

Assessing Student Engagement And Learning Outcomes In Multimedia-Enhanced Education: A Study In Kuwait's Colleges Of Basic Education

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Article Info	Abstract
Article History Received: September 27 ,2023 Accepted: December 30 ,2023	<i>The purpose of this research is to investigate on the impact of factors that influence the multimedia usage by the students of Basic Education in Kuwait on the learning outcome achievement. The research adopts a positivist paradigm with quantitative approach and survey strategy. Convenience sampling is the techniques used for the data collection and self-administered questionnaire both in hardcopy and electronic forms have been used to reach sample size of 206 students from the Colleges of Basic Education in Kuwait. Analysis includes both descriptive and inferential statistics the former being used for testing the reliability of the data and normality conditions, and the latter being used for hypothesis testing. The 4X4 ANOVA was used for testing the association of four factors of student engagement with the multimedia and the four variables measuring the learning outcome achievement. Results indicated that multimedia tools used (MTU) had a statistically significant association with all the four variables of learning outcome achievement; whereas student engagement level (SEL) had a statistically significant association with academic performance (ACP) and retention of knowledge (RTK), instructional method (INM) had an association with learning satisfaction (LRS), and frequency of multimedia use (FMU) had an association with technology self-efficacy (TSE). These findings have led to the suggestions to the top leadership of colleges of basic education and multimedia developers that includes advanced training for faculty, collaboration between the academics and multimedia developers, promoting structured use of multimedia tools, incorporating flipped classrooms and problem-based learning to promote student engagement, introducing real-world cross-disciplinary projects and real-time student feedback during instruction. The outcome of this research could be useful to both academics and practitioners as the research is based on real-life data.</i>
Keywords : Multimedia Tools, Student Engagement Level, Instructional Method, Frequency Of Multimedia Use, Learning Satisfaction, Academic Performance	
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Introduction

The integration of multimedia tools in education is now a global phenomenon, transforming educational methods into dynamic, interactive, and learner centric. Advancements in technology have enabled educators to leverage multimedia applications in the form of audio-visuals, simulations, and digital learning platforms to enhance engagement and learning outcomes. Research has highlighted the benefits of multimedia in fostering experiential learning, improving retention of knowledge, and catering to diverse learning styles (Ghozali et al., 2024). In the technologically advanced countries, multimedia has become an integral part of the curriculum, supported by policies promoting digital literacy and technological inclusivity (Wang & Si, 2024). As education systems across the globe embrace digital transformation, particularly collegial education, multimedia emerges as a powerful tool in shaping the future of teaching and learning.

In Kuwait, educational reforms are taking place rapidly and the use of multimedia in education has seen a significant rise, particularly in the Colleges of Basic Education. It is because technology is increasingly integrated into the curriculum of Basic Education. The capability of multimedia tools in creating interactive and culturally relevant content has been realized and have been channeled in aligning the learning experiences with Kuwait's vision for educational advancement. Multimedia tools have produced very good results especially in addressing language barriers, supporting collaborative learning, and promoting creativity among students (Hassan et al., 2024). Despite this progress, challenges such as learning satisfaction (LRS), academic performance (ACP), retention of knowledge (RTK), and technology self-efficacy (TSE) of students is underexplored in Kuwait's educational context.

Researchers have made attempts to explore these variables in recent times. For instance, Altekait&Alduaij(2024) found significant direct relationship between information quality and student

satisfaction in Kuwait. It was found that peer interaction had a positive significant influence on e-learning outcomes in Kuwait during the COVID-19 pandemic, while instructors and course design factors were found to have minimal impact (Alkhaldi et al., 2024). Alshammari & Al-Enezi (2024) provided practical insights to support the extensive adoption technology in teacher preparation programs in Kuwait to align with modern educational trends with the dynamic needs of the student. Hasan (2024) has established a significant positive relationship between students' self-efficacy levels and their academic performance, emphasizing the critical role of fostering confidence and resilience in achieving academic success. However, most existing research focuses on higher education or general education contexts, leaving a need to explore multimedia's application in the foundational levels of education in Kuwait. This research aims to bridge these gaps by examining the association between multimedia tools used (MTU), student engagement level (SEL), instructional methods (INM), and frequency of media use (FMU) with the key educational outcomes in Colleges of Basic Education in Kuwait as perceived by the students.

With this backdrop, the objectives of this study are fourfold: (1) to investigate the impact of MTU, SEL, INM, and FMU on LRS, ACP, RTK, TSE; (2) to evaluate the effectiveness of multimedia tools in enhancing educational outcomes; (3) to identify the specific instructional strategies that optimize the use of multimedia in education; and (4) to provide actionable recommendations for top leadership of Basic Education and the developers of multimedia tools to maximize the benefits of multimedia in Kuwait's Colleges of Basic Education.

Theoretical Background

The interplay between technology use and educational outcomes achievement forms the theoretical foundation for this research. A primary theory underpinning this study is the Technology Acceptance Model (TAM), which postulates that perceived ease of use and perceived usefulness significantly influence users' acceptance of technology (Al-Adwan et al., 2024). In the context of this research, TAM provides insights into how the FMU and INM affect SEL and LRS. By applying TAM, this study explores how these factors interact to enhance or hinder ACP, RTK, and TSE among students in Kuwait's colleges of basic education.

Additionally, Unified Theory of Acceptance and Use of Technology (UTAUT), which integrates constructs like social influence and facilitating conditions (Bayaga & du Plessis, 2024) to explain behavioral intentions toward technology adoption also provide the theoretical grounding to this research. UTAUT's relevance lies in its ability to contextualize how institutional support, accessibility of multimedia tools, and peer influence shape student engagement and learning outcomes. This framework is particularly pertinent in examining how INM and FMU facilitate or constrain academic outcomes and TSE, highlighting the importance of a supportive educational ecosystem for effective multimedia integration.

Lastly, the study aligns with the Cognitive Load Theory (CLT), which underscores the impact of instructional design on learners' cognitive processes (Zhang, 2024). According to CLT, well-structured multimedia content can reduce extraneous cognitive load and enhance learning efficiency, directly contributing to LRS and RTK. By adopting CLT, the research emphasizes the role of effective multimedia design and frequency of use in optimizing learning experiences. Together, these theoretical frameworks provide a robust foundation for exploring the relationships between multimedia usage, instructional strategies, and educational outcomes in the study's context.

The Conceptual Model

The conceptual model of this research examines the relationships between the independent variables: MTU, SEL, INM, and FMU and the dependent variables: LRS, ACP, RTK, and TSE. The model is anchored in the TAM, UTAUT, and CLT to provide theoretical grounding.

MTU refers to the variety and type of multimedia tools integrated into the educational process (Onyejelem & Aondover, 2024). It is hypothesized to directly impact all dependent variables by providing diverse and engaging ways to deliver content, improving learning satisfaction, retention, and performance.

SEL represents how actively students participate in learning activities facilitated by multimedia tools and innovative instructional methods (Pandita & Kiran, 2023). SEL is postulated to mediate the relationship between MTU and FMU and learning outcomes -LRS, ACP, and RTK, reflecting the role of engagement in enhancing the effectiveness of educational tools.

INM reflects the strategies employed by instructors to deliver educational content using multimedia tools (Rosyara, 2024). Grounded in CLT, INM affects the cognitive load experienced by students, directly influencing LRS and indirectly impacting ACP and RTK.

FMU measures how frequently multimedia tools are used by educators and students (Law & Stock, 2019). Drawing from UTAUT, FMU is expected to enhance TSE by providing repeated exposure, thereby increasing familiarity and confidence in using technology.

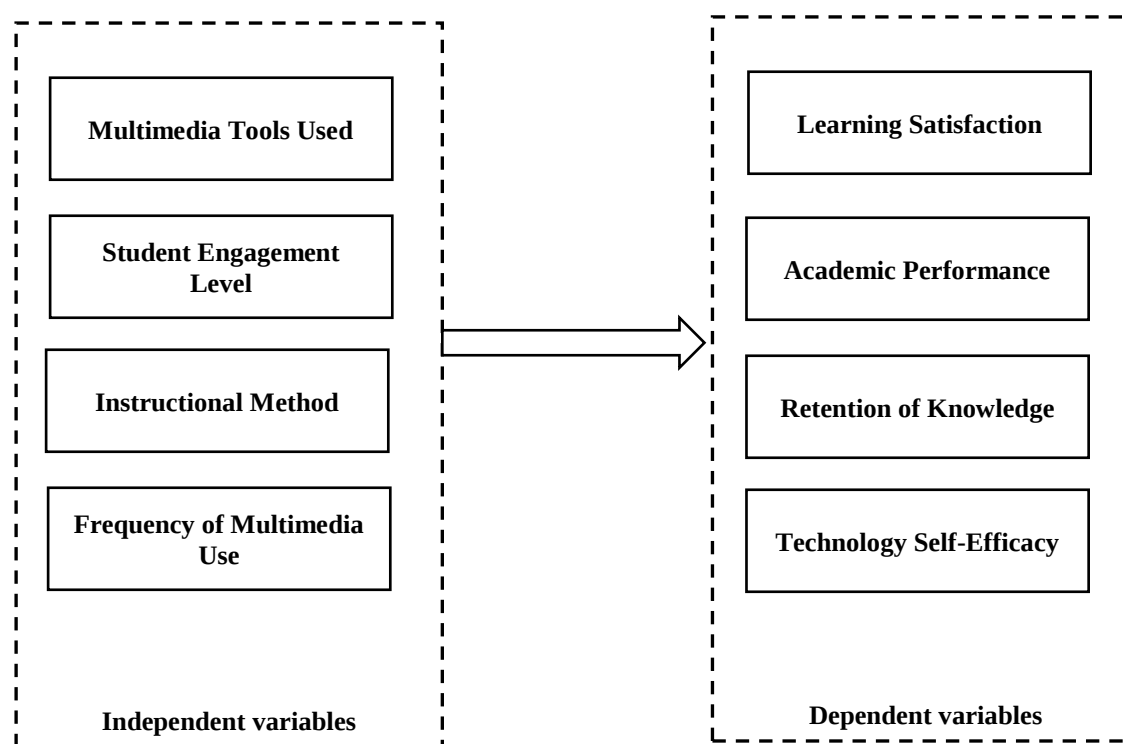
Among the dependent variable of this research, LRS refers to the overall satisfaction students derive from their learning experiences (Wu, 2024). It is directly influenced by MTU, SEL, and INM, as well-structured and engaging multimedia use enhances the learning environment.

ACP denotes students' academic achievements (Ghozali et al., 2024), which are hypothesized to be indirectly influenced by MTU, SEL, and INM through enhanced engagement and instructional effectiveness.

RTK measures the extent to which students can retain information over time (Rosyara, 2024). CLT suggests that well-designed multimedia tools and effective instructional methods reduce extraneous cognitive load, facilitating better retention.

TSE is the confidence students have in using technology effectively (Pan, 2020), directly influenced by FMU and indirectly supported by MTU and SEL. TAM and UTAUT highlight the importance of exposure and perceived ease of use in developing this confidence.

The conceptual model is depicted in Figure 1.



Legend:

MTU = Multimedia Tools Used; LRS = Learning Satisfaction; SEL = Student Engagement Level; ACP = Academic Performance; INM = Instructional Method; RTK = Retention of Knowledge; FMU = Frequency of Multimedia Use; TSE = Technology Self-Efficacy.

Figure 1: The Conceptual Model

Research Methodology

Research philosophy

This research is based on the positivist research paradigm with the deductive reasoning for the arrival at the logical conclusion about the problem under consideration. Obviously, quantitative approach has been chosen for the approach to research. The whole process of research revolves round the cycle of building a conceptual model based on the existing theories, developing hypotheses, making observations through the collection of real-life data, analysing the data for the testing of the hypotheses, and arriving at a meaningful conclusion about the problem.

Research Design

The research follows a cross-sectional research design on the temporal domain and adopts a survey strategy for the collection of quantitative data. The questionnaire design followed the standard procedure. Even though the population was finite gaining access to the student unique tracking number or mobile was not possible and hence probability sampling was not practical and hence the convenience sampling technique was used. Moreover, convenience sampling also provides the flexibility to increase the sample size if the situation demands (Shamsudin et al., 2024). It is important to confirm that the sample size chosen is adequate for the analysis and the most common used in SEM for testing sample size adequacy is through the Cohen's Effect size

method. Effect size influences the power of the statistical tests and the ability to detect meaningful relationships within the model (Hair & Alamer, 2022). The most common method used is the G*Power estimate (Westland, 2010). The online G*Power Estimation Tool (Version 3.1.9.7). For a two tailed rejection, effect size of 0.3 (medium), and 95% confidence level the minimum sample size required as per the G*Power estimate is 134. However, to make the sample representative of all the colleges of basic education in Kuwait a sample size of 206 has been used in this research.

Respondent details

The data for this research was collected between the month of May and September 2024 from colleges of Basic Education in Kuwait, achieving a total sample size of 206 respondents. The data collection process utilized a mixed approach, combining both digital and physical formats to ensure comprehensive coverage and accessibility for participants. Of the total responses, 32 were submitted through Google Forms, leveraging digital convenience, while the remaining 174 were collected in hard copy format, accommodating participants who preferred or had access to traditional paper-based methods. This dual approach ensured a higher response rate and inclusivity, reflecting diverse preferences and technological access among the respondents. The students were randomly chosen from the final year and pre-final years so that they would have experience of multimedia usage. They were from several disciplines including -Arabic Language and Literature, Art Education, Computer Science, Curriculum and Teaching Methods, Educational Technology, English, Home Economics, Interior Design, Islamic Studies, Library and Information Sciences, Mathematics, Music Education, Physical Education and Sports, Psychology, Science, Social Studies, and Special Education. The students were familiar with multimedia tools such as - Al Mawrid (Arabic Language and Literature), Google Arts & Culture (Art Education), Codecademy(Computer Science), Moodle and Blackboard (Curriculum and Teaching Methods) and so on.

Questionnaire design

The questionnaire design was based on the standard procedure of selecting items from the standard scales, modifying them to suit the current requirement, and reconfirming their reliability and validity (Boateng et al., 2018). The reliability and validity of the standard scales used in this study are well-established in prior research, ensuring robust measurement of the constructs. For Student Engagement Level (SEL), the National Survey of Student Engagement (NSSE) by Kuh (2001) and Fredricks et al. (2004) has been widely validated, with reported Cronbach's Alpha values typically exceeding 0.80, indicating high internal consistency. The Constructivist Learning Environment Scale (CLES) for Instructional Method (INM), developed by Taylor et al. (1997) and Aldridge et al. (2000), is a reliable tool with reported alpha coefficients ranging from 0.78 to 0.89, supporting its application for instructional settings. For Learning Satisfaction (LRS), the Learning Satisfaction Scale by Arbaugh (2000) and Bolliger (2004) consistently achieves alpha values above 0.85, validating its use in assessing student satisfaction with multimedia-enhanced learning. All these scales have been validated with reliable indices by various authors in many different contexts where they have been used. However, as these items were slightly modified to suit the requirement of this research, their reliability has been estimated once again and discussed in the subsequent sections. The research construct, brief explanation, standard scales, contributing authors, and the items chosen are provided in the Table 1.

Table 1: The research construct, brief explanation, standard scales, contributing authors, and the items chosen.

Research construct	Brief explanation	Standard scales	Contributing authors	Items Chosen
Independent variables (4 – Levels of categorical variables)				
Multimedia Tools Used (MTU)	The variety and type of multimedia tools employed in the teaching-learning process to enhance interactivity and engagement.	Self-designed items adapted from prior research	Mayer (2001); Moreno & Mayer (2007)	Level 1: Video-Based Content Level 2: Interactive Simulations Level 3: Presentation Software (e.g., PowerPoint) Level 4: Digital Learning Platforms (e.g., Moodle, Blackboard)

Student Engagement Level (SEL)	The degree to which students actively participate and show interest in the learning process.	National Survey of Student Engagement (NSSE)	Kuh (2001); Fredricks et al. (2004)	Level 1: Passive Engagement (e.g., watching videos) Level 2: Interactive Engagement (e.g., participating in quizzes) Level 3: Collaborative Engagement (e.g., group discussions around multimedia) Level 4: Creative Engagement (e.g., creating multimedia content)
Instructional Method (INM)	Teaching strategies and approaches used by educators to deliver content effectively.	Constructivist Learning Environment Scale (CLES)	Taylor et al. (1997); Aldridge et al. (2000)	Level 1: Lecture-Based with Multimedia Supplement Level 2: Flipped Classroom with Multimedia Resources Level 3: Fully Online Multimedia-Based Learning Level 4: Blended Learning (combination of in-person and multimedia)
Frequency of Multimedia Use (FMU)	How often multimedia tools are utilized during instruction to aid in knowledge dissemination and engagement.	Self-reported frequency scales	Garrison & Anderson (2003); Tamim et al. (2011)	Level 1: Rarely (less than once a week) Level 2: Occasionally (once a week) Level 3: Frequently (2-3 times a week) Level 4: Very Frequently (daily use)
Dependent variable (Likert 5-point scale)				
Learning Satisfaction (LRS)	The overall satisfaction of students with the learning experience facilitated by multimedia tools.	Learning Satisfaction Scale	Arbaugh (2000); Bolliger (2004)	1. I am satisfied with the learning experience when multimedia is used in my classes. 2. The integration of multimedia improves the overall quality of my learning. 3. Multimedia-based classes make learning more enjoyable for me. 4. I feel that multimedia enhances my motivation to learn

				the material. 5. I am pleased with the use of multimedia tools in my education.
Academic Performance (ACP)	The measurable outcomes of students' educational attainment, typically through grades or scores.	Self-reported GPA or assessment scores	Pascarella & Terenzini (1991); Kuh et al. (2006)	1. Multimedia tools make it easier to understand complex topics. 2. My academic performance improves when multimedia is used in teaching. 3. I am able to remember the course content better when multimedia is used. 4. I find it easier to follow the course material with multimedia support. 5. Multimedia tools enhance my ability to apply what I learn in class.
Retention of Knowledge (RTK)	The ability of students to retain and recall information over time as a result of the teaching-learning process.	Test-based memory retention scales	Baddeley (1992); Mayer & Moreno (2003)	1. I can recall key concepts from the lessons taught using multimedia tools 2. The multimedia content used during the lessons has helped me retain information effectively 3. I feel confident in applying the knowledge gained through multimedia-based instruction 4. I can easily remember and explain the topics covered in class when multimedia tools were used 5. Multimedia-

				enhanced learning sessions have improved my long-term understanding of the subject matter
Technology Self-Efficacy (TSE)	Confidence in one's ability to effectively use technology in learning and teaching environments.	Computer Self-Efficacy Scale (CSES)	Compeau & Higgins (1995); Teo (2010)	1. I am confident in my ability to navigate multimedia tools used in my classes. 2. I feel capable of learning new multimedia tools for educational purposes. 3. I am comfortable using various multimedia resources for my studies. 4. I believe I can troubleshoot minor technical issues when using multimedia tools. 5. I can effectively use multimedia tools to complete class assignments.

Results And Findings

Descriptive Statistics

Reliability measures

The reliability analysis indicates a high level of internal consistency across the scale, with Cronbach's Alpha values ranging from 0.91 to 0.93 (Table 2) when individual items are deleted, confirming the robustness of the scale. All items exhibit strong corrected item-total correlations (ranging from 0.69 to 0.85), indicating their significant contribution to the overall construct. Notably, FMU demonstrates the highest corrected item-total correlation (0.85) and the lowest Cronbach's Alpha if deleted (0.91), underscoring its critical role in maintaining scale reliability. The scale means and variances remain consistent across items, reflecting a balanced contribution of each item without disproportionate skewness. These findings validate the scale's reliability, with all items collectively and individually contributing meaningfully to the measurement construct.

Table 2: Reliability of the data

Item-Total Statistics				
	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
MTU	26.57	24.68	0.69	0.92
SEL	26.87	23.22	0.69	0.93
INM	26.69	23.37	0.74	0.92

FMU	26.60	23.48	0.85	0.91
LRS	26.62	23.67	0.81	0.92
ACP	26.40	24.09	0.78	0.92
RTK	26.41	23.74	0.76	0.92
TSE	26.48	23.67	0.76	0.92

Normality of the data

The normality analysis of the data based on skewness and kurtosis values reveals that the variables are approximately normally distributed, with slight deviations. Skewness values for all variables range from -0.31 to 0.17 (Table 3), and Kurtosis values from -0.04 to -1 indicating that the data is fairly symmetric and close to normality, threshold values -1 to +1 for Skewness and -3 to +3 for Kurtosis (Demir, 2022). Hence, the data may be subjected to inferential statistical analysis.

Table 3: Skewness and Kurtosis of the data (n = 206)

	Minimum	Maximum	Mean	Std. Deviation	Skewness		Kurtosis	
	Statistic	Statistic	Statistic	Statistic	Statistic	Std. Error	Statistic	Std. Error
MTU	2.00	5.00	3.81	0.78	0.17	0.17	-1.00	0.34
SEL	1.00	5.00	3.51	0.98	-0.31	0.17	-0.04	0.34
INM	1.00	5.00	3.68	0.91	-0.17	0.17	-0.41	0.34
FMU	2.00	5.00	3.78	0.80	0.08	0.17	-0.83	0.34
LRS	1.00	5.00	3.76	0.81	-0.03	0.17	-0.38	0.34
ACP	1.00	5.00	3.98	0.79	-0.26	0.17	-0.32	0.34
RTK	1.00	5.00	3.97	0.84	-0.24	0.17	-0.68	0.34
TSE	1.00	5.00	3.90	0.85	-0.14	0.17	-0.73	0.34

Inferential Statistics

Impact of MTU

The ANOVA results (Table) indicate a statistically significant association between MTU and all dependent variables(LRS:F=240.19; p=0.00, ACP: F=382.78' p=0.00;RTK: F=283.83, p=0.00; TSE: F=256.03; p=0.00) (Table 4) confirming statistically significant differences among the groups. The between-group mean squares for LRS (102.46), ACP (120.91), RTK (95.76), and TSE (111.31) suggest considerable variation attributed to the different levels of MTU. Additionally, the within-group variances remain low, as reflected in mean squares of 0.43 for LRS and TSE and 0.32 and 0.34 for ACP and RTK, respectively.

Table 4: Association of MTU

		Sum of Squares	df	Mean Square	F	Sig.
LRS	Between Groups	307.39	3.00	102.46	240.19	0.00
	Within Groups	86.17	202.00	0.43		
	Total	393.56	205.00			
ACP	Between Groups	362.72	3.00	120.91	382.78	0.00
	Within Groups	63.81	202.00	0.32		
	Total	426.52	205.00			
RTK	Between Groups	287.28	3.00	95.76	283.83	0.00
	Within Groups	68.15	202.00	0.34		
	Total	355.44	205.00			
TSE	Between Groups	333.93	3.00	111.31	256.03	0.00
	Within Groups	87.82	202.00	0.43		
	Total	421.75	205.00			

Impact of SEL

SEL does not significantly influence LRS and TSE, as indicated by low F-values (0.32 and 0.72, respectively) and high p-values (0.81 and 0.54) (Table 5). Conversely, SEL exhibits a significant association with ACP ($F = 299.81$, $p < 0.00$) and RTK ($F = 258.24$, $p < 0.00$), with high between-group mean squares (ACP: 101.49, RTK: 91.97) and relatively low within-group variances (ACP: 0.34, RTK: 0.36). These findings suggest SEL substantially impacts ACP and RTK but not LRS or TSE.

Table 5: Association of SEL

		Sum of Squares	df	Mean Square	F	Sig.
LRS	Between Groups	0.92	3.00	0.31	0.32	0.81
	Within Groups	195.08	202.00	0.97		
	Total	196.00	205.00			
ACP	Between Groups	304.46	3.00	101.49	299.81	0.00
	Within Groups	68.38	202.00	0.34		
	Total	372.84	205.00			
RTK	Between Groups	275.92	3.00	91.97	258.24	0.00
	Within Groups	71.94	202.00	0.36		
	Total	347.86	205.00			
TSE	Between Groups	2.28	3.00	0.76	0.72	0.54
	Within Groups	213.54	202.00	1.06		
	Total	215.83	205.00			

Impact of INM

INM significantly impacts LRS, as shown by a high F-value (272.57) and a p-value of 0.00, with a substantial between-group mean square (86.82) and low within-group variance (0.32) (Table 6). However, no significant association is observed for ACP, RTK, and TSE, with low F-values (0.15, 0.02, and 0.40, respectively) and high p-values (0.93, 0.99, and 0.75). These results indicate that while INM having a statistically significant association with LRS, its impact on ACP, RTK, and TSE is negligible.

Table 6: Association of INM

		Sum of Squares	df	Mean Square	F	Sig.
LRS	Between Groups	260.47	3.00	86.82	272.57	0.00
	Within Groups	64.34	202.00	0.32		
	Total	324.82	205.00			
ACP	Between Groups	0.83	3.00	0.28	0.15	0.93
	Within Groups	372.01	202.00	1.84		
	Total	372.84	205.00			
RTK	Between Groups	0.13	3.00	0.04	0.02	0.99
	Within Groups	347.74	202.00	1.72		
	Total	347.86	205.00			
TSE	Between Groups	1.29	3.00	0.43	0.40	0.75
	Within Groups	214.54	202.00	1.06		
	Total	215.83	205.00			

Impact of FMU

FMU does not significantly influence LRS, ACP, or RTK, as reflected by low F-values (0.24, 0.26, and 1.24, respectively) (Table 7) and high p-values (0.86, 0.85, and 0.30). In contrast, FMU significantly impacts TSE,

with a very high F-value (331.09) and a p-value of 0.00, supported by a substantial between-group mean square (106.36) and low within-group variance (0.32). These findings indicate that FMU is significantly associated with TSE but has negligible effects on LRS, ACP, and RTK.

Table 7: Association of FMU

		Sum of Squares	df	Mean Square	F	Sig.
LRS	Between Groups	1.18	3.00	0.39	0.24	0.86
	Within Groups	323.64	202.00	1.60		
	Total	324.82	205.00			
ACP	Between Groups	1.44	3.00	0.48	0.26	0.85
	Within Groups	371.40	202.00	1.84		
	Total	372.84	205.00			
RTK	Between Groups	6.28	3.00	2.09	1.24	0.30
	Within Groups	341.58	202.00	1.69		
	Total	347.86	205.00			
TSE	Between Groups	319.08	3.00	106.36	331.09	0.00
	Within Groups	64.89	202.00	0.32		
	Total	383.97	205.00			

Discussions

It was revealed through the hypothesis testing that MTU is associated with all the variables of enhancing student engagement and learning outcomes. These findings align with earlier research on technology-enabled learning. For instance, Al-Mukhaini et al. (2014) demonstrated that the integration of multimedia resources in Oman significantly improved student engagement and academic performance, corroborating the strong association of MTU with LRS and ACP in the current study. Similarly, Khalil and Ebner (2016) found that the use of multimedia tools in Austrian higher education institutions enhanced RTK by making content more accessible and interactive. The significant relationship between MTU and TSE resonates with the findings of Hasan (2024), who reported that technology adoption among Kuwaiti students boosted their confidence and self-efficacy.

Wu (2024) through the research on multimedia learning theory supports the significant influence of MTU on LRS by promoting active cognitive engagement. In the Gonzáles-Gutierrez et al., (2022) identified multimedia tools as critical in fostering academic performance (ACP) in classrooms, echoing the ANOVA results of this study. A study by Albahouth (2024) in Saudi Arabia highlighted how consistent use of multimedia tools minimized within-group variations in academic outcomes, akin to the low within-group variances noted here. Additionally, Segar & Asmawi (2024) validated the role of multimedia-enhanced environments in improving retention of knowledge (RTK) across diverse student groups in English language learning, supporting the significant findings for RTK. Finally, the robust link between MTU and TSE in this study aligns with findings by Ghazali et al., (2024), who emphasized the role of multimedia in fostering technology self-efficacy among educators and students globally.

It was also revealed through the hypothesis testing that SEL was significantly associated with ACP and RTK, but not with LRS and TSE. The findings align with existing research on technology-enabled learning, where student engagement has been shown to have a differential impact on learning outcomes. For instance, Chen (2024) found that multimedia-enhanced education improved ACP significantly, particularly in higher education settings. Similarly, a study by Rosyara (2024) found that RTK is positively influenced by interactive and engaging multimedia tools. However, like the current study, research by Zepke and Leach (2010) noted that engagement levels do not always directly correlate with LRS or TSE, as these outcomes are influenced by factors beyond engagement, such as intrinsic motivation and prior exposure to technology.

Alqurashi (2016) observed in a blended learning environment that engagement strongly predicts performance outcomes but has a limited direct effect on satisfaction. These patterns are consistent across regions; for example, Martin and Bolliger (2018) found that while student engagement is crucial for academic success in technology-enabled settings, it does not uniformly translate to higher satisfaction or self-efficacy, echoing the study's findings. In the context of Kuwait, Al-Hunaiyyan et al. (2020) highlighted that multimedia tools primarily enhanced knowledge retention and performance rather than satisfaction metrics. Collectively, this

body of evidence supports the nuanced role of student engagement in influencing specific learning outcomes, reinforcing the conclusions drawn in this study.

The hypothesis testing has revealed that INM is significantly associated with LRS but not with ACP, RTK and TSE. Studies have consistently shown that interactive instructional strategies incorporating multimedia tools enhance student satisfaction by fostering engaging and dynamic learning environments (Zuhairi et al., 2024). However, the negligible impact of INM on ACP echoes research by Alenezi (2020), which found that the mere presence of technology in classrooms does not directly improve grades unless complemented by robust pedagogical practices. The insignificant association with technology self-efficacy (TSE) concurs with research by Scott & Walczak (2009) suggesting that self-efficacy is more strongly influenced by personal experience with technology rather than the instructional method itself.

Furthermore, the strong impact of INM on LRS supports findings from Kuwait by Henda & Alkhezzi (2022), which emphasized that innovative instructional strategies significantly elevate student satisfaction in higher education. In contrast, research by Demetriadis et al., (2008) highlights that while multimedia strategies improve engagement, their effects on academic outcomes are context-dependent. Additionally, through studies in Bangladesh, Azad (2024) suggest that faculty training in integrating multimedia effectively is critical to maximizing benefits across all outcomes, including ACP and RTK. These corroborations highlight the nuanced role of INM, emphasizing the need for comprehensive approaches to technology-enhanced learning in Kuwait's educational context.

Hypothesis testing also revealed that FMU significantly impacts TSE but does not significantly influence LRS, ACP, or RTK. The findings of this study align partially with prior research on technology-enabled learning in Kuwait and globally, highlighting varied impacts of FMU on learning outcomes. For instance, Hasan (2024) found that frequent use of multimedia tools significantly enhanced TSE among students in Kuwait, as students reported greater confidence in using technology for learning tasks. However, studies such as Hoch et al., (2021) observed that FMU often does not directly translate to improved LRS or ACP, supporting the lack of significant association in this study. Similarly, a meta-analysis by Schmid et al. (2014) revealed that while multimedia integration can boost technology-related self-efficacy, its impact on RTK and academic outcomes depends heavily on instructional strategies. Moreover, Wu et al., (2024), emphasized that FMU must be paired with interactive teaching methods to significantly influence LRS and ACP.

Implications Of The Research

Implications of this research are in the form of suggestions to the top-level leadership and multimedia developers to improve the effectiveness of multimedia-based learning in the colleges of basic education in Kuwait. These suggestions are based on the time-tested methods used in various universities across the world and also well researched for their effectiveness.

As it was revealed through this research that MTU had a statistically significant association with all the dependent variables of this research, the top-leadership should provide regular and advanced training for faculty to effectively integrate the advanced multimedia tools into their teaching practices (Anselmo et al., 2024), enhancing TSE and improving student LRS. The academics should collaborate with multimedia developers to create curriculum academically aligned, culturally relevant, and interactive content that directly supports ACP, RTK, and SEL. Promoting structured use of multimedia tools in classrooms through academic policies and incentives (Lubis, 2023), ensuring optimal FMU and aligning it with specific learning outcomes is worth a try. Ensuring seamless access to updated multimedia tools and infrastructure in all classrooms (Ahmad, 2024), including reliable internet and technical support, to maintain consistent and effective usage may be initiated. Integrating multimedia tools that facilitate group activities and discussions, which can amplify SEL and foster a deeper connection between students and instructors may also be initiated. Establishing systems for collecting feedback from students and faculty on the effectiveness of multimedia tools (Rosyara, 2024), enabling iterative improvements in INM and alignment with desired learning outcomes is quintessential.

It was revealed that SEL had a statistically significant association with ACP and RTK. Drawing through this revelation, incorporating teaching methodologies like flipped classrooms and problem-based learning that actively engage students (Zainuddin et al., 2024), fostering both ACP and RTK through the use of multimedia may be tried. Redesigning classrooms and learning environments to support collaborative and interactive activities that naturally boost SEL while improving ACP and RTK will surely help (Leow & Neo, 2015). Encouraging initiatives that integrate multiple subjects into engaging and real-world cross-disciplinary projects (Igbinenikaro et al., 2024) to enhance student involvement and reinforce knowledge retention can be tried. Using digital platforms to track and analyze SEL metrics (Rafique, 2023), enabling data-driven interventions to enhance ACP and RTK outcomes (Cacheda et al., 2024) has to be initiated. Offering workshops, hackathons, and competitions that align with curriculum objectives to increase engagement (Garcia, 2024) and indirectly boost ACP and RTK. Developing structured peer mentoring systems where students engage with each other to deepen understanding and improve performance (Rojas-Ocaña, et al., 2024) will help leveraging SEL to enhance both ACP and RTK.

It was revealed that INM had a statistically significant association with LRS. So, encouraging faculty to employ varied instructional methods, such as case-based learning, storytelling, and simulation exercises (Mu & Hatch, 2024), to cater to diverse learning preferences and enhance LRS has to be tried. Establishing mechanisms for real-time student feedback during instruction (Wang et al., 2024), allowing educators to adapt their methods dynamically to improve satisfaction levels. Designing instructional content that reflects local contexts and cultural values (Mpuangnan & Ntombela, 2024), especially related to the rich heritage of Kuwait, ensuring students find the methods relatable and engaging, can improve LRS. Combining traditional classroom teaching with online modules to create a hybrid instructional method (Ravichandran, 2024) that enhances flexibility and satisfaction among learners may be tried. Using micro-learning modules, focused instructional sessions to break down complex topics (Alias & Razak, 2024), making the learning experience more manageable and satisfying for students will also enhance LRS. Organizing workshops and faculty development programs (Kerimbayeva et al., 2024) to share and implement INM that have demonstrated effectiveness in boosting LRS.

Lastly, FMU has a statistically significant association with TSE as revealed in the hypothesis testing. Drawing from this revelation it is advisable to collaborate with developers to design adaptive multimedia tools that are flexible to users' proficiency levels, gradually increasing complexity to build TSE over time (Benkhalfallah et al., 2024). Offering specialized certification programs for students and faculty to enhance their expertise in specific multimedia tools (Cowley et al. 2021), directly improving TSE can be tried. Introducing gamification elements within multimedia tools, such as badges and rewards for frequent and effective use (Alkhawaldeh & Khasawneh, 2024), fostering greater technology self-efficacy can help. Developing analytics dashboards that visualize the frequency and effectiveness of multimedia tool use (Brown et al., 2024. June), enabling users to self-assess and improve their technological skills has been successfully tried in many universities and hence worth a try. Encouraging students and faculty to create custom multimedia content for teaching and learning purposes, which will increase their hands-on experience and confidence in using such tools can also be introduced in the colleges of basic education in Kuwait.

Conclusion

This research investigates the impact of the key factors of multimedia usage on the educational outcome achievement, as perceived by the students of Basic Education in Kuwait. The study emphasizes the increasing importance of multimedia in transforming traditional education into an interactive and engaging experience. By addressing gaps in understanding the specific roles and interactions of these variables, this research contributes to the broader discourse on effective multimedia integration in the foundational education in Kuwait.

The study is based on survey strategy, collecting data from a sample of 206 final year and pre-final year students in Kuwait's Colleges of Basic Education. A mixed approach was adopted, with responses gathered through both Google Forms (32 responses) and hard copies (174 responses), ensuring diverse participation. Statistical analyses, including reliability tests and ANOVA, were employed to explore the relationships between the constructs and assess the internal consistency of the data.

The findings reveal that MTU is the most critical factor that has a significant positive association with all the four variables of learning outcome achievement. SEL had a significant impact on ACP and RTK; INM had a significant impact on LRS; and FMU had an impact on TSE.

Based on these findings, the study offers actionable implications for top leadership of colleges of Basic Education and multimedia developers. Leadership should prioritize faculty training programs, invest in infrastructure to support multimedia integration, and encourage pedagogical innovations that align with multimedia usage. Multimedia developers should focus on creating adaptive, interactive, and culturally relevant content tailored to students' needs. Collaborative efforts between educators and developers can further enhance the educational value of multimedia in Kuwait's foundational education.

Despite its contributions, the study has limitations, including its focus on a single educational context and reliance on self-reported data, which may introduce biases. Future research could expand to include longitudinal studies or explore additional variables that influence educational outcomes in multimedia-rich environments.

This study is particularly timely, as it aligns with Kuwait's broader efforts to modernize education and integrate technology into teaching practices. As the demand for innovative educational approaches grows, the findings provide critical insights for educators, administrators, and policymakers seeking to leverage multimedia to enhance learning outcomes and student success.

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