The Role of Digital Tools in Enhancing Student Engagement: A Study of Technology Integration in KSA Classrooms

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Abstract

This study investigates using quantitative research design, in which digital tools have and continues to affect student engagement in KSA classrooms. Structured surveys and questionnaires were administered to 170 participants, and data was collected from teachers and students at various levels of education. Performing the analysis using SPSS reveals significant findings about the challenges and benefits of digital tool integration. It showed significant results dealing with the challenges and benefits of digital tool integration. Statistical results reveal that the use of digital tools dramatically increased student engagement (mean = 1.46, SD = 0.500), understanding of complex material (mean = 1.49, SD = 0.501), critical thinking (mean = 1.50, SD = 0.501), and collaboration (mean = 1.55, SD = 0.499). Nevertheless, major barriers include poor access to devices (31.8%), technical difficulties (30.6%), and absence of training (17.1%). The study underscores the important role that context-specific strategies and comprehensive professional development can play in maximizing the usefulness of these tools. Some recommendations include access to devices, strengthening technical infrastructure,

continuing to train teachers, and identifying ways of studying the long-term consequences of digital tools in education.

Keywords *KSA classrooms, quantitative research, teacher training, technology integration, digital tools, student engagement, SPSS analysis, critical thinking, collaboration*.

1. Introduction

1.1 Background

Educational digital transformation has been a huge turn over the past 2 to 3 decades leading to a radical transformation in the educational processes of teaching and learning. (Akour and Alenezi, 2022). This is a transformation of digital tools and technologies such as interactive whiteboards, online learning platforms, and educational apps, playing around within a virtual reality. They not only increased the reach of educational resources but also empowered personalization of the same to the individual needs of the student. Government initiatives and policies to promote digital literacy and prepare students for a technology-based world have accelerated the adoption of digital tools throughout the KSA (Gabriel *et al.*, 2022). The COVID-19 pandemic further emphasized the need for digital transformation, since the educational system has had to develop rapidly through digital transition to get to remote learning, addressing its possibilities as well as its challenges due to digital integration.

The engagement of students is a very important factor for the positive learning outcome. (Marrone *et al.*, 2021). Motivated students, students engaged in a class and students more likely able to retain information work better with students engaged in the class. It has been researched that there is a stronger relation between higher participation and greater academic performance, more attendance, and overall greater satisfaction with learning (Cohen *et al.*, 2021). Interactive and immersive learning experiences that are available in digital tools can make engagement so much more than just digital. Thus, for example, gamified learning platforms can ameliorate the complexity of complex subjects to enjoyable and collaborative tools such as discussion forums and group projects can foster an atmosphere of community and collaboration among the students (Zhao *et al.*, 2021). In the KSA, there has been an impetus for student engagement, which has necessitated the implementation of several digital strategies to make learning more dynamic and interactive to produce better educational results (Brown *et al.*, 2022).

Educators have always struggled with keeping student engagement in traditional classrooms. Often, lectures and rote memorization can lead to passive learning – beware, many students may disengage. Learning paces vary, learning styles differ, and interactive activities are limited, making this issue much worse. Moreover, there are so many external distractions it's hard to keep the student motivated and the student feels that there aren't many real-world applications for it. These indicate a significant need for innovative teaching approaches to keep students interested.

Although digital tools hold the potential to re-engineer education and promote greater student engagement, their efficacy is poorly understood (Alqudah, Batarseh, and El-Issa, 2024). Due

to this context specificity, existing research on these tools fails to generalize conclusions. Although the importance of technology in the curriculum is recognized, its best practices and how much of the educational needs they can cover remain a question. Yet, more comprehensive studies will still have to be conducted involving other party stakeholders, such as students, teachers, and parents. To build evidence-based methods for utilizing technology to increase student engagement and learning outcomes, these gaps must be addressed (Lockman and Schirmer, 2020).

The objective of this research is to discover how digital tools make the learning process in KSA classrooms more interesting to students and to see whether digital tools are effective substitutes for traditional teaching methods. It aims to explore the degree to which digital tools are currently integrated into KSA classrooms, to explore learning challenges in a traditionally engaged setting, and to assess the effect of digital tools on improving engagement and learning outcomes for students. Moreover, it seeks to provide recommendations for incorporating technology into education. The research questions guiding this study are: First, how are KSA classrooms now using digital tools? Can we maintain student engagement within traditional classroom environments? How do digital tools affect student engagement and learning outcomes? What recommendations concerning the suitable way of integrating digital tools in educational settings can be inferred?

This study is important for educators and policymakers because it helps to understand what kind of digital tools work in boosting student engagement, a critical variable for improving learning outcomes. Integrating technology properly can help educators produce more dynamic, interactive teaching techniques that can be customized to meet the needs of the different students. This research will help the policymakers get evidence-based recommendations that they can utilize for developing educational policies and allocating money for digital literacy and technological integration in their schools. The study's focus on KSA classrooms grounds the findings in specific challenges and opportunities within the KSA educational context and translates to local stakeholders.

2. Literature Review

The term Cognitive Engagement means Intellectual investment and effort that the students use to make learning. (Sulis, 2022). It is thinking through critically, figuring out problems, and being willing to interact with hard-thinking ideas. Students will persevere in challenging tasks and will delve deeper into the subject matter if they are cognitively engaged. (Chew and Cerbin, 2021). Emotional Engagement included the feelings and attitudes students felt toward their

learning experiences. A sense of belonging, interest, and enjoyment in the classroom is learned by them. Motivation and a supportive learning environment can be increased by positive emotional engagement while negative emotional engagement would disengage and apathy. Behavioural Engagement is evidenced by students' participation and involvement in academic and extracurricular and extracurricular activities. That includes taking classes, working on the assignments, and talking in the discussions. (Cents-Boonstra *et al.*, 2021).

Being behaviourally engaged is often correlated with better academic work and school success**.** Self Determination Theory (SDT), as proposed by Deci and Ryan is one of the major theories explaining motivation, particularly the influences that motivation has on student engagement. (Ryan and Deci, 2020). SDT posits that individuals have three basic psychological needs: relatedness, competence, and autonomy. Students are more likely to experience intrinsic motivation (essential to sustained engagement) when these needs are satisfied. (Chiu, 2022). The term autonomy refers to the capacity to control actions and decisions. Within education, something like this can be helped by allowing students to choose their learning activities or projects, which encourages ownership and responsibility. Competence comes from simply feeling effective and capable in one's efforts. By adding instant feedback, adaptive pathways, and exercises to develop skills with interactive content, the use of digital tools can increase this. A sense of connection and belonging with others is called relatedness. Digital tools that facilitate group projects discussion forums, and online collaborative platforms can make peers and teachers more accessible, and give people the feeling of being connected with their group. (Marion and Fixson, 2021). A good way is to meet these psychological needs with the use of digital tools to make learning more enjoyable and effective.

The Constructivist Learning Theory, as put to use by Piaget and Vygotsky, states that learners construct knowledge through activity with the environment (Khadidja, 2020). According to this theory, learning is an active, contextualized knowledge-construction process rather than a knowledge-acquiring process. Though constructivist approaches propose hands-on experiential learning, the student is engaged, explores, asks questions, and solves problems. The selection of digital tools increases the interactive simulations, virtual labs, and educational games based on the constructivist principles of experiential learning that allow students to discover new things and make sense of constructivist principles (Veraksa, Colliver, and Sukhikh, 2022). For example, virtual reality (VR) has the potential to provide students with a sense of what historical events or scientific phenomena are considered particularly if students can manipulate these abstractions. The constructivist theory also highlights the seeing learning as the result of

social interaction. With the help of digital tools and collaborative platforms, the projects can be done according to the feedback. It is also important to develop communication and teamwork skills critical to Information-age working life besides making understandings more robust (Veraksa and Samuelsson, 2022).

Zajda emphasizes the developmental psychological needs of the students as well as the social and experiential dimensions of learning via SDT and constructivist theory. When taken together, these theories describe how in turn, digital tools can bring us a more engaging and efficient learning environment, by being more personalized, interactive, and collaborative (Zajda and Zajda, 2021).

Technology integration in education has played a dominating role for the past century. (Drake and Reid, 2020). At first, education technology was made up of very simple tools, a chalkboard, and an overhead projector. In the 1980s computers became more widely incorporated into learning processes, and new ways of relating to knowledge appeared. The internet revolution began its rise in the 1990s and education was changed by the ability to conduct online research, connect with other people over the internet, and the advent of e-learning sites. In the early 2000s, as personal devices were introduced as laptops and tablets became more ubiquitous, learning became more accessible and more flexible. However, since then educational practices have been further transformed by artificial intelligence, virtual reality, and mobile technology to become more personalized, more immersive, and more engaging. (Alam, 2021).

Learning Management Systems (LMS) is a tool where course content is managed, student progress tracked, and communication established between teachers and students via platforms Moodle, Canvas, and Google Classroom. They are systems that support blended learning environments and have a central place for resources and assignments among students (Akhmedova and Rahmatova, 2024). Along with LMS, the Interactive Whiteboards introduced that have dynamic interactive lessons, where students can interact with content are something that SMART Boards are very useful for. They have multimedia presentations, collaborative activities, and real-time feedback support on the boards (Tsayang, Batane, and Majuta, 2020). In the sector of entertainment and education, Educational Apps and Games are introduced through gamification, Kahoot! Duolingo and Quizlet make applications such as learning to be fun and interactive. These tools reinforce concepts, provide practice opportunities, and provide rewards or competition (Makhovych, 2024). Furthermore, the invention of Virtual and Augmented Reality (VR/AR) including Google Expeditions and Oculus Rift are just examples

of technologies that allow students to get an immersive learning experience whereby the students can transport to other historical periods, scientific environments, and places (Chan, Bogdanovic and Kalivarapu, 2022). These tools serve the function of making abstract concepts more tangible and interesting.

Different types of digital tools have been explored for their effect on students' engagement in a multitude of studies. The research of (Patrick and Nnamani, 2024) on interactive whiteboards has revealed that they can improve student participation and motivation by a substantial amount. According to (Krishnapriya *et al.*, 2024) interactive whiteboards led to higher student engagement because they made the lessons more dynamic and interactive, and offered real-time feedback and collaborative activities. Similar patterns are also observed among educational apps and games and increased levels of engagement. Simultaneously, virtual and augmented reality (VR/AR) technologies have also been shown to improve engagement with immersive learning experiences. (Fitrianto and Saif, 2024)) Reported a study that found that VR simulations increase student interest and engagement because they were able to learn complex concepts in an immersive, hands-on, experiential way.

3. Methodology

3.1 Research Design

The research design of this study is quantitative and the impact of digital tools on student engagement in KSA classrooms is studied. Structured surveys and questionnaires were used to collect data on teachers' and student's use patterns and their perceptions of digital tools used. To discover significant trends, correlations, and potential cause-and-effect relationships, the collected data were analyzed using the SPSS. Statistical analysis results unveil a comprehensive, data-driven understanding of how digital tools impact student engagement, and how these tools effectively serve educational purposes.

3.2 Data Collection Methods

For this study, quantitative information concerning the use and perceptions of digital tools in KSA classrooms was extracted from structured surveys and questionnaires. Closed-ended questions and multiple-choice questions were included in the surveys to make the survey comprehensive of the research variables. Moreover, a set of controlled experiments was run in chosen classrooms to identify the effect of digital tools on student engagement directly. This approach permitted the quantification of variables with precision and the identification of sought trends, correlations, and possible causality.

3.3 Sampling

The study included participants who were from many KSA schools at the primary, secondary, and higher education levels. To focus on relevant contexts, purposive samples of schools that integrated digital tools into their teaching practice were drawn. The interviews involved teachers and students who were quite willing to share their classroom experiences and who had used digital tools in their classrooms. Several factors were considered when selecting participants: it depended on the level of digital tool use, student population, and willingness of other schools to participate. By taking this approach, the findings were better able to be relevant and represented diverse experiences and perspectives. There were 170 respondents.

3.4 Data Analysis

SPSS analysed all the data. The data was summarized using means, standard deviations, and frequencies. Significant differences between groups were determined using inferential statistical tests (t-tests and ANOVA). Relationships between variables were examined through correlation analyses and regression analyses were performed to identify potential predictors of student engagement. This comprehensive approach enabled the precise quantification of variables and identification of important trends, correlations, and potential causal relationships to gain a well-understood understanding of the effect of digital tools on student engagement.

Results and Analysis

Section-1

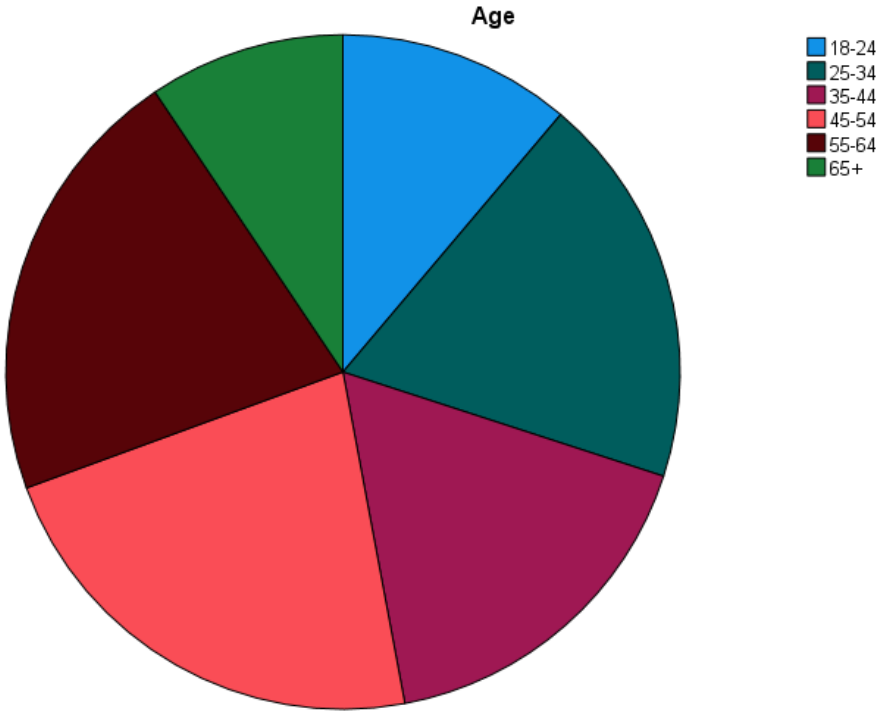
Demographic Analysis

Participants aged between 45 and 54 form the largest population as demonstrated by their proportion of 22.4% (38 respondents) of the total population. After that, 55-64 years old are 21.2% (36 people), and the 25-34-year-old participants are 18.8% (32 people). The remaining: 35-44 age group has 17.1% (29 participants), and the 18-24 age group 11.2% (19 participants). The lowest number is in the group of people who are above 65 years, 9.4 % (16) participants, as presented in Table 1 and Figure 1. This reveals a reasonably equal spread in the age demographics although more biased towards the intermediate age bracket.

Table 1 Age demographics presentation along with the age brackets

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	18-24	19	11.2	11.2	11.2
	25-34	32	18.8	18.8	30.0
	35-44	29	17.1	17.1	47.1
	45-54	38	22.4	22.4	69.4
	55-64	36	21.2	21.2	90.6
	65+	16	9.4	9.4	100.0
	Total	170	100.0	100.0	

Figure 1 Distribution of participants among age groups



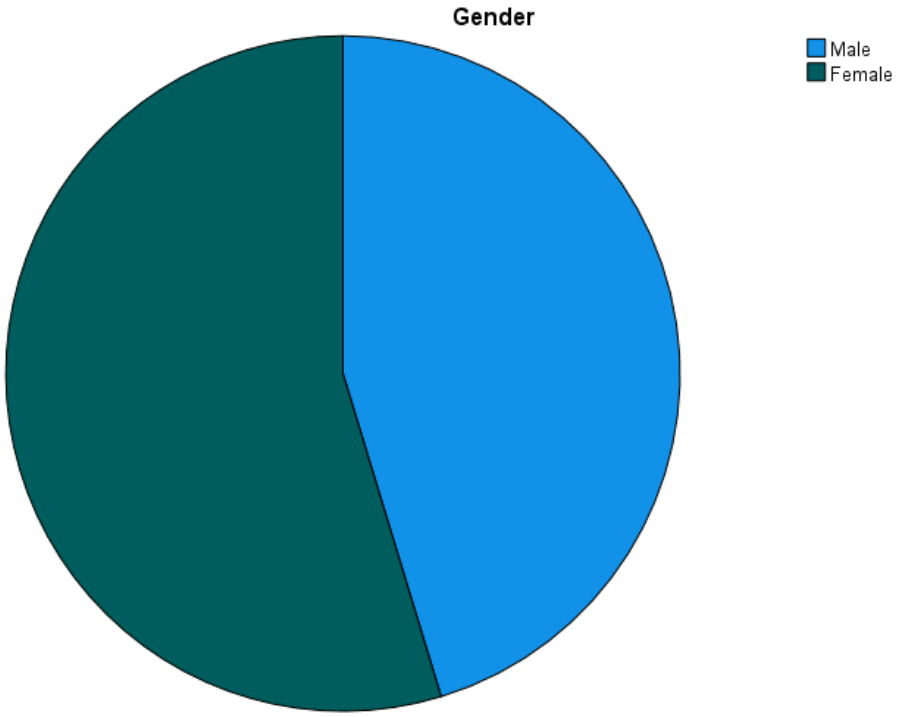
Gender Distribution- More Female Participants

In terms of gender, Table 2 is comprised of slightly more female participants, counting 54.7 or 93 participants in total. Male participants constituted 45.3% of the total participants of which 77 were males. This also suggests that gender demographics in this study are even, although a slightly higher dint of the respondents are females. A good comparison has been made between males and females if the gender proportions are compared within the sample in Figure 2, but it can be noted that the number of females was slightly more than males. The distribution appears rather standard for numerous investigations and might be crucial for thinking about any sex-specific peculiarity in the analysis.

Table 2 Gender distribution among two categories

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Male	77	45.3	45.3	45.3
	Female	93	54.7	54.7	100.0
	Total	170	100.0	100.0	

Figure 2 Gender Distribution among participants



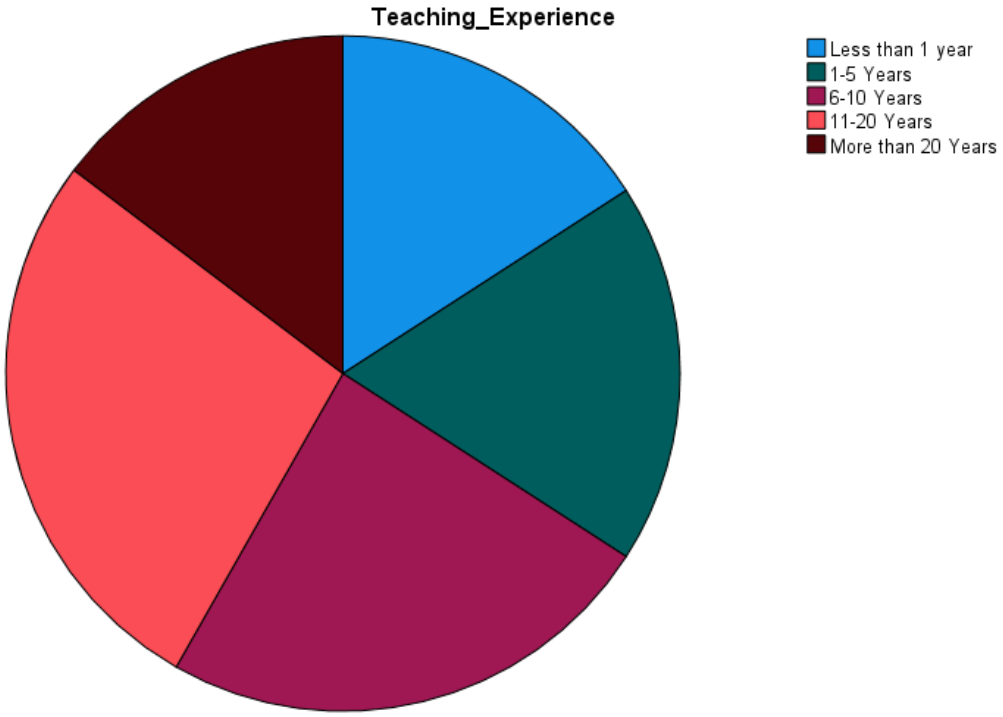
Teaching Experience Frequency along with the number of years

The teaching Experience of the respondents is also distributed according to the following mode in Table 3: The result reveals that the distribution of the experience is quite wide among the faculty members teaching experience. The largest group is the participants with 11-20 years of teaching experience where 27.1% (46 of the participants) are inclined. The 11-15 years group comes next with 24.1%, 41 participants and lastly, the 1-5 years group contributes 18.2%, 31 participants. A fifth of the participants, 20.6% (36 participants), had 1 to 5 years of teaching experience, 15.9% (27 participants) had less than 1 year of experience; and 14.7% (25 participants) had more than 20 years of teaching experience. This distribution shows a relatively evenly split set of responses with a slight bias in Figure 3 towards middle to late-career teachers meaning that the sample provides a base of data that spans a considerable range of teaching experience.

Table 3 Frequency of Teaching Experience Along with the split set

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Less than 1 year	27	15.9	15.9	15.9
	1-5 Years	31	18.2	18.2	34.1
	6-10 Years	41	24.1	24.1	58.2
	11-20 Years	46	27.1	27.1	85.3
	More than 20 Years	25	14.7	14.7	100.0
	Total	170	100.0	100.0	

Figure 3 Graphic representation of Teaching Experience with the proportion of experience bracket



Section-2

Descriptive Statistics

The results of ten survey questions concerning the usage of digital tools in education appear to be positive among the participants. The responses were on a 2-point scale whereby 2 respondents got a point for "Strongly Agree" while the rest got a point for "Agree". All the means of all the questions are close to 1 as the result of the participant's response, which is 'Strongly Agree' or 'Agree' the statement regarding the positive impact of digital tools in teaching.

The least favorable statement was, ''With the support of digital technologies, I face fewer challenges with classroom management'' where the mean = 1.42. This implies that more than half of the participants closely agreed that the use of ICT improves the management of the classroom. Although the mean score is not equal to 1, there might be response deviation; some participants may agree more than strongly agree. This result aligns with the generally held view that dishonest digital tools help teachers facilitate classrooms better, possibly by providing real-time responses and monitoring students, and agency.

In close succession, the objectives, "Digital tools make personalized learning for students possible," and "Digital tools lead to a better understanding of complex concepts by students" received mean scores of 1.49 and 1.45 respectively. These scores demonstrate a high level of concern with the notion that teachers feel technology aids in the process of differentiation of lessons, and materials to accommodate learners and facilitate understanding of concepts which may be difficult. The results also have small standard deviations with both (0.501 and 0.499) and therefore, most of the respondents shared similar views towards the perceived educational values of digital tools in the enhancement of adaptive learning and understanding.

Equally significant was the item "more student engagement when learning with technology" which scored a mean of 1.46. This was resonant with IS participants' belief or attitude that the use of digital tools boosts students' motivation. It is suggested that the tools include social and fun as well as various activities that enhance students' desire and willingness to learn. This proves the possibility of digital tools as a motivator with a low standard deviation of 0.500.

The remaining items, namely, "Through digital tools, students can be engaged in the class", "Through digital tools, interaction is possible", "Digital tools are a requirement of modern education", and "The use of the digital tools enhances collaborations among students", have

mean scores which range between 1.48 and 1.55 showing total agreement. The standard deviation for these questions from 0.499 to 0.501 shows that all participants have almost equal opinions regarding those questions. Such items add to the rationale that technology intensifies communication and cooperation in the classroom and is considered critical to modern learning.

The least supported statement is There's enough training for teachers on how to use digital tools effectively mean score of 1.52 Though it is slightly higher than other means, they all characterized the statement as generally true. In a way, it proposes that although most of the teachers are sure about themselves in class and acquainted with the technology, there may be certain doubts regarding sufficient preparation. The score indicates that whilst teachers are aware of the importance of using technology in teaching and learning, they might occasionally perceive they receive inadequate encouragement or training on the efficiency of the tools. This minor advantage of the mean score on this item might suggest some deficiency in training practices that would have to be changed so that teachers could apply newer technologies in their practice.

Overall, the results of the descriptive statistics in Table 4 show that participants have high perceptions of the usefulness of digital tools in enhancing students' motivation, interaction, and cooperation, as well as a skillful and individualized approach. The answers very positively correlate with the attempts to use modern technologies in delivering education and improving the results of students. Nonetheless, there is a slight possibility of improvement regarding the provision of sufficient training for teachers hence the slightly high mean score obtained for the training item. Implications of these findings include the fact that while adoption of digital tools is well embraced as useful, there is potential for increased effectiveness if there is more focus on professional development.

Table 4 Tabular Presentation of Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
1: Digital tools interact with students in the class	170	1	2	1.48	.501
2: Digital tools allow for interaction	170	1	2	1.55	.499

3: Digital tools make personalized learning for students possible	170	1	2	1.49	.501
4: When we use digital tools, students are more motivated to learn	170	1	2	1.46	.500
5: Digital tools lead to a better understanding of complex concepts by students	170	1	2	1.45	.499
6: Digital tools are necessary to modern education.	170	1	2	1.50	.501
7: The digital tools give students better collaboration	170	1	2	1.55	.499
8: There's enough training for teachers on how to use digital tools effectively	170	1	2	1.52	.501
9: Classroom management is made easier with digital tools	170	1	2	1.42	.495
10: Digital tools increase the interest of students to learn more.	170	1	2	1.54	.500
Valid N (listwise)	170				

Hypothesis Testing

HO: There is no significant relationship between digital tools in enhancing student engagement in the technology integration of KSA Classrooms

HA: There is a significant relationship between digital tools in enhancing student engagement in the technology integration of KSA Classrooms

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.174[a]	.60	.54	.495	.030	5.234	1	168	.023

a. Predictors: (Constant), Digital Tools

b. Dependent Variable: enhancement of student engagement

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	1.282	1	1.282	5.234	.023[b]
	Residual	41.165	168	.245		
	Total	42.447	169			

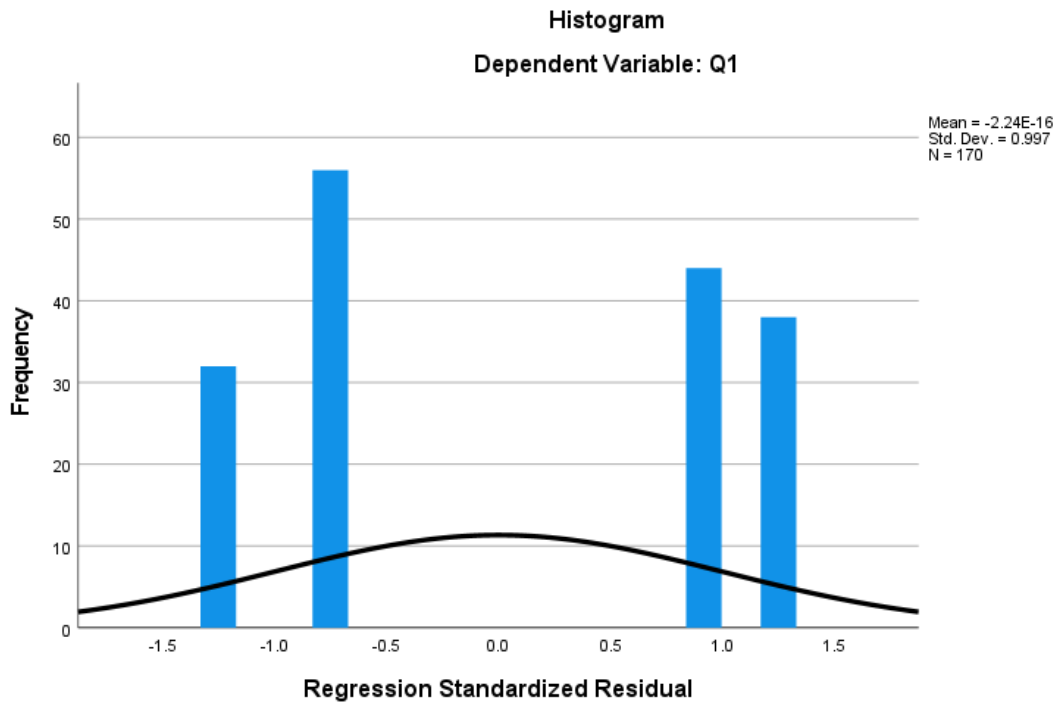
a. Predictors: (Constant), Digital Tools

b. Dependent Variable: enhancement of student engagement

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients		
		B	Std. Error	Beta	t	Sig.
1	(Constant)	1.754	.125		14.084	.000
	Q2	-.175	.076	-.174	-2.288	.023

a. Predictors: (Constant), Digital Tools



In the case of the current study, the null hypothesis (H0) indicated that the two variables of interest were not correlated, while the alternative hypothesis (HA) stated that the variables were indeed correlated. To test this, a regression equation was run using "Digital Tools" as the independent variable and "Enhancement of Student Engagement" as the dependent variable.

From the model summary of Prin-2 a positive correlation with an R-value of 0.174 shows that there is a rather weak relationship between the use of digital tools for teaching and learning and the level of engagement of students. Nevertheless, the R-squared of 0.60 means the model provides a measure of enhancement in the student involvement experience and the variation it explains is a significant 60 percent. This leads me to reason that the R-squared value implies

that even with the low r-value, digital tools might still be useful to drive students' engagement in classrooms. We also find reasonable values of adjusted R-squared equal to 0.54 which consider the number of predictor variables used in the analysis.

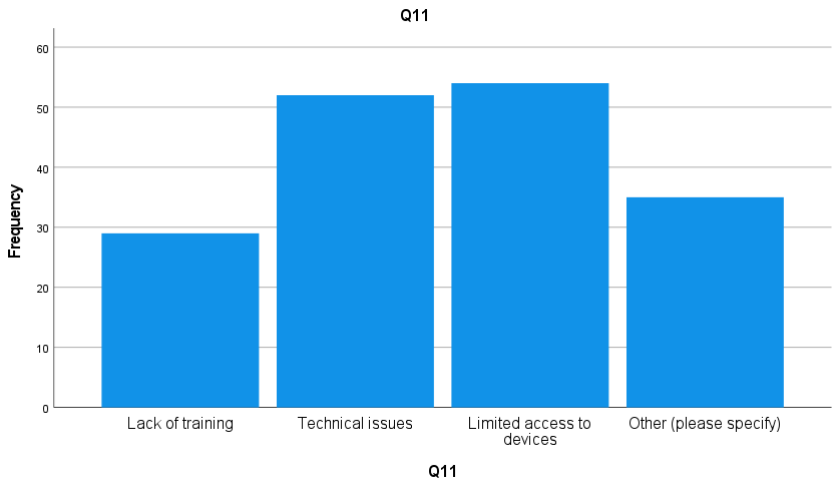
The F-change statistic was 5.234 and an approximate significance value for the F-change of p = 0.023 for the given research for checking the relationship. The p-value of 0.023 ore lower than the accustomed alpha level of 0.05, which points to the statistical significance of the relation between the two variables digital tools and student engagement). With this result then, the null hypothesis (H0) must therefore be dismissed, this means that there is sufficient evidence to warrant confirmation that indeed, tools use amplifies student engagement in KSA classrooms. The p value of the study is 0.023 which or less means that the outcome is not likely to be chance therefore supporting the use of digital tools to enhance engagement.

Based on the results obtained, it therefore makes sense to support the results of the alternative hypothesis (HA), that there is a significant correlation of digital tools with students' engagement in the IT of KSA classrooms. It is still moderately strong, with an R-value of 0.382, however, the most important values are the statistical significance of 0.023 and the proportional contribution of the independent variable digital tools, equal to 0.60. This finding implies that research exploring the kind of digital tools used and how the behaviors and learning achievements of the students were influenced by them could reveal more information as to the factors leading to these results.

Section-3

Where do you get stuck when it comes to integrating digital tools into your teaching?

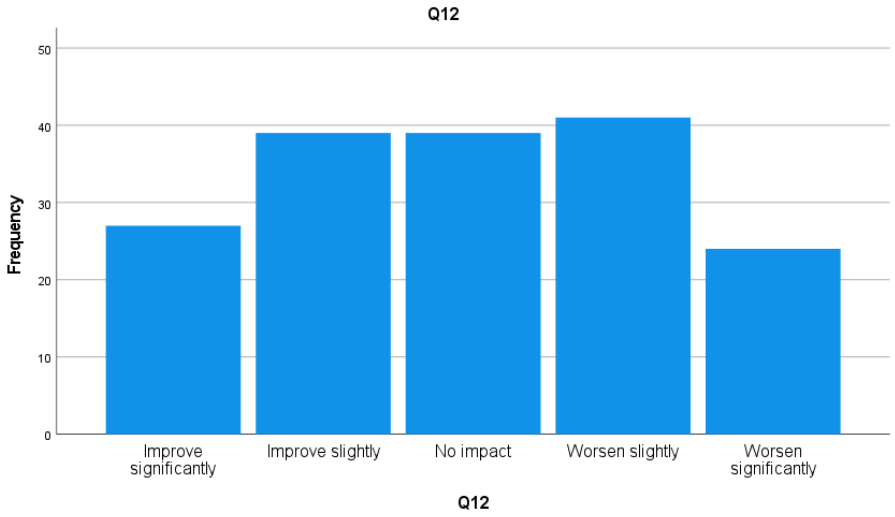
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Lack of training	29	17.1	17.1	17.1
	Technical issues	52	30.6	30.6	47.6
	Limited access to devices	54	31.8	31.8	79.4
	Other (please specify)	35	20.6	20.6	100.0
	Total	170	100.0	100.0	



The above-mentioned responses suggest the following as some of the difficulties teachers experience while incorporating technology into their teaching. The most frequent problem was lack of access to the devices and only 31.8% of the participants, 54 of them, faced this problem. This indicates that many educators are challenged with getting students proper access to effective tools for e-learning. After that, 52 participants (30.6%) pointed to technical issues as the major issue which may be as different as connectivity issues up to software failures, making the integration process even more difficult. Insufficient training was identified by 29 participants (17.1%); these results indicate the requirement for educational and staff development and training to address and improve teachers' ability to integrate information technologies into teaching and learning processes. Further, 35 participants, (20.6 %) fell under the "Other" category suggesting that other contexts or resource influences may be at play in the use of digital tools. These findings point out the priorities for future development, including the provision of more technology, improvements in support, and more favorable training options for teachers.

How do digital tools help students to understand the complex course material?

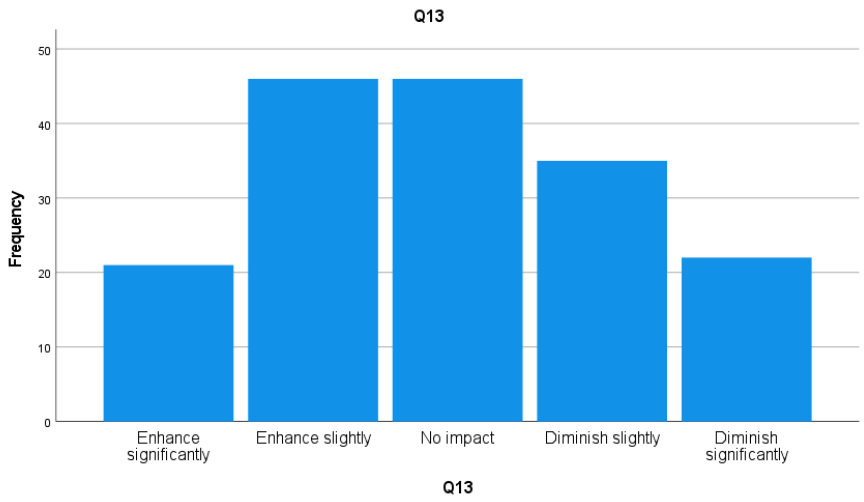
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Improve significantly	27	15.9	15.9	15.9
	Improve Slightly	39	22.9	22.9	38.8
	No impact	39	22.9	22.9	61.8
	Worsen slightly	41	24.1	24.1	85.9
	Worsen significantly	24	14.1	14.1	100.0
	Total	170	100.0	100.0	



The use of technology affects students' grasp of intricate content, and an equally diverse perception prevailed among the teachers. The largest chunk of the respondents who Felt that digital tools alert students to hard materials is 15.9% which equals 27 participants who deemed that the tools enhance grasping of hard content in "a significant" manner. However, 41 participants (24.1%) who do not agree stated that the digital tool either "worsened slightly" or "worsened significantly" (24 participants, 14.1 %), which indicates doubting the efficacy or suitability of the digital tool for some topics or students learning needs. The remainder 39 participants (22.9%) selected the option 'none' which means one is likely to think that the tools do not help as expected in enhancing knowledge. Further, 39 participants (22.9 percent) wrote that they only have a slightly better understanding, meaning that even though digital tools can improve understanding to a certain degree, their use is likely to be seen as marginal. These studies imply that the use of technology for the improvement of understanding could be context-, use, cooperative learning-, curricular-, and content contingent.

Do you believe that digital tools impact the student's critical thinking?

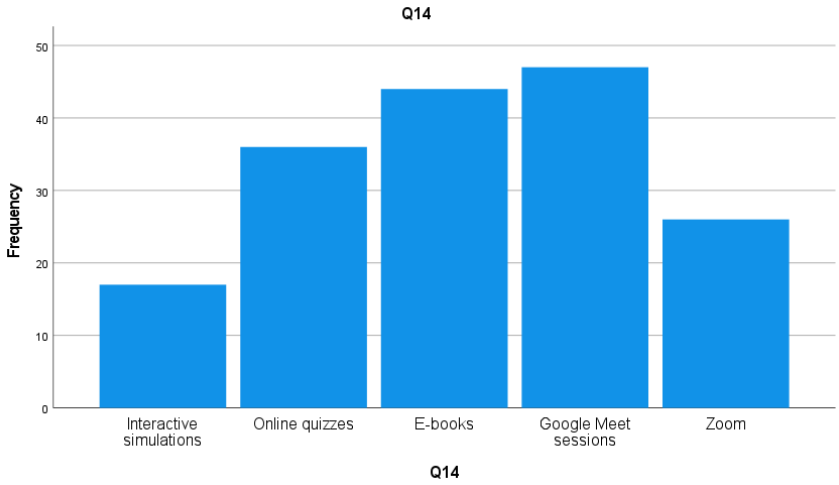
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Enhance significantly	21	12.4	12.4	12.4
	Enhance slightly	46	27.1	27.1	39.4
	No impact	46	27.1	27.1	66.5
	Diminish slightly	35	20.6	20.6	87.1
	Diminish significantly	22	12.9	12.9	100.0
	Total	170	100.0	100.0	



From the responses to these effects of digital tools on students' critical thinking skills, there appears to be a light attitude towards the issue. A small number of the participants (21, 12.4 %) are convinced that with the help of digital tools students ' critical thinking skills are 'enhanced significantly,' while 46 (27.1 %) participants responded that students' critical thinking skills could be 'enhanced slightly' by using digital tools. At the same time, an equal number of participants (46, 27.1%) respond to digital tools as having "no effect" on critical thinking which suggests that for a subset of educators, the use of these tools does not seem to develop one's ability in critical thinking. Furthermore, 35 participants (20.6 %) opine that digital tools ''lessen slightly'' student critical thinking, while 22 (12.9 %) believe that it ''lessen significantly.'' These findings indicate that whereas some instructors perceive technology as helpful in the development of critical thinking other teachers have doubts about it being a neutral or even non-facilitating aspect of critical thinking. The above implications suggest that the effective use of ICTs for the fostering of critical thinking requires a careful and conscious decision of which and how tools to use.

What type of below-mentioned tools do you use frequently?

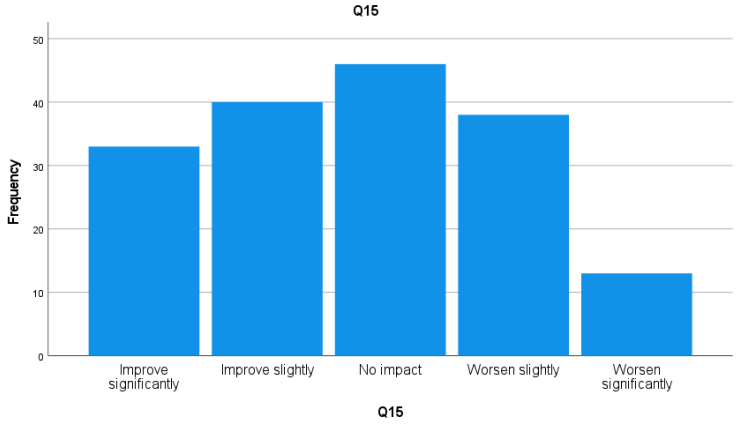
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Interactive simulations	17	10.0	10.0	10.0
	Online quizzes	36	21.2	21.2	31.2
	E-books	44	25.9	25.9	57.1
	Google Meet sessions	47	27.6	27.6	84.7
	Zoom	26	15.3	15.3	100.0
	Total	170	100.0	100.0	



The survey responses show the teachers and students favored the use of specific tools in the classroom. The most popular of them is Google Meet most of the participants 47 out of 170 (27.6%) stated that they availed it. This implies that video conferencing is relevant in online or hybrid forms of teaching and learning activity. E-books are also quite popular, 44 participants, (25.9%) often read e-books and it proved that e-books are essential for students and important as a type of digital reading material. Another familiar device is online quizzes, 36 of the respondents reported that they used it, with 21.2% meaning that quizzes serve as useful tools for assessment as well as for consolidating the material. Finally, the least often utilized type of technology-enhanced learning is the one where the students interact with the content, and only 10% of the respondents reported engaging in it frequently; it confirms the hypothesis that such applications may be useful for specific subjects but are not that often incorporated. Zoom, used by 26 participants (15.3%) has a moderate level of usage suggesting that it complements Google Meet.

What is the effect of digital systems on students' capacity to independently collaborate?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Improve significantly	33	19.4	19.4	19.4
	Improve Slightly	40	23.5	23.5	42.9
	No impact	46	27.1	27.1	70.0
	Worsen slightly	38	22.4	22.4	92.4
	Worsen significantly	13	7.6	7.6	100.0
	Total	170	100.0	100.0	



As for the opinions of study participants concerning the effect of digital systems on students' ability to self-organize collaborative learning, the opinions are diverse. An interesting 33 of participants (19.4%) indicated that digitization of systems enhances students' collaboration capabilities by a notch, stating that communication and teamwork are made better by it. Another 40 participants (23.5 %) suggest that the digital systems 'improve slightly', meaning that although some positivity is acknowledged, it may not be significant. However, 46 participants (27.1%) answered ''no impact'' which means, to some participants, the digital systems do not appear to make independent teamwork possible. Ambiguous or negative perceptions are also present: 38 participants (22.4%) think that digital systems "worsen slightly", and 13 participants (7.6%) that they "worsen significantly" –perhaps due to the risk of over-burgeoning technology, or due to a lack of fully effective technology to foster 'real' collaborative work. In sum, the following results reflect the seemingly paradoxical enhancement of a multiplicity of students' collaborative skills as enabled by digital systems.

Discussion

Demographically, the sample is divided among ages as witnessed by the fact that people of this age group had the highest representation of 22.4% among 45–54 years. Participants 55-64 follow closely with 21.2%, then 25-34, at 18.8%. The other age groups are those between 35 and 44 years (17.1), 18 and 24 years (11.2), and above 65 years (9.4). The age distribution in this already balanced distribution is quite skewed towards the middle age brackets. Of course, this spread is essential to understand the different perspectives regarding digital tool integration among different age groups when regarding technology adoption and adaptation. This age distribution is consistent with trends seen in educational literature where middle-aged educators play a large role in the sample. Research has already shown that educators in their 45 to 54 age brackets tend to be more experienced and perhaps understand the pros and cons of digitizing

the classroom in a more enriched way. The insights from this demographic are important for understanding how technology can boost student engagement.

Results indicate close to a balance in the gender distribution of the sample favoring females to the extent of 54.7% female and 45.3% male. This close to an equal gender representation will add to the advantage of the study in the sense that it will give rise to a balanced analysis of gender difference responses to the integration of digital tools. Traditionally, the gender composition of educational research has been uneven, but more recently, there is evidence of a growing number of female educators among them, which is a feature of this sample. Because of this slight female predominance, the findings may also have influenced how gender dynamics in the classroom affect the adoption and use of digital tools as highlighted in past research (De la Torre-Sierra and Guichot-Reina, 2022).

Analysis of the teaching experience of the participants shows a large spread in distribution; the largest group having 11–20 years of experience (27.1%). After these are those with 6–10 years (24.1%), 1–5 years (18.2%), less than 1 year (15.9%) and more than 20 years (14.7%). These distributions represent a wide spectrum of teaching experiences, offering a robust set from which to quantify the effect of digital tools at various career stages. Not only are educators who have successfully integrated technology in their work and classrooms for many years able to offer insight into long-term benefits and potential challenges, but educators with less experience in implementing new tools will also provide us with valuable lessons to experiencing the 'bumps in the road' along with the learning curves of using new tools (Bruno, Rabovsky and Strunk, 2020). It frequently includes experienced educators because these have been established in the educational field. Nevertheless, the importance of including less experienced teachers in technology integration includes fresh perspectives brought by them and they are generally more flexible with recent technology tools.

Finally, the demographic analysis of the sample covers the entire spectrum of the age, and teaching experience of the participants. A diverse representation is needed to reach a detailed knowledge of how digital tools can promote a student's engagement. The conclusions resonate with previous trends in research (Wilson, Ritzhaupt, and Cheng, 2020) as they point to demographic factors when assessing the effect of technology integration in KSA classrooms. The balanced age and gender distribution, but also the diverse level of teaching experience, make this a study that reflects a large variety of experiences to cover more nuances in the analysis.

The results from the descriptive statistics and hypothesis testing offer a rather deep insight into the use of digital tools to promote student engagement in KSA classrooms. Mean scores very close to 1 on a 2-point scale indicate strong agreement for statements about the positive impact of digital tools on teaching and learning from the participants in the survey. The mean score for the least favorable statement, "I manage a classroom with the support of digital technologies better," was 1.42. Overall, however, digital tools are perceived positively, and this hints that their effect on classroom management may be less than expected. (Kahu, Thomas and Heinrich, 2024) showed that digital tools can increase engagement but may not necessarily make teaching easier. This means participants feel that digital tools significantly empower student motivation, the statement, "learning with technology more student engagement" scored a mean of 1.46, which indicates that learning with technology can enhance students' engagement.

(Wekerle, Daumiller, and Kollar, 2022) found that digital technologies can improve student engagement by making learning both more interactive and fun. In addition, the low standard deviation of 0.500 for this item provides further support for the consistency of the belief in this among the participants.Mean scores for other items included 'Through digital tools, students can be involved in the class (1.48),' Through digital tools, there are interactions' (1.48),' As well as 'Digital tools are a necessity of modern education (1.55)'. It then seems that these results should point to a strong consensus on the importance of digital tools in allowing interaction, engagement, and collaboration in the classwork process.

(Hennig-Thurau *et al.*, 2023) identified that the digital tools are highly important in contemporary education. This means the other statement "There's enough training for teachers on how to use digital tools effectively" scored about a little more as translated to 1.52 versus 1.33 for "Digital tools should be used strategically." (Ovcharuk *et al.*, 2020) highlighted the current finding in his paper since it would be impossible to deploy digital tools in education if they are not properly trained. The results indicate that teachers recognize the value of digital tools yet might not be well positioned to exploit them effectively, recommending better training.

The results of the hypothesis testing further entrench the positive effect of digital tools on student engagement. The regression on student engagement and the use of digital tools revealed a positive relation (R = 0.174) and R squared was 0.60, implying that digital tools account for a significant number of variances in student engagement. The F-change statistic of 5.234 and a p=0.023 imply that there is a statistically significant relation between digital tools and student

engagement. The present findings are corroborative of the alternative hypothesis (HA) that there is a relationship between the use of digital tools and student engagement in KSA classrooms.

A limited device access challenge is identified as the biggest challenge by participants (31.8 of respondents). (Christopoulos and Sprangers, 2021) observed that biggest problem in integrating digital tools effectively is the lack of access to technology. 30.6% of participants cite technical issues that make the integration process even more complicated. These issues encompass connectivity problems to software failures, like what Christopoulos and Sprangers, 2021 have highlighted, as they stressed the importance of having sound technical infrastructure to allow digital learning

Also, 17.1% of respondents blamed a lack of training as an obstacle that cannot be overlooked, so there must be full-fledged professional development programs. Alam (2009) found that an inadequate level of training can impede using digital tools in education. Mixed perceptions are reported regarding how digital tools have redefined students' understanding of complex course material. At the same time, however, 15.9 percent of participants think that digital tools increase understanding, but 24.1 percent believe that they slightly hinder comprehension. The divergent opinions suggest that the effectiveness of digital tools may lie with factors such as which tools, and what content versus students' learning styles. (Kundu and Bej, 2021) also reported varying outcomes, similar to the benefits of digital tools and the need for context-specific efforts to maximize those benefits.

Responses are also varied to the question about how digital tools affect critical thinking skills. However, only 12.4 percent of people say that digital tools significantly improve critical thinking, 27.1 percent say they make no difference, and 20.6 percent say that the digital tools' impact on critical thinking abilities is slightly negative. The findings suggest that the work that could have been done to help foster critical thinking may only be as effective as it can be when used in the context of the curriculum, and in the end, was not used as it had hoped to. (Hursen, 2021), found that the effects of digital tools on critical thinking depend on their pedagogical employ. Of the 827 respondents, 27.6% indicate at least some use of Google Meet. The way that video conferencing tools are preferred in facilitating online and hybrid learning environments demonstrates this preference. Respondents use e-books, as well, with 25.9% using them. E-books are also an important digital reading material. For both assessment and reinforcement of learning, online quizzes are a favored choice by 21.2% of those surveyed.

(Nkomo, Daniel, and Butson, 2021) has shown positive effects related to using digital tools on student engagement and learning outcomes. Survey results show different opinions on how digital systems influence students' building of independence in collaboration. About 19.4 percent of participants agreed that digital systems play a significant role in improving collaboration, 27.1 percent disagree, and 22.4 percent think the digital systems slightly reduce collaboration. These responses indicated that digital tools allow communication and teamwork, but their efficiency may depend on the tools used and context in which they are used. Rafique (2023) also found that the impact of digital tools on collaboration has been influenced by context.

Conclusion

The study of use of digital tools to facilitate student engagement in KSA classrooms divulges into its challenges as well as gains that digital tools have on student engagement. This suggests that while device access, technical problems and a lack of training are big roadblocks, digital tools in and of themselves are a very positive influence on student engagement, understanding of complex material, critical thinking and collaboration. The diverse responses show the need to satisfy the diverse needs of learners in different contexts and need for comprehensive professional development of supportive professional strategies for digital tools to be maximally effective. The study is aligned to past research, which confirms the important function of digital tools in contemporary education. Taken as a whole, the results highlight that digital tools present an opportunity to help address some of the challenges while also offering the possibility of using them to fully benefit teaching and learning outcomes only if support and resources are provided. Such an understanding will offer an indication for future efforts to integrate technology more adequately in educational settings.

Limitations

Limitations in this study on the effect of digital tools on student engagement in KSA classrooms are the level of sampling, self-reported bias, and a single location. Since the design is cross sectional, it does not allow establishing causality, and the rapidly changing nature of digital technologies may make the findings quickly outdated. Such limitations should be recognized when reading the results and planning future work.

Recommendations

To raise digital tool integration in KSA classrooms, we need to increase access to hardware, invest in dependable infrastructure, and ensure teachers have a full professional development cycle behind them. What is needed is ongoing training and support, as well as further research on what types of contexts are effective for digital tools. Additionally, teachers can learn from each other to build a collaborative environment where the best practices can all be shared concerning technology in education.

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