

Systematic Review of the Positive and Negative Impacts of Digital Tools on Creativity in Fine Art Education: 2019-2025

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Abstract

This study focuses on the relationship between digital tools integration in art education and its impact toward the students. There are numerous studies from literature review in investigating the impact of digital tools integration in art education, however, there are lacking study that focuses on elucidating the effect of digital tools integration toward the creative development of the art students. Moreover, the rationale of the digital tools' integration is not explained as well. With the potential benefits, the current literature does not address the potential factors in hindering the creativity of art students when using digital tools in their learning. Therefore, current study revealed that the art students agreed that digital tools integration improved their learning efficiency as well as their emotion and satisfaction. This review also categorized multiple factors that are potential to improve and hinder the creativity of the art students when using digital tools in their art education. This outcome deems to be the latest opinion and result by the art students when they are using digital tools in their learning process. With that, the stakeholder can refer to this outcome for further education planning. Objective: The aim of this study is to investigate the impact of integrating digital tools and platforms on fine art education. Specifically, this study targets to understand the perceived advantages by student when utilising digital tools in their art learning process, to evaluate how the integration of digital tools contributes to the creativity and to identify the potential factors that may hamper creativity of the students when using digital tools in art education. Theoretical Framework: Based on the latest technological advances, digital tool is a group of technologies that effectively distribute, preserve, analyse, and display information by integrating the knowledge of multiple disciplines (Jiang, Wang, & Tsai, 2022). It is distinguished by digitalisation, networking, and interaction. As digital tools are perceived to provide numerous benefits to the learning process, its effect on creativity should be studied. Creativity is defined when the combination of originality and effectiveness (Runco & Jaeger, 2012). However, creativity can be judged in several ways from different perspectives (Walia, 2019). Creativity is one of the important elements in art works, as it serves as a unique expression by an individual. By understanding the relationship between digital tools and creativity in art education, it can provide a clearer perspective in planning blending learning environment among art students. Method: This study applies systematic review method to collect related articles that investigated the effect of digital tools integration in art learning. The searching of articles was done in Scopus, with only research published between 2019 to 2025 were selected. Several inclusion and exclusion criteria were formulated to ensure the consistency of each included articles and to ensure the articles fulfil our research objectives. Then, the included articles were summarised with demographic details and findings. Thematic analysis was carried out to identify the similar findings across the studies, to generate themes that were significant to our study objectives. Results and Discussion: Our findings showed that integration of digital tools in art education can improve the learning efficiency of the students which, one of them is creativity. This integration also helped to enhance their emotion and satisfaction during the learning process. Moreover, we revealed the potential factors in improving the creativity of the students are the AI features or tools that can help them to explore more idea and design, thus improving their creativity. The learning experience plays vital role in creative development as well. This is because with higher motivation and engagement in the learning environment, students tend to be motivated with idea and exploration. Nevertheless, there are some potential factors in hindering the creativity of students when using digital tools which are moral and ethical issue when creating innovative idea, competency of the

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teachers and the funding and resources in the art education. Research Implications: Current study provides latest insight on the perceived advantages by digital tools integration in art education. Related stakeholder can utilise the information to plan their learning tools which will help in enhancing the learning process. Moreover, related stakeholder also can avoid the potential factors that hinder the creative development in art students when they understand the underlying reason as proposed by current study. This will assist to maximise the benefits of digital tools integration in art education in future. Originality/Value: This study serves as an empirical analysis by collecting the data over the world to understand the impact of digital tools integration in art education. The consistency of the result was observed, thus providing the significance to the field in acknowledging the perceived advantages of digital tools integration in art education, and how creative development among students is achieved. Moreover, the concerns that might influence creativity was also addressed across the studies and was highlighted in current study.

Keywords: *digital tool, creativity, art education, hybrid, innovation*

Introduction

Recent technological developments and the expanding use of blended learning environments have significantly increased the use of digital tools and platforms into fine art education (Kumar et al., 2021). Traditional creative processes are rapidly being supplemented by these digital technologies, which include designing and animating resources, online communication platforms, virtual studios, and applications for digital painting. These tools have given students new channels for creativity and expression as the education sector adopts digitalisation, enabling them to experiment with cutting-edge digital art and design forms. For fine art students who often rely on hands-on, physical mediums, research has shown that digital tools can promote creativity, improve accessibility, and encourage worldwide interaction (Fischer, Lundin, & Lindberg, 2020). However, there are growing worries about these technologies' possible detrimental effects on creativity, even though they have been demonstrated to provide a number of advantages in improving learning experiences, including better resource access, collaboration, and support for personalised learning pathways (Tapalova & Zhiyenbayeva, 2022). In particular, studies on artificial intelligence (AI) and digital learning tools, like those by Namaziandost & Rezai (2024), highlight significant concerns about striking a balance between technological assistance and the creative process because of the danger of becoming overly dependent on automated systems. The application of technology may enhance the learning experience outside of the classroom, giving students more flexibility and access to resources in blended learning environments, which combine online and in-person training. Teachers must reconsider how to foster creativity and engagement in fine art students in light of the trend towards blended learning environments (González-Zamar, Abad-Segura, Luque de la Rosa, & López-Meneses, 2020).

Based on our current knowledge, the lack of investigation into how digital tools and platforms affect the creative capacities and involvement of fine art students is a research gap in the integration of these tools and platforms into fine art education. Although a lot of research has been done on how digital tools can improve learning experiences by facilitating collaboration and improving access to resources (Haleem, Javaid, Qadri, & Suman, 2022), most of this research has concentrated on general education rather than the unique requirements and difficulties of fine art education. Most of the previous research has focused on the advantages of digital tools, including their capacity to encourage artistic expression, promote group learning, and increase access to a variety of artistic materials. It has also focused on how these tools can be used to their fullest potential in art education instruction in order to maximise student engagement and creative results (Baidoo-Anu & Owusu Ansah, 2023). However, not much research has investigated how fine art students' creative growth could be hampered by an excessive reliance on technology, especially artificial intelligence and automated systems. The benefits of digital technologies are frequently highlighted in existing studies, but the ways in which their integration and the preservation of conventional artistic practices might coexist are not fully examined.

As abovementioned, current study aims to fulfil the gap in the literature in understanding the perceived advantage of digital tools integration in art education, which way the advantages promote creativity and what are potential factors that may hinder creativity development after digital tools integration in art education. Current study also collected the most recent studies to provide latest insight and opinions from students or teachers in integrating digital tools in art education. In general, current research is to investigate the impact of digital tools and platforms on fine art education. With the latest information, institute, government or relevant stakeholder can plan the strategy that works best for the future education system. To achieve this goal, three objectives were formulated to thoroughly

investigate the perceived advantages, potential factors promoting creativity and potential factors hindering creativity in art education. Below were the research objectives:

1. To identify the perceived advantages of using digital tools and platforms for creative expression in art education.
2. To examine the potential factors in promoting creative engagement of art students.
3. To elucidate the potential factors that hinder creative engagement of art students.

With that, three research questions were formulated as follows:

1. What are perceived advantages of using digital tools and platforms for creative expression in art education?
2. How do the potential factors promote creative engagement of art students?
3. What are and how are the potential factors that hindering creative engagement of art students?

Theoretical Framework

Blending Learning

Blended learning has been a potent teaching strategy in art education in recent years, especially when it comes to encouraging creativity. Blended learning gives students more freedom in how they interact with material and work with classmates by fusing traditional in-person instruction with digital tools and internet platforms. This fosters growth in creativity. According to a study by Wahyudi et al. (2020), students' capacity for creative thought is much improved when the 3CM (Content, Collaboration, and Communication) model is implemented in a hybrid educational setting. Students are inspired to think creatively, work together, and interact intimately with the material by combining online and offline learning activities. Collaboration features on the internet and in-person training combine to provide a dynamic atmosphere that fosters creativity through peer engagement, problem-solving, and evaluation. In the same way, Border et al. (2021) stressed how crucial it is to collaborate with students to create digital learning resources to foster creativity. According to their research, students who actively contribute to the development of educational materials have a stronger bond with the subject matter, which in turn encourages increased creativity. When included into a blended learning framework, this co-creation process not only enables students to interact with the content but also provides them with the chance to showcase their creativity by creating their own educational resources. As students collaborate to create and modify resources that improve their educational experience, this method fosters both individual and group creative expression.

Student Creativity

In hybrid educational settings, online communities play a crucial role in fostering innovative thinking. According to Marshalsey & Sclater (2020), students' creativity can be greatly increased in distributed studio instruction through online educational communities. Online tools that enable sharing, critiquing, and working with peers give students the support and engagement they need to grow as creative beings in fields like art and design, where teamwork and criticism are essential to the process of creativity. By providing chances for continuous interaction with teachers and classmates, these virtual environments guarantee that creative development continues outside of the conventional classroom. Students feel more comfortable expressing their ideas and work when they have a sense of belonging, which further develops their creative potential. Additionally, the benefits of online assistance networks for innovative problem-solving were emphasised by Lim & Han (2020). An online platform was created for this study to support idea development, brainstorming, and group problem-solving—all of which are critical for promoting creativity. Students were given the opportunity to work with peers and receive real-time feedback on the platform, which promoted greater engagement with creative projects and enabled them to approach difficulties in a more original way. In the framework of art education, this kind of support structure fosters critical and reflective thinking in students, which improves their capacity for creative problem-solving. Additionally, it has been shown that incorporating blended learning and the flipped classroom into cultural arts education fosters creativity. According to Nurhayati et al. (2021), these models enable students to work on the material on their own before class and use in-person time for creative, cooperative problem-solving. By allowing students the flexibility to investigate concepts at their own speed and then use their innovative thinking in a more participatory, hands-on environment during class, this structure fosters creativity. A rich atmosphere for creativity and invention is produced by combining self-paced learning with dynamic, group projects in the classroom.

Overall, it has been shown that incorporating blended learning strategies into art instruction greatly promotes creativity. Blended learning fosters innovative thinking and problem-solving by giving students the freedom to interact with the material, work together with classmates, and get immediate feedback. Whether through flipped classrooms, online communities, co-production of learning materials, or organised models like 3CM, these methods inspire students to experiment, work together, and reach their full creative potential in art education. The potential for promoting creativity in blended learning settings will only grow as technology develops further, making it a crucial instrument for teaching modern art.

Methodology

Research Design

This study employed research method of systematic literature review. According to PRISMA 2020 guidelines in preparing systematic review, we conducted our searching in Scopus (Elsevier) while limiting the search in art and humanities field.

Data Collection

The inclusion criteria included English articles, articles published between 2019 to 2025, original articles, study that utilising digital tools in art education, study that accessing the outcome or experience of the students; while studies that fulfilled our exclusion criteria, namely non-English articles, review articles, editorial comments, book chapter, study that utilised digital tool in other education field, study that did not assess creativity as one of the learning outcome or performance were excluded.

Our searching strategy included three groups of keywords, giving a total of 18 combinations of searching. First group included “digital” OR “technology” OR “online”; while second group included “art education”; while third group included “creativity” OR “creative” OR “expression” OR “innovation” OR “innovative” OR “experience”. The combination of keywords was summarised in Table 1.

Table 1: Keyword combinations in the searching strategy

Group 1	Group 2	Group 3
Digital	Art education	Creativity
Technology		Creative
Online		Expression
		Innovation
		Innovative
		Experience

Total of 634 articles were found, and 553 articles were removed to due non-English articles, review paper, book chapter, editorial comments, redundancy and inappropriate study direction when filtering via title. 81 articles were selected for further reading. 46 articles were removed due to inappropriate study direction during abstract filtering. 35 articles were then continued with the full text reading. 25 articles were removed due to the research design and inappropriate study outcome.

Data Analysis

Only total ten articles were included in this review. The characteristics of the studies were summarised in the table. Thematic analysis was done to categorize the potential theme for perceived advantages of digital tools integration in art education, factors promoting the creativity and factors hindering creativity.

Results

Descriptive Overview Of Included Studies

Total ten articles were included in this review. The respondents included from countries such as Lithuania, Spain, The Netherlands, Poland and Ukraine (Boiko et al., 2023); Latin America (Grájeda et al., 2024), Ukraine (Lahoda, Soboliev, Tokar, Ivanenko, & Budiak, 2024); central Taiwan (Liao et al., 2025), China (Meng, Yang, & Zhang, 2025; Oubibi & Hryshayeva, 2024; Zhang & Jiang, 2025) and Malaysia (Omran Zailuddin et al., 2024). Two studies did not specify the respondents' countries (Kicklighter, Seo, Andreassen, & Bujnoch, 2024; Rong, Lian, & Tang, 2022). Six articles involved only students' perception in evaluating the outcome (Kicklighter et al., 2024; Lahoda et al., 2024; Meng et al., 2025; Omran Zailuddin et al., 2024; Oubibi & Hryshayeva, 2024; Rong et al., 2022); while four articles involved both student and teachers in evaluating the outcome usage of digital tools in art

education (Boiko et al., 2023; Grájeda et al., 2024; Liao et al., 2025; Zhang & Jiang, 2025). Each of the studies applied multiple and different type of methodology namely, quantitative and qualitative survey (Boiko et al., 2023; Zhang & Jiang, 2025); quantitative survey and observational method (Grájeda et al., 2024); qualitative and thematic analysis (Lahoda et al., 2024); quasi-experimental research design (Liao et al., 2025; Meng et al., 2025; Oubibi & Hryshayeva, 2024; Rong et al., 2022); quantitative survey only (Kicklighter et al., 2024) and case study approach (Omran Zailuddin et al., 2024). The range of sample size for quantitative was huge, ranging from 256 to 9,244 students (Boiko et al., 2023; Grájeda et al., 2024). Only two studies revealed the sample age, average 9.76 years old (Oubibi & Hryshayeva, 2024) and between 21 to 23 years old (Omran Zailuddin et al., 2024). Six studies included respondents who were specified in Art Education (Grájeda et al., 2024; Lahoda et al., 2024; Liao et al., 2025; Meng et al., 2025; Omran Zailuddin et al., 2024; Zhang & Jiang, 2025); one study included respondents with experience in art education (Boiko et al., 2023); one study included first year high school students (Oubibi & Hryshayeva, 2024) while two studies did not specified the education background of the respondents (Kicklighter et al., 2024; Oubibi & Hryshayeva, 2024). The digital tools used by each studies were different, namely AI-neural networks Midjourney and Leonardo, AutoCAD, Julivi CLO 3D and Tilt Brush tool (Lahoda et al., 2024); VR youtube 360, VR spatial ability assessment software, VR blockworks (Liao et al., 2025); Firefly, Substance Sampler, ChatGPT, genAI (Kicklighter et al., 2024) Adobe After Effects and Maya (Meng et al., 2025); Unreal (software) (Zhang & Jiang, 2025); Dall-E, Wombo Dream, remove.bg and Prisma (Omran Zailuddin et al., 2024); while some did not specify the name of tools by giving general type of digital tools used, for instances AI (Artificial Intelligent) tools, VR (Virtual Reality), AR (Augmented reality), online teaching platforms, AI and VR fine art training (Grájeda et al., 2024; Meng et al., 2025; Oubibi & Hryshayeva, 2024; Rong et al., 2022). The digital tools usage duration for learning were 1 year (Grájeda et al., 2024); average frequency of using VR was 6 times per student per month (Lahoda et al., 2024); total 18 hours of teaching, with 1 hour of each week (Liao et al., 2025); 15 weeks (Kicklighter et al., 2024); 20 weeks of course teaching and practical operation (Meng et al., 2025); four consecutive weeks of training: 3 times of 20 minutes trainings by art teachers in a week; the students had free hand-painting creation training for the other time (Rong et al., 2022); while three studies did not specify the training duration (Omran Zailuddin et al., 2024; Oubibi & Hryshayeva, 2024; Zhang & Jiang, 2025). The summarized details were elucidated in Table 2.

Table 2: Demographic and study design overview of the included articles

Author, year	Studied country	Type of study	Sample characteristic	Type of digital tools or platform	Teaching duration
(Boiko et al., 2023)	Students and teachers from Lithuania, Spain, The Netherlands, Poland and Ukraine	Quantitative and qualitative survey	Sample size: Total of 256 students and 95 teachers Sample age: NA Education background: Student had experience in art education Teachers involved in art education	NA	2-5 years of experience in art education
(Grájeda et al., 2024)	Students and teachers from private university in Latin America	Quantitative survey (30 questions) Observational method	Sample size: 9,244 respondents from School of Arts Sample age: NA Education background: 276 students from Marketing and Logistics; 322 from Graphic Design and 332 from Communication	AI tools, AI-enhanced class and ChatGPT	1 year

(Lahoda et al., 2024)	Students in Ukraine	Qualitative thematic analysis	Sample size: 37 respondents Sample age: NA Education background: Students in Department of Textile and Clothing Design	AI-neural networks Midjourney and Leonardo AutoCAD Julivi CLO 3D Tilt Brush tool	Average frequency of using VR was 6 times per student per month
(Liao et al., 2025)	Students and teachers in central Taiwan	Quasi-experimental research design	Sample size: Control group, N=35; experimental group, N=29 Sample age: NA Education background: Second year students from Automotive department of a technical high school	Meta Quest 2 VR equipment - VR youtube 360 - VR spatial ability assessment software - VR blockworks	Total 18 hours of teaching, with 1 hour of each week.
(Kicklighter et al., 2024)	Students Country: NA	Quantitative survey	Sample size: N=52 Sample age: NA Education background: NA	- Photoshop's generative fill - Firefly - Substance Sampler - ChatGPT - genAI	15 weeks
(Meng et al., 2025)	Students from Ningbo University of Finance and Economics, China	Experimental research design	Sample size: Control group, N=40; experimental group, N=40 Sample age: NA Education background: Students who enrolled in Digital Animation Art courses	- Adobe After Effects and Maya - VR - AR - Online teaching platforms	20 weeks of course teaching and practical operation
(Oubibi & Hryshayeva, 2024)	Primary students from Zhejiang province, China	Experimental research design	Sample size: Control group, N=27; experimental group, N=25 Sample age: Average of 9.76 years old Education background: NA	VR technology	NA
(Rong et al., 2022)	Students Country: NA	Experimental research design	Sample size: Control group, N=16; experimental group, N=17 Sample age: NA Education background: First year of high school students	AI and VR fine art training	Four consecutive weeks of training: 3 times of 20 minutes trainings by art teachers in a week; the students had free hand-painting

					creation training for the other time.
(Zhang & Jiang, 2025)	Students and teachers from China	Quantitative and qualitative survey	Sample size: Control group, N=29; experimental group, N=33 Sample age: NA Education background: - From the Department of Art - Information literacy score: Control group 3.34/6; experimental group 3.56/6	Unreal (software)	NA
(Omran Zailuddin et al., 2024)	Students from Malaysia	Case study approach	Sample size: between 21 to 23 Sample age: NA Education background: from Faculty of Creative Technology, Universiti Malaysia Kelantan	Case study 1: Dall-E Case study 2: Wombo Dream Case study 3: remove.bg and Prisma	NA

Abbreviations: AI: Artificial intelligent; AR: Augmented reality; N: Number of respondents; NA: Not applicable; VR: Virtual reality; 3D: Three-dimensional

Thematic Synthesis And Key Findings

Perceived advantages after integration of digital tools in art education

Based on our research objective, our first aim was to study the perceived advantages by integrating AI tools in art education. This review found that **all studies acknowledged AI can greatly improve the effectiveness and quality of learning outcome in art education**. This can be discussed in different aspects, as all studies involved in different type of fine art education, different type of digital tools and different learning outcome assessment. Nevertheless, all studies resulted in improved learning efficiency and outcome such as more efficient in completing targets (Boiko 2023, Kicklighter 2024); effectiveness of AI in improving the creativity, thinking and knowledge (Grájeda et al., 2024; Liao et al., 2025; Oubibi & Hryshayeva, 2024; Rong et al., 2022; Zhang & Jiang, 2025); increased the quality of work (Lahoda 2024, Meng 2025, Zailuddin 2024). These positive outcomes provided good user experience as user can expect positive outcome when using digital tool in art education. Some students expressed the less repetitive works need to be done thus improving the effectiveness of learning outcome (Lahoda et al., 2024). Even though, there is one study revealed that the students were not comfortable in using digital tools as it was a new learning for them, the students expressed positivity in using digital tools in their art education as it helped in the final outcome (Kicklighter et al., 2024). The second theme for perceived advantages **was the students' learning emotion and satisfaction leading to better learning outcome**. This review categorized students' acceptance, satisfaction and emotions in the same category as these were noted by most of the studies when using digital tools in art education. For instances, the digital tools enhanced the learning experience of students by providing more interactive and collaborative learning environment giving more joy and surprise for the students (Grájeda et al., 2024; Oubibi & Hryshayeva, 2024). This learning environment also induced less anxiety and distraction, which can increase concentration of the students (Rong et al., 2022). The perceived advantages were summarized in Table 3.

Table 3: Perceived advantages by the respondents after digital tools integration in art education

Author, year	Outcome
(Boiko et al., 2023)	Acceptance of students towards new learning tools Students felt it was more convenient to use the tools in completing their learning targets Predictors of Digital-age preparedness - Openness had a strong relationship with evaluating creativity and digital competencies - Conscientiousness had strong relationship with critical thinking, lifelong learning and problem-solving strategies
(Grájeda et al., 2024)	Student acceptance Growing acceptance was indicated by the SIUAIT score, which rose from 58.84 in the first semester of 2023 to 60.60 in the second semester. Outcome of AI usage - Effectiveness of AI (63.57 > 64.70) - Effective of ChatGPT (61.47 > 63.48) - Student proficiency in AI tools (62.21 > 64.24) - Teacher proficiency in AI tools (61.62 > 63.90) - Advanced student skills in AI tools (59.16 > 62.96) Emotional response Traditional displayed a negative emotional climate since it lacked interactive features (sad, anger, fear, surprise), whereas AI displayed a more positive emotional climate (joy, surprise). Teaching experience by the professors AI tools have a great deal of opportunity to improve the teaching-learning process by providing fresh opportunities to liven up lessons, tailor instruction, and encourage student research and innovation.
(Lahoda et al., 2024)	Enhanced working experience Designers don't need to make tangible samples to experiment with textures and colours using virtual reality. Improved quality of the work VR makes it easier to concentrate on the characteristics and quality of design objects. Impact of VR in creative process 86.4% of students showed positive response toward effectiveness of VR in enhancing creativity
(Liao et al., 2025)	Learning outcomes Experimental group was higher in public art knowledge, public art skills, environmental literacy knowledge assessment, environmental literacy skills, environmental literacy attitude at week seventh; Experimental group was higher in public art creation – spatial performance knowledge at week twelfth Aesthetic composition in public art No significant changes between experimental and control group Student and teacher evaluation on the artwork VR improved understanding of public art, environment literacy issues, skills dimension, creative thinking and design, attitude dimension, creative attitude and initiative,
(Kicklighter et al., 2024)	Student acceptance 55% of students felt uncomfortable; 26% were indifferent and 19% were comfortable Benefits of AI tools

	66.7% of students felt positive about the AI tools usage.
(Meng et al., 2025)	Score outcome of students Experimental group had higher scores than control group in terms of theoretical knowledge, practical skills, originality design and comprehensive performance. Satisfaction students Experimental group had higher satisfaction than control group in term of promotion of learning interest, degree of knowledge mastery, cultivation of teamwork ability, stimulation of innovative thinking and enhancement of autonomous learning ability. Score evaluation by the teachers Experimental group had higher score than control group in terms of picture quality, creative novelty, technology application maturity and comprehensive score.
(Oubibi & Hryshayeva, 2024)	Student acceptance Students expressed gratitude for the immersive educational experience. Learning outcome Experimental group was observed to have improved flows state, quiz and creativity than control group.
(Rong et al., 2022)	Emotional expression The students had less anxiety and distraction level Student outcome The creativity and concentration of the students improved. The efficiency of the learning improved.
(Zhang & Jiang, 2025)	Learning outcome - Following the VR experience, the mean for creativity and critical thinking were 4.68 ± 0.85 and 4.23 ± 0.89, respectively. These findings suggest that by utilising the new digital tools to expand their lesson plans, teachers gained confidence in their own capacity for creativity. - Teachers thought VR would attract students' interest, boost their involvement, and motivate them to participate in the process of learning.
(Omran Zailuddin et al., 2024)	Creativity Main of students had good outcome; students successfully developed their creative faculties by turning abstract ideas from screenplays into tangible visuals. Improved work efficiency Most expressed a favourable attitude towards this new addition, mainly appreciating the instantaneous visual feedback that enhanced their design process.

Abbreviations: AI: Artificial intelligent; VR: Virtual reality

Potential factors in promoting creativity after digital tools integration in art education

Next, we explored the possible reason for the digital tool in promoting creativity. This review revealed that most of the studies acknowledged the **visualization ability of digital tools, features or tools that available in the digital tools, which helped in sparking the creativity of students**. With the convenience provided by the digital tools, students can judge more outcome based on visualization, increase their thinking, and with lesser effort (Lahoda et al., 2024; Liao et al., 2025; Meng et al., 2025; Oubibi & Hryshayeva, 2024). With digital tools, students can explore more features, providing more capacities in producing different design or image, increasing their imagination and quality of work (Grájeda et al., 2024; Omran Zailuddin et al., 2024; Rong et al., 2022; Zhang & Jiang, 2025). In addition, the **students' learning experience and motivation** was one of the themes found by the included studies. With the integration of digital tools in art education, this will promote a more interactive environment, sparking the learning intention of the students. As Boiko et al. (2023) mentioned, openness of the students was related to the increased creativity of the students and preparedness of students depends on the students' self-efficacy. With that being said, teaching with digital tools provided a more stimulating environment (Grájeda et al., 2024); interactive session (Lahoda et al., 2024); engaging materials (Liao et al., 2025; Zhang & Jiang, 2025); practical session (Meng et al., 2025); and

better fine art instruction evaluation (Rong et al., 2022). The description on potential factors in promoting creativity after digital tools integration in art education were summarized as Table 4.

Table 4: Potential factors promoting creativity after digital tools integration in art education

Author, year	Factors affecting creativity in using digital tools
(Boiko et al., 2023)	Openness is the key Effective adaptation in a new learning environment is predicated on openness, which is the cornerstone of creativity, and conscientiousness, which is the basis of continuous improvement. Preparedness of students Students' self-efficacy in the creative process is determined by how prepared they are to function effectively in a new learning environment.
(Grájeda et al., 2024)	Enhanced features in AI tools With the use of these resources, students can develop their creative abilities by investigating novel mediums and methods Reduced repetitive work AI techniques are used to automate tedious design activities and produce original versions. Positive learning environment Indicating that incorporating AI technologies into the classroom can greatly assist the development of a more stimulating and emotionally supportive learning environment.
(Lahoda et al., 2024)	VR tools features AI tools allowed students to create whatever they want and can stimulate the outcome, this can lessen the time and increase efficiency, thus promoting creativity among the students. Increase the interaction between designer and product It provides a dynamic setting for experimentation and teamwork, bridging the disconnect between designer and product. Wide information access and personalisation learning This makes learning more efficient and adaptable to various learning styles. Improved motivation and interaction Learning is made more exciting and engaging for them through the usage of captivating immersive technologies.
(Liao et al., 2025)	VR learning environment More engaging pictures and images improved their understanding Visualization of VR Can help to transform idea into a visual to ensure more realistic idea and promote thinking
(Kicklighter et al., 2024)	AI tools feature AI tools were effective in promoting inspiration, idea and working repetitive and tedious tasks
(Meng et al., 2025)	AI learning environment Offers more varied learning resources and practical chances, as well as enhances animation course practices.
(Oubibi & Hryshayeva, 2024)	Learning environment Virtual reality devices give students access to an engaging environment that can boost motivation and broaden their creative perspectives, which increases the possibility of igniting creativity. AI tools feature

	the software's built-in capabilities can support the process of innovation, encouraging originality and improving the finished result.
(Rong et al., 2022)	Learning environment Artificial intelligence will improve the intuitiveness of fine art instruction evaluation. This can boost their enthusiasm for studying fine arts and enhance their capacity for learning. AI tools feature With the help of teachers and appealing equipment, new technology-driven instruction improves pupils' focus and inventiveness. It also improves how different classroom components interact and communicate with one another.
(Zhang & Jiang, 2025)	AI tools feature These results demonstrated that the integration of instruction into the creation of VR-based educational materials improved subjects' understanding of the advantages of tailored instruction to meet the needs of individual students. The interactive feature improved understanding of the students Learning environment Individuals that participated in virtual reality-based instruction expressed more motivation, engagement, and satisfaction along their educational journey. VR covers limitation of traditional class VR helps in accessing sites that cannot be visited physically and useful for model creation in getting precise measurement
(Omran Zailuddin et al., 2024)	AI features Diversification of the features User experience Enhanced the manual work to a better piece of final work

Abbreviations: AI: Artificial intelligent; VR: Virtual reality

Potential factors in hindering the usage of digital tools integration in art education

We also found some potential factors in hindering creativity with the integration of digital tools in art education. One of them were **moral and ethical issue** when using digital tool to generate art works (Boiko et al., 2023; Grájeda et al., 2024; Kicklighter et al., 2024; Meng et al., 2025). Most of the students had this concern and dilemma due to the inclusiveness and integrity of the works. As digital tools will be used by multiple users, the generation of art piece might be limited, and integrity can be questioned. The students were concerned about the over-reliance toward the digital tools might cause the reduction of creativity by the individual. Next, the **competency of the instructor or teachers** play important role in determining the positive outcome of the digital tools integration in art education (Grájeda et al., 2024; Kicklighter et al., 2024; Lahoda et al., 2024; Meng et al., 2025; Oubibi & Hryshayeva, 2024). If the teachers are not able to utilise the advantageous features of digital tools in the classroom, the students will not be able to experience the positive outcome. Moreover, the student may feel overwhelmed when need to learn additional digital skill without proper guidance. Lastly, the potential limitation to integrate digital tool in art education is the **funding and resources** (Meng et al., 2025; Oubibi & Hryshayeva, 2024). With sufficient funding, the accessibility to the digital tools will be ensured, providing students with more features for exploration and creation. The potential factors in hindering creativity after digital tools integration in art education were summarised in Table 5.

Table 5: Potential factors in hindering the creativity after digital tools integration in art education

Author, year	Potential factors in hindering creativity when using digital tools
(Boiko et al., 2023)	- Moral and ethical dilemmas and relates them to the student's life experiences to generate own work.
(Grájeda et al., 2024)	- Highlighted difficulties like the requirement for specialised AI training, availability of appropriate technology, and worries about the reproduction of prejudices and preconceptions. - To prevent falling behind, they underlined the significance of regular training on AI trends and tools.

	- It was also emphasised how crucial it is to continue to apply AI with a critical and moral mindset. - Cost of licensing.
(Lahoda et al., 2024)	- Instructor capability and competency. - Reduced in physical activity. - Reduced in social interaction.
(Liao et al., 2025)	- Small sample size might cause generalization.
(Kicklighter et al., 2024)	- Some students were concerned about whether AI is becoming backbone of the artwork or producing subpar outcomes in future. - Competency of instructor.
(Meng et al., 2025)	- Excessive use of digital tools in new media may reduce the creativity of students. - Lacks fund in providing innovative tools. - Teachers' competency in teaching.
(Oubibi & Hryshayeva, 2024)	- Support from technical team to solve technical challenges.
(Rong et al., 2022)	- NA
(Zhang & Jiang, 2025)	- The majority stated that they preferred drawing to VR for design. Several of them claimed that the VR offered no further design features.
(Omran Zailuddin et al., 2024)	- Some students were overwhelmed by the numerous amounts of ideas generated by AI.

Abbreviations: AI: Artificial intelligent; NA: Not applicable; VR: Virtual reality

Discussion and Limitations

Based on our thorough review of the articles, most of our included studies did not solely measure the creativity of the respondents, the included studies generally measured the quality of art works, including creativity after digital tools integration, for instance the design and the variabilities created by the students. By standardizing grading system used for creativity evaluation may not adequately represent the complex nature of creative thought in digital animation art. Therefore, we assume the positive outcome of the study is concurrence with the improved creativity of the students (as creativity metric is one of our inclusion criteria when selecting the articles). With that, this review disclosed that digital tools integration in art education provided advantages in term of improving learning efficiency and quality of work, as well as enhanced the students' learning experience and emotion. This review outcome corroborate with a systematic review which studied in different field, STEAM (science, technology, engineering, arts and mathematics), revealing the digital utilisation can enhance the creativity of students (Samaniego, Usca, Salguero, & Quevedo, 2024).

Our review suggested that the improved quality of artwork by the students with the usage of digital tools were also mainly due to the features and tools available, making less labour- and time-intensive work by the student, thus improving the efficiency. This is also supported by other study stating the positive impact of using digital tools in creating illustration (Xie, 2024). This study also found that utilisation of digital art can improve the painting performance of the students, specifically the painting performance, learning experience and colour recognition (Chen, Lin, & Chien, 2022). With a positive user experience, the emotion of the user will be influenced as well, which can positively contribute to the development of creativity.

However, we also found that emotion plays important role in the digital utilisation, as was mentioned by Hu & Li (2025). The studied outcome suggests that the features of the digital tools can help the student to enhance their work quality and streamline their working process. This will create a good working process when the students are dealing with the assignments. With the integration of digital tools, especially VR as observed in the included studies, it was mentioned that the visualisation helps to improve the students understanding by providing interaction environment. VR offers a range of sensory experiences and enabling students to engage in highly immersive educational experiences in a virtual setting (Yu & Wang, 2025). Given its capacity to offer more experiential learning opportunities, VR has demonstrated significant promise in aiding students in comprehending important course components and demonstrations. By providing positive learning environment, this can create motivation within the students, which is vital to sustain the continuous learning of the students, thus achieving better learning outcome (Le, 2023). Indirectly, this will inspire students to work on a variety of artistic and scientific projects, giving them the tools they need to unleash their creativity in this modern world

(Samaniego et al., 2024). Therefore, creating motivation among students will help to increase the creativity of the students.

Nevertheless, it is very important to understand the capacity of the resources and students' preparedness when utilising VR in the education. As revealed by Lin et al (2024), VR usage among middle school education did not show positive outcome as expected due to the lack of literacy and proficiency among students and teachers. This is also one of our findings, showing that the literacy of teacher is a main concern by the researchers when implementing digital tools in art education. The literacy of the teachers is crucial as the teachers should utilise the digital tools correctly to solve the limitations seen in the traditional class. As observed in the study by Oubibi & Hryshayeva (2024), even though the primary school students might not be equipped with high literacy in digital tools, the researchers utilised the VR tools with acceptable level of animation to spark their creativity in producing ceramic of various design. The teachers need to have certain level of literacy to produce a learning plan that tailored with the literacy level of students. With that, it is very crucial for the institution to train the teachers to enhance their digital skills and also subscribe digital tools that is useful for the teachers and students in art education.

Moving forward to digitalisation era, creativity might be challenge for art students. Creativity is the act of producing and putting to use worthwhile and unique ideas (Samaniego et al., 2024). Our study depicted the concern of reliability toward digital tools causing a risk of lacking creativity and ethical issue. Although there is concern in this aspect, this should not be a reason in hindering the use of digital tools in art education. To handle these complexities and guarantee that the rights of artists, AI developers, and other players in the digital ecosystem are upheld, ethical frameworks are required (Le-Nguyen, 2024).

This study has some limitation to be addressed, as only one searching engine was used which may limit the total included studies. This can cause generalisation of the result and do not represent the overall scenario. However, ten included studies from different countries showed similar direction of study outcome which showed that integration of digital tools in art education provided several perceived advantages, which help to strengthen our outcomes. Current study applied thematic analysis, which is solely based on the grouping of the findings. The similar theme was grouped for discussion which may spark different opinion by readers. Higher level of analysis should be included, such as meta-analysis, to generate a statistical value to produce a convincing result. However, the limited study included and different of study design were employed, thus statistical analysis was not feasible. Moreover, the perceived advantages by the ten included studies did not only focus on creativity but examined overall performances. Nevertheless, this does not mean creativity factor was not considered. Authors had studied their evaluation metrics in methodology part which all of them included creativity as one of the performance outcomes.

Previous research showed the socio-economic status of the respondent influenced respondents' motivation in using digital tools (Heinz, 2016). It suggested that future research should provide complete demographic of the respondents such as age, education background, type of AI tools and duration of AI usage/application to allow the reader to have a better understanding on the possible factors affecting the positive usage of AI in art education. For example, the outcome by Kicklighter et al. (2024), showed that 55% of the students expressed uncomfortable experience in adapting the AI tools and the author explained the possible misunderstanding of AI definition by the respondent. This misunderstanding might be due to the lack of digital usage experience among the respondents, or the teaching duration was insufficient to achieve the positive outcome. Furthermore, the reader was not able to understand the background of the respondents and the justification of misunderstanding between researchers and respondents. This should be avoided in future research to ensure significant contribution to the field.

Conclusion

In summary, the current research found that the integration of digital tools in art education can increase the effectiveness and quality of learning outcome of students in art education. It also helps to enhance better and positive emotion and create satisfaction among students during the learning. These perceived advantages are achieved by the students as the digital tools provide multiple features or tools that can help to reduce their burden and repetitive works. Moreover, the visualization ability of the digital tools further enhancing the learning environment thus promoting creativity among the students when completing their art working. However, there are several issues were identified to be potential factors that might hinder students from engaging digital tools that can help in creative thinking. There are moral and ethical issue when using digital tools to create art works, competency of the instructor or teachers

in utilising digital tools to enhance the learning environment and most importantly, is the funding and resources. The lack of funding and resources will hamper the usage of digital tools, and thus teachers and students will not have motivation to adapt with new learning tools and environment. These findings are vital and need to be addressed when moving forward to the hybrid learning environment in art education.

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