Impact of multimedia technology on university students learning agility and creativity

أثر تكنولوجيا الوسائط المتعددة على سرعة تعلم طلاب الجامعات وإبداعهم

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Abstract

Multimedia technology is argued in the literature to play a critical role in enhancing students' learning agility and creativity. Nevertheless, only a few studies have empirically investigated the same, particularly among university students. This is especially vital for Saudi Arabia's higher education sector, where significant resources have been invested under the Vision 2030 program. Recently, multimedia technology has included upcoming technologies such as artificial intelligence, augmented reality, and virtual reality. This study empirically investigates the impact of multimedia technology on the development of university students' learning agility and creativity. In this study, we employed a quantitative methodology. We surveyed 318 university students to accomplish the research objectives. The study's findings underscore that availableness and multimedia technology deployment are vital to developing university students' learning agility and creativity. The study contributes to the literature regarding technology adoption and skill enhancement. Additionally, the findings of the study aid in the achievement of Saudi Vision 2030 by increasing awareness of multimedia technology use to foster university students learning agility and creativity.

Keywords: Multimedia technology, learning agility, creativity, students, Saudi Arabia, Vision 2030.

خلاصة

يقال في الأدبيات أن تكنولوجيا الوسائط المتعددة تلعب دورًا حاسمًا في تعزيز سرعة التعلم والإبداع لدى الطلاب. ومع ذلك، لم تقم سوى عدد قليل من الدراسات بالبحث التجريبي في الأمر نفسه، خاصة بين طلاب الجامعات. وهذا أمر حيوي بشكل خاص لقطاع التعليم العالي في المملكة العربية السعودية، حيث تم استثمار موارد كبيرة في إطار برنامج رؤية 2030. في الآونة الأخيرة، شملت تكنولوجيا الوسائط المتعددة التقنيات القادمة مثل الذكاء الاصطناعي، والواقع المعزز، والواقع الافتراضي. تبحث هذه الدراسة تجريبيا في تأثير تكنولوجيا الوسائط المتعددة على تنمية سرعة التعلم والإبداع لدى طلاب الجامعة. في هذه الدراسة، استخدمنا المنهجية الكمية. قمنا باستطلاع آراء 318 طالبًا جامعيًا لتحقيق أهداف البحث. تؤكد نتائج الدراسة على أن التوفر ونشر تكنولوجيا الوسائط المتعددة أمران حيويان لتطوير سرعة التعلم والإبداع لدى طلاب الجامعة. وتساهم الدراسة في الأدبيات المتعلقة بتبني التكنولوجيا وتعزيز المهارات. بالإضافة إلى ذلك، تساعد نتائج الدراسة في تحقيق رؤية السعودية 2030 من خلال زيادة الوعي باستخدام تكنولوجيا الوسائط المتعددة لتعزيز مرونة التعلم والإبداع لدى طلاب الجامعة.

الكلمات المفتاحية :تكنولوجيا الوسائط المتعددة، سرعة التعلم، الإبداع، الطلاب، المملكة العربية السعودية، رؤية 2030.

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Introduction

In recent years, cultivating students' learning agility and creativity has become a primary educational objective worldwide, owing to their considerable financial, social, and individual benefits (Vincent-Lancrin et al., 2019). Technology plays a significant role in the classroom environment (Singh et al., 2013).

Multimedia technology has the potential to greatly enhance students' learning agility and creativity via the provision of novel tools and environments (Pun, 2013; Glaveanu et al., 2019). Multimedia technology can play an essential role in advancing the human capital of a nation (Singh & Alhamad, 2022a) and invigorating the youth's mind (Singh & Agarwal, 2011). Therefore, academicians in several nations also believe multimedia technology can foster students learning agility and creativity (Park et al., 2019).

In the last decade, multimedia technology has been integrated into education (Alam et al., 2022). LCD or DLP projectors, smartboards, digital cameras, classroom response systems, and document cameras were previous instances of this technology in the classroom (Singh & Chand, 2012). Recently, technologies like augmented reality (AR), virtual reality (AR), and artificial intelligence (AI) have been integrated with multimedia technology to deliver interactive education to students in the classroom (Saddik, 2018). In the twenty-first century, internet resources and multimedia technology-based applications aid instructors in imparting more advanced learning degrees while maintaining academic integrity (Callet & Niebur, 2013).

It provides students with beneficial tools for honing their critical thinking and problem-solving abilities (Neo & Neo, 2009; Alhamuddin et al., 2023).

Multimedia technology learning tools are distinctive in facilitating student engagement with authentic situations. It makes the study interesting for the students, which is important for continuing their education (Singh & Alhamad, 2022b). Furthermore, the educational benefits of simulation and visualization cannot be replicated in a textbook or other written materials (Singh et al., 2011a; Guo et al., 2020). Consequently, multimedia technology in educational settings effectively engages and sustains students' interest (Shi & Liang, 2012). The classroom's use of multimedia technology can catalyze students' critical thinking and expose their creativity (Sabzian et al., 2013).

However, the results of more current and earlier meta-analyses and reviews indicate that only limited research has examined the impact of learning interventions augmented with multimedia technology on students' learning agility and creativity (Valgeirsdottir & Onarheim, 2017), especially university students. This is especially critical in the Saudi Arabian higher education sector, where advanced technologies have been integrated into the higher education sector under the Vision 2030 program (Singh & Alshammari, 2023; Al-Mamary & Al-Shammari, 2023; Beyari & Alrusaini, 2023). Further, instructors teach university students in Saudi Arabia through multimedia tools such as video conferencing (Alquhaif et al., 2023). Therefore, this research addresses the impact of multimedia technology in developing university students learning agility and creativity.

Study Objectives

The current study objectives are:

1. To investigate the impact of multimedia technology in developing university students learning agility and creativity.
2. To suggest strategies for developing the learning agility and creativity of university students.
3. To acknowldge the contribution of the study to the technology adoption and skill development literature.

Literature Review

The learning agility of university students is considered a critical factor for their fruitful educational attainment in the current technology-driven environment (Singh, 2017). Learning agility in a technological environment is defined as the student's ability to learn, adapt, and orient toward new technologies (De Meuse et al., 2010). Learning agility is considered an essential skill for young learners to seek jobs in today's technology-driven marketplace (Hwangbo et al., 2019; Singh et al., 2011b). Learning agility allows students to learn technology-related skills in an educational environment and later apply the skills they learned in their work environment (Singh et al., 2011c; Dries et al., 2012).

Creativity is widely referred to as a process by which an individual or group generates something that is both innovative or original and practical or suitable for a given social setting. Many personal and environmental variables

impact creativity (Plucker et al., 2004; Richardson & Mishra, 2018). Various studies have established that students' creativity can be enhanced and identified numerous factors influencing creative development. While intervention studies have shown that creativity may be fostered in academic and non-academic contexts from kindergarten to adulthood, no widely acknowledged formulae or sets of instructions ensure success (Lai et al., 2018).

A multimedia learning environment entails presenting information via multiple channels, such as auditory and visual (Jiang & Benbasat, 2007; Takács et al., 2015; Michalski et al., 2016). Educational technology researchers have historically examined multimedia technology (Donnelly et al., 2010; Yu, 2021). The primary focus of the majority of researchers is the enhancement of teacher-student interactions using multimedia technologies. Numerous published works have theorized on multimedia technology to foster learning agility and creativity (Loveless, 2007; Anseel, 2017; Glaveanu et al., 2019). For instance, Loveless (2007) suggests that the interplay between the characteristics of digital technologies, the ability of learners to express elements of higher-order thinking through technology, and creative processes gives rise to activities that emphasize creativity in the context of new technologies. According to Anseel (2017), multimedia technology is important for young learners' learning, skill-building, and creative potential in a technology-driven environment. Glaveanu et al. (2019) suggest that multimedia technology can be a nurturing medium, facilitating an atmosphere that promotes learning agility and creativity.

Some researchers examine the influence of digital technology on developing creativity and learning agility by focusing on the dynamics of human-computer interaction. Lubart (2005) and Glaveanu et al. (2019) had four possible societal functions for computers in the context of learning

agility and creative activity. The first function is that of a "nanny computer", which means technology's ability to help the learning agility and creativity by offering a nurturing atmosphere and mentality. The second function of technology is to serve as a pen pal, enabling learners to exchange ideas and enhance communication and cooperation throughout the creative and learning process. The third role pertains to the "computer as coach," whereby computers function as expert systems that enhance students' learning and creativity by providing academic materials that strengthen cognitive processes, methods, and approaches associated with creativity. The fourth function is "computer as a collaborator," which means that computers may actively contribute to the production, assessment, and refining of ideas in collaboration with learners throughout the learning and creative process.

Although the correlation between technology, learning agility, and creativity is often discussed in the field of education, limited studies have examined the impact of multimedia technology on students' learning agility and creativity, according to previous literature reviews and meta-analyses (Valgeirsdottir & Onarheim, 2017).

Thus, the literature review suggests that

- Multimedia technology presents the potential to foster student learning agility and creativity.
- There is a paucity of studies that have investigated multimedia technology's impact on student learning agility and creativity.

Accordingly, this study will create knowledge to utilize the potential of multimedia technology to foster student learning agility and creativity.

Moreover, it would fill the identified research voids in the existing body of literature.
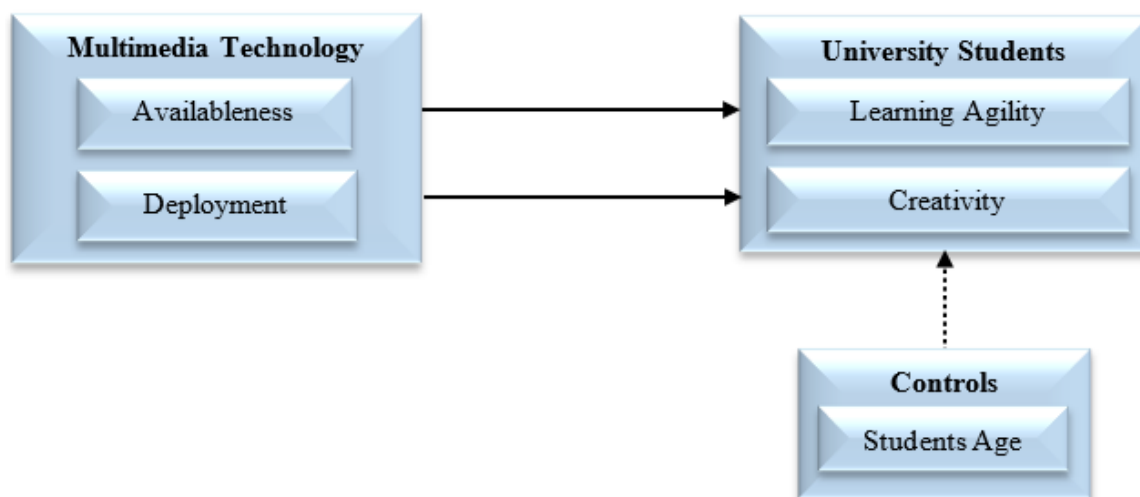
Figure 1. Model of Multimedia Technology Impact on Students' Learning Agility and Creativity (Authors design)

The model used in this study is illustrated in Figure 1. The model illustrates multimedia technologies' effect on developing students' learning agility and creativity. The research included a control variable: students' age.

The hypotheses of research are presented as follows:

H1: Multimedia technology positively impacts the learning agility of university students.

H2: Multimedia technology positively impacts the creativity of university students.

Methodology

A quantitative research method was implemented to accomplish the research goals. Now we explain the research components, including the sampling, data gathering methods, variables, regression model, and analytic approaches.

Sampling

This research gathered primary data by employing questionnaires. Surveys were given at the University of Ha'il (Saudi Arabia) to evaluate the effect of multimedia technology on the learning agility and creativity of university students. Non-probabilistic sampling was utilized to obtain responses from 318 university students. The features of the sample utilized in this investigated study are presented in Table 1.

Table 1.
Features of the Study Sample

Variable(s)	Type(s)	Number(s)	%age
Study Year	Year-1	82	25.79
	Year-2	80	25.16
	Year-3	79	24.84
	Year-4	77	24.21
Age Group	18-22	175	55.03
	23-27	101	31.76
	28-32	42	13.21
Student Gender	Male(s)	157	49.37
	Female(s)	161	50.63

Questionnaire Development and Distribution

We developed a survey to collect the primary data, The survey employed a five-point Likert scale (ranging from strongly agree to strongly disagree) to get student perspectives on the influence of multimedia technology on learning agility and creativity. The survey questions were translated into Arabic to augment the students' understanding and involvement. We were able to

survey several students while minimizing possible bias using the online distribution and collection of surveys (Singh & Alwaqaa, 2023). Before soliciting their participation, students were provided with a comprehensive explanation of the research objectives and informed that their answers would remain confidential. The students who provided their permission participated in the surveys.

Variables

Table 2 presents the variables utilized in the current research and their definitions.

Table 2.
Study Variables and Definitions

Variable(s)	Definition
Dependent Variable(s)	
Learning Agility (LAG)	Student's ability to learn, adapt, and orient towards new technologies (De Meuse et al., 2010)
Creativity (CTY)	A process by which an individual or group generates something that is both innovative or original and practical or suitable for a given social setting (Plucker et al., 2004; Richardson & Mishra, 2018)
Independent Variable(s)	
Availableness (ALS)	The availableness of various forms of multimedia technology (such as VR, AR, AI, interactive learning activities, etc.) to university students (Sabzian et al., 2013)
Deployment (DPY)	Effective deployment of multimedia technology by students for educational objectives (such as assignments, class discussions, exam evaluations, etc.) (Abdulrahaman et al., 2020)
Control Variable	
Student's Age (SAG)	Student's age (Singh & Alodaynan, 2023)

This study's dependent variables are the students' learning agility (LAG) and creativity (CRE). Deployment (DPY) and availability (ALS) of multimedia technologies are two independent variables. As the age of students may influence their propensity to acquire learning agility and innovation in the classroom, we controlled age (SAG) in the model.

Study Models

We examined the regression models for determining multimedia technology's impact on university students learning agility and creativity:

$$LAG_t = \beta_0 + \beta_1\ ALS_t + \beta_2\ DPY_t + \beta_3\ SAG_t + \varepsilon_t \quad (1)$$

$$CTY_t = \beta_0 + \beta_1\ ALS_t + \beta_2\ DPY_t + \beta_3\ SAG_t + \varepsilon_t \quad (2)$$

Where,

LAG – Learning Agility
CTY – Creativity
ALS – Availableness
DPY – Deployment
SAG – Student's Age
ε – Error term

Data Analysis Method

The present investigation used ordinary least squares (OLS) regression analysis to assess the influence of multimedia technology on the learning agility and creativity of university students. Linear regression coefficient estimation is the primary aim of OLS regression analysis, with the consequence of minimizing the discrepancy between estimated and actual values (Hosman et al, 2010; Singh et al., 2023). This research used the OLS regression approach because of its successful alignment with the investigation's aims.

Analyses and Results

Descriptive Data and Correlation Coefficients

Table 3 shows the descriptive data of the variables. The presented data includes the mean values for the following variables: the student's age (25.27), the availability of multimedia technology (3.99), creativity (4.06), and the successful deployment of multimedia technology (4.01). Variance in data is quantified in terms of the coefficient of variation (CV) concerning a reference population (Singh et al., 2022a). Each variable in the research has a low CV (Table 3).

Table 3.
Descriptive Data

Variable(s)	Mean	Min.	Max.	Std. Dev.	Coeff. of Variation
Learning Agility (LAG)	4.12	1	5	0.71	0.17
Creativity (CTY)	4.06	1	5	0.65	0.16
Availableness (ALS)	3.99	1	5	0.72	0.18
Deployment (DPY)	4.01	1	5	0.88	0.22
Students Age (SAG)	25.27	18	32	4.89	0.19

The Pearson correlation coefficients for every variable in the research are shown in Table 4. If the explanatory variables have a significant bilateral correlation, there may be worries about multicollinearity (Singh et al., 2022b). In the presence of multicollinearity among independent variables, p-values will fail to accurately predict the significance of the variables, resulting in less precise coefficients (Alhamad & Singh, 2021; Jiehong et al., 2022). The absence of substantial relationships among the explanatory factors is seen in Table 4 (Singh & Alhulail, 2022).

Table 4.
Correlation Coefficients

Variable(s)	LAG	CTY	ALS	DPY	SAG
Learning Agility (LAG)	1				
Creativity (CTY)	0.201	1			
Availableness (ALS)	0.303	0.215	1		
Deployment (DPY)	0.298	0.285	0.306	1	
Students Age (SAG)	0.305	0.308	0.257	0.278	1

Multicollinearity and Heteroscedasticity Statistics

The present research data were subjected to the requisite checks for multicollinearity and heteroscedasticity (Table 5). To assess multicollinearity, variance inflation factor (VIF) values were used. Multicollinearity concerns were absent in the data (Table 5); all VIF values were below 5 (Alın, 2010; Singh & Alhulail, 2023). Heteroscedasticity was then evaluated using the Breusch-Pagan & Koenker (B.P.K) test. All of the p-values for the B.P.K test were below 0.05, leading us to conclude no heteroscedasticity concerns (Lewbel, 2012; Singh, H. P., & Alhamad, 2021).

Table 5.
VIF and B.P.K P-Value(s)

Variable(s)	VIF Value(s)	B.P.K P-Value(s)
Learning Agility (LAG)	2.874	0.014
Creativity (CTY)	2.978	0.025
Availableness (ALS)	3.057	0.031
Deployment (DPY)	3.142	0.019
Students Age (SAG)	3.168	0.034

Hypotheses Testing Analyses

The hypotheses are tested via multivariate regression analysis, as seen in Table 6.

Model A (LAG) in Table 6 illustrates an adjusted R^2 value of 0.612. This value accounts for 60.4% of the variation in the relationship between multimedia technology availableness and deployment (McCausland et al., 2021). A p-value of 0.021 depicts that the model is statistically significant at the 5% level. This indicates that using multimedia technologies improves university students' learning agility. This validates the hypothesis H1 of this investigation. Moreover, a noteworthy and favorable correlation exists between the availableness and deployment of multimedia technologies for university students and their capacity for learning agility. This suggests that the availability and

efficient use of multimedia technologies are critical factors in developing the learning agility of students.

The proportion of variance explained by the availability and implementation of multimedia technology is 62.1%, as depicted by the modified R^2 of 0.621 in model B (CTY) (Table 6). The p-value for the model is 0.018, which is statistically significant at a 5% confidence level. This shows that the usage of multimedia technologies enhances the creative abilities of university students. Therefore, we accept hypothesis H2 of the research. Furthermore, a noteworthy and favorable correlation exists between university students' creativity level and the availableness and deployment of multimedia technologies. This suggests that the availableness and deployment of multimedia technologies are essential components in nurturing innovation among university students.

Table 6.
Hypotheses Testing Analyses

Variable(s)	Model A (LAG)				Model B (CTY)			
	Coeff. (B)	Std. Error	T-Stat	P-Value	Coeff. (B)	Std. Error	T-Stat	P-Value
Availableness (ALS)	4.612**	1.639	2.814	0.005	4.614**	1.693	2.725	0.007
Deployment (DPY)	4.582**	1.641	2.792	0.006	4.512**	1.698	2.657	0.008
Students Age (SAG)	0.812	0.603	1.347	0.179	0.825	0.606	1.361	0.175
R^2	0.581				0.593			
Adjusted R^2	0.612				0.621			
P-Value	0.021*				0.018*			

Note: A result is deemed significant at the 0.05 and 0.01 levels, denoted by * and **

Discussion

The research results have shown that availableness and deployment of multimedia technologies foster the learning agility of university students. These results are aligned with prior research, especially Loveless (2007), Anseel (2017), and Glaveanu et al. (2019), who informed student learning agility can be enhanced by employing multimedia technologies. This finding confirms Loveless's (2007) assertion that multimedia technology assists students sharpen their unique learning styles. This finding also supports Anseel's (2017) and Glaveanu et al.'s (2019) assertions that multimedia technology nurtures the learning agility of young learners in a technology-driven environment. Previous scholarly works have postulated that technology has the potential to enhance learning agility. Nevertheless, the present study surpasses this expectation by providing empirical evidence that supports this claim in the context of multimedia technology. Furthermore, the current research contributes to the extant literature by demonstrating the criticality of university administration efficiently utilizing and deploying multimedia technology to promote students' learning agility.

The research findings demonstrate that the presence and use of multimedia technology stimulate the ingenuity of university students. The findings presented in this study are consistent with previous research, particularly those of Loveless (2007), Anseel (2017), and Glaveanu et al. (2019), which demonstrated that the use of multimedia tools may improve the creative capacities of students. This result provides more evidence in favor of Loveless's (2007) assertion that multimedia technology cultivates the creative abilities of university students. This study further substantiates the claims made by Anseel (2017) and Glaveanu et al. (2019) that in a technology-driven environment, young learners' creativity is fostered via the use of multimedia technology. Prior academic literature has expected that technology may augment the capacity for creativity. However, this anticipation is surpassed by the current research, which supports this assertion within the realm of multimedia technology. Moreover, the present investigation makes a scholarly contribution by illustrating the importance of university administration's effective use and deployment of multimedia technology to foster students' creative potential.

Conclusions

In this study, 318 Saudi university students were surveyed by employing a quantitative methodology. This study illustrated the influence of multimedia technology on the learning agility and creativity of university students by employing an empirical methodology. Previous studies have suggested that technology might enhance students' learning agility and creativity. The results of the study supported the

conclusions drawn in prior studies, which indicated that improvements in multimedia technology are essential for fostering students' learning agility and creativity. However, the present study went a step further and offered empirical evidence to support this claim in the context of multimedia technology. The present investigation enriches the extant literature on skill development and technology management by demonstrating how crucial it is for university administration to implement and utilize multimedia technology effectively to develop students' learning agility and creativity.

As part of its Vision 2030 government initiative, Saudi Arabia invested substantially in its educational institutes. Accordingly, the research findings have considerable implications for the country. The findings will provide valuable insights for emerging countries like Saudi Arabia, which want to foster a culture of innovation and adaptability among university students. Innovation and learning agility are critical qualities that Saudi university students must develop to realize the goals outlined in Saudi Vision 2030. The results of this research suggest that the integration of multimedia technologies in the classroom might have a substantial impact on promoting learning agility and innovation among university students in Saudi Arabia. Hence, Saudi institutions need to strive for the proliferation and integration of developing multimedia technologies to enhance students' learning agility and promote their creativity. In the realm of higher education in Saudi Arabia, the promotion of developing multimedia technologies like augmented reality (AR), virtual reality (AR), and artificial intelligence (AI) should be given special consideration.

Limitations

This study possesses certain drawbacks that could be in further research. The present inquiry included 318 students hailing from a solitary public institution in Saudi Arabia. In subsequent investigations, it is possible to augment the sample size by gathering data from more institutions. Subsequently, scholars may collect data from private and public colleges to compare their strategies for fostering learning agility and innovation among students. Future research may also collect data from other institutes (like colleges of education and polytechnic colleges) to investigate multimedia technology's effect on students' learning agility and creativity across various contexts. Future research may include surveying graduates to determine their level of

commitment to developing their learning agility and creativity. Given the cultural similarities between Saudi Arabia and the other Gulf Cooperation Council (GCC) states, future scholars may also benefit from collecting data from these countries.

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