Review Article

Graphic Design and Education: A Systematic Review on The Evolution, Diverse Aspects, Innovations in Teaching Methods, and Interconnected Changes in Design

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Abstract

This systematic literature review aims to provide a comprehensive overview of the evolution of design education by exploring diverse aspects of graphic design, innovations in teaching methods, and interconnected changes in the field. The PRISMA model with four phases which are identification, screening, eligibility, and inclusion has been used in the search study. The review synthesizes existing research from various sources to examine the historical development, current trends, and future directions in design education. It encompasses a wide range of perspectives, including the changing landscape of graphic design, the integration of innovative teaching methods, and the impact of interconnected changes on design practices. The findings from this review aim to inform educators, practitioners, and researchers about the multifaceted nature of design education and contribute to the ongoing discourse in the field.

Keywords: graphic design, evolution, innovations, education.

INTRODUCTION

In recent times, graphic design has evolved significantly to encompass various aspects of visual communication in various environments. This includes traditional formats such as books and posters as well as advanced applications such as mobile apps and 3D animations. Incorporating aesthetic elements into the design process increases the richness of the produced materials and contributes to the wider influence of graphic design in the field of art design. (Ding et al., 2020). The art and design degree covers a wide spectrum, including painting, drawing, sculpture, and graphic design. Students will be introduced to basic design concepts, colour theory, critical analysis, and creative approaches. Although design has the potential to solve problems, like other art forms, there is no guarantee of success (Yu & Yu, 2022). The importance of colour matching has become a key factor in the quality of art and design, especially with the widespread use of information technology. However, many designers lack a systematic study of colour matching, which makes it difficult to create impressive artwork (Yang et al., 2022).

This research is supported by a comprehensive methodology that includes a literature review and case studies that shed light on the current state and trends in contemporary graphic design. Intensive technological development has led to educational methods and active strategies at the higher education level that reflect the best practices in the field (Alharthi, 2020; Ahmad Shahrizal et al., 2022; Hasbullah et al., 2023). In its recent growth, the graphic design industry has struggled with challenges such as the time and resource cost of designing solutions from scratch. Information-sharing platforms are increasingly valued to meet these challenges. Graphic design training simulates industry practices and emphasizes a studio-like environment. Artificial intelligence and Web 2.0 have significantly shaped education, driving the development of new pedagogical models that integrate social and technological changes (Ibrahim et al., 2023; Owens & Gibson, 2017; Salawali et al., 2021). The integration of structural packaging principles into design education, the struggle to establish a research culture in graphic design, and the evolving research landscape amid COVID-19 are key topics. Additionally, the role of social media platforms like Facebook in higher education and the challenges of assessing design quality are crucial to be analyzed (Azmi et al., 2024).

The recognition of video games as a commodity made up of art, design, science, technology, and marketing techniques emphasizes the need for graphic design education to prepare students to adapt to an ever-changing world (Wong Shaw Chiang et al., 2018). In short, graphic design education should promote lifelong learning, critical thinking, problem-solving and reflective skills. The goal is to train students to become design generalists who can adapt to the changing graphic design landscape and face changing audiences and profit goals.

MATERIAL AND METHODS

The systematic review process has three main steps including identification, screening and eligibility that help select several relevant papers for this report.

Identification

Finding linked, similar terms using dictionaries, thesauruses, encyclopaedias, and past research is the first step in the process of keyword recognition. In this article, the keywords used are education, graphic design, teaching, and art. As shown in Table 1, search strings were developed for the Scopus, Web of Science, and ScienceDirect databases based on relevant keywords. This initial step of the systematic review successfully extracted 558 publications from the three databases.

Table 1: The search strings

Category	Description
Scopus	TITLE-ABS-KEY ("ART" AND "GRAPHIC DESIGN" AND "EDUCATION" AND "TEACHING") AND PUBYEAR > 2017 AND PUBYEAR < 2024 AND (LIMIT-TO (DOCTYPE, "ar")) AND (LIMIT-TO (LANGUAGE, "English")) AND (LIMIT-TO (SRCTYPE, "j")) AND (LIMIT-TO (OA, "all")) AND (LIMIT-TO (PUBSTAGE, "final"))
Web of Science	https://www-webofscience-com.eresourcesptsl.ukm.remotexs.co/wos/woscc/summary/f7dde5c7-6a3c-4701-bb3d-c3112bddfea3-c6e1fb5e/relevance/1
Science Direct	https://www-sciencedirect-com.eresourcesptsl.ukm.remotexs.co/search?qs=%E2%80%9CART%E2%80%9D%20AND%20%E2%80%9CGRAPHIC%20DESIGN%E2%80%9D%20AND%20%E2%80%9CEDUCATION%E2%80%9D%20AND%20%E2%80%9CTEACHING%E2%80%9D&years=2023%2C2022%2C2021%2C2020%2C2019%2C2018&lastSelectedFacet=accessTypes&articleTypes=FLA&accessTypes=openaccess

Screening

A total of 558 articles were prepared for the screening step, the second step in the process. At this stage, the title and essential content of each article were carefully examined and removed based on the following criteria: non-English articles, publication before 2018, non-journal articles, in-press publications, and non-open access articles. The articles were then checked for duplication, resulting in the removal of three duplicate reports. Ultimately, 80 articles remained open for evaluation.

Eligibility

A total of 80 articles have been prepared for the third step, which is called eligibility. At this point, the titles and important content of every article were carefully examined to make sure that the inclusion criteria were met and that the articles fit into the current study and its goals. As a result, three articles were eliminated due to being out of the graphic design field, 45 articles were excluded because the title was not significant to the related topic, 3 articles were removed because the abstract was not related to the field of study and 8 articles could not be fully accessed. Lastly, Table 2 shows the selection criterion in searching the articles and it indicates that 21 articles are available for review. The flow diagram of the proposed search study, adopted from (Moher et al., 2009) is illustrated in Figure 1.

Table 2: The selection criterion in searching.

Criterion	Inclusion	Exclusion
Language	English	Non-English
Timeline	2018 - 2023	<2018
Literature type	Journal (Article)	Besides Journal (Article)
Publication stage	Final	In Press
Open access	All	Non-Open Access

FINDINGS

The studies show how graphic design is moving toward digital tools, highlighting the advantages of technical support and weight-based colour matching as well as their superiority. The field of graphic design is constantly changing, and their support of creative teaching strategies, emphasis on the value of ethical design, and call for increased research in the field have all influenced this evolution. All articles were categorised based on four main themes, which are diverse aspects of graphic design (4 articles), innovations in teaching methods (10 articles), interconnected changes in design (4 articles) and evolution of design education (3 articles). The four themes are discussed as follows.

Diverse Aspects of Graphic Design

The broad field of graphic design is defined by a variety of factors, each of which functions as a unique thread connected to the complex patterns of visual communication. The graphic design consists of a wide range of elements, from the careful selection of colour models like CMYK, HSB, and RGB, which are essential in creating artwork of outstanding quality, to the delicate decisions made regarding colour quantity, background hues, and colour matching styles (W. Wang, 2022). Moving past the details, the field widens to include the interactive qualities of contemporary graphic design made possible by state-of-the-art design software. This is where the interaction between creativity and technology takes place, identifying a specific aspect within the larger field. Xie (2023) discovered that when modern graphic design and technically aided design interacted, modern graphic design greatly improved. However, the variety goes even further, combining training in aesthetics and the study of visual culture as necessary

elements of graphic design expertise. This comprehensive approach to graphic design education embraces a wider understanding that enhances a designer's artistic fluency, going beyond the purely technical (Presol Herrero & Pérez Manzanares, 2020). Further adding to the complexity of graphic design is the importance of environment and space design, which is particularly apparent in the context of game production. Fundamentally, the field flourishes because of its variety, weaving inventive and creative artwork that continuously modifies the visual environment. The summary of the articles with the theme "Diverse Aspects of Graphic Design" is shown in Table 3.
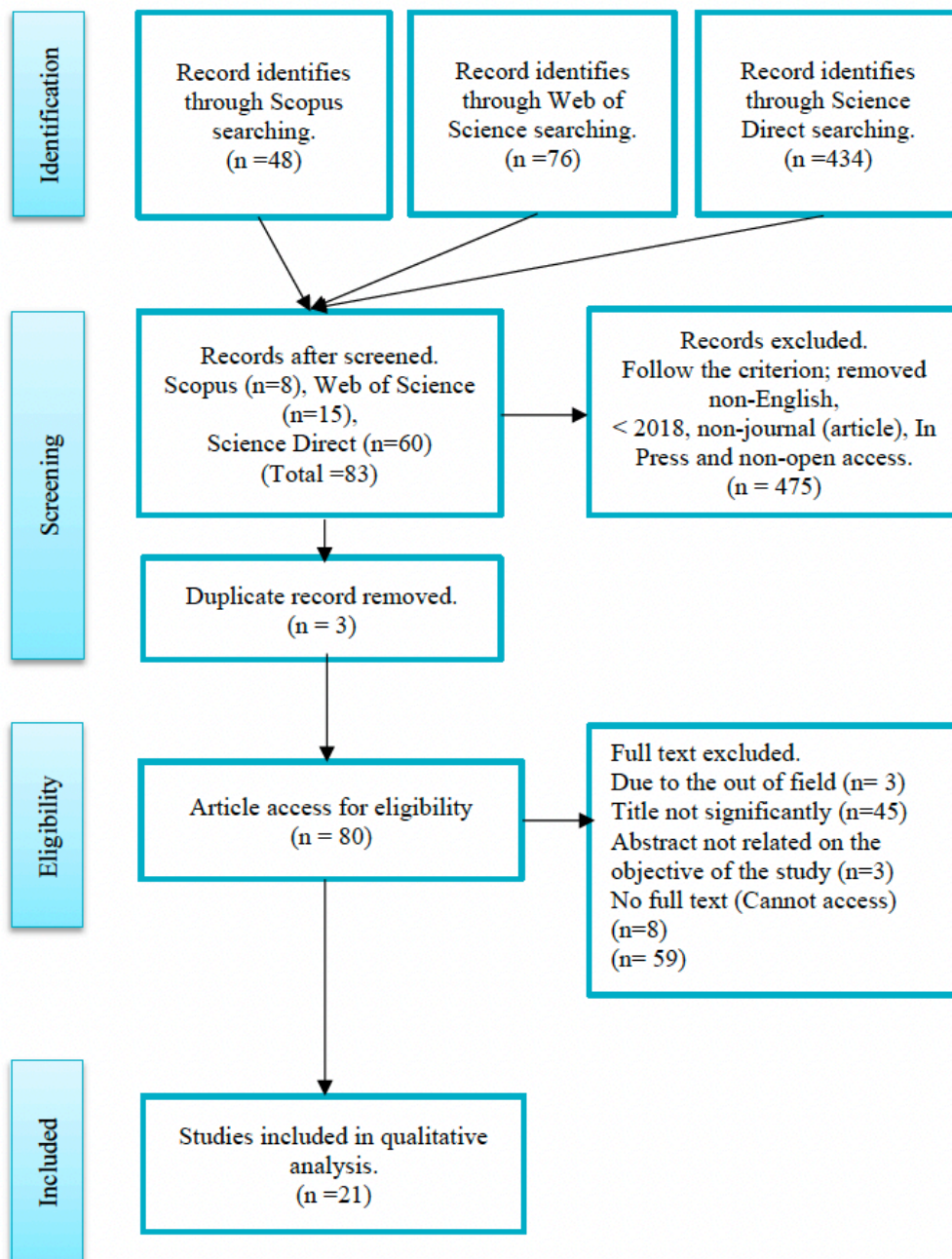

Figure 1: Flow diagram illustrating the proposed search strategy for the study.

Table 3: Summary of diverse aspects of graphic design.

Authors	Journal	Methodology	Result	Advantages
W. Wang (2022)	Mobile Information Systems	With the use of computer technology, the hue and colour amount rate of a mathematical framework are successfully selected. The backdrop colour, colour amount, and colour-matching style must all be selected at the same time. Applying hue-saturation-brightness (HSB), red, green, and blue (RGB), cyan, magenta, yellow, key (CMYK), and other modes is suggested to obtain the approximate hue sum, which can be a useful standard for the modernization of art design.	The experimental findings demonstrate the great colour difference accuracy of both colour-matching groups used for this article. Regardless of whether the weight factor is genuine art picture accuracy or computer colour matching, the colour difference formula accuracy offered by the weight factor for the colour difference is superior to the colour difference formula accuracy provided by other weight factors.	It clarifies for individuals how colour matching in art and design may be done with technology. Additionally, it enhances their ability to produce high-calibre works of art for designers and artists. The method used in the study is global and advantageous to many designers and artists. Additionally, it can foster a creative atmosphere that produces more original and powerful artistic results.
Xie (2023)	Journal of King Saud University - Science	Empirical analysis includes engaging with industry professionals and design experts through surveys and interviews. Chi-square tests, Multivariable Logistic Regression, and ANOVA are utilized for evaluation. The analysis emphasizes the importance of considering user experience in design and aims to identify the key components and methods essential for effective interaction design.	When technically assisted design and modern graphic design interacted, it was discovered that the latter greatly enhanced the former.	Technology in graphic design offers expanded creative possibilities, enhanced user experiences, exploration of psychological effects for captivating designs, the use of virtual and augmented reality, AI integration for automated designs and collaboration, and ensures continuous evolution in the field.
Presol Herrero & Pérez Manzanares (2020)	Vivat Academia. Revista de Communication	Two approaches are developed: recovery and bibliographic exploration, which looks at the connections between the technical knowledge of the two fields; and practical analysis of the outcomes from its use in the classroom and questionnaire, which functions as a qualitative research instrument for students pursuing degrees in advertising and public relations.	The results show that the transversal teaching style, along with historical and theoretical training on visual media, is well-suited for the use of digital techniques and the development of projects for the establishment of branding, visual identity, and brand image.	Students' creative works demonstrate their proficiency in design and aesthetic communication, which will help them succeed in visual communication in the future.
Okur & Aygenc (2018)	Eurasia Journal of Mathematics, Science and Technology Education	Advanced technologies were utilized in the design of Assassin's Creed Unity, creating highly realistic and accurate 3D environments. Players interact with the game world through hand-eye coordination, auditory cues, and knowledge-based perceptions. The game's success is largely attributed to its compelling story, architectural design, and graphic elements, which effectively guide and immerse players.	An extensive assessment of many people who play video games regularly has verified this important influence.	More research on the beneficial effects of video games on education is suggested, along with suggestions for incorporating games like Assassin's Creed Unity into educational activities and enhancing teachers' knowledge of and proficiency with video game use in the classroom.

Innovations in Teaching Methods

In an era of rapidly evolving technology, the graphic design community faces challenges that drive innovation and necessitate rethinking teaching approaches. Scholars have explored diverse learning methods in graphic design with positive outcomes, highlighting the potential for innovative, globally applicable teaching strategies. Research and studies in graphic design reveal key insights and

advancements. The effective use of the Integrated Risk Management (IRM) platform showcases successful data-rich designs, while Convolutional Neural Network (CNN) clustering techniques adeptly process patterns, colours, shapes, and functions aligned with data value trends (Xu, 2022). Remarkable topics emerge that highlight the positive effects of blended learning (Alsuwaida, 2022), effective didactic decisions by growing the experimental group (Matjaž Duh & Martina Kač Nemanič, 2020), and advances in radiology application's entertainment value, graphic design, usability, and educational potential, the reaction was favourable for user understanding (Ruth Connaghan et al., 2019).

Challenges faced by design educators in successful courses using desktop applications and online resources are acknowledged. Previous researchers have proven that the innovation in teaching methods in several projects including computational thinking (Y. Wang, 2023), blended learning (Nurrijal et al., 2023), adaptive teaching (Tan, 2023), and flipped classroom (Joy et al., 2023) improve the user's level of knowledge. Acknowledging prerequisites such as colour science, design graphics, and computer graphics, innovative teaching strategies such as visual modelling and observation are emphasized. The preference for personal education over Facebook is emphasized, emphasizing its complementary role, while the development of a Small Private Online Course (SPOC)-based flipped classroom model supports the long-term growth of open education (Y. Wang, 2021). Regarding package design, The STEAM method significantly boosts creativity in package design, with ethnic design graphics enhancing creative potential in non-practical art classes. Previous work has been proven and have a positive impact towards the user of science (Delgado-Rodríguez et al., 2023), language (Nasab & Rahimi, 2023), engineering (Rusni et al., 2023), arts (Liu et al., 2023) and mathematics (Haas et al., 2023). Table 4 presents a summary of articles centred around the theme of "Innovations in Teaching Methods".

Table 4: Summary of innovations in teaching methods.

Authors	Journal	Methodology	Result	Advantages
Xu (2022)	Mathematical Problems in Engineering	Create a visual design system and management technique using the information resource-sharing platform's large data and data points.	The outcomes show that the IRM platform effectively produces successful graphic design examples. The CNN and clustering methods efficiently manage pattern, colour, shape, and character features, aligning well with data trends and effectively analyzing the feature data value of graphic design.	This is an important piece of study for graphic designers. With a maximum prediction error of just 2.34 per cent, pattern features of graphic design are the primary source of this problem. The remaining prediction errors are all within 2.03%.
Alsuwaida (2022)	Journal of Information Technology Education: Research	A pilot study using both qualitative and quantitative methods was used in the investigation. Pre-surveys, in-depth individual interviews, and a focus group's pre-and post-tests were used to gather data.	The findings revealed three key themes: 1) Incorporating blended learning into art education using the Quality Matters™ Higher Education Rubric, 2) The impact of Voki on developing 21st-century skills in a blended learning environment, and 3) Voki's effect on student interactions. Overall, Voki enhanced students' 21st-century skills in the blended learning setting.	Effects on the Community Students' comprehension of the course requirements and ability to raise their grades were both enhanced by the QMHER. A lot of Web 2.0 resources were also beneficial for teaching and understanding concepts related to art and design.
Matjaž Duh & Martina	Croatian Journal of Education	The experimental method of empirical-analytical pedagogical research. It entailed contrasting how a cutting-edge didactic	A series of didactic decisions, including the combination, diversity, and dynamism of	The experimental program could be used in a variety of social settings and was

Kač Nemanič (2020)		approach affected the growth of artistic knowledge and creativity in art design when teaching graphic design.	instructional forms, methodologies, and didactic communication, have been found to have beneficial effects in favour of the experimental group.	appropriate for both boys and girls.
Ruth Connaghan et al. (2019)	Adv Exp Med Biol	To develop a user-friendly AR application, functional and non-functional criteria were listed using a SE methodology. The application features interactive learning materials, marker identification, 3D models of buckle fracture, and interaction. Surveyed and interviewed 71 kids to evaluate the app, getting their opinions on its usability, design, and educational value.	The response was positive in terms of the application's educational potential, graphic design, usability, and entertainment value. Notably, it was shown that the programme enhances user comprehension of radiology across all age groups following a trial period.	This study demonstrates the enormous potential for utilising digital technologies more specifically, augmented information to interest the next generation in science at an early age.
Pontis & van der Waarde (2020)	She Ji: The Journal of Design, Economics, and Innovation	Examine two information design courses to present a research-driven, science-based, student-focused approach that will prepare educators to handle these changes.	Even though both courses are successful based on student work and course assessments, these examples also draw attention to new difficulties facing design educators.	The article concludes with potential research topics, including the value of teaching experience and determining the needs and motivations of students.
Gula et al. (2023)	Journal of Curriculum and Teaching	Surveying students in higher education to ascertain whether HEIs are capable of teaching graphic design using methods such as comparative analysis, systematisation, generalisation, and survey.	A survey of graphic design students found that desktop applications like Adobe Photoshop and Affinity Designer, along with online tools like Canva and Pixar, significantly aid skill development, including 3D design programs like Blender and Pain. Innovative teaching strategies include visual modelling, autonomous reproduction, and observation.	Research has shown that teaching graphic design in higher education institutions for the arts through the effective use of differentiated methods aids in the development of students' skills in several areas, including the ability to create design objects using modern computer graphics programmes, use project graphics fundamentals.
Souleles (2012)	Research in Learning Technology	This phenomenographic study examines how graphic design undergraduates at a Cyprus university perceive the platform's potential for both teaching and learning. The importance of the studio and student self-reflection is a defining feature of education in art and design.	Participants preferred in-person training over Facebook, viewing it as a supplement to studio work. However, some used Facebook to join support groups and access study-related information.	Future research may focus on Facebook's integration with studio-based teaching and learning.
Y. Wang (2021)	Wireless Communications and Mobile Computing	This model simplifies teaching design into SPOC platform and flipped classroom activities, applied to open education. Data is collected via surveys and interviews, analyzed with EXCEL and SPSS, and supplemented by in-depth learner and professor interviews. Insights from these platforms guide teaching plan adjustments for optimization.	To support the long-term growth of open education, a SPOC-based flipped classroom teaching design model was developed based on comparison, and an empirical implementation was conducted at the Open University.	It incorporates flipped classrooms, MOOCs, and SPOCs to advance college teaching reform and raise the standard of graphic design education.
Sakon & Petsangsri (2021)	Archives of Design Research	The "Creative Packaging Design" subject is taught using the CREATE approach. 2) Course Outline 3) The Creative Thinking	The ANOVA test indicated that the average creativity score for packaging design was	Our approach included several important components, such as encouraging students to

		Test Data was gathered three times to examine the impacts of creativity using repeated measures: before the study, following the study, and during a follow-up phase. ANOVA.	significantly below the desired level, suggesting that the STEAM approach impacted students' creativity. Post-test results showed a strong recall of course material, with scores significantly higher than both pretest and those two weeks post-graduation. The minimal difference between follow-up and post-test scores further indicates strong retention of key concepts.	share ideas and to "think outside the box" in general.
Diachenko et al. (2021)	International Journal of Health Sciences	Basic experimentation techniques are used in the workplace, along with techniques for observation and interviewing.	In practical extracurricular classes, participants positively assessed the use of the graphic function of ethnodesign for educational purposes. The approach, which actively involves students and fosters creativity, effectively enhances the inventive potential and creative abilities of art students.	The research work's point of view is the continued execution of training and educational initiatives devoted to teaching design methodologies.

Interconnected Changes in Design

A paradigm shift in design education was driven by the design-based research (DBR) technique, which not only informed curriculum development but also gathered positive and educational feedback from students. The combination of mobile augmented reality (AR) and virtual reality (VR) not only enhanced student creativity and facilitated e-portfolios, but also provided authentic learning environments (Sinfield & Cochrane, 2020). This transformative approach goes beyond the traditional study-based classroom, providing students with broader educational opportunities, fostering greater community outreach, and encouraging engagement on a global scale. In the field of art education, work indicates that generative artificial intelligence (AI) has the potential to enhance creativity, self-expression, and interconnected co-creativity, providing new avenues for exploration (Vartiainen et al., 2023). Frascara (2022) emphasizes ethical communication design that balances social and environmental responsibility with beneficial outcomes and advocates an organized, multidisciplinary approach to solving complex design problems related to human behaviour. It emphasizes the need to address issues through research, expert participation, and iterative design processes, and expresses concern about the readiness of teachers, students, and practitioners for a more responsible approach. Defending interdisciplinary and methodological approaches in design education and practice, the essay completes its arguments with illustrative design projects. In addition, Mansour et al. (2020) demonstrated the applicability of organic waste materials in textile dyeing, emphasizing biodegradability and environmental awareness. The research introduces students to integrated ways of thinking in both personal and work environments to instil awareness of circular economy principles and sustainability in various artistic activities. The summary of articles associated with this theme is provided in Table 5.

Table 5: Summary of interconnected changes in design.

Authors	Journal	Methodology	Result	Advantages
Sinfield & Cochrane (2020)	E-Learning and Digital Media	The investigation of new technologies, such as mobile augmented reality and virtual reality, over the course of two redesign iterations, to increase the impact and reach of their work portfolios. The students used the concept of Visual Poetry and a combination of typography and moving images to create a range of works of art that were inspired by a specific place. To digitally improve their work and facilitate the building of student portfolios, they shared these works via an ecosystem of technologies.	The DBR technique guided the curriculum development, student feedback was favourable and instructive, and mobile AR and VR increased student creativity and portfolios. AR and VR also provide authentic learning environments.	Students will have expanded educational options outside of the traditional studio-based classroom with the curriculum overhaul, including increased community outreach and participation in an increasingly global setting.
Vartiainen et al. (2023)	International Journal of Education Through Art	This study explored middle school students's creative use of text-to-image generative AI. Qualitative content assessments of newly developed learning activities demonstrated how innovative digital artefacts and cooperative conversations were used to externalize generative AI-formed relations. Peer collaboration in AI-driven creation fostered idea generation, while dialogic teaching encouraged critical analysis and understanding of human-technology relations.	In art education, generative AI can improve creativity, self-expression, and networked co-creativity.	Generative AI can improve art education and offer ideas for new lines of inquiry.
Frascara (2022)	She Ji: The Journal of Design, Economics, and Innovation	The state of communication design is critically analysed in this study, with an emphasis on how design processes are affected by simplicity and how complicated human interactions are with communications.	The study emphasizes ethical, fact-based communication design that balances social and environmental responsibility. It advocates a multidisciplinary approach to complex design issues, focusing on problem reframing, expert research, and iterative design. The study also highlights stakeholder analysis and questions the preparedness of educators, students, and practitioners for a more responsible design approach.	In addition to highlighting the necessity of interdisciplinary and methodical approaches in design education and practice, the essay offers examples of design projects.
Mansour et al. (2020)	Energy Reports	Utilize some naturally occurring waste items that include pigments to recycle natural dyes for textile colouring, as these dyes are becoming more and more popular due to their biodegradability and environmental consciousness.	The results of the research showed the possibility of using organic waste materials as natural dye supplies for textile colouring, with an emphasis on advancing biodegradability and environmental consciousness.	A range of integrated ways of thinking is introduced to students to raise their knowledge of the circular economy and sustainability challenges in all of their art endeavours, from personal to professional settings.

Evolution of Design Education

The common thread running through these discussions is the evolution of design education. Together, the arc of change in design education is highlighted, covering various aspects. First, there is an emphasis on promoting global citizenship and student mobility through engaging cultural learning experiences, emphasizing the need to prepare them for an interconnected and globalizing world (Iain Macdonald & Myrna MacLeod, 2018). Second, the study of the Graphic Design Elective in the HND Commercial Art programme focuses on its relevance to the printmaking industry and the employability of graduates. This study shows the urgent need to develop the project education system to meet industry expectations and adapt to the dynamic demands of the workforce (Sarpong-Nyantakyi et al., 2022). Finally, the third degree deals with the challenges of graphic design in creating an academic research culture, showing a desire to understand the historical development and barriers that prevent the integration of research practices in the academic field of graphic design. Together, these discussions crystallize the multifaceted evolution of design education, encompassing global perspectives, industrial relevance, and academic research culture (Corazzo et al., 2019). The evolution of design education reflects a dynamic response to global, industrial, and academic demands. The focus on fostering global citizenship and enhancing student mobility prepares learners for an interconnected world while adapting curricula to meet industry expectations ensures the employability of graduates. Additionally, addressing the challenges in creating a robust academic research culture within graphic design highlights the need for a deeper integration of research practices. Together, these elements underscore the importance of continuously evolving design education to stay relevant, innovative, and responsive to the changing landscape of both industry and academia. Refer to Table 6 to see the summary of the articles on this theme.

Table 6: Summary of the evolution of design education.

Authors	Journal	Methodology	Result	Advantages
Iain Macdonald & Myrna MacLeod (2018)	International Journal of Art & Design Education	This study uses data from student interviews and reflective journals to examine how UK design students engaged with and managed the execution of real projects in an African setting, particularly Mozambique. It also looks at the broader effects on the group of friends and classmates who watched the experience online rather than going to Africa.	Within the framework of university learning, teaching, and assessment procedures, design educators can look beyond corporate and traditional consumer channels to a more socially conscious and community-focused approach that transcends boundaries.	According to the report, design educators in universities should break away from conventional business conventions and take a more community-focused and socially conscious approach.
Sarpong-Nyantakyi et al. (2022)	Higher Education, Skills, and Work-based Learning	A qualitative, evaluative case study explored CAPGD stakeholder perspectives, involving industry supervisors, graduates, and academics. Focus groups and semi-structured interviews provided comprehensive insights and conclusions.	The results show that the outdated polytechnic-based curriculum lacks a practical approach, leaving most graduates without the skills to meet industry standards.	To fill a vacuum in the literature, the findings offer distinctive insights into the employability of graduates in commercial art, particularly in Ghana.
Corazzo et al. (2019)	The Design Journal	Examination of data that is accessible to the public	By looking through publicly available data, find a tiny quantity of graphic design research that is focused among a small number of universities and follows traditional academic, non-practice-based trends.	As a result, we offer several suggestions for a sustainable agenda for graphic design research changes.

DISCUSSION AND CONCLUSION

The intricate weave of graphic design as a discipline, as detailed in the passage, reveals the deep interconnection between traditional artistic elements and modern technological advancements. The selection and application of colour models like CMYK, HSB, and RGB, alongside the decisions surrounding colour matching, demonstrate the field's reliance on both aesthetic judgment and technical precision. This convergence of art and technology is further emphasized by Xie (2023), who highlights the significant improvements in graphic design when modern techniques are paired with technologically aided design. The expansion of graphic design beyond mere technical execution into the realms of aesthetics and visual culture underlines the importance of a comprehensive educational approach, one that equips designers with both artistic fluency and technical proficiency.

The discussion on the evolving challenges within graphic design education underscores the importance of innovative teaching strategies. The incorporation of platforms such as Integrated Risk Management (IRM) and techniques like Convolutional Neural Networks (CNN) exemplifies how data-driven methods are revolutionizing the way patterns, colours, and functions are approached in design. The positive outcomes from blended learning (Alsuwaida, 2022), adaptive teaching (Tan, 2023), and the flipped classroom model (Joy et al., 2023) reflect the growing importance of flexible, student-centred learning environments. Moreover, the use of computational thinking and the integration of science, technology, engineering, arts, and mathematics (STEAM) in package design illustrate the growing trend towards interdisciplinary approaches in design education, which foster creativity and critical thinking in students across various fields.

The ongoing evolution in graphic design education and practice demonstrates a clear shift towards a more integrated, technology-enhanced, and ethically grounded approach. The use of advanced technologies like augmented reality (AR) and virtual reality (VR) not only expands the creative potential of students but also provides them with authentic, immersive learning experiences that extend beyond traditional classroom boundaries. This transformation is supported by the design-based research (DBR) technique, which plays a crucial role in curriculum development and student engagement, thereby ensuring that educational practices remain relevant and impactful. The integration of sustainability principles, as seen in the use of organic waste materials for textile dyeing (Mansour et al., 2020), further emphasizes the importance of instilling environmental awareness and responsibility in future designers.

Based on encouraging results, there are a lot of possible research directions to enhance graphic design education and skill development. By adding more gamification components, educators can make the experience more entertaining while evaluating the effects of various game mechanics, challenges, or rewards on maintaining user motivation and engagement in graphic design education. The efficacy of modern methods of instruction in graphic design education, such as visual modelling, autonomous reproduction, and observation, also needs to be studied. This involves investigating how these tactics affect students' creative thinking, skill development, and learning experiences. It is advised that future researchers carry out in-depth user experience (UX) studies to understand how designers view and interact with technologically aided design tools.

In conclusion, the intersection of technology, ethics, and interdisciplinary education in graphic design signifies a broader shift towards a more holistic approach to design education. By embracing innovative teaching strategies, fostering creativity through technological tools, and promoting ethical and sustainable practices, the field of graphic design is poised to address the complex challenges of the modern world. This comprehensive approach not only enhances the artistic and technical skills of students but also prepares them to contribute meaningfully to a rapidly evolving visual and environmental landscape.

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CONFLICTS OF INTEREST

All authors declare no conflicts of interest.

AUTHOR CONTRIBUTIONS

Halina Ramli: Conceptualization, Visualization, Investigation, Original draft preparation. **Norshahila Ibrahim**: Data curation, Writing, Original draft preparation. **Putri Taqwa Prasetyaningrum**: Writing, Reviewing and Editing. **Muhammad Abdul Malik Saedon**: Writing, Reviewing and Editing.

DECLARATION OF GENERATIVE AI

During the preparation of this work, the authors used ChatGPT to enhance the clarity of the writing. After using ChatGPT, the authors reviewed and edited the content as needed and take full responsibility for the content of the publication.

DATA AVAILABILITY STATEMENT

Data is available on request from the authors.

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