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PAPER

The Impact of Motion Graphics versus Text-Based Formats on Anxiety and Learning: A Case Study in Jordan

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ABSTRACT

This study examines the impact of animated graphics versus text-based learning formats on students' anxiety, engagement, comprehension, and academic performance in an object-oriented programming (OOP) course. Sixty university students were divided into two groups: one using animated graphics and the other text-based media. Results revealed that students in the group using animated graphics had significantly lower levels of anxiety and higher levels of engagement, confidence, and ease of comprehension than those in the group using text-based material. Positive correlations were observed between engagement and comprehension, as well as between confidence and performance, in the animated graphics group. These results highlight the potential of animated graphics to enhance learning experiences by reducing anxiety and improving academic performance in technical subjects such as OOP. The lessons learned from this study can guide educators in integrating multimedia tools to optimize student learning and promote student well-being.

KEYWORDS

anxiety, motion graphics, multimedia learning tool, text-based

1 INTRODUCTION

Education plays an essential role in shaping students' attitudes and equipping the next generation with new knowledge, skills, and abilities that will serve them throughout their lives. Through education, students will obtain the livelihoods necessary for their own well-being and that of their communities [1]. Rapid technological advances have fundamentally transformed the field of education, notably through the integration of multimedia technologies. Equipped with the necessary software and hardware, these technologies have enhanced the learning process by providing digital content that fosters motivation, interest, preparation, and commitment in students and teachers [2].

The emergence of computer-based multimedia technologies, such as text, audio, images, video, and interactive content, enables students to actively engage with a

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variety of learning media and use interactive tools, thereby enhancing their learning experience. In addition, the role of teachers has evolved from being the sole source of information to guiding students in a technology-enriched educational environment. Today, they use these tools to enhance their teaching style in order to enrich the educational experience [3].

Research into multimedia learning experiences indicates that alternative content formats can have diverse effects on the learning process. Learning environments that incorporate multimedia tools influence student engagement and offer a unique learning experience [4]. With today's generation heavily reliant on cell phones and technology, attention spans have shortened considerably, resulting in less patience to engage with uninteresting course material. Since animated graphics are a form of multimedia, they have gained prominence in educational establishments, becoming a powerful tool and a highly effective method of engaging learners and improving learning outcomes [5].

Trainers now use a variety of techniques such as animation, video, design, and analysis to effectively convey information, disseminate knowledge, and offer resources, continually adapting to the changing educational environment [4]. Integrating animated video content into the teaching process is highly effective and efficient, helping students to better understand the material being explained. Animated videos have the potential to stimulate student engagement in educational activities, thereby improving learning outcomes by activating their thoughts, concerns, emotions, and skills [2], [6].

Despite the growing use of animated videos, there is little substantial evidence of their effectiveness as educational resources. Researchers have examined and compared the effectiveness of videos as educational resources compared to traditional print materials [7]. These studies indicate that animation can be incredibly useful in specific situations, such as demonstrating complex procedures or communicating abstract ideas. However, it may not always provide a distinct advantage over other teaching methods [8], [9].

Animation gives students a faster experience, enabling them to understand and assimilate content more effectively. It takes advantage of natural visual perception, where the eyes instinctively focus on movement to interpret information [10]. By presenting content in a dynamic and engaging way, animation captures attention and facilitates the comprehension and memorization of complex concepts, making it an invaluable resource for learning and communication [11].

Animations can serve as attractive, less intimidating tools that reduce anxiety by making complex or difficult content more accessible. They offer an immersive and interactive learning experience, helping to create a more positive and less stressful learning environment [12]. By simplifying complex subjects and fostering a supportive environment, animations can significantly reduce the cognitive overload that is often at the root of student anxiety [13]. This reduction in anxiety is crucial, especially for students facing socio-economic difficulties, who may experience amplified stress as part of their studies [14], [15].

While motion graphics—a specialized form of animation focusing on animating text, shapes, and graphic elements—share many of these pedagogical advantages, their impact on learning in technical fields such as object-oriented programming (OOP) has not been sufficiently studied. Programming concepts are inherently complex and abstract, so effective teaching strategies are needed. This study aims to address this challenge by exploring the comparison between animated graphics and traditional text-based formats in teaching OOP. We will focus on how these methods

can reduce student anxiety, increase engagement, and improve understanding and academic performance.

The aim of this study is to examine the effects of animated graphics and text-based teaching aids on students' performance in an OOP exam, as well as on their anxiety levels, engagement, ease of comprehension, and confidence. Using methodologies such as hypothesis testing, this study seeks to reveal the benefits of integrating animated graphics into educational environments, with the aim of enhancing the growing field of multimedia learning research and providing valuable information for educators.

The remainder of this paper is organized as follows. Section 2 presents a comprehensive review of the literature on the subject studied in this paper. It will conclude with the formulation of hypotheses that we will seek to validate when discussing the main results obtained. Section 3 describes the methodology used. The main results obtained are presented in Section 4 and discussed in Section 5. Section 6 presents the main conclusions of this study.

2 RELATED WORK

In this research [16], the authors investigate how anxiety relates to the achievements of first-year students at the Universidad Autónoma de Baja California. By using the Adult Manifest Anxiety Scale A (AMAS-A), the researchers discovered a link between higher anxiety levels and lower performance, especially in written assessments and presentations. Furthermore, it was discovered that a number of students exhibited prominent levels of anxiety, which could potentially affect both their performance and overall health. The results of the study show the importance of focusing on anxiety within the educational environment to support students' success and overall health. The study concluded by suggesting universities should implement strategies to help students manage their anxiety, which could lead to improved performance and decreased failure rates.

Almaiah et al. [17] explore how different forms of anxiety, such as social anxiety, computer anxiety, and AI anxiety, affect students' experiences in e-learning. Students from various institutions were included in the sample population for this study, which explored how these anxieties would influence their motivation, satisfaction, and self-efficacy levels. Results show that higher levels of social and computer anxiety are associated with lower academic performance and decreased engagement in e-learning. The researchers also talk about artificial intelligence (AI) in education, which can either reduce or increase these anxieties depending on how it is implemented. The authors suggest that addressing these fears directly could improve student outcomes and increase participation in online learning settings.

The study [18] aims to examine the relationship between anxiety and academic performances such as academic achievements, school dropouts, and self-concepts for academics across various stages of development. The results show that anxiety is weakly correlated to overall academic achievement, with slightly more negative effects on language and math than science disciplines. The study indicates that higher levels of anxiety are associated with high dropout rates and poor self-perception in mathematics. This research highlights the need to address anxiety at educational institutions, as it can negatively impact students' perceptions of their own abilities and hinder their long-term educational prospects, even though its direct effect on educational performance may be modest. According to the authors, interventions

aimed at addressing anxiety could be helpful, especially for students from low-income backgrounds who may be vulnerable.

Furthermore, this study [19] explores different factors causing anxiety and examines how it affects the academic performance of students at universities located in Larkana, Pakistan. To gather detailed information from students who suffer anxiety, the authors designed the study on a qualitative basis, encompassing semi-structured interviews. Results show a meaningful relationship between anxiety and academic performance among students. The study emphasizes that these symptoms do not only affect their focus and memory but also reduce motivation, leading to lower student grades. The authors suggest multiple strategies for students to overcome anxiety, such as engaging in productive activities, physical exercise, and seeking social support, which would help them achieve better academic outcomes.

While the investigated studies highlight the significant correlation between anxiety and academic performance, other study has shifted its focus towards exploring the impact of various educational technologies, such as multimedia resources, on enhancing student motivation, engagement, and overall learning. These tools are crucial for enhancing the learning experience, particularly in the field of complex and technical subjects. Such as in the research [20], the authors explore how visualization tools, such as 3D models and animations, influence students' interest and academic performance in natural sciences such as biology, chemistry, and geology. The study involved 565 students from high schools in the Czech Republic. It shows that using visualizations significantly boosted students' motivation levels in terms of engagement, effort, self-perceived competence, and understanding the relevance of the subject matter. Additionally, students who were exposed to 3D models and animations demonstrated greater knowledge acquisition in chemistry compared to the control group. The research also highlighted that factors such as age, subjects being taught, and teacher characteristics played a role in shaping these outcomes. These results indicate that incorporating tools into teaching can effectively enhance students' motivation and learning outcomes, especially in complex scientific disciplines.

Additionally, Utaminingsih et al. [2] discuss how animation learning management could be created and implemented in Central Java, Indonesia, to motivate 4th-grade students. In terms of research and development orientation, the author discovered that animated video significantly increased comprehension and engagement among students, hence higher motivation and improved outcomes of learning. Recommendations are made that using the integration of adult videos in schooling could enhance student motivation, which leads to better academic performance.

One of the most important factors that affected the learning experience for students is the global COVID pandemic. The switch to remote education impacted performance and engagement. Kanetaki et al. [21] evaluated an online platform's effectiveness during this period, finding that a well-organized module positively influenced student participation, satisfaction, and task completion. Kanetaki et al. [22] also explored the impact of instructional videos on learner engagement in COVID. They found that engagement remained consistent across different settings, demonstrating the sustainability and effectiveness of instructional videos for asynchronous learning in engineering education.

Despite extensive study on the effectiveness of multimedia learning tools in educational environments, our understanding of their exact influence in highly technical and abstract disciplines such as OOP remains inadequate. The majority of previous research has concentrated on fields such as biology, chemistry, and general education, where subjects are frequently more readily comprehensible [16], [17], [18], [19]. Nevertheless, the extent to which motion graphics might assist students in

understanding fundamental programming principles and reducing their anxiety in demanding courses has not been exhaustively investigated.

Although multimedia learning has been extensively studied within cognitive load theory, its specific implications in technical learning settings such as OOP have not been thoroughly investigated. It is essential to understand how different teaching formats impact the cognitive load on students as they navigate abstract programming concepts, as this knowledge is key to refining educational strategies and materials.

The literature frequently lacks studies of educational interventions that just focus on the cognitive or emotional aspects of their effects. This study uniquely bridges this gap by simultaneously assessing the cognitive outcomes (engagement, ease of understanding, confidence, and academic performance) and emotional responses (anxiety levels) of students exposed to motion graphics versus text-based learning materials. This integrated approach provides a more comprehensive understanding of the impact that instructional methods have on the process of learning and the outcomes of technical education.

This study contributes valuable insights into designing and implementing effective educational tools for programming courses. The findings offer practical guidance for educators aiming to boost student engagement, reduce anxiety, and enhance academic performance by using instructional materials tailored for complex and abstract subjects.

The research objective of this paper is to analyze two learning styles: motion graphics and traditional text-based reading. The analysis includes anxiety levels, engagement, ease of understanding, confidence, and the total score of the exam. Additionally, this paper aims to further examine the link between the format of the teaching method and anxiety level.

In this paper, the authors suggest that incorporating motion graphics into course material enriches the educational experience compared to text-based formats. Motion graphics introduces a range of elements, creating a more immersive and captivating learning environment. The authors believe that this approach will improve comprehension, reduce anxiety, and boost students' confidence.

We propose the following hypotheses:

- **H1:** Students in the motion graphics group will score higher in the OOP exam compared to those in the text-based group.
- **H2:** Students in the motion graphics group will report a reduction in anxiety after using the video/motion graphics format compared to those learning by text-based format.
- **H3:** Students in the motion graphics group will report higher levels of engagement, confidence, and ease of understanding compared to those in the text-based group.

3 MATERIALS AND METHODS

3.1 Participants

The study involved a group of 62 third- and fourth-year university students, including 29 men and 33 women. Participants were divided into two groups: 31 students were assigned to the "motion graphics" group (see Figure 1) and 31 to the "text-based" group (see Figure 2).

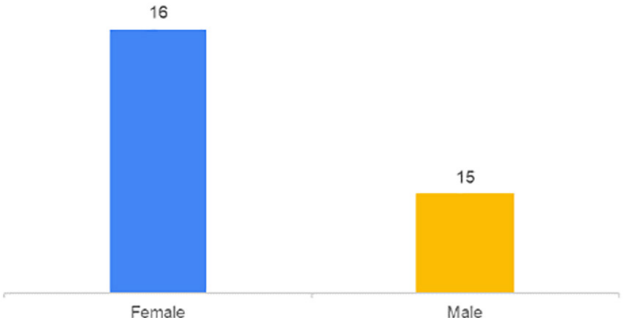

Fig. 1. Gender distribution of students in the "Motion Graphics" group

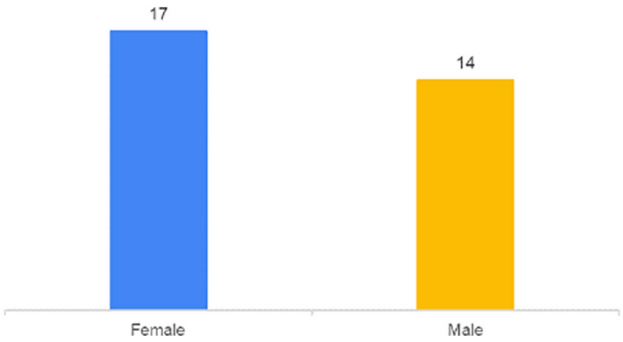

Fig. 2. Gender distribution of students in the "Text-based" group

The sample size of 62 participants is considered sufficient based on power analysis and literature recommendations [23], [24]. Previous studies with similar designs and sample sizes have detected significant effects [25], [26], confirming the adequacy of our sample size.

3.2 Materials

A motion graphics lesson is an educational video that integrates moving pictures, text, and audio to provide instructional material dynamically. In contrast to conventional lectures, animations employ motion images to clarify intricate concepts, rendering them especially suitable for abstract or technical subjects. Our study encompassed identical content presented in both animation and text versions, covering the following OOP material:

1. Classes and Objects: Definitions, creation, and instantiation.
2. Encapsulation: Data hiding and access modifiers such as public, private, and protected.
3. Inheritance: Understanding parent and child classes, single and multiple inheritance concepts.
4. Polymorphism: Method overloading and overriding, runtime vs. compile-time polymorphism.
5. Abstraction: Abstract classes and interfaces, hiding implementation details from the user.

The motion graphics group studied an eight-minute animated video, whereas the text-based group studied the identical content in a six-page PDF document.

3.3 Metrics

We assessed Anxiety, Engagement, Understanding, and Confidence through a survey. Anxiety levels were measured with 16 items from the Multidimensional Test Anxiety Scale (MTAS) [27], which covers dimensions such as Cognitive Obstruction, Social Derogation, Tenseness, and Physiological Hyperarousal. Participants rated each item on a 5-point Likert scale (1 = Strongly Disagree to 5 = Strongly Agree), with higher scores indicating greater test anxiety. In our study, the 16-item MTAS demonstrated high internal consistency, with a Cronbach's alpha of 0.861, indicating reliability within our sample.

To evaluate Engagement, Understanding, Confidence, and Anxiety Reduction, a custom single-item Likert scale questions was developed for this study. These single-item measures provided efficient assessments of participants' perceptions while minimizing survey fatigue. The questionnaire was administered electronically after the exam, and participants were assured of the confidentiality and anonymity of their responses [27].

3.4 Procedure

1. Content Delivery
   - The motion graphics group observed animations demonstrating OOP principles, including classes, objects, inheritance, and polymorphism.
   - The text group reviewed a document discussing the same principles of OOP.
2. Assessment
   - Following the demonstration, a ten-question multiple-choice assessment was developed to evaluate participants' understanding of OOP concepts, with two questions per key topic, targeting varying cognitive levels from knowledge to analysis.
   - The assessment was reviewed by three information technology educators to ensure content validity and appropriate difficulty.
   - Cronbach's alpha for the assessment was 0.71, indicating acceptable internal consistency.
3. Reduce Anxiety Measurement
   - After the exam, students completed a questionnaire assessing their anxiety experienced during the test. The questionnaire assesses their anxiety using a standardized scale, enabling a comparison of anxiety levels between the two groups.

4 MAIN RESULTS

4.1 Descriptive statistics

Descriptive statistics were calculated for the primary variables—test scores, engagement levels, ease of comprehension, post-content engagement confidence, and anxiety reduction—to provide a summary of the data collected in the study. Detailed statistics for each variable are provided below.

Descriptive statistics for the test scores by the animated chart-based group are presented in Table 1.

Descriptive statistics of the test results in the "text" group are presented in Table 2.

Table 1. Descriptive statistics: Exam scores in the motion graphics group

Descriptive Statistics					
	N	Minimum	Maximum	Mean	Standard Deviation
Total Score	31	4.00	10.00	7.35	1.76
Valid N (list wise)	31				

Table 2. Descriptive statistics: Exam scores in the text-based group

Descriptive Statistics					
	N	Minimum	Maximum	Mean	Standard Deviation
Total Score	31	2.00	9.00	5.90	1.87
Valid N (list wise)	31				

In the motion graphics group, the mean exam score was 7.35, with a deviation of 1.76, while the text-based group had a mean score of 5.9 with a standard deviation of 1.86. Students using motion graphics achieved a higher mean of 7.35 compared to those in the text-based group (5.90), indicating better performance among motion graphics users. The standard deviations are close in value, suggesting that the range of means within each group is comparable. Refer to Table 2 for detailed information. These results suggest that motion graphics might be more effective in enhancing learning outcomes compared to text-based materials.

Descriptive statistics for anxiety reduction after using the motion graphic format for the motion graphics group are shown in Table 3, and for the text group in Table 4.

Table 3. Descriptive statistics: Anxiety reduction in the motion graphics group

Descriptive Statistics					
	N	Minimum	Maximum	Mean	Standard Deviation
Total Score	31	2.00	5.00	3.58	0.77
Valid N (list wise)	31				

Table 4. Descriptive statistics: Anxiety reduction in the text-based group

Descriptive Statistics					
	N	Minimum	Maximum	Mean	Standard Deviation
Total Score	31	1.00	5.00	2.81	0.79
Valid N (list wise)	31				

The data show that the animated graphics group achieved an anxiety reduction score of 3.58, higher than the score of 2.81 achieved by the text graphics group. This indicates that participants who viewed the animated images experienced a reduction in anxiety. Standard deviations for both groups were fairly similar, with values of 0.77 for animated graphics and 0.79 for text, suggesting that the range of responses was comparable. In essence, while the graphic format reduced anxiety, participants in both groups had different experiences in terms of anxiety levels. These results

suggest that animated graphics may be more effective at reducing anxiety in students, as indicated by the higher mean score on the anxiety reduction question.

Descriptive statistics for engagement, ease of understanding, and confidence in the motion graphics group are shown in Table 5.

Table 5. Descriptive statistics: Engagement, ease of understanding, and confidence in the motion graphics group

Descriptive Statistics				
		Engaging Content Format	Easy Understand Information Presented	Confident Exam After Interacting
N	Valid	31	31	31
	Missing	0	0	0
Mean		2.84	3.03	2.84
Std. Deviation		0.86	0.95	0.86
Minimum		1	1	1
Maximum		4	4	4

For the motion graphics group, the mean score for engagement is 2.84, ease of understanding is 3.03, and confidence after interacting with the content is 2.84, indicating that participants found the motion graphics format to be effective. The standard deviations, ranging from 0.86 to 0.95, point to a degree of variation in responses, particularly in ease of understanding, but overall, the motion graphics format was perceived as engaging, easy to understand, and confidence-boosting, reflecting a positive learning experience.

Descriptive statistics for engagement, ease of understanding, and confidence in the text-based groups are shown in Table 6.

Table 6. Descriptive statistics: Engagement, ease of understanding, and confidence in the text-based group

Descriptive Statistics				
		Engaging Content Format	Easy Understand Information Presented	Confident Exam After Interacting
N	Valid	31	31	31
	Missing	0	0	0
Mean		2.16	2.55	2.39
Std. Deviation		0.82	0.72	0.67
Minimum		1	1	1
Maximum		3	4	3

The mean scores for ease of understanding are 2.55, confidence after interacting with the content is 2.39, and engagement is 2.16, which were low among the participants who received text-based content. This suggests that there is an impression that the text format did not have a strong effect. The standard deviation range, ranging from 0.67 to 0.82, shows a level of variation in responses suggesting distinct differences in experiences. Overall, participants found the text format less captivating, less engaging, and less conducive for purposes of understanding and boosting confidence compared to the motion graphics group.

4.2 Hypothesis test

To assess the hypotheses, independent samples t-tests were conducted to compare the means of the motion graphics and text-based groups across various measures.

H1: Students in the motion graphics group will score higher on the OOP exam compared to those in the text-based group.

The results show that the Sig. = 0.810 indicates equal variances between the two groups. In statistical terms, 'Sig.' refers to the p-value, which helps determine whether there is a significant difference between the variances of the groups [28]. A Sig. value greater than 0.05, as seen here, suggests that the variances are not significantly different [29]. The t-test results, t (60) = 3.148, and the p-value p = 0.003, reveal a statistically significant difference in mean exam scores, with the motion graphics group scoring, on average, 1.4516 points higher than the text-based group, as shown in Table 7.

Table 7. T-test results comparing exam scores between the motion graphics and text-based groups

Independent Samples Test											
		Levene's Test for Equality of Variances		t-test for Equality of Means							
		F	Sig.	*t*	*df*	Significance		Mean Difference	Std. Error	95% Confidence Interval of the Difference	
						One-Sided p	Two-Sided p			Lower	Upper
Total Score	Equal variances assumed	.058	.810	3.148	60	.001	.003	1.45161	.46119	.52910	2.37413
	Equal variance not assumed			3.148	59.794	.001	.003	1.45161	.46119	.52903	2.37419

The effect size, Cohen's d = 0.799, suggests a medium to large effect, indicating a substantial difference. The results suggest that the inclusion of motion graphics improves exam performance compared to text-based instruction, highlighting the practical importance of this difference, as shown in Table 8.

Table 8. Samples effect sizes for test score between the motion graphics and text-based groups

Independent Samples Effect Sizes					
		Standardizer	Point Estimate	95% Confidence Interval	
				Lower	Upper
Total Score	Cohen's d	1.81570	.799	.279	1.314
	Hedge's correction	1.83880	.789	.275	1.298
	Glass's delta	1.86824	.777	.236	1.306

Notes: a. The denominator used in estimating the effect sizes. Cohen's d uses the pooled standard deviation. Hedges' correction uses the pooled standard deviation, plus a correction factor. Glass's delta uses the sample standard deviation of the control (i.e., the second) group.

The findings back up Hypothesis 1, showing that the group using motion graphics performed better on the OOP exam than the group that used the text format. The mean score for the motion graphics users was 7.35, while it was 5.90 for the text-based users, displaying a gap (t (60) = 3.148, p = 0.003). The effect size (Cohen's d = 0.799) suggests a moderate to significant impact, indicating that incorporating motion graphics had a positive influence on educational outcomes. A power analysis in G*Power 3.1 confirmed that our sample size (31 participants per group, alpha = 0.05, effect size = 0.799) achieved a power of 0.93, ensuring adequate reliability in detecting significant differences between groups.

H2: Students in the motion graphics group will report a greater reduction in anxiety after using the video/motion graphics format compared to the text-based format.

The results show that the Sig. = 0.491 indicates equal variances between the two groups. The t-test results, t (60) = 3.914, p < 0.001, the p-value is less than 0.05, reveal a statistically significant difference in mean reduction in anxiety between the motion graphics and text-based groups, on mean, 0.774-points higher agreement that their anxiety was reduced compared to those in the text-based group, as shown in Table 9.

The effect size, Cohen's d = 0.994, indicating a substantial difference in anxiety reduction between the two groups. The results suggest that the use of motion graphics results in a reduction in anxiety levels compared to learning through text. The significant effect size indicates a strong impact on students' anxiety, as shown in Table 10.

Table 9. T-test results comparing reduce of anxiety level between the motion graphics and text-based groups

Independent Samples Test											
		Levene's Test for Equality of Variances		t-test for Equality of Means							
		F	Sig.	*t*	*df*	Significance		Mean Difference	Std. Error	95% Confidence Interval of the Difference	
						One-Sided p	Two-Sided p			Lower	Upper
Total Score	Equal variances assumed	.480	.491	3.914	60	<.001	<.001	.774	.198	.379	1.170
	Equal variance not assumed			3.914	59.925	<.001	<.001	.774	.198	.379	1.170

Table 10. Samples effect for anxiety level decreased text/motion graphics sizes between the motion graphics and text-based groups

Independent Samples Effect Sizes					
		Standardizer	Point Estimate	95% Confidence Interval	
				Lower	Upper
Total Score	Cohen's d	.779	.994	.462	1.519
	Hedge's correction	.789	.982	.456	1.500
	Glass's delta	.792	.977	.415	1.526

Notes: a. The denominator used in estimating the effect sizes. Cohen's d uses the pooled standard deviation. Hedges' correction uses the pooled standard deviation, plus a correction factor. Glass's delta uses the sample standard deviation of the control (i.e., the second) group.

The findings back up Hypothesis 2 and show that the group using motion graphics has significantly greater reductions in anxiety compared to the group that used the text format. The mean score for the motion graphics users was 3.58, while it was 2.81 for the text-based 276 users with a statistically significant difference (t (60) = 3.914, p = 0.001). The effect size (Cohen's d = 0.994) indicates that the decrease in anxiety resulting from the use of motion graphics is not statistically significant, but it is useful. A post hoc power analysis confirmed that our sample size was sufficient, achieving a power of 0.987 with an effect size of 0.994, an alpha level of 0.05, and 31 participants per group, ensuring reliable detection of significant differences.

H3: Students in the motion graphics group will report higher levels of engagement, confidence, and ease of understanding compared to those in the text-based group.

The t-test results reveal that the motion graphics group reported significantly higher engagement (t (60) = 3.173, p = 0.002), ease of understanding (t (60) = 2.260, p = 0.027), and confidence (t (60) = 2.310, p = 0.024) compared to the text-based group, with mean differences of 0.677, 0.484, and 0.452, respectively. The effect sizes, ranging from medium to large (Cohen's d = 0.770 to 0.843), indicate that these differences are not only statistically significant but also meaningful, underscoring the effectiveness of motion graphics in enhancing the learning experience, as shown in Tables 11 and 12.

Table 11. T-test results comparing engagement, understanding, and confidence between the motion graphics and text-based groups

Independent Samples Test											
		Levene's Test for Equality of Variances		t-test for Equality of Means							
		F	Sig.	*t*	*df*	Significance		Mean Difference	Std. Error	95% Confidence Interval of the Difference	
						One-Sided p	Two-Sided p			Lower	Upper
Engaging Content Format	Equal variances assumed	0.009	0.925	3.173	60	0.001	0.002	0.677	0.213	0.25	1.104
	Equal variance not assumed			3.173	59.867	0.001	0.002	0.677	0.213	0.25	1.104
Easy Understand Information Presented	Equal variances assumed	1.013	0.318	2.26	60	0.014	0.027	0.484	0.214	0.056	0.912
	Equal variance not assumed			2.26	56.07	0.014	0.028	0.484	0.214	0.055	0.913
Confident Exam After Interacting with Content	Equal variances assumed	0.514	0.476	2.31	60	0.012	0.024	0.452	0.196	0.061	0.843
	Equal variance not assumed			2.31	56.507	0.012	0.025	0.452	0.196	0.06	0.843

Table 12. Samples effect sizes comparing engagement, understanding, and confidence between the motion graphics and text-based groups

Independent Samples Effect Sizes					
		Standardizer	Point Estimate	95% Confidence Interval	
				Lower	Upper
Engaging Content Format	Cohen's d	0.841	0.806	0.285	1.321
	Hedge's correction	0.851	0.796	0.281	1.304
	Glass's delta	0.82	0.826	0.28	1.359
Easy Understand Information Presented	Cohen's d	0.843	0.574	0.063	1.08
	Hedge's correction	0.854	0.567	0.063	1.066
	Glass's delta	0.723	0.669	0.139	1.19
Confident Exam After Interacting with Content	Cohen's d	0.77	0.587	0.076	1.093
	Hedge's correction	0.78	0.579	0.075	1.079
	Glass's delta	0.667	0.677	0.146	1.198

Notes: a. The denominator used in estimating the effect sizes. Cohen's d uses the pooled standard deviation. Hedges' correction uses the pooled standard deviation, plus a correction factor. Glass's delta uses the sample standard deviation of the control (i.e., the second) group.

The results of the t-test suggest that students in the motion graphics group are likely to feel more engaged and confident and find it easier to understand compared to those in the text-based group. In all three aspects, the motion graphics group scored higher with moderate to large effect sizes (Cohen's d ranging from 0.770 to 0.843), indicating that these differences are not only statistically significant but also meaningful. This confirms that motion graphics play a role in improving the learning experience more than text-based formats. Post hoc power analyses in G*Power confirmed that our sample size was sufficient to detect these differences, with power levels of 0.949 for engagement, 0.953 for ease of understanding, and 0.949 for confidence. These findings reinforce the reliability of the results for Hypothesis 3, showing that motion graphics positively impact the learning experience.

4.3 Correlation analysis

In this research endeavor, the authors study the connections between two groups: motion graphics and text-based formats, to better understand the relationship between key learning factors—such as engagement, ease of understanding, confidence, anxiety, and performance. The goal is to investigate how these factors interact and impact each other in ways that depend on the learning format used. By analyzing the correlations within each group, it is possible to pinpoint the dynamics that influence the effectiveness of each learning approach. The findings from this study reveal the strengths and obstacles linked to each format.

In the motion graphics group, insignificant links were found between anxiety and factors such as engagement, comprehension, confidence, and overall scores. This implies that anxiety levels did not impact these outcomes. However, there was a significant positive correlation between engagement and understanding ($r = .538$, $p = .002$), suggesting that more engaged students tended to understand the material.

Additionally, confidence and total score had a positive but non-significant correlation (r = .139, p = .456), suggesting a weak relationship between confidence and performance, as shown in Table 13.

Table 13. Correlation analysis of key learning variables in the motion graphics video group

Correlations						
		Anxiety Level Decreased Text/Video Format	Engaging Content Format	Easy Understand Information Presented	Confident Exam After Interacting	Total Score
Anxiety Level Decreased Text/ Video Format	Pearson Correlation	1	–0.005	–0.119	0.046	0.139
	Sig. (2-tailed)		0.979	0.525	0.807	0.456
	N	31	31	31	31	31
Engaging Content Format	Pearson Correlation	–0.005	1	0.538**	0.144	–0.071
	Sig. (2-tailed)	0.979		0.002	0.44	0.704
	N	31	31	31	31	31
Easy Understand Information Presented	Pearson Correlation	–0.119	.538**	1	0.293	–0.087
	Sig. (2-tailed)	0.525	0.002		0.11	0.642
	N	31	31	31	31	31
Confident Exam After Interacting	Pearson Correlation	0.046	0.144	0.293	1	0.105
	Sig. (2-tailed)	0.807	0.44	0.11		0.574
	N	31	31	31	31	31
Total Score	Pearson Correlation	0.139	–0.071	–0.087	0.105	1
	Sig. (2-tailed)	0.456	0.704	0.642	0.574	
	N	31	31	31	31	31

The level of anxiety within the text-based group shows a strong positive correlation with knowledge (r = .482, p = .006) and confidence (r = .462, p = .009), suggesting that lower levels of anxiety are linked to higher levels of understanding and confidence. In addition, there is a positive association between anxiety and the total score, although it is not statistically significant (r = .257, p = .163). The correlation analysis reveals a significant positive relationship between confidence and overall score (r = .405, p = .024). This indicates that higher levels of confidence are associated with better performance in the text-based group, as shown in Table 14.

Table 14. Correlation analysis of key learning variables in the text based group

Correlations						
		Anxiety Level Decreased Text/Video Format	Engaging Content Format	Easy Understand Information Presented	Confident Exam After Interacting	Total Score
Anxiety Level Decreased Text/ Video Format	Pearson Correlation	1	0.05	.482**	.462**	0.257
	Sig. (2-tailed)		0.791	0.006	0.009	0.163
	N	31	31	31	31	31
Engaging Content Format	Pearson Correlation	0.05	1	0.183	0.004	0.315
	Sig. (2-tailed)	0.791		0.324	0.983	0.084
	N	31	31	31	31	31
Easy Understand Information Presented	Pearson Correlation	.482**	0.183	1	0.305	0.09
	Sig. (2-tailed)	0.006	0.324		0.095	0.63
	N	31	31	31	31	31
Confident Exam After Interacting	Pearson Correlation	.462**	0.004	0.305	1	.405*
	Sig. (2-tailed)	0.009	0.983	0.095		0.024
	N	31	31	31	31	31
Total Score	Pearson Correlation	0.257	0.315	0.09	.405*	1
	Sig. (2-tailed)	0.163	0.084	0.63	0.024	
	N	31	31	31	31	31

Within the motion graphics group, it was found that anxiety showed minimal correlations with parameters such as engagement, comprehension, confidence, and overall scores. This suggests that anxiety levels did not have an impact on these outcomes. Nevertheless, a significant correlation was observed between engagement and comprehension ($r = .538$, $p = .002$), suggesting that students who exhibited higher levels of interest were more likely to understand the subject. Moreover, the correlation between confidence and overall score was found to be not statistically significant ($r = .139$, $p = .456$), indicating that there is no significant link between confidence and performance.

5 DISCUSSION

The present study revealed a significant influence of anxiety on students' learning outcomes. Participants who used text-based resources and experienced higher levels of anxiety encountered greater difficulty comprehending the material and exhibited a lack of confidence. This indicates that conventional text-based forms may be perceived as too difficult, particularly in demanding disciplines such as OOP. In contrast, children who were taught using motion graphics appeared to have lower levels of anxiety and achieved higher academic performance. This suggests that the

use of motion graphics could potentially alleviate anxiety by enhancing the level of engagement and facilitating comprehension of the content.

The results emphasize the efficacy of motion graphics as a useful instrument in educational environments, namely in reducing anxiety, improving involvement, and understanding. The association identified between engagement and ease of comprehension within the motion graphics group provides more evidence in favor of the notion that multimedia technologies have the potential to establish a more positive and efficient learning environment. These findings are consistent with prior studies on the advantages of multimedia learning aids, underscoring the need of tailoring educational methods to suit the requirements of various disciplines and student demographics.

Motion graphics have multiple applications in education, as demonstrated by these findings. It is essential for educators to integrate motion graphics into their syllabuses for complex subjects such as object-oriented programming, which is constantly evolving and struggles to engage students. To enhance student understanding and reduce anxiety about difficult coursework, educational institutions may invest in the creation of high-quality animations. Besides, professional development in motion graphics will enable educators to enhance learning and make it friendlier yet intellectually exciting for students.

Nevertheless, it is crucial to acknowledge the constraints of this research. Given the limited sample size and the narrow scope of the study, our conclusions may not have wide applicability. A comprehensive understanding of the influence of motion graphics requires more study with larger and more diverse cohorts of students. Furthermore, future research could investigate the long-term effects of these multimedia tools on learning and anxiety, therefore providing a more comprehensive understanding of their total influence.

6 CONCLUSIONS

In conclusion, this study highlights the significant impact of anxiety on academic performance, particularly when comparing animated graphics to text-based formats. The results of our study suggest that students in the animated graphics group had reduced levels of anxiety, which were associated with better comprehension and notably higher confidence. Conversely, higher anxiety levels in the textual group were linked to lower comprehension and confidence, highlighting the urgent need to tackle anxiety in educational establishments.

The practical value of this research is significant: introducing animated graphics into educational contexts improves students' comprehension and retention of complex information, thereby enhancing learning outcomes. It also lowers students' anxiety levels, which improves their academic performance and self-confidence. Finally, it makes the material more attractive and visually appealing, which holds students' attention and motivates them. Educators should consider the use of animated graphics in their teaching methods when teaching subjects that are abstract in nature, such as OOP. Institutions should help educators develop resources for animated graphics and train them. Policy-makers can stimulate the adoption of multimedia tools in curricula by encouraging improved educational outcomes.

This study suggests that the use of animated graphics in teaching can help reduce anxiety and improve student performance, particularly in difficult and abstract subjects such as OOP. These findings add to the growing body of evidence that multimedia tools can make learning more effective and engaging.

In the future, further research into the ability of multimedia tools to alleviate anxiety and facilitate multifaceted learning goals is recommended. It will be essential to expand this research to encompass different domains, a greater number of samples, and diverse educational environments in order to fully understand the extent of the effectiveness of these tools. The aim is to create more inclusive and effective educational environments to meet the needs of all budding learners.

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