

The Illusion of Multimedia Exposure: Predicting Study Engagement in Kuwaiti Undergraduates

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Received: 2 March 2026; **Revised:** 14 April 2026;

Accepted: 17 April 2026; **Published:** 30 April 2026

Abstract

Amidst the global integration of Technology-Enhanced Learning (TEL), this study investigates the relationship between students' holistic multimedia exposure and their study engagement in the under-researched context of Kuwaiti higher education. Drawing on the Cognitive Theory of Multimedia Learning (CTML), the study examines if increased exposure to multimedia predicts higher levels of study engagement. A quantitative, cross-sectional survey design was employed. A sample of 222 undergraduate students from Kuwait's Public Authority for Applied Education and Training (PAAET) completed a self-administered online questionnaire. The sample was predominantly female (85.1%) and largely within the 18–21 age range (76.1%), indicating limited demographic diversity. Multimedia exposure was measured using a custom 8-item scale ($\alpha = .893$), and study engagement was assessed using the 9-item Utrecht Work Engagement Scale (UWES-S) ($\alpha = .903$). Data were analyzed using t-tests, ANOVA and simple linear regression. The findings indicate that while students report high levels of study engagement, particularly on affective dimensions, their multimedia exposure is dominated by traditional tools like PowerPoint. No significant differences were found across gender or age groups. Crucially, linear regression analysis revealed that multimedia experience is not a statistically significant predictor of study engagement ($R^2 = .002$, $p = .553$). The assumption that frequent multimedia use inherently enhances student engagement is challenged. In the Kuwaiti context, technology functions primarily as a delivery medium rather than a catalyst for engagement. This underscores the critical importance of pedagogical design and instructional quality over mere technological access in fostering meaningful student involvement.

Keywords: Multimedia Exposure, Student Engagement, Technology-Enhanced Learning, Pedagogical Design, Instructional Quality



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Citation:

Alameir, H. F. M. (2026). The Illusion of Multimedia Exposure: Predicting Study Engagement in Kuwaiti Undergraduates. *Journal of Computer and Creative Technology*, 4(1), e3726. <https://doi.org/10.65205/jcct.2026.e3726>

1. Introduction

One of the growing features of instructional delivery across universities worldwide is the use of multimedia technologies such as learning management systems, instructional videos, simulations, mobile learning applications, virtual reality environments and interactive assessment platforms. This transformation, commonly conceptualized as Technology-Enhanced Learning (TEL), reflects a paradigm shift from conventional teacher-centered pedagogies toward more flexible, interactive and learner-centered instructional models (Kehrwald & McCallum, 2015; Lata, 2024; Noroozi, 2025). Multimedia technologies promise substantial pedagogical benefits. Through multimodal representation of content and opportunities for experiential learning, multimedia environments are frequently promoted as catalysts for improved learning outcomes, heightened motivation and deeper engagement. The systematic review of 48 articles by Staneviciene & Žekienė (2025) indicates that multimedia tools enhance student engagement, especially when such use is integrated with pedagogical intentionality. In another systematic review of 15 articles, Kassa (2025) similarly concluded that the relevance of multimedia use for cognitive abilities is contingent on its purposeful design.

Apparently, evidence indicates that the positive effects of multimedia use are not consistent or universal. A within-subjects experiment testing the effect of varying multimedia conditions (Rich Multimedia, Sparse Multimedia and No Multimedia) on lecture engagement and lecture performance shows no significant effect (Schmidt et al., 2025). Hence, the authors concluded that in contrast to commonly held knowledge, multimedia design is not impactful on student learning. Other studies also affirm the insignificant effect of multimedia on learning outcomes (Liu et al., 2021; Yulhendri et al., 2022). Indeed, evidence supports the position that the educational influence of multimedia is complex. Poorly designed multimedia environments may foster cognitive overload, encourage media multitasking and promote superficial learning, thereby diminishing academic engagement and performance (Kassa, 2025; Wood & Zivcakova, 2015). The educational value of multimedia technology use remains contingent on how they are designed, implemented and experienced by learners, raising critical questions regarding its actual impact on core learning processes. This inconsistency reveals a critical disconnect between substantial institutional investment in educational technologies and the often modest or negligible gains in student engagement outcomes. In contexts such as Kuwait, where higher education systems are rapidly adopting digital infrastructures, technology use may remain largely passive, serving as a content delivery tool rather than an interactive, engagement-enhancing mechanism shaped by local pedagogical cultures and institutional practices. As a result, understanding the influence of multimedia use on students' learning processes has become a central concern of educational technology research.

Student engagement constitutes a central construct in contemporary educational scholarship and is widely recognized as a robust predictor of academic achievement, persistence and meaningful learning (Jerez, 2024; Wong et al., 2024; Zhai & Li, 2025). Engagement is conceptualized as a multidimensional phenomenon encompassing behavioral, emotional, and cognitive components (Wong & Liem, 2022; Wong et al., 2024; Xu et al., 2023). Behavioral engagement reflects active participation in learning activities, emotional engagement captures students' affective responses and sense of belonging while cognitive engagement denotes sustained intellectual investment and strategic learning efforts (Joshi et al., 2022; Singh et al., 2022). Study engagement represents an optimal state of learning (Bakker et al., 2015; Ouweneel et al., 2011). As instructional delivery becomes increasingly mediated by multimedia technologies, the nature of engagement itself is bound to evolve. Different multimedia technologies

stimulate distinct dimensions of engagement; for instance, interactive platforms and simulations may enhance behavioral participation, emotionally rich videos may evoke affective involvement, while structured multimedia presentations may support deeper cognitive processing. However, students' exposure to multimedia technologies represents a foundational technological condition rather than a direct indicator of pedagogical quality. It is therefore argued that students' multimedia exposure constitutes a necessary but insufficient condition for enhanced engagement, as supported by the Cognitive Theory of Multimedia Learning (CTML).

CTML explains how learners process information presented through combined verbal and visual formats (Mayer, 2009; Mayer, 2020). CTML is founded on three core assumptions: that learners process information through separate visual and verbal channels (Dual-Channel), that each channel has limited processing capacity (Limited Capacity), and that meaningful learning occurs through active cognitive engagement involving the selection, organization, and integration of information with prior knowledge to form coherent mental representations (Baddeley, 2020; Mayer, 2002). In this study, CTML provides a theoretical basis for understanding how multimedia exposure may relate to study engagement. While CTML is commonly applied in experimental studies of instructional design, its principles of active processing and cognitive load management also provide a useful lens for examining how repeated exposure to multimedia environments may shape learners' engagement patterns (Mayer, 2009; Mayer, 2020). Although the present study focuses on the frequency of multimedia exposure, CTML explains how exposure to multimedia instructional delivery complements verbal instructs to shape how engaged students are.

The relationship between multimedia-rich instructional delivery and study engagement operates as a technology-mediated learning mechanism. Through this, instructional media design influences learners' cognitive involvement, motivation and sustained participation in academic tasks. Examining this relationship is essential for understanding how instructional technologies shape learning processes. A significant research gap exists regarding the direct predictive power of multimedia exposure on the psychological state of engagement. Moreover, much of the extant literature examines isolated technologies rather than students' holistic multimedia exposure across multiple platforms. Such holism is Germane to the systematic understanding of multidimensional educational outcomes such as student engagement. In addition, the existing research originates from Western institutional contexts, leaving the applicability of these findings to regions like the Middle East largely unexplored. Against this backdrop, the present study systematically examines the relationship between multimedia exposure and study engagement among a cohort of Kuwaiti undergraduate students, while also exploring potential variations across age and sex groups. Specifically, it seeks to determine the extent to which students' multimedia exposure predicts their levels of study engagement and whether meaningful differences exist across demographic categories of gender and age. Specifically, it investigates three questions: 1. What are the main patterns of multimedia exposure among respondents? 2. Are there statistically significant differences in multimedia exposure and study engagement between male and female respondents? 3. Are there statistically significant differences in multimedia exposure and study engagement across different age groups of students? 4. To what extent does multimedia exposure predict study engagement among respondents? The variables of study are represented in the conceptual framework in Figure 1.

2. Research Objectives

The main objective of this study is to examine the relationship between multimedia exposure and study engagement among respondents. Specifically, the study seeks to:

1. Examine the main patterns of multimedia exposure and study engagement among the respondents.
2. Determine whether statistically significant differences exist in multimedia exposure and study engagement between male and female respondents.
3. Assess whether statistically significant differences exist in multimedia exposure and study engagement across different age groups of students.
4. Evaluate the extent to which multimedia exposure predicts study engagement among respondents.

3. Conceptual Framework

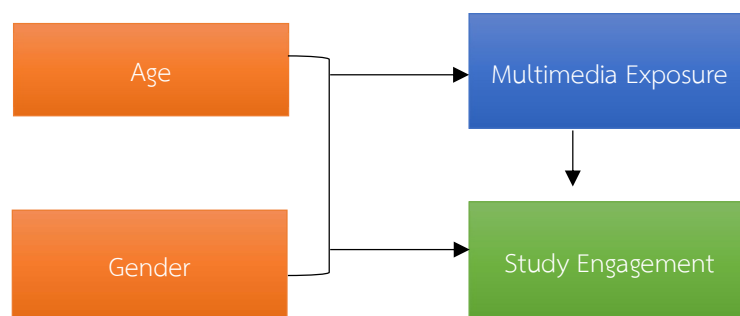


Figure 1. The Conceptual Frame of the Study

4. Research Methodology

4.1 Research Design

The study employed a quantitative, cross-sectional survey design. This approach is aimed at examining the relationship between multimedia exposure and study engagement and at describing the characteristics of a population at a single point in time.

4.2 Population and Sample

The target population comprised all undergraduate students enrolled at the Public Authority for Applied Education and Training (PAAET) during the second semester of the 2024/2025 academic session. PAAET is among Kuwait's largest providers of vocational and technical education, with an estimated student population of 17,459 (Education in Kuwait, 2025), which served as the working population size (N) for this study. Sample size estimation was conducted using an online sample size calculator (Calculator.Net, n.d.). Assuming a 95% confidence level, a 50% population proportion and a 6.5% margin of error, a minimum sample size of 225 respondents was determined to be adequate for statistical representativeness.

Data were collected using a self-administered online questionnaire developed with Google Forms. A voluntary sampling approach was employed and the survey link was disseminated through institutional communication channels, including official email lists and student WhatsApp groups. The introductory section of the questionnaire provided detailed information about the study's purpose, estimated

completion time, and assurances of confidentiality. Informed consent was obtained electronically, with participation proceeding only after respondents indicated their agreement.

The survey remained open for approximately four weeks. Responses were monitored to ensure sufficient participation and data collection concluded upon reaching the minimum required sample size. The dataset was exported in CSV format and imported into SPSS for analysis. No personally identifiable information was collected and access to the dataset was password-protected to ensure confidentiality. Following data screening, three cases with substantial missing data were excluded, yielding a final analytic sample of 222 valid responses.

4.3 Variables and Measurement

Multimedia exposure was operationalized as the extent and frequency of respondents' contact with instructional multimedia tools during classroom learning. It was measured using an 8-item self-report scale developed for this study. There is a seeming dearth of relevant, standardized instrument, and this custom scale was created to address that gap. The items covered commonly used instructional media, including short video clips, films or documentaries, audio content, PowerPoint presentations, hardcopy diagrams or visual aids, digital games or gamified tools, interactive whiteboards or smartboards and digital field trips or virtual simulations. Responses were captured on a five-point frequency scale ranging from 0 (*Never*) to 4 (*10 times or more*). Higher scores indicate greater multimedia exposure. The scale demonstrated high internal consistency in the present study (Cronbach's $\alpha = .893$). Although a pilot study was not conducted, the items were developed based on relevant literature and subjected to expert review to ensure content validity. Construct validity of the multimedia exposure scale was assessed by correlating the multimedia exposure scale with a four-item measure of perceived importance of technology adapted from Svenningsson et al. (2022). A positive and statistically significant correlation was obtained ($r = .174, p = .010$), providing evidence that the scale captures respondents perceived level of technological exposure.

Study engagement was operationalized as students' positive, fulfilling and persistent involvement in academic activities, characterized by vigor, dedication and absorption. It was measured using the 9-item student version of the Utrecht Work Engagement Scale (UWES-S) developed by Schaufeli & Bakker (2004). Respondents responded to each item on a five-point Likert scale ranging from 0 (*Never*) to 4 (*Always, Everyday*). Higher scores indicated higher levels of study engagement. Item of the scale are presented in Figure 2. The scale demonstrated excellent internal consistency in the present study, with a Cronbach's alpha coefficient of .903 for the nine items, indicating high reliability. Composite engagement scores were computed by aggregating responses across all items, with higher composite scores reflecting greater study engagement.

4.4 Research Hypotheses

The following research hypotheses were formulated for the study:

H₀₁: There will be no statistically significant difference in mean multimedia exposure scores and mean study engagement scores based on gender.

H₀₂: There will be no statistically significant difference in mean multimedia exposure scores and mean study engagement scores based on age.

H₀₃: Multimedia exposure will not be a statistically significant predictor of study engagement.

4.5 Method of data analysis

Distributions of data were computed using simple percentile analysis. Data normality was assessed. Although the Kolmogorov-Smirnov test indicated a significant departure from normality ($p < .05$), this result was interpreted with caution, as the Kolmogorov-Smirnov test is widely recognized to be overly sensitive to minor deviations in larger sample sizes (Demir, 2022; Kim, 2013). Given that the absolute skewness (.803) and kurtosis (.19) were relatively small, and that the sample size exceeded 200, the data was reasonably assumed to follow a normal distribution due to the Central Limit Theorem, which states that the sampling distribution of the mean approaches normality as sample size increases, regardless of the population distribution (Demir, 2022). The raw scores were therefore retained. To examine group differences, an Independent Samples t-test was used to determine gender-based variations while a One-Way Analysis of Variance (ANOVA) was used to assess age-related differences. Levene's test was used to examine sub-group homogeneity of variance. A simple linear regression was performed to examine whether multimedia exposure significantly predicted study engagement. The strength and direction of the relationship were assessed using the standardized beta (β) coefficient and Pearson's r , while model fit was evaluated with the coefficient of determination (R^2) and the F statistic. Statistical significance was set at $p < .05$, and all analyses were conducted using SPSS (Version 25).

5. Results

5.1 Distributions of Demographic Characteristics

As shown in Table 1, the age distribution of respondents ($n = 222$) was skewed toward younger categories, with the majority aged 18–21 years (76.1%). Smaller proportions were aged 22–25 years (16.7%), 26–29 years (3.6%), and 30 years and above (3.6%). In terms of gender, the sample was predominantly female (85.1%) while male respondents accounted for only 14.9%.

Table 1. Demographic Distributions of Respondents

Variable	Category	Frequency	Percent (%)
Age	18–21	169	76.1
	22–25	37	16.7
	26–29	8	3.6
	30 & above	8	3.6
Gender	Female	189	85.1
	Male	33	14.9

5.2 Multimedia Exposure among Respondents

The result is shown in Figure 2., which indicates a distinct exposure of traditional instructional tools over specialized digital simulations. PowerPoint presentations emerge as the most integrated medium, with only 20.7% of respondents reporting no use and a large plurality (29.3%) utilizing the tool with high frequency (10 or more times). This suggests that slide-based presentations remain the foundational standard for content delivery in the study context. In contrast, advanced digital interventions such as digital games/gamified tools and virtual simulations exhibit the lowest rates of adoption. Over half of the respondents (55.0% and 54.1%, respectively) reported zero engagement with these tools. While these technologies represent the "high-tech" end of the spectrum, their utilization is primarily concentrated in

the “1–3 times” range, suggesting experimental rather than systemic use. Intermediate visual aids, specifically short video clips and films/documentaries, show moderate to high levels of use. Short video clips are particularly notable for their broad occasional use, with 32.0% of respondents employing them 1–3 times. Meanwhile, interactive whiteboards demonstrate a polarized usage pattern: while 36.5% of respondents have never utilized them, they maintain the second-highest percentage of frequent users (15.3% at 10+ times), indicating that where the hardware is available and mastered, it becomes a consistent part of the respondent's toolkit. Overall, the results delineate a hierarchy of multimedia adoption where accessibility and tradition (PowerPoint and Video) precede the integration of immersive or interactive digital simulations.

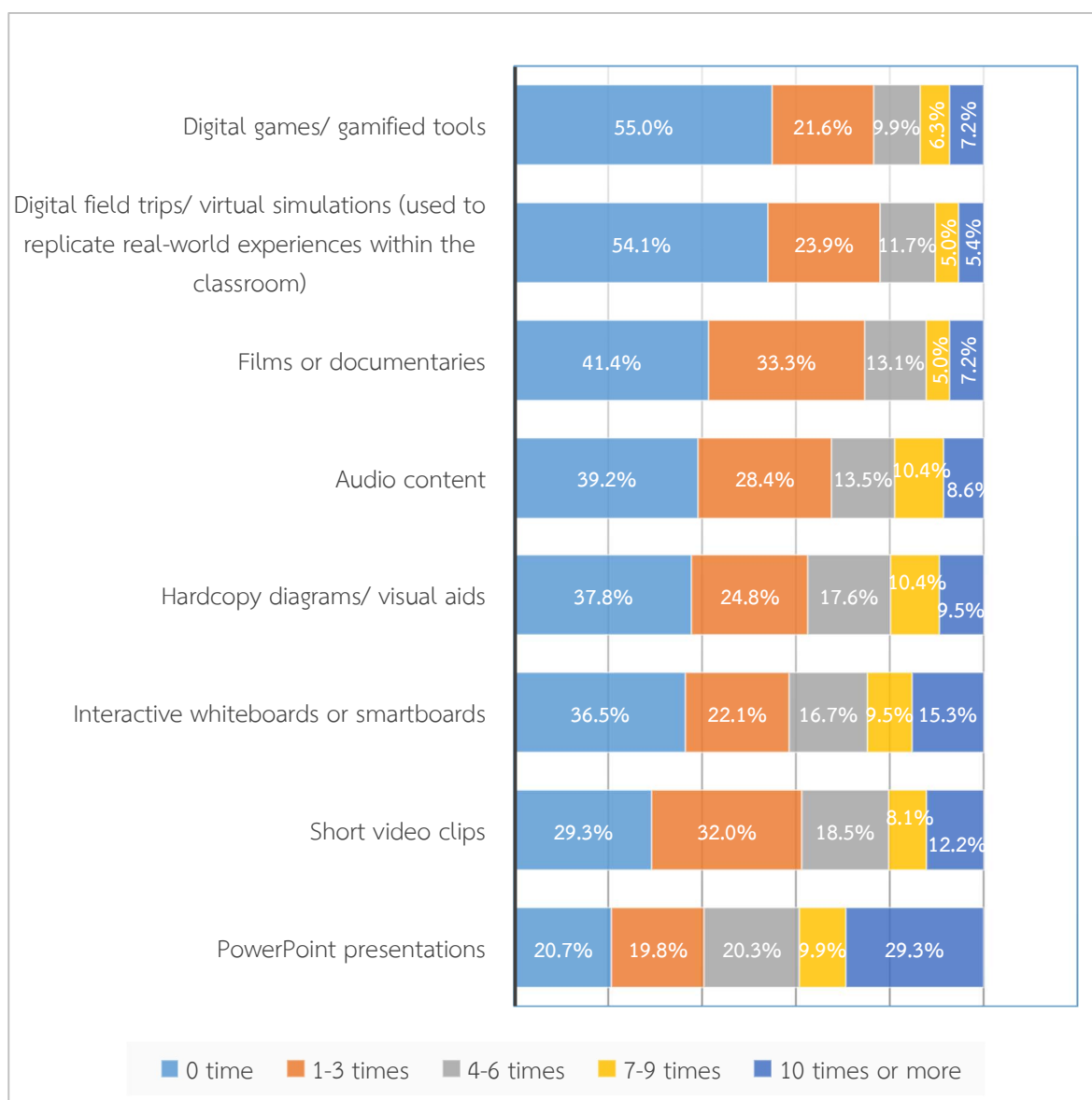


Figure 2. Frequency distribution of responses to multimedia exposure items among respondents

5.3 Study Engagement among Respondents

The result is shown in Figure 3.

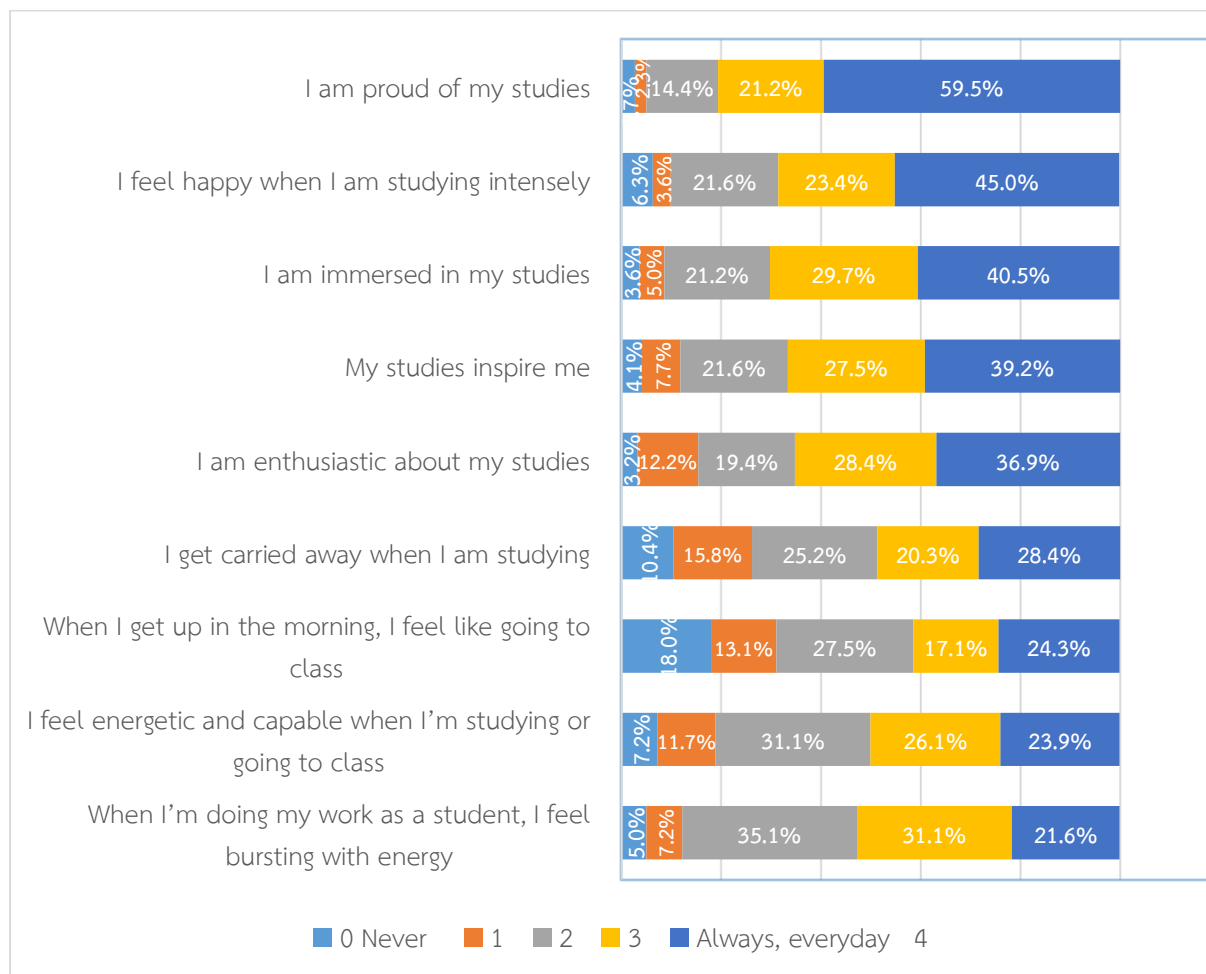


Figure 3. Frequency Distribution of Responses to Study Engagement Items among Respondents.

Figure 3. shows that overall, a substantial proportion of respondents reported consistently high engagement in their studies. For instance, 59.5% of participants indicated they are proud of their studies “always/every day,” while 45.0% reported feeling happy when studying intensely at the same frequency. Similarly, immersion in studies was high, with 40.5% indicating daily engagement, and 39.2% of respondents stated that their studies inspire them on a daily basis. Responses to items assessing enthusiasm and affective energy showed slightly lower frequencies of daily engagement yet still reflected substantial engagement: 36.9% reported being enthusiastic about their studies, and 28.4% reported getting carried away when studying. Items reflecting motivation to attend classes and perceived energy were moderately endorsed, with 23.9% feeling motivated to attend class upon waking. Finally, the item assessing overall energy and vigor in academic work revealed that 21.6% of respondents felt “bursting with energy” as students on a daily basis, though a larger share reported moderate engagement (35.1% at level 2 and 31.1% at level 3). These results indicate that while affective and cognitive engagement is

generally high among respondents, there is variation in the intensity and frequency of engagement across specific dimensions, with pride and happiness in studying being the most consistently endorsed indicators.

5.3 Effect of Gender on Multimedia Exposure and Study Engagement

Multimedia exposure was similar between female respondents (Mean $\pm$ SD = 10.13 $\pm$ 8.02) and male respondents (Mean $\pm$ SD = 10.58 $\pm$ 7.69) with no statistically significant difference (t = -0.295, p = .768). Levene's test (Levene Statistic = 1.126, p = .290) confirmed that the assumption of equal variances was met. These results suggest that both genders possess comparable levels of multimedia exposure within the Kuwaiti higher education context. Similarly, scores for study engagement did not differ significantly by gender. Although females reported a marginally higher mean score (Mean $\pm$ SD = 24.87 $\pm$ 7.91) compared to males (Mean $\pm$ SD = 23.36 $\pm$ 7.86), the difference was statistically negligible (t = 1.009, p = .314). The negligible effect size (Cohen's d = -.056, 95% CI [-.425, .314]) further indicates minimal practical difference between genders. The homogeneity of variance was supported by Levene's test (Levene Statistic = .148, p = .701). The lack of significant gender-based divergence suggests that the digital divide in Kuwaiti higher education is not characterized by gender. The summary of gender-based results is presented in Table 2.

Table 2. Result of Independent Samples t-Test comparing multimedia exposure and study engagement by gender among respondents

	Gender	Mean $\pm$ SD	Levene's Test for Equality of Variances		Independent Samples t Test		Cohen's d	
			Test statistic	p value	t	p value	Point estimate (d)	95% CI
Multimedia exposure	Female	10.13 $\pm$ 8.02	1.126	.290	-	.768	-.056	-.425, .314
	Male	10.58 $\pm$ 7.69			0.295			
Study engagement	Female	24.87 $\pm$ 7.91	0.148	.701	1.009	.314	.190	-.180, .560
	Male	23.36 $\pm$ 7.86						

5.4 Effect of Age on Multimedia Exposure and Study Engagement

Although the 26–29 age group reported the highest mean score of multimedia exposure (Mean $\pm$ SD = 13.13 $\pm$ 7.34), the variance between groups was statistically negligible (F = 0.733, p = .533). Levene's test confirmed the homogeneity of variances (Levene Statistic = 0.899, p = .443), validating the use of the ANOVA model. These findings suggest that multimedia exposure remain relatively uniform across the undergraduate age spectrum in the study setting. Similarly, no statistically significant difference was observed in study engagement levels across the different age groups (F = 1.835, p = .142). While mean scores showed a slight upward trend in older cohorts specifically the 30 and above group (Mean $\pm$ SD = 29.00 $\pm$ 8.38) and the 26–29 group (Mean $\pm$ SD = 28.75 $\pm$ 4.92) compared to the younger 18–21 cohort (Mean $\pm$ SD = 24.50 $\pm$ 8.02), this trend did not reach statistical significance. The assumption of equal variances was maintained, as indicated by Levene's test (Levene Statistic = 0.958, p = .413). The results are supported by a small effect size (η^2 = .025), suggesting limited practical variation in engagement across age groups. The results of these analyses are presented in Table 3. Both multimedia exposure and study engagement are consistent across various life stages within the study context.

Table 3. Result of One-Way ANOVA Comparing Multimedia Exposure and Study Engagement by Age among Respondents

	Age	Mean±SD	Levene's Test for Equality of Variances		ONE-WAY ANOVA		Eta	Eta ²
			Levene Statistic	p value	F	p value		
Multimedia exposure	18-21	9.86±8.13	0.899	.443	0.733	.533	.100	.010
	22-25	10.57±6.96						
	26-29	13.13±7.34						
	30 & above	12.63±9.26						
Study engagement	18-21	24.50±8.02	0.958	.413	1.835	.142	.157	.025
	22-25	23.49±7.45						
	26-29	28.75±4.92						
	30 & above	29.00±8.38						

5.5 Predictive analysis of Multimedia Exposure and Study Engagement

The results presented in Table 4.

Table 4. Results of Linear Regression Analysis Showing Multimedia Exposure as a Predictor of Study Engagement

R ²	Adjusted R ²	R ² Change	Standardized β	p value (β)	95.0% Confidence Interval for β	F statistic	p value (F change)	Zero-order correlation	p value (Zero-order correlation)
.002	-.003	.002	.040	.553	-0.092-0.172	0.353	.553	.040	.277

Dependent variable: Study engagement

Table 4 indicates that multimedia exposure is not a statistically significant predictor of study engagement within this sample. The model yielded a negligible coefficient of determination ($R^2 = .002$), suggesting that multimedia exposure accounts for only 0.2% of the variance in study engagement. After adjusting for the number of predictors, the Adjusted R^2 dropped to $-.003$, further confirming the lack of explanatory power. The standardized coefficient ($\beta = .040$) was statistically non-significant ($p = .553$), and the 95% Confidence Interval for β (-0.092 to 0.172) includes zero, reinforcing the absence of a meaningful linear relationship. Furthermore, the overall model fit was non-significant, as evidenced by the F-statistic ($F = 0.353$, $p = .553$). The zero-order correlation ($r = .040$, $p = .277$) also reflects a weak, non-significant association between the two variables.

These findings demonstrate that frequent use or familiarity with multimedia tools does not automatically translate into higher levels of academic engagement. The mere presence or use of technology is insufficient to drive student involvement. The lack of predictive significance implies that study engagement is likely influenced by other exogenous factors such as instructional quality, curriculum relevance or intrinsic motivation rather than multimedia exposure alone. This result highlights a critical pedagogical gap where technology serves as a medium but not necessarily as a catalyst for deeper academic commitment, especially in Kuwaiti undergraduate context.

6. Conclusion

There is a clear hierarchy of technology adoption in the study setting, with passive, presentation-based tools like PowerPoint remaining dominant. Interactive and immersive technologies like gamification and virtual simulations are adopted only peripherally. Gender and age are inconsequential in determining multimedia exposure and study engagement. A critical disjuncture exists between multimedia technology exposure and its actual impact on student engagement in the study setting.

A simplistic interpretation of the Cognitive Theory of Multimedia Learning (CTML) is challenged by this study. The mere presence of multiple media aids is insufficient; study engagement is contingent on pedagogical quality. Hence, for policymakers and institutional leaders in Kuwait and the broader MENA region, the implication is stark: financial investment must pivot from technological infrastructure to human infrastructure. The focus must shift toward sustained professional development that equips educators with the pedagogical skills to transform technology from a passive content-delivery system into an active catalyst for study engagement.

7. Discussion

Findings from the present study reveal a clear hierarchy of multimedia exposure among respondents, characterized by the dominance of conventional presentation tools and the marginal use of advanced interactive technologies. PowerPoint remains the primary instructional medium, while digital games and virtual simulations which are tools associated with higher-order cognitive engagement and skills development, are rarely integrated into routine teaching. This pattern suggests that technology in Kuwaiti higher education is largely used to support traditional content delivery rather than to facilitate learner-centered, interactive pedagogies. These findings align with regional evidence indicating that despite substantial investment in digital infrastructure, effective pedagogical integration of technology remains limited across the Gulf and the wider MENA region (Eltaiba et al., 2025; Fareed et al., 2025). While this region demonstrate strong digital connectivity and advanced e-government systems, persistent deficits in digital skills, teacher training and curriculum modernization constrain the transformative use of technology in education (Fareed et al., 2025). Similarly, Eltaiba et al. (2025) emphasize that technology-enhanced learning (TEL) in MENA remains hindered by teacher-centered instructional cultures and misalignment between educational practices and labor market demands. The low adoption of simulations and gamified tools observed in this study reflects these broader structural and pedagogical barriers. As TEL is widely recognized for its capacity to promote digital literacy, critical thinking and employability skills (Eltaiba et al., 2025), the continued reliance on passive instructional technologies raises concerns about graduates' preparedness for an increasingly digital and automated economy. Collectively, the findings underscore that meaningful digital transformation in Kuwaiti higher education requires a strategic

shift from infrastructure-focused investments toward sustained development of pedagogical capacity and learner-centered curriculum reform.

Current findings also indicate generally high levels of study engagement among respondents, particularly on affective dimensions such as pride, happiness in studying, inspiration and immersion. These results suggest that many students experience strong emotional attachment and psychological investment in their academic work. Respondents therefore reveal a strong foundation of affective and cognitive connection to their studies, which represents a considerable advantage for the region's educational and developmental ambitions and provides an important intrinsic motivational base for integrating advanced educational technologies and pursuing sustainable development goals. However, comparatively lower levels of daily vigor and motivation to attend classes point to variability across engagement dimensions. While affective and cognitive engagement appear robust, behavioral energy is less consistently sustained. This multidimensional pattern aligns with contemporary conceptualizations of engagement as a complex construct encompassing affective, cognitive and behavioral components (Wong & Liem, 2022; Wong et al., 2024). Meta-analytic evidence further demonstrates that these engagement dimensions are strongly associated with academic achievement and subjective well-being, with affective engagement being particularly influential for students' psychological well-being (Wong et al., 2024). The prominence of affective indicators in the present findings therefore reflects a favorable psychological foundation for academic excellence among undergraduates in the study setting. At the same time, the nuanced variation in behavioural engagement signals a critical need for higher education institutions to sharpen student engagement, behaviour wise, because academic achievement is most strongly associated with behavioral engagement (Wong et al., 2024).

The present study found no statistically significant differences in multimedia exposure or study engagement across gender and age groups in the study context ($p > 0.05$). Female and male students reported comparable levels of multimedia exposure ($M = 10.13$ and 10.58 , respectively) and study engagement ($M = 24.87$ and 23.36 , respectively). The 26–29 and the 18–21 age groups had the highest and lowest mean score of multimedia exposure ($M = 13.13$ and 9.86 , respectively). The mean scores of study engagement showed a slight upward trend in older cohorts specifically the 30 and above group ($M = 29.00$), the 26–29 group ($M = 28.75$) compared to the younger 18–21 cohort ($M = 24.50$). This insignificant pattern indicates that access to multimedia technologies as well as psychological investment in studies have become normative features of the undergraduate learning environment in the study setting rather than differentiating characteristics across gender and age categories. These findings are consistent with the findings of Zhang et al. (2025), who reported that gender was not a significant factor influencing students' online learning engagement in China. Nevertheless, current findings contrast with the report by Heo & Toomey (2020), who asserted that male undergraduates exhibited significantly better learning outcomes than their female counterparts while using multimedia resources in a Northeastern USA university. Similarly, Passig & Levin (2001) reported that male and younger children exhibited significantly better engagement with interactive multimedia. Further, Kobicheva (2022) observed significantly higher engagement levels among female rather than male students in online learning contexts in Russia. A study among a group of Western Australian students also indicates that multimedia exposure increases student engagement with males more engaged than females in multimedia-exposed classes (Chipangura & Aldridge, 2019). The divergence between the present findings and most of these earlier studies may reflect contextual and temporal shifts. The Kuwaiti higher education environment is characterized by widespread

digital access and institutional investments in educational technologies, which may have minimized traditional demographic divides. In addition, as digital tools have become ubiquitous and embedded in routine instruction, their use may no longer differentially shape engagement across age or gender, but rather function as a common baseline condition for all students. This underscores the importance of focusing future pedagogical interventions on instructional quality, motivation and learning design rather than on demographic segmentation.

The present study found that multimedia exposure did not significantly predict study engagement in the study setting ($p > 0.05$). This finding challenges the widespread assumption that increased exposure to digital and multimedia tools automatically enhances student engagement and instead reinforces the argument that technology alone is insufficient to stimulate meaningful academic involvement. This result aligns closely with the position of Yulhendri et al. (2022), who reported that multimedia use had no direct effect on student engagement in their study among a cohort of undergraduates in Indonesia. The findings also echo Consoli et al. (2025), who demonstrated that the quality of technological integration explains substantially more variance in student engagement than mere frequency of use of technology in Switzerland. This reinforces the view that engagement is driven less by how often multimedia tools are used and more by how well they are pedagogically embedded to support cognitive activation, individualized learning and classroom management. From the perspective of the Cognitive Theory of Multimedia Learning (CTML), this null effect can be seen as counter-intuitive given the core assumption that learners process information through separate visual and verbal channels (Dual-Channel) (Mayer, 2009; Mayer, 2020). Increased exposure to multimedia is, by implication, supposed to improve study engagement. Nevertheless, CTML further explains this null effect by emphasizing that meaningful learning occurs only when learners are able to actively select, organize and integrate multimedia information into coherent mental representations. Mere exposure without instructional design alignment may therefore fail to activate the generative cognitive processes necessary for engagement.

Systematic reviews and experimental studies have shown that well-designed multimedia environments can enhance student engagement when guided by instructional design principles such as signalling, segmenting and embodiment (Doherty, 2022; Staneviciene & Žekienė, 2025). However, Doherty (2022) further demonstrated that while these principles can increase behavioral indicators of engagement, they do not necessarily improve affective or cognitive engagement outcomes. This distinction suggests that even pedagogically refined multimedia may influence certain engagement dimensions while leaving others unaffected. Within the Kuwaiti context, the current findings suggest that multimedia exposure is not a differentiating factor that enhances engagement. The Gulf countries have experienced a rapid intensification of digital transformation particularly following the COVID-19 pandemic (Fareed et al., 2025). The ubiquity of traditional multimedia may therefore have diminished motivational impact, making engagement increasingly dependent on instructional quality, curriculum relevance and students' intrinsic motivation rather than on technology use alone. This study underscores the need for a shift in higher education policy and practice, from expanding access to digital tools toward strengthening pedagogical design capacity and instructional intentionality, to realize the full engagement potential of multimedia-supported learning environments.

8. Limitations

The use of a non-probability, convenience sample, which was predominantly female, is a limitation of the findings. This female-dominated sample (85.1%) may limit generalizability, and future studies could address this by employing stratified random sampling to ensure balanced gender representation. The cross-sectional design also precludes any causal claims.

9. Recommendations

Institutions should move beyond passive media (e.g., static PowerPoint) and adopt interactive platforms such as educational games or virtual simulations to better stimulate the cognitive and behavioral dimensions of engagement. Future research should employ qualitative methods to explore 'why' technology use does not correlate with engagement in this specific context. Additionally, examining mediating variables like Technostress or Digital Literacy may provide a more comprehensive understanding of the digital learning landscape.

10. Contributions

The findings emphasize that 'frequency of exposure' does not equate to 'student engagement.' This provides a clear mandate to transition from passive content delivery to Active Learning strategies that utilize multimedia as a cognitive stimulus rather than a mere information carrier. This research serves as a strategic guide for resource allocation. It suggests that institutional investment should prioritize pedagogical training and digital literacy for faculty over the simple acquisition of more hardware, as technology alone is not a catalyst for student commitment.

By applying internationally validated tools (UWES-S) in the specific context of Kuwaiti vocational education, this study contributes essential regional data to the global discourse on digital engagement, filling a significant geographical and sectoral gap in the literature.

11. Declaration of Generative AI

The author used generative AI, specifically, ChatGPT, to assist with language refinement and improvement of sentence clarity during manuscript preparation. The author retained full control of the content and is solely responsible for all interpretations, analyses and conclusions presented in the manuscript.

12. CRediT Author Statement

Haidar F. M. Alameir: Conceptualization, Literature Review, Methodology, Data Collection, Data Analysis, Writing (Original Draft Preparation), Writing (Review and Editing).

The author has read and approved the final manuscript.

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