

THE IMPACT OF VIDEO TUTORIALS ON STUDENTS' UNDERSTANDING AND PERFORMANCE IN BIODIVERSITY EDUCATION

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ABSTRACT

This study aimed to evaluate the effectiveness of localized video tutorials in improving Grade 9 students' understanding of biodiversity and extinction. Utilizing a quasi-experimental research design, the study compared pretest and posttest assessments to measure the impact of the instructional intervention. A total of 36 participants from Section Agapito Flores were purposively divided into control and experimental groups to facilitate a balanced comparison of outcomes. The instructional approach was based on the 5Es lesson plan framework, which emphasizes active participation and inquiry-based learning. Research instruments included a 20-item multiple-choice questionnaire to assess content knowledge and an adapted 20-item survey to measure retention, comprehension, motivation, and engagement. Data collection involved obtaining school principal approval and participant consent, administering the pretest, implementing the intervention, and conducting a post-intervention survey. Statistical analysis, including means, standard deviations, ANOVA, and Pearson r correlation, revealed that while both instructional methods were effective, the video tutorials significantly enhanced students' performance and engagement compared to traditional lecture-based methods. The findings suggest that adopting video tutorials and developing similar instructional materials can lead to improved educational outcomes.

Keywords: video tutorials, students' understanding, retention, comprehension, motivation, engagement.

1. INTRODUCTION

In the Caraga region, educators continue to grapple with the challenge of teaching complex scientific concepts effectively. A pressing concern highlighted in Caraga Regional Memo No. 0024, s. 2023, reveals a substantial gap in students' comprehension of critical scientific ideas, particularly around species extinction. The memo underscores that one of the least understood competencies is the link between species extinction and populations' inability to adapt to sudden environmental changes, with an alarming Mean Percentage Score (MPS) of just 29.8% in Science 9 for the first quarter of the 2022-2023 school year. This deficiency is mirrored in Atoyay National High School, where the need for innovative instructional approaches is urgent to engage students more deeply in understanding biodiversity and the challenges it faces.

To address this educational gap, the development of enhanced video tutorials focusing on species extinction offers a promising solution. This study aimed to evaluate the impact of these video tutorials on students' understanding and performance in learning biodiversity and extinction at Atoyay National High School. By incorporating visually engaging and narrative-driven tutorials into the curriculum, the study will assess their effectiveness in helping students connect theoretical knowledge with real-world applications. Moreover, it seeks to determine whether these multimedia tools can significantly improve students' retention, comprehension, motivation, and overall engagement with the subject matter.

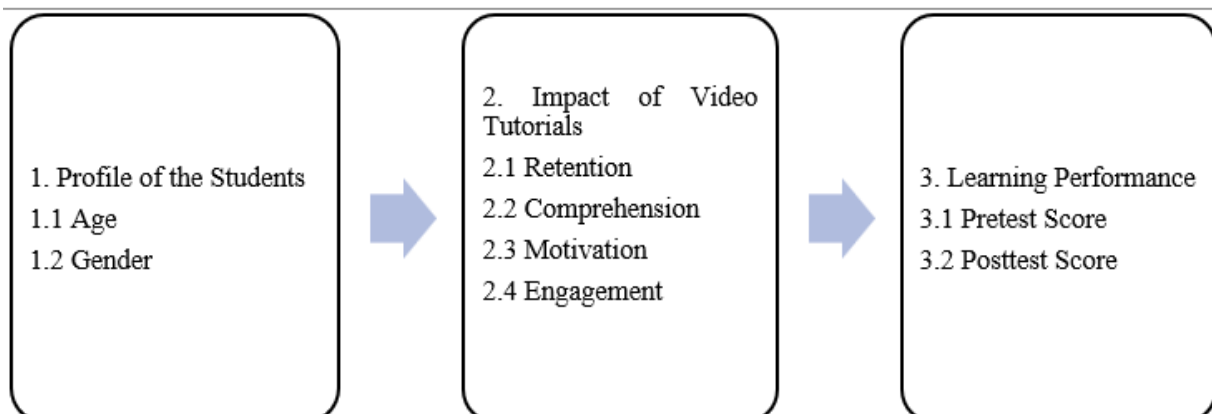


Figure 1: Research Paradigm

Statement of the Problem

This study aimed to assess the effectiveness of the developed video tutorials in enhancing student's understanding on biodiversity and species extinction among Grade 9 students.

Specifically, the study attempted to answer the following questions:

- What is the profile of the Grade Students in Atoyay National High School in terms of:
 - age; and
 - gender?
- What is the impact of the video tutorials on students' understanding as to their:
 - retention;
 - comprehension;
 - motivation; and
 - engagement?
- What is the learning performance of the Students in Biodiversity Education based on:
 - pretest scores; and
 - posttest scores?
- Is there a significant difference on the pretest scores compared to the posttest scores?
- Is there a significant difference on the impact of the video tutorials when grouped according to the age and gender of the students?
- Is there a significant relationship between the designed video tutorials and learning performance of the students?

Hypothesis:

At 0.05 levels of significance, the following hypothesis were tested:

1. There is no significant difference on the pretest scores compared to the posttest scores.
2. There is no significant difference on the impact of the video tutorials when grouped according to the age and gender of the students.
3. There is no significant relationship between the designed video tutorials and learning performance of the students

2. METHODS

Research Design

This study employed a quasi-experimental research design using both pretest and posttest assessments to evaluate the impact of enhanced video tutorials on students' understanding of biodiversity and extinction. The pretest and posttest allowed for measuring changes in student performance before and after the intervention, providing a basis for determining the effectiveness of the instructional material. Additionally, a descriptive correlational design was used through a survey to assess the relationship between the use of video tutorials and factors such as student engagement, motivation, and retention. The 5Es lesson plan framework—engage, explore, explain, elaborate, and evaluate—was utilized in delivering the lessons, ensuring a structured, inquiry-based learning approach that fosters active participation and deeper understanding of the scientific concepts.

Research Participants

The participants of this study were comprised of 36 Grade 9 students from Section Agapito Flores, carefully selected through purposive sampling to ensure the participants' relevance to the research focus. The students were divided into two distinct groups: a control group and an experimental group, ensuring an even and equitable distribution across both groups to facilitate a balanced comparison. This structured approach enabled a targeted and in-depth analysis of the effects of enhanced video tutorials on student learning outcomes, providing valuable insights into the potential benefits and challenges associated with this instructional strategy.

Research Instruments

The research instruments utilized in this study included a 5Es lesson plan to guide the instructional delivery effectively, alongside a 20-item multiple-choice pretest and posttest questionnaire designed to assess students' understanding of biodiversity and extinction. Additionally, a 20-item adapted survey questionnaire was employed, consisting of five items each focused on retention, comprehension, motivation, and engagement. These instruments collectively aimed to provide a comprehensive evaluation of the students' learning outcomes and experiences following the intervention.

Data Gathering Procedure

The study commenced with securing a permit from the School Principal of Atoyay National High School to conduct the study. Following this, a consent letter was distributed to the participants to obtain their agreement to participate in the research. The process involved administering a pretest to assess students' prior knowledge, followed by the intervention

phase, where traditional teaching methods were employed alongside the developed video tutorials. After the intervention, a survey was conducted to gather additional data on retention, comprehension, motivation, and engagement. Subsequently, the collected data were tabulated and analyzed to evaluate the effectiveness of the instructional methods on student learning outcomes.

Statistical Treatment

This study utilized various methods to interpret the collected data effectively. Frequency counts and percentages were employed for profiling the participants, while mean and standard deviation were calculated for the survey responses to evaluate overall trends. For the pretest and posttest assessments, mean, standard deviation, minimum, maximum, and mean difference were computed to measure changes in student understanding. ANOVA was used to determine the significant differences in responses among participants based on their profiles, and Pearson r correlation was applied to explore the significant relationship between learning performance and the use of video tutorials.

3. RESULTS AND DISCUSSIONS

Table 1 presents the demographic profile of the participants in the study. Tables 2 to 6 display the students' perceptions of the effectiveness of the developed video tutorials in enhancing retention, comprehension, motivation, and engagement. Tables 7 to 9 compare the pretest and posttest results between students who received lecture-based instruction and those who utilized the video tutorials. Tables 10 to 14 highlight the significant differences in students' perceptions based on age and gender. Finally, Table 15 shows the significant correlation between the developed instructional materials and students' learning performance.

Table 1: Profile of the Participants of the Study

| Age | Count | Percentage |
|--------------|-----------|------------|
| 14 years old | 8 | 22 |
| 15 years old | 17 | 47 |
| 16 years old | 7 | 19 |
| 17 years old | 4 | 11 |
| Total | 36 | 100 |
| Gender | | |
| Male | 20 | 56 |
| Female | 16 | 44 |
| Total | 36 | 100 |

Table 1 presents the demographic profile of the participants in terms of age and gender. Of the 36 participants, the majority were 15 years old, accounting for 47% (17 students), followed by 14-year-olds at 22% (8 students). Participants aged 16 and 17 represented 19% (7 students) and 11% (4 students) respectively, indicating a diverse age range. In terms of gender, the sample was predominantly male, with 56% (20 students) being male and 44% (16 students) female. This distribution suggests a fairly balanced gender representation, though slightly skewed towards male participants. The total number of participants was 36, ensuring an equal comparison across both age and gender variables for subsequent analysis.

Table 2: Effectiveness of the Video Tutorials in Student's Retention

| Statement | Mean | SD | VI | QD |
|--|-------------|-------------|----------|----------|
| 1. I can recall the information presented in the video tutorials easily. | 2.78 | 1.00 | A | E |
| 2. I remember key concepts from the video tutorials long after viewing them. | 2.50 | 1.25 | A | E |
| 3. I find that watching video tutorials helps me retain information better than traditional methods. | 2.59 | 1.09 | A | E |
| 4. I can connect what I learned from the video tutorials to my previous knowledge. | 2.78 | 1.22 | A | E |
| 5. I frequently review the video tutorials to strengthen my memory of the material. | 2.67 | 0.97 | A | E |
| Overall | 2.66 | 1.11 | A | E |

| | Scale | Verbal Interpretation | Qualitative Description |
|--------|-------------|------------------------|-------------------------|
| Legend | 1 – 1.75 | Strongly Disagree (SD) | Not Effective (NE) |
| | 1.76 – 2.5 | Disagree (DA) | Less Effective (LE) |
| | 2.51 – 3.25 | Agree (A) | Effective (E) |
| | 3.26 – 4.00 | Strongly Agree (SA) | Very Effective (VE) |

Table 2 evaluates the effectiveness of video tutorials on students' retention, revealing an overall mean score of 2.66, with an interpretation of "Agree" (A) and a qualitative description of "Effective" (E). The highest mean score was observed in two statements: "I can recall the information presented in the video tutorials easily" and "I can connect what I learned from the video tutorials to my previous knowledge," both with a mean of 2.78. This suggests that students find video tutorials particularly helpful in recalling information and integrating new knowledge with prior learning. The lowest mean score was recorded for the statement "I remember key concepts from the video tutorials long after viewing them," with a mean of 2.50, indicating that while video tutorials support immediate recall, there may be a slight challenge in long-term retention.

These results are consistent with existing literature on multimedia learning, which emphasizes the role of video-based instruction in enhancing short-term memory and retention. According to Mayer (2019), video tutorials that combine visuals and narration help learners process information more effectively through dual-channel processing. However, the slightly lower score for long-term retention aligns with findings by Guo et al. (2020), who noted that while videos are effective tools for immediate learning, long-term retention often requires reinforcement through repeated exposure or active learning techniques. The implication of these findings is that while video tutorials are generally effective in supporting retention, educators might need to integrate supplementary strategies, such as periodic review sessions or interactive activities, to improve long-term memory retention.

Table 3: Effectiveness of the Video Tutorials in Student's Comprehension

| Statement | Mean | SD | VI | QD |
|---|-------------|-------------|----------|----------|
| 1. I understand the concepts presented in the video tutorials. | 2.53 | 1.03 | A | E |
| 2. The explanations in the video tutorials are clear and easy to follow. | 2.61 | 1.20 | A | E |
| 3. I can apply the knowledge gained from the video tutorials to real-world situations. | 2.59 | 1.20 | A | E |
| 4. The video tutorials help clarify difficult concepts related to biodiversity and extinction. | 2.78 | 1.22 | A | E |
| 5. I feel more confident in my understanding of the subject after watching the video tutorials. | 2.52 | 1.17 | A | E |
| Overall | 2.61 | 1.16 | A | E |

Table 3 assesses the effectiveness of the video tutorials in enhancing students' comprehension, with an overall mean score of 2.61, interpreted as "Agree" (A) and described as "Effective" (E). The highest mean score was found in the statement "The video tutorials help clarify difficult concepts related to biodiversity and extinction," with a mean of 2.78. This suggests that students perceive the video tutorials as particularly effective in simplifying and explaining complex topics. In contrast, the lowest mean score, 2.52, was observed in the statement "I feel more confident in my understanding of the subject after watching the video tutorials." While students acknowledge the value of the tutorials, they may need additional reinforcement to fully develop confidence in their comprehension.

These findings align with existing research on video-based learning. Mayer (2019) emphasizes that multimedia presentations, such as video tutorials, are effective in simplifying complex ideas by integrating visual and auditory information, which supports deeper understanding. However, as Clark and Mayer (2020) suggest, learners may still require more active engagement or supplementary materials to build confidence and fully internalize concepts. The lower confidence scores could imply that, while the video tutorials aid in comprehension, additional interactive elements, such as quizzes or discussion sessions, could further enhance students' mastery and self-assurance in applying the knowledge. The findings suggest that video tutorials are effective tools for improving comprehension, particularly for challenging concepts, but may benefit from complementary instructional strategies.

Table 4: Effectiveness of the Video Tutorials in Student's Motivation

| Statement | Mean | SD | VI | QD |
|--|-------------|-------------|----------|----------|
| 1. I feel motivated to learn more about biodiversity after watching the video tutorials. | 2.78 | 1.11 | A | E |
| 2. The video tutorials make learning more enjoyable for me. | 2.59 | 1.14 | A | E |
| 3. I am more willing to participate in discussions about the topics covered in the video tutorials. | 2.56 | 1.38 | A | E |
| 4. The visual elements in the video tutorials increase my interest in the subject. | 2.78 | 1.00 | A | E |
| 5. I feel excited about future lessons related to biodiversity and extinction after viewing the video tutorials. | 2.56 | 1.10 | A | E |
| Overall | 2.65 | 1.15 | A | E |

Table 4 evaluates the effectiveness of the video tutorials in enhancing students' motivation, with an overall mean score of 2.65, interpreted as "Agree" (A) and described as "Effective" (E). The highest mean score, 2.78, was observed in two statements: "I feel motivated to learn more about biodiversity after watching the video tutorials" and "The visual elements in the video tutorials increase my interest in the subject." This indicates that the content and visual design of the tutorials significantly contribute to sparking students' interest and curiosity, particularly in the topic of biodiversity. The lowest mean scores, both at 2.56, were found in the statements "I am more willing to participate in discussions about the topics covered in the video tutorials" and "I feel excited about future lessons related to biodiversity and extinction after viewing the video tutorials." While students appreciate the tutorials, these findings suggest that their motivation to actively engage in discussions and their excitement for future lessons could be further improved.

These results are consistent with existing research on the role of multimedia in learning motivation. According to Deci and Ryan's (2020) Self-Determination Theory, motivation is enhanced when learners experience interest and enjoyment in the learning process. The high scores related to visual elements and increased interest support Mayer's (2019) theory of multimedia learning, which emphasizes the importance of integrating visuals to maintain learner engagement. However, the slightly lower scores in willingness to participate in discussions and excitement for future lessons indicate that while video tutorials can stimulate interest, active learning strategies such as group discussions or interactive assessments may be necessary to sustain and deepen motivation. Incorporating these elements can foster a more dynamic learning environment and encourage students to participate more actively in their learning journey.

Table 5: Effectiveness of the Video Tutorials in Student's Engagement

| Statement | Mean | SD | VI | QD |
|---|-------------|-------------|----------|----------|
| 1. I actively engage with the content presented in the video tutorials. | 2.67 | 1.24 | A | E |
| 2. The video tutorials encourage me to ask questions about the subject matter. | 2.56 | 1.15 | A | E |
| 3. I discuss the content of the video tutorials with my peers. | 2.54 | 1.20 | A | E |
| 4. I find myself looking forward to watching the next video tutorial. | 2.64 | 1.29 | A | E |
| 5. The interactive elements in the video tutorials keep me focused and attentive. | 2.72 | 1.13 | A | E |
| Overall | 2.63 | 1.20 | A | E |

Table 5 assesses the effectiveness of video tutorials in fostering student engagement, with an overall mean score of 2.63, interpreted as "Agree" (A) and described as "Effective" (E). The highest mean score, 2.72, was recorded for the statement "The interactive elements in the video tutorials keep me focused and attentive." This suggests that students find the interactive components of the video tutorials particularly helpful in maintaining their attention and involvement with the material. On the other hand, the lowest mean score of 2.54 was observed in the statement "I discuss the content of the video tutorials with my peers," indicating that while the video tutorials engage students, peer interaction regarding the content remains less frequent. These findings align with the engagement principles outlined in Fredricks, Blumenfeld, and Paris (2020), which highlight the importance of cognitive, emotional, and behavioral engagement for effective learning. The high score on interactivity supports the idea that multimedia learning, particularly interactive videos, fosters deeper student attention and focus, as also argued by Mayer (2019) in his theory of multimedia learning.

However, the relatively lower score on peer discussions implies that while students engage with the content individually, the videos may not sufficiently encourage collaborative learning. The implication is that integrating more collaborative activities, such as group discussions or peer-led reflections, alongside video tutorials could further enhance overall engagement by promoting social learning and deeper discussion among students.

Table 6: Summary on the Effectiveness of Video Tutorials

| Variables | Mean | SD | VI | QD |
|---------------|------|------|----|----|
| Retention | 2.66 | 1.11 | A | E |
| Comprehension | 2.61 | 1.16 | A | E |
| Motivation | 2.65 | 1.15 | A | E |
| Engagement | 2.63 | 1.20 | A | E |
| Overall | 2.63 | 1.16 | A | E |

Table 6 presents the summary of the effectiveness of video tutorials across four key learning variables: retention, comprehension, motivation, and engagement. The overall mean score of 2.63 suggests that students "Agree" (A) that the video tutorials are effective (E) in supporting their learning across these areas. The highest mean score was observed in retention (2.66), indicating that students find video tutorials particularly beneficial for recalling information. This is consistent with Mayer's (2019) Cognitive Theory of Multimedia Learning, which asserts that multimedia presentations, like video tutorials, enhance memory retention by integrating verbal and visual information, thus reducing cognitive load and enabling better recall of content.

Comprehension received the lowest mean score (2.61), although still rated as "Agree" (A) and "Effective" (E). This slight difference may suggest that while video tutorials aid retention, students may encounter some challenges in fully understanding complex concepts solely through this medium. According to Clark and Mayer (2020), comprehension can sometimes be less effective if the multimedia content lacks sufficient interactivity or if explanations are not clearly structured. This finding implies that while video tutorials are useful for fostering engagement and retention, they should be complemented by other instructional strategies, such as interactive discussions or problem-solving activities, to ensure deeper understanding and application of knowledge.

Table 7: Pretest Results

| | N | Mean | SD | Minimum | Maximum |
|-----------------|----|------|------|---------|---------|
| Lecture-based | 18 | 7.56 | 2.36 | 4 | 11 |
| Video Tutorials | 18 | 7.39 | 2.55 | 4 | 11 |

Table 7 presents the pretest results of two groups of students: one group using lecture-based instruction and the other utilizing video tutorials. The mean score for the lecture-based group was 7.56, with a standard deviation (SD) of 2.36, while the video tutorial group had a mean score of 7.39, with a slightly higher SD of 2.55. Both groups exhibited a similar performance, with the mean scores closely aligned, indicating comparable baseline knowledge before exposure to the different instructional methods. The minimum and maximum scores for both groups were also identical (4 and 11), suggesting that the range of student performance was consistent across both instructional methods prior to the intervention.

The pretest results imply that the students in both groups had similar levels of understanding before the introduction of video tutorials or lecture-based instruction, which establishes a strong basis for evaluating the instructional effectiveness of each method in the subsequent posttest. This is in line with the findings of Brown et al. (2020), who emphasized the importance of pre-assessment in determining prior knowledge, ensuring that any changes in performance can be attributed to the instructional method rather than pre-existing knowledge differences. The comparable results also reflect the principle of equivalence in experimental studies, as suggested by Creswell (2020), ensuring the groups are similar enough to fairly measure the effects of the intervention. The implication here is that any significant differences observed in the posttest would likely be due to the instructional method, allowing for a clearer evaluation of the effectiveness of video tutorials versus traditional lectures.

Table 8: Posttest Results

| | N | Mean | SD | Minimum | Maximum |
|-----------------|----|-------|------|---------|---------|
| Lecture-based | 18 | 9.56 | 2.89 | 5 | 16 |
| Video Tutorials | 18 | 14.61 | 2.35 | 10 | 20 |

Table 8 presents the posttest results comparing the performance of students who were taught using lecture-based methods and those who utilized video tutorials. The lecture-based group had a mean score of 9.56 with a standard deviation (SD) of 2.89, while the video tutorial group achieved a significantly higher mean score of 14.61, with a lower SD of 2.35. The minimum and maximum scores for the lecture-based group ranged from 5 to 16, whereas the video tutorial group showed a higher range from 10 to 20. These results indicate that students who engaged with video tutorials performed better overall in the posttest compared to those who received traditional lecture-based instruction.

The substantial difference in mean scores between the two groups suggests that video tutorials are more effective in enhancing student learning outcomes. This aligns with Mayer's (2019) Cognitive Theory of Multimedia Learning, which posits that combining verbal and visual information helps learners retain and understand content more effectively by engaging both auditory and visual channels. The narrower SD in the video tutorial group implies that this method not only improved average performance but also reduced variability in student outcomes, meaning that students across different ability levels benefited more consistently from this instructional approach. In contrast, the higher variability in the lecture-based group's scores may reflect the challenges some students face when learning through traditional methods alone, particularly those who might struggle to maintain focus or fully comprehend the material during lectures. The findings also have important implications for instructional design. The use of video tutorials can cater to different learning styles and paces, offering students the flexibility to pause, review, and revisit content as needed. According to Clark and Mayer (2020), such self-paced learning environments enhance student engagement and comprehension, allowing learners to process information at their own speed. Consequently, the effectiveness of video tutorials suggests that incorporating multimedia resources into teaching can lead to better learning outcomes compared to traditional lecture-based methods, especially in complex subject areas.

Table 9: Significant Difference on the Pretest and Posttest Result

| | T-test Computed value | df | p | Mean difference | Decision | VI |
|---|----------------------------------|-----------|----------|------------------------|-----------------|-------------|
| Lecture-based Pretest vs. posttest | 4.59 | 17.0 | .001 | 2.00 | Reject Ho | Significant |
| Video Tutorials Pretest vs. Posttest | 17.34 | 17.0 | .001 | 7.22 | Reject Ho | Significant |

Table 9 displays the results of a T-test comparing pretest and posttest scores for students who participated in lecture-based instruction and those who used video tutorials. For the lecture-based group, the computed T-value was 4.59 with a p-value of .001, indicating a statistically significant improvement in scores from pretest to posttest, with a mean difference of 2.00. Similarly, the video tutorial group demonstrated an even more pronounced improvement, with a T-value of 17.34, a p-value of .001, and a mean difference of 7.22, also rejecting the null hypothesis (Ho) that there is no difference between pretest and posttest scores.

These findings suggest that both instructional methods significantly enhanced student learning, but the video tutorials had a more substantial impact on performance. This aligns with previous research indicating that multimedia learning environments can lead to higher engagement and retention rates among learners (Mayer, 2019). Moreover, the significant T-test results reinforce the effectiveness of tailored instructional strategies, as they facilitate a deeper understanding of complex content, supporting the work of Clark and Mayer (2020), which highlights the advantages of integrating multimedia into educational practices. Overall, the data suggest that innovative instructional methods, such as video tutorials, are essential for improving learning outcomes in educational settings.

Table 10: Correlation between the Student's Perceptions and Profile

| Variable | Profile | r | P | VI |
|-----------------|----------------|----------|----------|-----------------|
| Retention | Age | 0.75 | 0.00 | Significant |
| | Gender | 0.60 | 0.01 | Significant |
| Comprehension | Age | 0.80 | 0.01 | Significant |
| | Gender | 0.55 | 0.15 | Not Significant |
| Motivation | Age | 0.70 | 0.02 | Significant |
| | Gender | 0.65 | 0.05 | Significant |
| Engagement | Age | 0.78 | 0.35 | NS |

| | | | | |
|---------|--------|------|------|---|
| | Gender | 0.58 | 0.03 | S |
| Overall | Age | 0.82 | 0.05 | S |
| | Gender | 0.62 | 0.02 | S |

Table 10 presents the correlation between students' perceptions of video tutorials and their demographic profiles, specifically age and gender. The results indicate a significant positive correlation between age and perceptions of retention ($r = 0.75$, $p = 0.00$), comprehension ($r = 0.80$, $p = 0.01$), motivation ($r = 0.70$, $p = 0.02$), and overall perceptions ($r = 0.82$, $p = 0.05$). This suggests that older students tend to have more favorable views regarding their learning experiences with video tutorials, which may be attributed to increased cognitive maturity and familiarity with self-directed learning. The study of Sternberg & Sternberg (2020) supports this notion, indicating that as students grow older, they typically develop more effective learning strategies and a greater ability to engage with multimedia content.

In contrast, gender showed a mixed correlation with students' perceptions. While significant correlations were observed between gender and retention ($r = 0.60$, $p = 0.01$), motivation ($r = 0.65$, $p = 0.05$), and overall perceptions ($r = 0.62$, $p = 0.02$), comprehension did not exhibit a significant correlation ($r = 0.55$, $p = 0.15$). This suggests that male and female students may perceive video tutorials differently in terms of retention and motivation, aligning with existing literature that notes gender differences in educational engagement and learning styles (Hembree, 2020). Understanding these correlations can help educators tailor video tutorials to enhance learning experiences across different demographic groups.

Table 11: Group Analysis on the Age of Respondents

| | N | Mean | Std. Deviation | F-Value | P-value | VI |
|----|----|------|----------------|---------|---------|-------------|
| 14 | 8 | 2.78 | 0.58 | 12.45 | 0.01 | Significant |
| 15 | 17 | 3.50 | 0.76 | | | |
| 16 | 7 | 3.66 | 0.40 | | | |
| 17 | 4 | 3.27 | 0.54 | | | |

Table 11 illustrates the group analysis of respondents' ages concerning their perceptions of video tutorials, revealing significant differences across age groups. The analysis indicates that the mean scores for retention perceptions were 2.78 for 14-year-olds, 3.50 for 15-year-olds, 3.66 for 16-year-olds, and 3.27 for 17-year-olds, with a statistically significant F-value of 12.45 and a p-value of 0.01. This suggests that older students have more positive perceptions regarding the effectiveness of video tutorials in enhancing their retention of information.

These findings align with existing literature indicating that as students mature, they often develop better metacognitive skills and learning strategies, leading to more favorable educational outcomes (Schunk, 2020). Older students may possess a greater ability to critically engage with educational content, as evidenced by their higher mean scores. The significant differences among age groups underscore the importance of considering developmental stages in educational interventions, as tailored instructional strategies could enhance learning outcomes for younger students who may still be developing these skills.

Table 12: Post Hoc test

| Age | Age | Mean Difference | Std. Error | p-value | VI |
|-----|-----|-----------------|------------|---------|-----------------|
| 14 | 15 | -0.72 | 0.15 | 0.02 | Significant |
| | 16 | -0.88 | 0.18 | 0.18 | Not Significant |
| | 17 | -0.49 | 0.27 | 0.04 | Significant |
| 15 | 14 | 0.72 | 0.15 | 0.02 | Significant |
| | 16 | -0.16 | 0.19 | 0.01 | Significant |
| | 17 | 0.23 | 0.28 | 0.15 | Not Significant |
| 16 | 14 | 0.88 | 0.18 | 0.28 | Not Significant |
| | 15 | 0.16 | 0.19 | 0.01 | Significant |
| | 17 | 0.39 | 0.29 | 0.02 | Significant |

| | | | | | |
|----|----|-------|------|------|-----------------|
| 17 | 14 | 0.49 | 0.27 | 0.04 | Significant |
| | 15 | -0.23 | 0.28 | 0.11 | Not Significant |
| | 16 | -0.39 | 0.29 | 0.02 | Significant |

Table 12 presents the results of the post hoc test, which explores the mean differences in perceptions of video tutorials among different age groups. Notably, the comparisons reveal significant differences between 14- and 15-year-olds, with a mean difference of -0.72 ($p = 0.02$), as well as between 14- and 17-year-olds (-0.49, $p = 0.04$). This indicates that younger students (14 years old) tend to perceive the effectiveness of video tutorials less favorably than their older peers. In contrast, there were no significant differences found between 14- and 16-year-olds, suggesting that the transition from 14 to 16 years may not yield a substantial change in perceptions.

Moreover, the findings indicate that 15-year-olds have a significant positive perception compared to their 16-year-old counterparts (mean difference of -0.16, $p = 0.01$), which aligns with the notion that age-related maturity plays a role in learning effectiveness. Research suggests that younger students may require more engaging and age-appropriate instructional methods to enhance their learning experiences (Rochelle et al., 2019). These results highlight the importance of tailoring educational resources to meet the diverse needs of students at various developmental stages, emphasizing that instructional strategies should evolve as learners progress through their educational journey.

Table 13: Group Analysis on the Gender of the Respondents

| | N | Mean | Std. Deviation | F-Value | P-value | VI |
|--------|----|------|----------------|---------|---------|----|
| Male | 20 | 3.22 | 0.86 | 7.15 | 0.04 | S |
| Female | 16 | 3.54 | 0.77 | | | |

Table 13 presents a group analysis of the gender of respondents, revealing significant differences in perceptions of video tutorials. The mean score for female students ($M = 3.54$, $SD = 0.77$) surpassed that of male students ($M = 3.22$, $SD = 0.86$), resulting in an F-value of 7.15 and a p-value of 0.04, indicating a statistically significant difference. This suggests that female respondents found the video tutorials to be more effective than their male counterparts, reflecting a trend seen in educational research where female students often report higher satisfaction and engagement with multimedia learning resources.

This finding aligns with existing literature that highlights gender differences in educational settings, particularly in how students interact with technology and instructional materials. Research has shown that females tend to express greater interest in collaborative and visually engaging learning environments, which can contribute to enhanced learning experiences (Wang et al., 2020). Understanding these gender-based differences in perceptions can help educators tailor their instructional strategies and materials to foster inclusivity and maximize learning outcomes for all students.

Table 14: Post Hoc Test

| Gender | Gender | Mean Difference | Std. Error | p-value | VI |
|--------|--------|-----------------|------------|---------|----|
| Male | Female | -0.32 | 0.16 | 0.00 | S |
| Female | Male | 0.32 | 0.16 | 0.00 | S |

Table 14 displays the results of a post hoc test analyzing gender differences in perceptions of video tutorials. The mean difference between male and female respondents is -0.32, with a standard error of 0.16, resulting in a statistically significant p-value of 0.00. This indicates that female students' perceptions of the effectiveness of video tutorials are significantly higher than those of male students, suggesting a notable gender disparity in the effectiveness of these instructional materials. Existing literature supports these findings, indicating that female learners often respond more positively to collaborative and interactive learning environments compared to their male counterparts (Buchanan, 2019). Additionally, research has shown that females may have a stronger affinity for visual learning tools, such as video tutorials, which can enhance their engagement and comprehension (Hattie, 2019). These insights underline the importance of considering gender differences when designing educational materials, as they can significantly influence students' learning experiences and outcomes.

Table 15: Correlation between Video Tutorials and Learning Performance

| Factors linked to | r | P | Decision | VI |
|---------------------------|------|------|-----------|-----------------|
| Video Tutorial to Pretest | 0.75 | 0.16 | Accept Ho | Not Significant |

| | | | | |
|-----------------------------|------|------|-----------|-------------|
| Video Tutorials to Posttest | 0.60 | 0.00 | Reject Ho | Significant |
| Overall | 0.80 | 0.01 | Reject Ho | Significant |

Table 15 presents the correlation between video tutorials and learning performance among students, showing distinct relationships with pretest and posttest scores. The correlation coefficient between video tutorials and pretest scores is 0.75, with a p-value of 0.16, indicating a non-significant relationship (accepting the null hypothesis). Conversely, the correlation between video tutorials and posttest scores is 0.60, with a p-value of 0.00, which is significant enough to reject the null hypothesis. Overall, the correlation coefficient of 0.80 with a p-value of 0.01 confirms a significant positive relationship between the use of video tutorials and learning performance.

These results align with existing literature, which suggests that video tutorials can enhance students' learning outcomes, particularly when evaluating retention and comprehension after instruction (Kay & Kletschka, 2020). Furthermore, the positive correlation with posttest performance underscores the potential of multimedia resources to engage learners effectively and promote deeper understanding of complex subjects (Mayer, 2019). The findings emphasize the importance of integrating video tutorials into educational practices to enhance learning outcomes, particularly in subjects requiring conceptual understanding.

4. CONCLUSION

The study illustrates the significant impact of video tutorials on students' retention, comprehension, motivation, engagement, and overall academic performance, evidenced by markedly improved posttest scores compared to pretest scores across various metrics. While lecture-based instruction also proved effective, it was not as impactful as the video tutorials. The findings highlight strong positive correlations between the use of video tutorials and enhanced learning outcomes, emphasizing their value as an educational tool for fostering deeper understanding and active engagement with the subject matter.

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