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Evaluating art students' engagement with digital technologies in classroom settings

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ABSTRACT

This study explores how art students engage with digital technologies, focusing on the emotional, behavioral, and cognitive dimensions of engagement. Conducted at Abai Kazakh Pedagogical University, the research used a descriptive case study approach with online surveys completed by 60 graduate students from the Art Education, Graphic, and Design Department. The survey, consisting of 31 questions, assessed students' familiarity with digital tools and their engagement levels. Analysis with SPSS software revealed that students were most familiar with traditional digital art tools but less so with advanced technologies like Artificial Intelligence (AI), 3D printing, and Augmented Reality (AR). Engagement was highest with familiar tools, while less familiar technologies saw reduced emotional and behavioral involvement despite strong cognitive engagement driven by curiosity and motivation to learn. The study highlights the direct relationship between familiarity and engagement, suggesting that greater exposure to digital tools can enhance voluntary participation and skill development. These findings offer insights into integrating digital technologies into art education and call for further research to include educators' perspectives for a broader understanding of engagement in art classrooms.

1. Introduction

Many modern art classrooms focus on education with digital technologies. Teachers and students use technological or internet-connected tools such as laptops, interactive whiteboards, 3D printers, etc. Moreover, most of the programs are taught interactively online via engaging platforms instead of just taking notes of what the teacher says in the classroom (Hernandez-de-Menendez et al., 2020; Oubibi et al., 2024). Incorporating technology into education offers students a captivating learning experience, helping them maintain greater interest in the subject without interruptions (Godsk and Møller, 2024). Understanding how different forms of technology support different levels of students' expertise for varying levels of engagement and artistic creation is essential. For example, examining different types of digital technology can provide students, teachers, and educational institutions with clear expectations of curricular activities and blended learning pathways in technology-based environments (Bond et al., 2020; González-Zamar and Abad-Segura, 2021).

Analyzing all relevant previous studies indicates that, unfortunately, they have not paid enough attention to examining the level of student engagement when using digital technologies in the specialized art education and design field. This study, on the other hand, prioritizes advancing the field of art education and technology integration. This research initiatively aims to establish a comprehensive framework that systematically assesses and analyzes the engagement levels of art students with digital technology. The significance of this inquiry lies in its potential to bridge gaps in our understanding of the intricate relationship between art education and contemporary technological tools. Concentrating on the Department of Art Education at Abai Kazakh National Pedagogical University, a leading institution in teacher education and pedagogy in Central Asia, this case study offers a contextualized lens to the investigation and provides insights that are not only academically rigorous but also directly applicable to the practical setting.

The results of this research can enhance pedagogical practices, curriculum development, and institutional policies, contributing to the cultivation

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of a dynamic and technology-enhanced learning environment for art students.

This study answers a very critical question: "What is the Level of Engagement of Art Education and Design Students at Abai Kazakh National Pedagogical University in the Use of Digital Technologies?"

Therefore, we have prepared a list of 10 types of digital technologies used in art education classrooms to get a general understanding. The following research questions guide this analysis:

- How familiar are art education and design students at Abai Kazakh National Pedagogical University with digital technologies used in the classroom?
- Which digital technology used in the classroom contributes to increased engagement of art students?
- To what extent do art students possess digital literacy skills, and how does their proficiency correlate with their engagement in technology-centered learning?
- What is the degree of their behavioral, emotional, and cognitive engagement using these technologies?

This study contributes to the literature in two ways:

- Evaluating the degree of art students' interest and engagement in using digital technologies.
- Investigating the most applicable digital technologies in art education and design according to the art students' perspectives.

2. Literature review

At the core of any significant change in our lives lies a type of technology increasingly reliant on machine learning and artificial intelligence. Over the years, education has undergone significant changes, experienced multiple digital transformations, and utilized Artificial Intelligence (AI) and associated technologies to enhance the educational experience (Thomas et al., 2022).

The practical and creative use of digital technologies is the direction in which education is heading. This contributes to the training of new students as professional and skilled art critics who possess a precise understanding of traditional artworks and can also engage with the latest achievements in the field of art science (Yefimenko et al., 2021).

The process of integrating digital technology into higher education in Kazakhstan has evolved concurrently with global changes. One of the key drivers behind this movement was the educational development program of the government of the Republic of Kazakhstan. In 2011, Kazakhstan launched the project of the Ministry of Education of Science “E-Learning System” (Dalayeva, 2013). Nurmuhametov et al. (2015) conducted studies on the challenges of e-learning development in Kazakhstan. They observed that due to the vast territory of Kazakhstan, its relatively low population density, and the resulting social challenges, introducing high-quality educational technologies and open education is considered a solution. Nowadays, most universities in Kazakhstan introduce various elements of distance education based on information technology.

Kropachev et al. (2020) emphasized that information technology is the future of education, declaring that the use of digital technologies and distance learning can create competitive advantages in achieving the highest learning outcomes and teamwork skills among students from various universities at the national or international level in the Republic of Kazakhstan.

Additionally, Kapezovich and Toktarbekovna (2014) indicated that e-learning is a new educational process utilizing digital technology in Kazakhstan.

In the broader academic discourse on higher education, many researchers believe that using various digital and educational technologies has enhanced student motivation and engagement and consider digital technology integration in education as essential (e.g., Henderson et al. (2015), Selwyn (2016), Salaber (2014), Walsh et al. (2021), and Zen et al. (2022)).

In a recent study, students positively assessed the impact of technology on enhancing creativity and the quantity and quality of artistic ideas.

Furthermore, recent studies have indicated that digital technologies can significantly support student engagement when used thoughtfully and appropriately (Schindler et al., 2017). Therefore, it is crucial to encourage greater student participation in digital learning environments, as student engagement is a prerequisite for successful learning (Lam et al., 2018). However, strategies for increasing student engagement and maintaining their motivation in technology-based learning can present challenges (Henrie et al., 2015).

Considering this importance, many researchers have recognized the need to specifically examine student behaviors and participation in technology-enhanced educational environments (Bergdahl et al., 2020; Ryan and Deci, 2020). However, numerous factors remain that require in-depth study, particularly in the context of student engagement in art education, where no comprehensive research has been conducted. Additionally, a precise categorization of these technologies, along with their applications and characteristics, has yet to be provided.

Given that the focus of this article is on the participation of art students in the use of digital technologies within art classrooms, two dimensions must be considered simultaneously. The first is the examination of the concept of student engagement and its various forms in technology-driven teaching methods (it is worth noting that engagement in traditional teaching methods differs from that in technology-driven approaches). The second is the

analysis and categorization of the types of digital technologies used in art classrooms, as well as an assessment of students' familiarity and awareness of these technologies.

3. Student engagement

As a quality indicator of learning, student engagement plays a leading role in the learning process. Engagement has long been considered a critical factor in decreasing dropout rates and contributing to academic success. Today, as we proceed with blended or hybrid learning that integrates digital technologies into the classroom, engagement is much more relevant to the effectiveness of technology-enhanced learning.

Student engagement is crucial to academic achievement (Sneck et al., 2022). In broad terms, student engagement involves actively participating in diverse academic and extracurricular activities, along with a dedication to attaining learning goals (Lobo et al., 2022).

Students' engagement represents their energy and effort in their learning community, discernible through various behavioral, cognitive, or affective cues along a spectrum that is influenced by a combination of external and internal factors, including intricate relationships, learning activities, and the learning environment (Bedenlier et al., 2020).

While discussions persist regarding the essence of student engagement, scholars concur that it is a mysterious and intricate concept characterized by three broadly acknowledged dimensions: behavioral, affective, and cognitive (Fredricks et al., 2004; Phothongsunan, 2020; Appleton et al., 2006). Some researchers call each dimension a house of facets called indicators.

Based on the definitions provided and the research objectives, a new definition of student engagement in technology-based education can be proposed, which aligns with previous definitions while emphasizing the digital technology dimension. The following definition guides this study: Student engagement is the energy and effort that students invest in a technology-driven learning community, observable through various behavioral, cognitive, or emotional indicators. Student engagement entails active participation and direct involvement in the educational process using modern tools and technologies. This engagement includes activities such as utilizing technological features for art production, collaborating on digital content creation, using online learning platforms, participating in virtual groups, and being assessed through technological tools.

Behavioral engagement: Skinner and Pitzer (2012) said that student behavior engagement has a beneficial influence when students actively participate in learning activities and adhere to established norms, such as the timely completion of assignments.

However, behavioral engagement with digital technologies addresses the extent to which technology enhances students' interaction with their peers. It also considers whether continuous use of technologies leads to active exploration of new topics.

Emotional engagement: It refers to students' emotional reactions, which include their interests, such as happiness, excitement, anxiety, and enthusiasm. According to the findings, the more satisfied students are with the subject and conditions, the more active they become and participate in learning.

In technology-driven education, the focus is on examining students' willingness to voluntarily use digital technologies. It also explores whether students experience positive emotions, such as excitement and enthusiasm, when working with these technologies.

Cognitive engagement: Students' mental exertion characterizes cognitive engagement. Cognitive engagement to accomplish tasks through a profound, self-regulated, and strategic learning approach instead of employing superficial learning strategies (Chiu, 2021a; 2021b). In the context of digital technologies, the level of students' focus and self-regulation during the use of these technologies is examined, along with their interest in exploring the features of these technologies.

Having clarified the definition of engagement in technology-driven education, it is now necessary to provide an explanation of the technologies under discussion. This research clarifies the topic by collecting and categorizing the various technologies used in art classrooms, thereby enhancing students' understanding of the technologies they interact with. During the study, it was revealed that some students were unaware that the tools they use daily are part of technology-driven educational methods.

3.1. What are the different types of educational technologies used in the art classroom?

To successfully integrate technology into art and design classrooms and evaluate students' engagement, it is essential to align it with academic standards. National core arts standards are built around a framework of four core processes (Creating, Presenting, Responding, and Connecting) in which artists of all mediums participate. Each digital technology used in art classrooms can be categorized into one or more domains. For instance, both virtual reality (VR) and augmented reality (AR) can fit into the Creating and Responding domains because we use virtual reality technologies to generate ideas and elicit audience responses and feedback (Table 1).

With the definition of engagement in technology-driven education clarified and the relevant technologies identified and presented to the participants, the research methodology is then implemented.

Table1: Various types of digital technologies used in art classrooms

Category	Technology	Description
Creating: Conceiving and developing new artistic ideas and work	AI	AI tools like DALL.E use human concepts to generate designs, enhancing creativity and efficiency in design processes
	Software and apps	Tools like CAD software and digital art apps foster creative thinking, offering features like undo/redo for exploration
	Conventional art tools	Traditional supplies combined with digital tools (e.g., tablets, 3D modeling) enhance e-learning and accessibility
Presenting: Interpreting and sharing artistic work	Animation and digital content	Skills in multimedia and web development promote creative expression and subject mastery
	3D Printing	Provides interactive, tangible models for exploring intricate details in art and design
	Video conferencing	Encourages active participation and collaborative learning in art education
Responding: Understanding and evaluating how the arts convey meaning	AR	Enables immersive product visualization and interactive learning experiences, accessible anytime
	VR	Offers a 3D visual environment for deeply interactive and engaging learning experiences
	Interactive whiteboards	Facilitates active engagement, group activities, and real-time feedback to improve critical thinking
Connecting: Relating artistic ideas and work with personal meaning and external context	Online art communities	Platforms like Behance and ArtStation allow students to showcase work, gain feedback, and find inspiration
	Online Tutorials	Platforms like Skillshare and Udemy provide diverse art courses accessible globally

4. Methodology

In this research, a descriptive survey method has been employed to examine and evaluate the interaction of art students with digital technology. Descriptive methods provide an opportunity to examine and depict the current situation precisely. Considering the case study and the specific focus on art students at the Department of Art Education, Graphic and Design at Abai Kazakh National Pedagogical University and their interaction with digital technology, a descriptive approach seems to facilitate the examination and presentation of participation patterns. Additionally, the descriptive survey method can be used to develop tools or analytical frameworks in the future. Data collection in this research was conducted using three questionnaires that contribute to obtaining more accurate information necessary to understand subtle differences in art students' interaction with digital technology.

The research community comprises 60 master's students in Art Education within the Department of Art Education, Graphics, and Design at Abai Kazakh National Pedagogical University, Kazakhstan. These students are in the first or second year of their graduate studies. There are 16 male students and 24 female participants in this study.

To achieve the research objectives, three questionnaires were designed to collect precise data regarding the engagement of art students in using digital technology. Structured questionnaires, developed by experts based on previous research, primarily focused on quantitative findings, encompassing three main variables: 1) Behavioral engagement, 2) Emotional engagement, and 3) Cognitive engagement.

After assessing content validity, the total number of valid questions for all three questionnaires was determined to be 31. The questionnaires were sent online to the students.

In the first questionnaire, comprising 13 questions, students were asked about their familiarity with various digital technologies used in art education.

The second questionnaire, including 9 key questions to assess students' emotional, behavioral and cognitive participation, focused on students' participation when using digital technologies in art classes.

The third questionnaire, including 9 questions, addressed the level of students' engagement with each type of digital technology. Students were asked questions that declared their emotional, behavioral, and cognitive participation for each technology.

After evaluating the content validity, the questionnaires were designed based on the previous research study, with the distinction that, in the present research study, the questions are oriented toward education and learning art. Subsequently, they were distributed online, through email and social media groups of art students, or in university classes. Participants were requested to provide their personal information, including name and academic year, to enhance response reliability. The results obtained from the questionnaires were collected online and stored on a specialized platform for online surveys. The gathered data were then classified into Excel sheets and analyzed using SPSS software. The reliability of the research was measured for each questionnaire separately, using Cronbach's alpha. The data showed a reliability coefficient of 0.85 for the second questionnaire, comprising emotional, cognitive, and behavioral participation levels). For the third questionnaire, each dimension of participation was assessed separately for reliability, resulting in coefficients of 0.73 for emotional participation, 0.77 for behavioral participation, and 0.71 for cognitive participation.

4.1. Research findings

The data shows that students' willingness to employ technology in art classes has been over 80% in all three engagement domains. Regarding details, the highest level of engagement was related to 'students' enthusiasm and excitement for using digital technologies. The lowest level of engagement was associated with 'students' interaction with classmates and group activities using digital

technologies. On average, cognitive engagement, at 87%, shows the highest level of student engagement. This indicates that students have a solid inclination to explore new technologies. On the other hand, the lowest level of engagement was dedicated to behavioral engagement, at 80%, suggesting that students may face challenges when using these technologies collectively or through interacting with others (Table 2).

Table 2: The level of student interest and engagement in using digital technologies in art classrooms

Factor	Variable	Percentage	Mean	Cronbach alpha
Emotional engagement	I like to volunteer to use new digital technologies in art classrooms	86		
	I am happy that I can use new technologies to learn and understand art subjects	82	86%	
	I am always excited and eager to use digital technologies	90		
Behavioral engagement	I actively memorize and learn the steps of applying and using these technologies	80		
	I actively interact with other students, think and ask questions while using digital technologies	78	80%	0.85
	I actively practice the functions and features of digital technologies in the field of art	83		
Cognitive engagement	I focus and actively listen when using digital technologies in the art classroom	84		
	I am determined to master these technologies in the field of artistic creation	89	87%	
	I am working hard to be able to use digital technologies more creatively	88		

Furthermore, considering that students were not familiar with some of these technologies, they were asked to disclose their familiarity with various digital technologies. According to Fig. 1, art students are most familiar with Conventional digital art supplies (86%). However, their familiarity with artificial intelligence was the lowest at 49%. Additionally, 3D printing and virtual reality technologies had relatively lower percentages than other technologies.

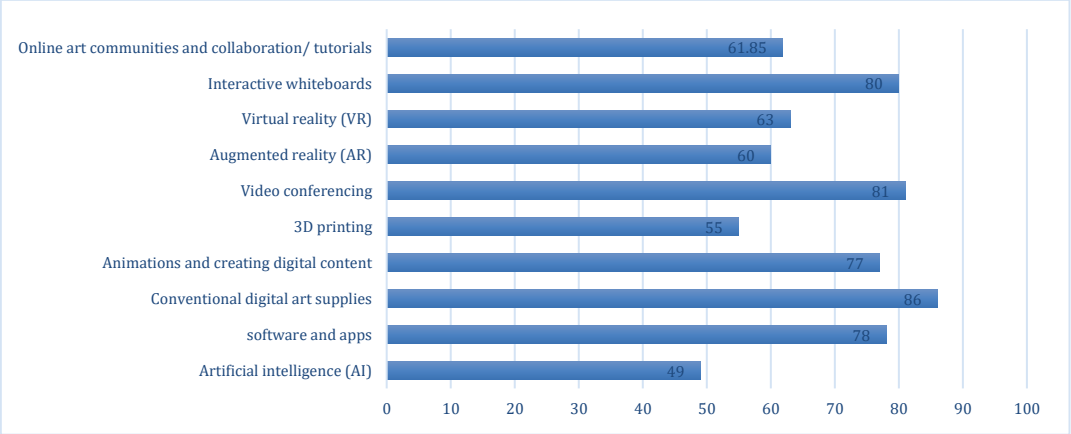

Fig. 1: Digital technologies facilitating education

According to the data in Table 3, students expressed the slightest willingness to volunteer to use AR and 3D printing. Their willingness to volunteer to use these technologies was below 20%. Additionally, conventional digital art supplies had the highest percentage in both variables, volunteering and creating a sense of happiness (above 70%). In response to the question, "Which of the following technologies is the most exciting in your opinion?" VR, AI, and 3D printing had the highest percentages, each exceeding 50%. On average, students indicated the most heightened emotional engagement with Conventional digital art supplies (70%) and the lowest with Animations and creating digital content (%29).

Table 3: The level of students' emotional engagement with various technologies (Cronbach alpha=0.71)

Variable	Description	Engagement level
Voluntary use	Students' willingness to use and try each technology	AI (30%), Apps (62%), Digital supplies (84%), Animations (36%), 3D printing (12%), Video conferencing (66%), AR (13%), VR (20%), Whiteboards (50%), Communities (20%)
Happiness	Technologies that make students feel happier in art	AI (42%), Apps (50%), Digital supplies (78%), Animations (23%), 3D printing (32%), Video conferencing (19%), AR (36%), VR (41%), Whiteboards (33%), communities (29%)
Excitement	Technologies that students find most exciting	AI (59%), Apps (33%), Digital supplies (49%), Animations (29%), 3D printing (54%), Video conferencing (18%), AR (51%), VR (62%), Whiteboards (26%), communities (25%)
Total engagement	Overall engagement across all metrics	AI (43%), Apps (48%), Digital supplies (70%), Animations (29%), 3D printing (32%), Video conferencing (34%), AR (33%), VR (41%), Whiteboards (40%), communities (36%)
Mean engagement	Average engagement level across all technologies	40%

Table 4 presents the results of data analysis regarding the level of participants' behavioral engagement. According to the perspective of participants, AI, AR, 3D printing, and VR technologies are perceived to be less user-friendly. This implies that the participants find it more challenging to use

these technologies. They also expressed that Conventional digital art supplies and Video conferencing are the most straightforward digital technologies. Regarding the variable of group activities and interaction with classmates, 3D printing had the lowest engagement rate at 13%, while Video conferencing had the highest engagement rate at 77%. Regarding interest in further practice, VR and 3D printing had the highest percentages. On average, regarding behavioral engagement, Animations and creating digital content had the lowest engagement rate at 20%, while Video conferencing had the highest engagement rate at 55%.

Table 4: The level of students' behavioral engagement with various technologies (Cronbach alpha=0.79)

Variable	Description	Engagement level
Ease of use	Technologies students find easier to use	AI (5%), Apps (37%), Digital supplies (70%), Animations (18%), 3D printing (11%), Video conferencing (72%), AR (10%), VR (16%), Whiteboards (49%), Communities (26%)
Interaction and inquiry	Technologies that encourage interaction with peers, thinking, and questioning	AI (19%), Apps (25%), Digital supplies (38%), Animations (21%), 3D printing (13%), Video conferencing (77%), AR (25%), VR (31%), Whiteboards (15%), Communities (22%)
Practice & learning	Technologies students are most interested in practicing learning features	AI (44%), Apps (38%), Digital supplies (44%), Animations (23%), 3D printing (50%), Video conferencing (18%), AR (37%), VR (68%), Whiteboards (10%), Communities (35%)
Total engagement	Overall engagement across all metrics	AI (22%), Apps (33%), Digital supplies (50%), Animations (20%), 3D printing (24%), Video conferencing (55%), AR (24%), VR (38%), Whiteboards (24%), Communities (27%)
Mean engagement	Average engagement level across all technologies	31%

Table 5 presents the results of data analysis regarding the level of participants' cognitive engagement. According to the data, students stated that using conventional digital art supplies and software and apps would lead to a higher concentration than other technologies. Furthermore, participants' inclination to professionalize in Software and Apps, VR, and 3D printing was higher than that of other technologies. In descending order, the technologies VR with 67%, Software and Apps with 66%, and 3D printing with 59% have the most significant influence on increasing students' creativity. On average, in contrast to behavioral engagement, where "Video conferencing" had the highest percentage, cognitive engagement had the lowest percentage at 15%. In comparison, engagement in using Software and Apps had the highest rate at 64%.

Table 5: The level of students' cognitive engagement with various technologies (Cronbach alpha=0.74)

Variable	Description	Engagement level
Concentration	Technologies that enhance students' focus while learning art topics	AI (44%), Apps (56%), Digital supplies (62%), Animations (14%), 3D printing (35%), Video conferencing (19%), AR (20%), VR (41%), Whiteboards (27%), Communities (33%)
Mastery and professionalism	Technologies students aspire to master and become proficient in	AI (52%), Apps (72%), Digital supplies (49%), Animations (32%), 3D printing (64%), Video conferencing (14%), AR (55%), VR (69%), Whiteboards (8%), Communities (58%)
Creativity	Technologies that enhance creativity in art education	AI (45%), Apps (66%), Digital supplies (33%), Animations (40%), 3D printing (59%), Video conferencing (14%), AR (50%), VR (67%), Whiteboards (20%), Communities (38%)
Total engagement	Overall cognitive engagement across all metrics	AI (47%), Apps (64%), Digital supplies (48%), Animations (28%), 3D printing (52%), Video conferencing (15%), AR (41%), VR (59%), Whiteboards (18%), Communities (43%)
Mean engagement	Average cognitive engagement level across all technologies	41%

5. Discussion

In this section, the findings related to the research questions are examined. The first research objective follows this question: How familiar are art students with digital technologies at the University under study? According to the results shown in Fig. 1, students generally exhibit an average level of familiarity with digital technologies. Specifically, AI, 3D printing, and AR had the lowest levels of familiarity, while conventional digital art supplies had the highest familiarity. Across the study, familiarity with newer and particularly virtual technologies was reported to be lower, which attracted students' attention and sparked a desire to learn about and explore these technologies, thereby leading to increased cognitive engagement.

The second aspect of the research question examines "Which digital technologies used in the classroom contribute to the increased engagement of art students?" According to the results in Table 6, the average cognitive, emotional, and behavioral engagement of students when using conventional digital art supplies was the highest, at 53%. Engagement with software and apps was relatively strong, while engagement with animations, digital content creation, and interactive whiteboards had the lowest averages. Conventional digital art supplies act as a bridge between digital technologies and artistic innovation and can be used in various artistic disciplines due to their diversity and appeal.

The third aspect of the research question addressed the question, "To what extent do art students possess digital literacy skills, and how are

their skills related to their engagement in technology-based learning?" To investigate this, new results were obtained by considering students' familiarity with each digital technology separately. While many previous studies focused on examining the role of specific types of digital technologies in education (González-Zamar and Abad-Segura, 2020; Kong, 2020; Afzal and Crawford, 2022), this study aims to simultaneously and comparatively examine various digital technologies used in art education.

Table 6: The mean of students' engagement with various technologies

Technology	Mean engagement (%)
AI	37
Software and apps	48
Conventional digital art supplies	56
Animations and creating digital content	25
3D printing	36
Video conferencing	34
AR	32
VR	45
Interactive whiteboards	27
Online art communities	35

Some previous studies (Siddiq et al., 2020) concluded that social media can effectively enhance student participation and academic progress. However, students' emotional engagement in Online art communities and collaboration/tutorials, which could occur on social media platforms, had the lowest average among all digital technologies. Considering students' familiarity with these technologies (64.8%), the excitement and interest of art students in using this digital platform were lower than that of the other technologies. Sousa et al. (2019) documented that using digital technologies in education could improve student learning processes and engagement through innovative applications of mobile technology, tablets, smartphones, and other digital supplies. According to Fig. 1, it was reported that Conventional digital art supplies had the highest familiarity level among all technologies (83.18%), and students, with an overall average of 67%, had the highest emotional engagement with this technology.

Regarding new digital technologies that students were less familiar with AI, 3D printing, AR, and VR, the reports indicated that the level of digital literacy skills and familiarity with technologies had a direct relationship with the level of emotional and behavioral engagement. In this way, lower levels of digital literacy skills can lead to reduced emotional and behavioral engagement but increased cognitive engagement.

The fourth aspect of the research question, "the level of behavioral, emotional, and cognitive engagement of students," was also examined. Regarding the results in Tables 3-5, the average participation of students in emotional, behavioral, and cognitive aspects in the use of digital technologies was reported as 39%, 30%, and 41%, respectively. Based on this, cognitive engagement had the highest average, while behavioral engagement had the lowest average. This result contrasts with some recent studies, in which behavioral engagement was reported as the most common dimension and emotional engagement as the least common (Bedenlier et al., 2020). The high percentage of cognitive engagement, however, suggests a lack of sufficient knowledge about technologies or a lack of updated information among students. Various factors may affect this result.

Internal and external factors, such as gender, age, field of study, academic level, learning environment, and interaction with teachers or peers, can all play a role in the level of engagement. Accordingly, this research indicates the need for future studies to explore other aspects affecting engagement. The present study has focused on student self-assessment; however, future research should also examine teachers' perspectives.

6. Conclusion

The results of the data analysis indicate that students are familiar with digital technologies in the field of art education. However, their familiarity with new technologies in areas such as AI, 3D printing, AR, and VR was evaluated lower. One reason could be the continuous evolution of technologies, demanding further exploration of their new capabilities. Moreover, the students' level of familiarity is directly associated with their emotional and behavioral engagement. On the other hand, a lower level of familiarity with digital technologies is significantly associated with a higher inclination toward cognitive interaction. Lack of knowledge may reduce voluntary participation motivation in academic activities; however, students' eagerness and curiosity to enhance their knowledge and skills using these technologies increase. On average, students demonstrated the highest inclination to participate in digital technologies related to "Conventional digital art supplies" and "Software and Apps." In contrast, the lowest inclination was observed for interacting with "Interactive whiteboards" and "Animations and creating digital content."

6.1. Suggestions and future implications

Given that various factors can affect the level of student engagement in art education, the following suggestions are proposed for further studies in this regard.

- Longitudinal studies: Conduct longitudinal studies to track art students' engagement changes over time.
- Pedagogical integration: Explore strategies for optimizing the use of digital tools to enhance the overall learning experience and creative development of art students.
- Comparison with traditional methods: Compare the engagement levels of students using digital technology with those using traditional methods.

This comparative analysis can highlight the advantages and potential drawbacks of incorporating technology in art education.

- Professional development for educators: Assess how well-equipped educators are to integrate digital tools effectively into their teaching methods.
- Collaborative learning environments: Explore the effect of collaborative digital platforms on fostering a sense of community and collaboration among art students.

Compliance with ethical standards

Ethical considerations

This study was conducted in compliance with ethical standards for research involving human participants. Ethical approval was granted by the Ethical Committee of Abai Kazakh National Pedagogical University, Kazakhstan, on 24 February 2023 (Ref. No. 6). All participants were informed about the purpose of the research and their consent was obtained prior to data collection. Participation was voluntary, and respondents were assured of the confidentiality and anonymity of their responses. Data were securely stored and used solely for the purposes of this study.

Conflict of interest

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

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