theories show how integrated multimedia instruction can transform traditional reading instruction into a more effective and engaging process, especially for struggling readers.

Although integrated multimedia instruction holds potential, there is limited direct evidence comparing its effectiveness to traditional print-based teaching in enhancing reading comprehension. Most research underscores the individual merits of each method, leaving a key gap in understanding their comparative impacts. Investigating this comparison is crucial to determining whether multimedia instruction provides notable benefits over print-based instruction, especially for senior high school students.

This study, therefore, attempts to fill this gap by attempting to find out whether or not integrated multimedia instruction can significantly enhance the reading comprehension achievement of students as compared to the traditional print-based instruction. By focusing on this comparison, the study provides worthy insights into how multimedia tools can improve learning results in senior high school classrooms.

LITERATURE REVIEW

This section discusses the theoretical basis of reading, reading comprehension, traditional print-based instruction, integrated multimedia instruction, previous studies, the limitations of current multimedia practices, and the research objective. Each of these aspects will be explored for its significance and relevance.

2.1. Reading

Reading is one of the critical skills in education since it is from reading that meaning and information are derived through interaction with texts. According to Anderson et al. (1985), reading is a dynamic process involving the interaction between the reader, the text, and the context, where decoding and meaning-making occur simultaneously. This then means that reading would not be mere recognition of words but active building of meaning.

The act of reading includes a number of cognitive processes which involve decoding, fluency, and comprehension. Decoding changes written symbols into speech, fluency assures that the reading is to be done smoothly and automatically, while comprehension allows the reader to make meaning of what has been read. These processes, as presented by Grabe (2008), interact to create a cohesive and holistic reading experience.

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While decoding and fluency represent the foundational blocks of reading, comprehension represents the end product of the reading process. Without comprehension, reading would be a mechanical process without any significant function to make knowledge acquisition and critical thinking achievable. Therefore, reading comprehension should be considered in depth because it lies at the very core of educational success and lifelong learning.

2.2. Reading Comprehension

Comprehension is the very essence of reading, for it permits readers to construct meaning and gain insight from texts. According to Kintsch (1998), comprehension is the process of being able to understand, interpret, and make meaning from written material, involving the interplay among cognitive processes such as decoding, activation of prior knowledge, making inferences, and integration of new information.

Furthermore, Snow (2002) states that effective comprehension requires readers to engage in a critical manner with a text beyond its literal meaning, to evaluate ideas and relate them to broader contexts. These cognitive and evaluative processes undergird the complexity of reading comprehension as an important determinant of academic success because it allows students to analyze and synthesize information across subjects. It also supports personal development in the fostering of critical thinking, enhancing problem-solving abilities, and deepens the understanding of diverse perspectives. According to Grabe (2008), successful comprehension integrates three key components: linguistic knowledge, including vocabulary and grammar, cognitive skills, such as summarization and inference, and metacognitive strategies in monitoring understanding and adjusting approaches if necessary. Combined, these elements demonstrate that reading is not a passive process; it is an active and intentional process wherein the readers are involved in constructing meaning.

Perfetti and Stafura (2013) indicate that high levels of comprehension ensure the reader can manage academic difficulties and reach life-long learning objectives. A reader with a higher ability to use comprehension can understand complicated ideas, synthesize information, and use knowledge in many areas. In general, however, much reading instruction has emphasized decoding strategies over comprehension strategies, so students may be less well prepared in using the whole range of strategies for deep processing of texts. This inability reveals one more point of concern with traditional instruction in reading, which is discussed further in the next section.

2.3. Traditional Print-Based Instruction

Traditional reading instruction has focused for years on foundational skills, such as decoding and fluency, through teacher-led explanation and repetitive exercises. While effective in developing basic literacy, this kind of instruction often emphasizes the mechanical processes of reading without fully addressing comprehension or critical engagement with texts. This gap in instruction becomes most evident as students are called upon to progress to more complex tasks that require inference, analysis, and synthesis.

In the domain of traditional instruction, print-based instruction has been the predominantly used mode of delivery when it comes to reading lessons. Traditional print-based instruction, though crucial in laying the basics of literacy, often fails in engaging students with diverse learning needs. Anderson and Pearson (1984) noted that it tends to give heavy emphasis to decoding processes and text comprehension but makes little provision for sensory details or interactions that can heighten engagement. As a result, many students, especially those who encounter difficulties with abstract or problematic materials, may not reach an engaging point with print-based instruction.

Guthrie and Wigfield (2000) further identify that motivation is an essential partner for successful reading. More often than not, motivating and engaging materials are absent from traditional print-based instruction. As a result, students may become less motivated about reading. This lack of motivational elements can limit their ability to develop deeper comprehension and sustain interest in reading.

Recognizing the limitations of traditional print-based instruction, the researcher wishes to investigate an innovative approach to meet the diverse needs of learners. One promising alternative is integrated multimedia instruction, which offers dynamism and interactivity not typically found in traditional instruction. This approach, with its potential to revolutionize reading instruction, is discussed below in detail.

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2.4. Multimedia Instruction

Based on the limitations of print-based instruction, multimedia instruction is a new approach that introduces dynamic and interactive features to fulfill the needs of multiple learners while also increasing learners' engagement. Multimedia instruction differs from traditional print-based instruction because it integrates text, visual, audio, video, and interactive tool to develop the most multimedia-rich instruction. Multimedia instruction breaks the mold of conventional instruction, which is often static and unable to reach a wider array of students, using various types of media to aid learning.

This adaptable approach has its foundation in Sweller's (1988) Cognitive Load Theory, which understands the need to optimize cognitive resources during the learning process. Conventional instruction frequently imposes an unnecessary load on learners because of poorly designed media or content that is too abstract. On the other hand, integrated multimedia instruction addresses these difficulties by organizing information in a way that is more conducive to learning and offers assistance. In Sweller's (1988) view, there are three types of cognitive load: intrinsic load (the inherent complexity of the material), extraneous load (the unnecessary load created by poorly designed or taught materials), and germane load (mental effort dedicated to understanding and focusing on the information). By minimizing extraneous load and increasing germane load, effective multimedia instruction helps students allocate cognitive resources towards mastering the content. By providing both visual and auditory elements of presentation, multimedia instruction promotes a more fluid and less-dense learning process.

Moreover, Paivio's (1990) Dual Coding Theory, which states that learning is more influential when information is presented in verbal and visual instructions, also reinforces the effectiveness of multimedia instruction. The human brain processes verbal content (any type of written or spoken text), and visual content (like an image, diagram, or video) in two different systems, while accessing and interacting with the same information. The combination of these two forms of information helps students create links in their minds and this facilitates memorization and understanding. Pairing reading with relevant images or video clips helps students move from the abstract to the concrete, which will result in greater understanding and retention over time.
Therefore, the researcher utilized several modes of interactive media to adapt to diverse learning needs as well. Images and videos help visual learners, spoken text or audio helps auditory learners, and interactive quizzes and hands-on activities help kinesthetic learners. This inclusive approach not only addresses individual preferences but also ensures that students are more actively involved in the learning process.

Multimedia instruction potentially makes a major contribution to reading instruction by providing learners with a more integrated and enjoyable educational experience that can be sorely lacking in traditional approaches. With its capacity to lower cognitive load, meet varied learning requirements, and enhance understanding, multimedia instruction can be a powerful tool for addressing the limitations of traditional print-based instruction.

2.5. Previous Studies

Data supporting the efficacy of multimedia instruction on reading comprehension is sound. For instance, Korat (2010) explored the effect of interactive multimedia storybooks on supporting children's literacy development. In this study, children who used multimedia storybooks—integrating text, audio, and interactive elements—showed significantly greater improvements in word recognition and story comprehension skills compared to those using traditional print storybooks. Multimedia components engage multiple sensory channels, leading to superior comprehension and retention.

Han (2010) also examined the benefits and drawbacks of using multimedia tools in English reading instruction. The study found that multimedia features, such as synchronized audio, visual aids, and interactive tools, made learning more engaging and clarified abstract concepts, fostering a more active and inclusive learning process. However, the research also highlighted potential technical challenges and emphasized the importance of teacher training to maximize the benefits of multimedia instruction.

Next, Lysenko and Abrami (2014) examined the comparative advantage of two web-based applications, ABRACADABRA (ABRA) and ePEARL, in enhancing reading comprehension among early elementary students. ABRA is an interactive multimedia literacy tool that integrates text, audio, and interactive features to support letter-sound knowledge, phonological blending, and reading comprehension. ePEARL, on the other hand, is a digital portfolio designed to foster self-regulated learning, encouraging students to set goals, reflect, and strategize during reading and writing tasks. The study revealed that students using these tools showed

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significantly better performance in reading comprehension compared to those relying on traditional methods. This research highlights the potential of incorporating interactive multimedia tools into reading instruction to enhance comprehension skills by effectively combining cognitive and motivational strategies.

Similarly, Samat and Aziz (2020) investigated the efficiency of multimedia learning in enhancing reading comprehension among indigenous pupils in Malaysia. Their findings showed that integrating text, images, and audio significantly supported students in understanding reading materials by catering to diverse learning styles. This inclusive approach provided scaffolding that improved both comprehension and engagement, further emphasizing the potential of multimedia tools to enhance reading instruction.

Furthermore, Day et al. (2024) examined the impact of animated e-books on elementary students' vocabulary acquisition and comprehension skills. Their study revealed that the integration of animations, interactive questions, and multimedia features in digital e-books significantly improved students' engagement and understanding. This research underscores the effectiveness of multimedia-enriched materials in advancing literacy development and fostering comprehension in a dynamic and interactive way.

Indeed, these reviewed studies have identified considerable advantages of multimedia instruction for improving reading comprehension and engagement across different contexts. At the same time, they reveal limitations such as fragmented approaches and technical problems that are themselves worthy of further research. These set the stage for exploring the barriers to its widespread implementation, as discussed in the next section.

2.6. Integrated Multimedia Instruction

While the potential that multimedia instructions hold is tremendous, full-scale adoption continues to unearth various drawbacks. Especially, the researcher has recognized a critical limitation: much of the existing research concentrates on the use of individual tools, such as image, audio, video, or interactive elements, rather than their integration into a cohesive construction. This separated approach can rise cognitive load and decrease the overall effectiveness of the learning experience, as learners are forced to navigate various tools and formats.

Integrated multimedia instruction appears to be a remedy for this limitation, unified in a system that provides coherence to the different multimedia elements. According to Sweller's (1988) Cognitive Load Theory, there is a need to reduce extraneous cognitive load caused by disjointed and ill-organized materials. Placing text, visual, audio, video, and interactive features within one seamless framework, integrated multimedia instruction minimizes the cognitive load associated with juggling separate tools.

This approach also resonates with Mayer's (2005) Cognitive Theory of Multimedia Learning, arguing that coherent and integrated presentations presented by each channel—visual and auditory—improve understanding and memorability. Additionally, grouping multimedia into a single platform — a web post for example — provides ease of access, and lets learners know where they can find all the resources in one place.

Integrated multimedia instruction therefore potentially addresses these challenges and goes beyond traditional print-based instruction by improving the quality of learning. Highlighting its transformative potential, it caters to a variety of learning needs, simplifies complex concepts, and engages students.

2.7. Research Objective

This study aims to examine how integrated multimedia instruction enhances students' reading comprehension. By incorporating text, visuals, audio, video, and interactive quizzes into a unified web-based format, it seeks to create an engaging learning experience. Focusing on senior high school students at MAN 1 Bandar Lampung, the research investigates whether this approach significantly improves reading comprehension compared to traditional print-based teaching.

RESEARCH METHODOLOGY

This section describes the research methodology used to investigate the effects of integrated multimedia instruction on students' reading comprehension in contrast to traditional print-based instruction. It includes the type of research, subjects, data collecting techniques, data analysis, and statistical formulas.

3.1. Type of Research

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This study utilizes a quasi-experimental research design, specifically a Pre-test Post-test Experimental-Control Group approach. By assessing students' comprehension levels both prior to and following the instructional period, this design thoroughly evaluated the multimedia approach's effectiveness against the traditional method. This framework allows for a clear comparison of results between the experimental group, which received integrated multimedia instruction, and the control group, which engaged in traditional print-based instruction.

3.2. Subjects

The subjects of this research were 38 students in the experimental group and 37 students in the control group, all from the 12th grade at MAN 1 Bandar Lampung. The experimental group was provided with reading instructions using integrated multimedia, which incorporated text, image, audio, video, and interactive quiz. In contrast, the control group was given traditional print-based instructions, relying solely on static text without any multimedia elements. To ensure impartial comparisons, both groups experienced a pre-test to establish their baseline reading comprehension abilities. This process granted an equitable starting point for assessing the influence of the distinctive instructions.

3.3. Data Collecting Technique

The data were obtained through reading comprehension tests that were conducted before and after treatments in both groups. The pre-test was employed to find out the participants' initial reading comprehension level before treatments. While the post-test measured the effect of the intervention on the comprehension level, that is, changes in the reading competence are determined.
The reading comprehension tests were validated by means of expert reviews and a pilot study was undertaken prior to implementation. The pilot study included a group of students with comparable characteristics to the real participants, guaranteeing that the tests were proper for assessing students' reading comprehension levels.

3.4. Data Analysis

The collected data were analyzed using SPSS software employing a mix of descriptive and inferential statistical methods. Descriptive statistics, such as mean, standard deviation, and percentages, were calculated to provide a comprehensive insight into students' performance in both the experimental and control groups. To additionally evaluate the difference in reading comprehension achievement, an independent sample t-test was carried out. This test compared the post-test mean scores of both groups to ascertain whether the identified differences were statistically significant. This method guaranteed thorough analysis by testing the null hypothesis (no difference between groups) in comparison to the alternative hypothesis (a notable difference between groups). The findings offered understanding into the effect of integrated multimedia instruction on reading comprehension.

3.5. Statistical Formula

The Independent Sample T-test formula is provided to calculate the statistically significant difference between both groups' mean scores:

$$t = \frac{\overline{X}_1 - \overline{X}_2}{\sqrt{\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}}}$$

Where:

- $\overline{X}_1, \overline{X}_2$: Mean scores of the experimental and control groups, respectively.
- s_1^2, s_2^2: Variances of the experimental and control groups, respectively.
- n_1, n_2: Sample sizes of the experimental and control groups, respectively.

This formula is utilized to determine if integrated multimedia instruction significantly improved students' reading comprehension compared to traditional instruction.

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RESULTS AND DISCUSSION

The following section outlines the findings of the study, emphasizing the differences in reading comprehension achievement between the experimental and control groups, followed by a discussion of the results in relation to relevant theories and previous research.

4.1. Results

The results of this study are presented in the table below.

Table 4.1. Comparison of Pre-Test and Post-Test Results between Experimental and Control Groups

Group	Pre-Test Mean	Post-Test Mean	Improvement	Percentage Increase
Experimental	62.7	83.3	20.6	32.85%
Control	60.0	70.3	10.3	17.17%

The table shows the mean scores for the experimental and control groups in both the pre-test and post-test, together with the computed gains and percentage increases for both groups. The experimental group, which underwent integrated multimedia instruction, has a pre-test mean score of 62.7, which climbs to 83.3 in the post-test, indicating a gain of 20.6 points. This equates to a percentage growth of 32.85%. Conversely, the control group, which was provided with traditional print-based instruction, begins with a pre-test mean score of 60.0, which elevates to 70.3 in the post-test, yielding a gain of 10.3 points and a percentage growth of 17.17%.

The percentage increase was calculated using the following formula:

$$\text{Percentage Increase} = \left(\frac{\text{Post-Test Mean} - \text{Pre-Test Mean}}{\text{Pre-Test Mean}} \right) \times 100$$

For the experimental group:

$$\left(\frac{83.3 - 62.7}{62.7} \right) \times 100 = 32.85\%$$

For the control group:

$$\left(\frac{70.3 - 60.0}{60.0} \right) \times 100 = 17.17\%$$

The table provides a quantitative summary of the changes in reading comprehension performance for both groups before and after interventions. It highlights the raw score gains and calculates the relative progress through the percentage increases, providing a comprehensive view of the results.

Furthermore, the results of the Independent Samples T-Test analysis for the post-test are presented in the table below.

Table 4.2. The Results of the Post-Test Independent Sample T-Test

Statistic	Experimental Group	Control Group	Difference
Mean Post-Test Score	83.3	70.3	13.0

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Standard Deviation	6.2	7.1	-
Sample Size (n)	38	37	-
t-value	-	-	6.784
Degrees of Freedom (df)	-	-	73
p-value	-	-	4.38×10^{-9}

The table presents the descriptive statistics comparing the post-test reading comprehension scores of the experimental and control groups. The experimental group achieved a higher mean post-test score (83.3) compared to the control group (70.3), with a difference of 13.0 points. The Independent Samples T-Test analysis yielded a t-value of 6.784 and a p-value of less than 0.05 (4.38×10^{-9}), indicating that the difference in post-test scores between the two groups is statistically significant. Then, to clearly visualize the improvements before and after the treatments, refer to the graph below.

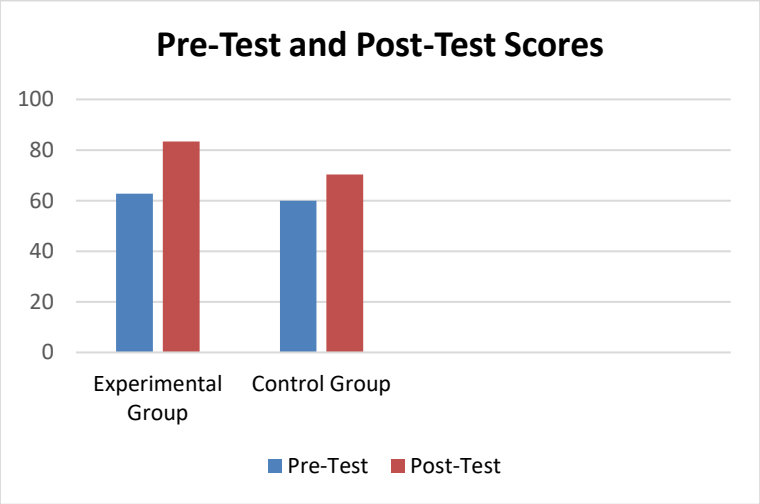

Figure 4.1. Pre-Test and Post-Test Score Comparison: Experimental vs. Control Groups

Furthermore, the percentage increase in reading comprehension scores for both groups is clearly illustrated in the following graph.

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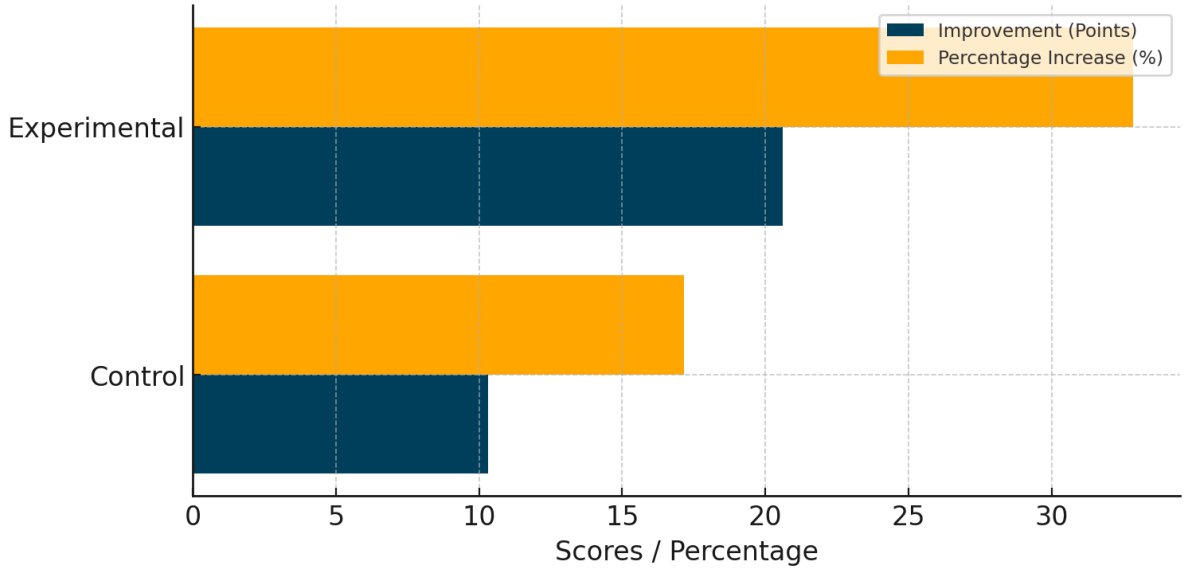

Figure 4. 2. Reading Score Improvement and Percentage: Experimental vs. Control Groups

4.2. Discussion

This research aims to determine whether using integrated multimedia—such as text, images, videos, and interactive quizzes—to teach reading is more effective than using printed texts alone. The study examines students' performance on reading tests before and after the interventions, analyzing how much students who learned with integrated multimedia improved and discussing their implications based on relevant theories and prior research.

To ensure a fair comparison, the researcher first assessed the initial abilities of both groups of students. The students in the experimental group, who would be learning with the new instruction, achieved an average score of 62.7 on a pre-test. The students in the control group, who would continue with the traditional instruction, scored an average of 60.0. Statistical analysis ($t = 0.697$, $p = 0.488$) revealed no significant difference between the two groups at the beginning of the study. This indicates that both groups of students had comparable starting points, allowing for a fair evaluation of the effectiveness of the different teaching instructions.

After the teaching intervention, the experimental group, which learned through a mix of text, visuals, audio, video, and interactive quizzes combined into a single web post, shows a noticeably higher post-test average score of 83.3 compared to the control group's 70.3. The statistical analysis ($t = 6.784$, $p = 4.38 \times 10^{-9}$) shows that the progress in the experimental group is much better than in the control group, supporting the effectiveness of the multimedia approach in improving students' reading comprehension.

This improvement can be understood through Mayer's (2005) Cognitive Theory of Multimedia Learning, which highlights the advantages of using different sensory channels to improve understanding and memory. By combining text, image, video, audio, and interactive quiz at the same time, the multimedia approach makes learning easier and helps students grasp information more deeply. On the other hand, traditional print-based teaching usually relies on just one way of presenting material, which can make it harder for students to fully understand and remember complex ideas.

Sweller's (1988) Cognitive Load Theory also backs this up, stressing the importance of keeping unnecessary mental effort to a minimum to make learning easier. Traditional print-based teaching often requires students to work harder to make sense of static materials, adding to their mental strain and making comprehension more difficult. In contrast, the integrated multimedia approach organizes the content into a single, clear format, cutting down on extra mental effort and helping students better understand and remember the material.

The use of multimedia tools in this study not only eases cognitive strain but also resonates with Vygotsky's (1978) Social Constructivism, which highlights the importance of tools in supporting learning. Interactive quizzes, audio features, and visual aids

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serve as scaffolding mechanisms in this multimedia approach, breaking down complex reading tasks into simpler, more manageable steps. These tools systematically guide students through the material, allowing them to concentrate on key information and gradually enhance their comprehension skills. This structured guidance aligns with Vygotsky's concept that tools can amplify cognitive capabilities, helping students reach a deeper level of understanding that might not have been achievable through traditional print-based instruction alone.

These theoretical perspectives collectively emphasize how an integrated multimedia approach successfully overcomes the shortcomings of traditional print-based teaching. By minimizing cognitive load, engaging multiple sensory channels, and offering structured support, this approach fosters a more interactive and supportive learning environment. The notable improvement in reading comprehension among the experimental group highlights the effectiveness of multimedia instruction in addressing the challenges of conventional instructions and catering to the varied needs of today's learners.

Furthermore, the findings of this study align with prior research demonstrating the advantages of multimedia instruction in improving reading comprehension. The marked improvement in reading comprehension scores within the experimental group emphasises the value of incorporating multimedia elements like quizzes and visual aids to promote active engagement and enhance understanding. This aligns with Dalton and Proctor's (2008) assertion that multimedia tools, especially annotated visuals and synchronized audio, offer crucial contextual support for struggling readers by providing diverse pathways to comprehension. Annotated visuals—such as diagrams or images paired with explanatory notes—help students link abstract concepts to tangible representations, enabling them to better understand complex ideas. Synchronized audio plays a key role in enhancing understanding by pairing spoken language with visual elements, helping learners process information through both hearing and sight. This dual-channel approach makes comprehension easier by reducing the mental effort needed to decode text on its own. For students who struggle with reading, multimedia tools act as a form of support, breaking complex ideas into smaller, manageable steps and guiding them systematically through the material. In this study, the use of multimedia features provided students with multiple ways to interact with and absorb the content, further reinforcing Dalton and Proctor's conclusion that multimedia tools are essential for closing comprehension gaps and supporting learners with diverse needs.

Additionally, multimedia approach, which combined text, visuals, audio, video, and interactive features within a unified web-based platform, successfully catered to the varied learning preferences of students, leading to better comprehension outcomes. This aligns with the findings of Samat and Aziz (2020), who showed that multimedia tools blending text, images, and audio provide valuable scaffolding for learners with diverse preferences. Their research highlighted that such an inclusive strategy enhances both engagement and understanding of the learners.
Likewise, Korat (2010) demonstrated that multimedia storybooks significantly improved children's literacy by stimulating multiple sensory modalities. The integrated use of multimedia elements in this study supported a wide spectrum of learners, reinforcing the conclusions of these earlier studies. By addressing different sensory inputs and learning styles, the multimedia instruction in this study proved to be highly effective in meeting the needs of a diverse student group, fostering comprehension and active participation.

This study highlighted the ability of multimedia instruction to sustain student motivation and engagement. The visually appealing and interactive design of the instructional materials likely played a key role in the experimental group's superior post-test performance compared to the control group. These findings are consistent with Lysenko and Abrami's (2014) research, which showed that tools such as ABRACADABRA and ePEARL improved both comprehension and motivation by integrating cognitive strategies with interactive features. By delivering information in an engaging and dynamic format, the multimedia approach fostered active participation, a crucial element for effective learning.

The integrated multimedia approach in this study excels at blending interactive and sensory-rich elements to create a learning environment that makes complex concepts more accessible and easier to understand for students. By bringing together text, visuals, audio, video, and interactive features on a single platform, it delivers a cohesive and engaging experience that supports comprehension while boosting motivation. These qualities align with Han's (2010) findings, which highlight how multimedia tools create an engaging learning environment that simplifies difficult material and makes it more enjoyable for students.

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Collectively, these insights underscore that multimedia instruction goes beyond enhancing comprehension—it also meets the diverse needs of today's learners through its dynamic, inclusive, and adaptable design. While multimedia instruction offers numerous benefits, its successful implementation comes with challenges that must be addressed. Hennessy et al. (2010) emphasized that the effectiveness of multimedia tools depends on their thoughtful integration into teaching practices. This involves ensuring access to reliable technology, equipping teachers with proper training, and creating high-quality multimedia materials. These elements are essential for unlocking the full potential of multimedia instruction, particularly in diverse classroom settings.

Despite these challenges, this study highlights the transformative advantages of integrated multimedia instruction compared to traditional print-based instruction. By accommodating a range of learning styles, encouraging active engagement, and improving information retention, multimedia instruction can significantly enhance reading comprehension outcomes. To fully harness its benefits, educators are encouraged to integrate multimedia tools thoughtfully and strategically into their teaching practices, maximizing their impact on students' learning.

CONCLUSION

This study demonstrates the significant advantages of integrated multimedia instruction in improving students' reading comprehension compared to traditional print-based methods. Students in the experimental group, who engaged with multimedia elements such as text, visuals, audio, video, and interactive quizzes integrated into a unified web-based platform, showed notable improvements in their post-test scores compared to the control group. These findings affirm the potential of multimedia instruction to enhance reading comprehension effectively.

While the results highlight the transformative impact of multimedia instruction, there are opportunities for further exploration. Future research could investigate its long-term effects on reading comprehension to determine whether the benefits persist over time. Additionally, examining how multimedia instruction performs across different age groups, educational levels, or subject areas could provide a more comprehensive understanding of its wider applicability. Another critical area for study is the role of teacher training in the effective implementation of multimedia tools, which could offer valuable insights for refining instructional strategies and maximizing the benefits of this approach in diverse classroom settings.

These recommendations for future study could help refine and expand the use of integrated multimedia instruction, ensuring it continues to evolve as a powerful tool for modern education. With thoughtful application and ongoing research, integrated multimedia instruction can play a pivotal role in fostering meaningful and inclusive learning experiences for all students.

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