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The integration of Artificial Intelligence into the teaching and learning processes of specialized Graphic Design software

La integración de la Inteligencia Artificial en los procesos de enseñanza-aprendizaje del software especializado de Diseño Gráfico

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Abstract

The inclusion of Generative Artificial Intelligence (GenAI), image recognition and its alteration in Adobe Illustrator and Adobe Photoshop has changed the parameters in the work logic of these platforms. Understanding the scope of the software and its effects on the creation of visual proposals within the objectives of the discipline is fundamental in the teaching knowledge in view of the rapid progression in the image construction mechanisms.

In this approach, the possibilities and relevance associated with the implementation of Artificial Intelligence as a catalyst in the teaching and learning processes of the specialized Graphic Design software are explored. It also highlights both the potential benefits and teaching challenges in the use of these tools, providing a vision of the configuration of the digital image from the virtues and limitations of new technologies.

Keywords: Teaching, learning, Graphic Design, software, Artificial Intelligence

Resumen

La incorporación de la Inteligencia Artificial Generativa (GenAI), el reconocimiento de la imagen y su alteración en los programas Adobe Illustrator y Adobe Photoshop ha cambiado los parámetros en la lógica de trabajo de dichas plataformas. Comprender los alcances del software y sus efectos en la creación de propuestas visuales dentro de los objetivos de la disciplina es fundamental en el conocimiento docente ante la rápida progresión en los mecanismos constructores de la imagen.

En este acercamiento se exploran las posibilidades y la relevancia asociada con la implementación de la Inteligencia Artificial como catalizador en los procesos de enseñanza-aprendizaje del software especializado de Diseño Gráfico. Asimismo, se destacan tanto los beneficios potenciales como los desafíos de enseñanza en el uso de estas herramientas, proporcionando una visión de la configuración de la imagen digital desde las virtudes y limitaciones de las nuevas tecnologías.

Palabras clave: Enseñanza, aprendizaje, Diseño Gráfico, software, Inteligencia Artificial

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Introduction

From ancient times to contemporary times, the transformation of teaching and learning processes in society has been permanently influenced by the incursion of new technological tools that have a strong impact on the way they are harnessed and used. This has posed great challenges in university-level education, since it has led to the continuous need to adapt and update curricular content, while at the same time opening up endless possibilities of application that were unthinkable until recently.

In this context, the integration of generative tools in the management of the image through specialized Graphic Design software has provoked reflection among teachers, who recognize the importance of incorporating these resources in a conscious way, evaluating the scope and ethical implications in the university environment. With this reflection, they not only seek to take advantage of these resources for academic training, but also to prepare students for future professional performance.

This paper explores the interrelation of Artificial Intelligence and university teaching in Graphic Design at the Autonomous University of the State of Mexico, from an ethnographic approach in teaching practice, through a constant reflection on the urgency of updating the contents and the needs of the area of teaching technology of the curriculum. Specifically, it highlights the prevailing need for the incorporation of AI in the teaching and learning processes of specialized software, such as Adobe Illustrator and Adobe Photoshop in the management and transformation of the image, as well as in the effects in the generation of visual proposals within the objectives of the discipline.

Educational Technology and Artificial Intelligence

The development of technological advances in the current context has impacted all areas of society globally, affecting the development of people in culture, communication, information, economy, science and education. This has had an influence on the social, cultural and economic sectors. In this sense, there has been a growing use of Information and Communication Technologies (ICT) in a generalized way as a support to speed up and solve daily tasks both personal and academic as well as work. There has also been an increasingly frequent use of New Information Technologies, ["constituted by multimedia technology, computing, general

public electronics, telecommunications, expert systems, virtuality, artificial intelligence, robotics"] (Ruiz de Velasco, cited by Campos, 1999, p. 5, own translation), highlighting above all the automation of communication and the transfer of information at a distance, both so common that they are sometimes done in a natural and intuitive way with the technological tools that we have at our disposal and use continuously.

These New Information Technologies have an impact on various areas, such as computing, multimedia, telecommunications, virtuality, artificial intelligence and education, among others. They are present in any activity and have repercussions on the behaviors of the Information Society, which ["is characterized by the ability of people to obtain and share diverse information, in a relevant way, from anywhere and in the way they prefer, through the technological tools available"] (Santos *et al.*, 2022, p. 166, own translation). Thus, in this society, emphasis is placed on the use of technological tools to obtain and share information from practically all over the world and by any means, giving decision-making power to people, who, both in the virtual world and in the non-virtual world, require certain skills to do so.

> Para construir conocimientos en cualquier campo del saber, las personas necesitan competencias fundamentales, basadas en el pensamiento crítico y creativo. Estas competencias son objetivos esenciales para la educación.
>
> El pensamiento crítico se ejerce en el cuestionamiento, al desafiar argumentos, rechazar conclusiones rápidas, detectar errores de razonamiento, identificar los presupuestos explícitos e implícitos de una afirmación, resolver problemas y decidir. Las capacidades reflexivas y creativas son competencias indispensables para la vida tanto en la esfera diaria, como en el mundo virtual. [To build knowledge in any field, people need fundamental competencies, based on critical and creative thinking. These competencies are essential objectives for education. Critical thinking is exercised in questioning, by challenging arguments, rejecting quick conclusions, detecting errors in reasoning, identifying the explicit and implicit presuppositions of a statement, solving problems, and deciding. Reflective and creative skills are essential skills for life both in the daily sphere and in the virtual world.] (Morduchowicz, 2023, p. 45, own translation)

In recent decades, information and communication have had a dizzying development that has questioned the way in which technological tools have entered education, especially about the training and skills of the teacher for teaching and, consequently, the learning of students through technological tools. As well as in relation to the ethical implications of its use in favor of improving education and, consequently, contributing to the improvement of the conditions of society.

In this sense, it is also important to address how public policies have been proposed in relation to education and more specifically to educational technology. That is why it is essential to review and analyze what the United Nations Educational, Scientific and Cultural Organization (UNESCO) has proposed over the years to outline the desirable educational policies to offer education within everyone's reach, providing different alternatives in access and diversification of educational resources.

> Technology has been used to support teaching and learning in multiple ways. Digital technology offers two broad types of opportunities. First, it can improve instruction by addressing quality gaps, increasing opportunities to practise, increasing available time and personalizing instruction. Second, it can engage learners by varying how content is represented, stimulating interaction and prompting collaboration. (UNESCO, 2023, p. 14)

In this sense, although it is clear to reflect on what is desirable and the goals that must be achieved to have universal access to quality education, the reality is different, since there are great inequalities in access to ICTS for educational purposes, even in developed countries. For this reason, the approach made in terms of access to technologies for education is carried out at a global level and emphasizes the problems of curricula in regional contexts.

> Most school curricula include learning about technology. There is wide variation among countries on how technology is taught and its importance. Technology education can be taught in separate subjects or integrated across disciplines. It can be compulsory or elective and be taught in various grades. As a stand-alone subject, technology has been conceived variably as skills and craft education, industrial arts, or vocational training. (UNESCO, 2023, p. 20)

In Global education motoring report summary 2023: Technology in education of UNESCO (2023), with reference to the situation in terms of the use of and access to technologies for education at a global level, reflects on what should be addressed by governments and educational institutions to solve the problems that are particularly detected in the different regional contexts in the world, emphasizing the importance of the implementation of strategies and policies that contribute to the reduction of inequality gaps in the use and access of ICTS in the classroom and at home, thus expanding the possibilities of students to access inclusive education without problems.

As far as governments are concerned, the same UNESCO report (2023) states that four areas must be addressed: 1) Education technology appropriate for the national and local contexts, 2) Student access to educational technology, 3) Scaling the use of educational technologies, 4) Encourage the use of technology in a sustainable future for education. These approaches are derived from the different studies that are being

carried out on an ongoing basis to visualize the different problems that must be addressed and to trace routes of attention at the global, regional or local levels. In this way, it is important to take this report into consideration to have an overview of the situation of the use of ICTs in education, what are the implications in the teaching and learning processes and how public policies can be implemented that can improve it in the face of the challenges that arise in a constantly changing world.

The constant advance in the use of technological tools that was enhanced in the face of the pandemic caused by COVID-19 opened up a huge panorama of possibilities for digital resources for education, while at the same time evidencing the lack of investment and updating in technology in the educational field by governments and the response capacity of educational institutions and teachers to face this circumstance with the technological resources they had in order to comply with the curricula.

> The set of basic skills that young people are expected to learn in school, at least in richer countries, has expanded to include a broad range of new ones to navigate the digital world. In many classrooms, paper has been replaced by screens and pens by keyboards. COVID-19 can be seen as a natural experiment where learning switched online for entire education systems virtually overnight. (UNESCO, 2023, p. 9)

According to UNESCO (2023), it is necessary to locate the importance of the use of educational technology today and in the coming decades.

> Education systems need to be better prepared to teach about and through digital technology, a tool that must serve the best interests of all learners, teachers and administrators. Impartial evidence showing that technology is being used in some places to improve education, and good examples of such use, need to be shared more widely so that the optimal mode of delivery can be assured for each context. (UNESCO, 2023, p. 9)

Through the different modalities in the teaching of classes and the participation of all the actors that converge in teaching-learning at the different educational levels, the UNESCO report (2013) emphasizes that the following areas must be addressed in a comprehensive manner: Access to technology, Governance and regulation, and Teacher Preparation. This is so that, according to each specific context, particular needs are met and broad and consistent access to education through ICTs is guaranteed to all students.

In the national context of Mexico, the Ministry of Public Education (SEP) is the one who proposes public policies in the field of education and, at all educational levels, outlines the problems to guarantee access to inclusive education that contemplates the use of technological tools

as a fundamental part of teaching and learning, as well as detects and addresses the problems that hinder anyone's access to quality education. As reflected in the General Education Law that mentions in article 9, section V:

> Las autoridades educativas, en el ámbito de sus respectivas competencias y con la finalidad de establecer condiciones que permitan el ejercicio pleno del derecho a la educación de cada persona, con equidad y excelencia, realizarán entre otras, las siguientes acciones: [...] v. Dar a conocer y, en su caso, fomentar diversas opciones educativas, como la educación abierta y a distancia, mediante el aprovechamiento de las plataformas digitales, la televisión educativa y las tecnologías de la información, comunicación, conocimiento y aprendizaje digital. [Educational authorities, within the scope of their respective competencies and with the aim of establishing conditions that allow the full exercise of each person's right to education, with equity and excellence, will undertake, among others, the following actions: [...] v. To publicize and, where applicable, promote various educational options, such as open and distance education, through the use of digital platforms, educational television, and information, communication, knowledge, and digital learning technologies.] (SEP, 2021, p. 19, own translation)

Specifically on this point, it is emphasized in Title Two of this law that the incorporation in the use of technology must be in a comprehensive manner, in accordance with the provisions of Article 18 in section III:

> El conocimiento tecnológico, con el empleo de tecnologías de la información, comunicación, conocimiento y aprendizaje digital, manejo de diferentes lenguajes y herramientas de sistemas informáticos, y de comunicación. [Technological knowledge, with the use of information technologies, communication, knowledge and digital learning, management of different languages and tools of computer systems, and communication.] (SEP, 2021, p. 19, own translation)

With the purpose of attending to what is mandated by the General Law of Education, specifically as proposed by the *Digital Education* Agenda: "instrumento de particular importancia para integrar y planificar las políticas públicas relacionadas con las tecnologías de la información, comunicación, conocimiento y aprendizaje digitales en el Sistema Educativo Nacional" [an instrument of particular importance for integrating and planning public policies related to digital information, communication, knowledge and learning technologies in the National Education System] (SEP, 2021, p. 7, own translation), all members of the education sector at the national level are involved so that, from their particular characteristics, they can apply the necessary actions to incorporate all institutions in the digital transformation of education.

Current status of educational technologies in Mexico's higher education institutions.

In the same sense, from the field of higher education, the National Association of Universities and Institutions of Higher Education (ANUIES) has carried out studies on the subject to have an updated national overview on the incorporation of ICTs in education. Through the report *Current status of educational technologies in Mexico's higher education institutions* (ANUIES, 2022), the level of use of educational technologies in Mexican universities affiliated with ANUIES and how the incorporation of post-pandemic information technologies has been developed is reviewed. In this regard, it is worth noting that only 37% of those surveyed consider the *usability and accessibility* of technological resources for education, as well as 52% of the Higher Education Institutions (IES) surveyed mention that they have a strategy in the incorporation of *digital skills* to support teaching and student training.

> El resultado es que sigue habiendo pocos planes de continuidad académica, solo unos cuantos lo han hecho y *menos aún* han intentado implementarlos. La literatura especializada sugiere, en cambio, que el diseño de planes de continuidad académica debe ser un proceso estratégico de innovación educativa que reúna a toda la comunidad académica para que sea bien implementado y constantemente evaluado. [The result is that there are still few academic continuity plans, only a few have done so and even fewer have tried to implement them. The specialized literature suggests, however, that the design of academic continuity plans should be a strategic process of educational innovation that brings together the entire academic community so that it is well implemented and constantly evaluated.] (Ponce et al., 2022, p. 276, own translation)

Thus, the efforts to integrate technological competencies in IES in Mexico are not yet important enough to impact the entire university community, which implies a challenge for the institutions themselves, teachers and students.

Based on this panorama, it becomes essential to incorporate institutional strategies that contribute to facilitating and guaranteeing: *equity and inclusion, quality and efficiency* in access to and incorporation of the technological resources necessary for the comprehensive training of students, taking up what UNESCO (2023) has identified: three problems that need to be addressed in the educational field and that, without a doubt, are a determining factor in improving the way in which education is developed. They are as follows:

- Equity and inclusion: Is fulfilment of the right to choose the education one wants and to realize one's full potential through education compatible with the goal of equality? If not, how can education become the great equalizer?

- Quality: Do education's content and delivery support societies in achieving sustainable development objectives? If not, how can education help learners to not only acquire knowledge but also be agents of change?

- Efficiency: Does the current institutional arrangement of teaching learners in classrooms support the achievement of equity and quality? If not, how can education balance individualized instruction and socialization needs? (UNESCO, 2023, p. 10)

Attention to these problems will contribute to improving the way in which the use of educational technology is implemented in higher education institutions. Undoubtedly, the constant incorporation of technological tools to face the changes that society urgently demands, the digital literacy that will be required in the immediate future, as well as the openness regarding the technological advances that will emerge and position themselves as alternatives to streamline the different activities of the human being, are pending tasks.

As can be seen, the interference of technology in the educational field has certain nuances according to each discipline. This paper will be addressed from the perspective of graphic designer and how they have adapted to the needs demanded by society, relying on the technology they have at hand to facilitate and respond increasingly quickly to the different design projects.

To have a global overview of what the expectations of Design are in the coming decades, it is important to review what the American Institute of Graphic Arts (AIGA) —through the document *Futures of Design,* which arises from the 2017 Design Census— mentions: Seven trends that it is important to visualize in order to understand what professional practice is demanding and that it is necessary to take into account from the educational institutions that offer the training of designers in order to adjust the curricular contents and identify those that are meaningful and necessary for what future design professionals can expect, that is: 1) Complex problems, 2) aggregation and curation, 3) bridging digital and physical experiences, 4) core values matter, 5) resilient organizations, 6) making sense in the data economy and 7) accountability for anticipating design outcomes (Davis, 2020).

Each of these trends is of utmost importance to review what society is demanding from the profession and what is being done from the academy in favor of a continuous improvement of the curricular contents, without losing sight of the fact that each design project requires special attention according to the context in which it is developed, and that it must be identified if the design professional has acquired the necessary knowledge to address these problems.

With all of the above, it is understood that technology for design is an issue that needs to be viewed from different perspectives, as some authors have suggested.

> La gran escalada tecnológica posiciona al diseñador gráfico como un comunicador de mensajes visuales, quien en un futuro inmediato deberá responder a la resolución de problemas complejos como: el desarrollo de productos, el conocimiento de ingeniería y computación pertenecientes de la disciplina, la aplicación de modelos de colaboración para la gestión de procesos y de equipos de trabajo, la gestión de proyectos, la identificación de oportunidades en el trabajo multidisciplinario como es la ingeniería de software, la experiencia de usuario, entre otros. [The great technological escalation positions the graphic designer as a communicator of visual messages, who in the immediate future will have to respond to the resolution of complex problems such as: product development, knowledge of engineering and computing belonging to the discipline, the application of collaboration models for the management of processes and work teams, project management, the identification of opportunities in multidisciplinary work such as software engineering, user experience, among others.] (Rodríguez et al., 2020, p. 117, own translation)

The complexity in which today's society is immersed requires creative design professionals who are open to new challenges that will arise in the immediate future, especially with the constant generation of technological products for social interaction, to which higher education institutions cannot be oblivious.

> Technology plays an outsized role in shaping the future of design. Streaming, cloud processing, machine learning, and augmented and virtual reality challenge traditional notions of information as something material, “fixed” in time and space. The “page” and “edition” today are fluid interactions, often customizable for particular users and purposes. (Davis, 2020, p. 5)

The importance of recognising the role that technology has played, is playing, and will increasingly play in the future of Graphic Design is a way of understanding the need to incorporate new technological tools that support the profession's development and provide future designers with the technological resources of Artificial Intelligence necessary to face these new challenges.

Therefore, it is necessary to emphasize the use of AI in the areas of academic training and professional performance of graphic designer in order to review and assess the use of the technological tools included within the specialized Design software for the teaching and learning of future Graphic Design professionals and the importance in the acquisition of this knowledge to understand and apply in a coherent way the incorporation of these resources that can support – and are having an

important impact – on the development of design projects, in accordance with the needs of the labor market.

> The traditional concern of designers (i.e., the form of objects) has broadened to include the structure of systems (i.e., smart-connected products and product-service ecologies). We are designing "finished" products less and less. Instead, we are designing platforms—creating opportunities in which others can design—performing a sort of "meta-design.". (Davis, 2020, p. 82)

Designers today must know the scope of the technological tools they have at hand and have adequate technological literacy that allows them to use technology in a comprehensive way. This is why it is important to know how specialized Graphic Design software works, which has incorporated generative tools for the use and alteration of the image, without forgetting that this use must be conscious and ethical.

> Apropiarse reflexivamente de las tecnologías y de la inteligencia artificial y procesar situaciones complejas en el entorno digital, son competencias digitales fundamentales que colocan a los ciudadanos en mejores condiciones para entender la realidad —cada vez más mediada por pantallas— para responder a los problemas y desafíos de este milenio, para tomar decisiones autónomas y para participar socialmente.
>
> Si las competencias digitales no construyen conocimiento, y si ese conocimiento no permite comprender el entorno digital y utilizarlo para la participación, las tecnologías —y la inteligencia artificial— servirán solo con fines instrumentales, bajo el manto ciego de la idealización. [Reflexively appropriating technologies and artificial intelligence and processing complex situations in the digital environment are fundamental digital skills that place citizens in better conditions to understand reality – increasingly mediated by screens – to respond to the problems and challenges of this millennium, to make autonomous decisions and to participate socially.
>
> If digital skills do not build knowledge, and if that knowledge does not allow us to understand the digital environment and use it for participation, technologies – and artificial intelligence – will serve only instrumental purposes, under the blind cloak of idealization.] (Morduchowicz, 2023, p. 46)

In the field of Graphic Design, AI models have ventured into information processing, through the interpretation and transformation of the image, with increasing capacity in their training systems and machine learning. This category, called computer vision, includes different functions and capabilities defined in the *Artificial Intelligence Index Report* (Maslej et. al., 2023), by the Stanford Institute for Human-Centered Artificial Intelligence, which describes them as follows:

> Computer vision is the subfield of AI that teaches machines to understand images and videos. Computer vision technologies have a variety of important real-world applications, such as autonomous driving, crowd surveillance, sports analytics, and video-game creation. This section tracks progress in computer vision across several different task domains which include: (1) image classification, (2) face detection and recognition, (3) deepfake detection, (4) human pose estimation, (5) semantic segmentation, (6) medical image segmentation, (7) object detection, (8) image generation, and (9) visual reasoning. (Maslej et al., 2023, p. 81)

Various platforms have emerged within application areas, configuring or creating images through their own processing and learning models. The 2023 report highlights DALL-E, Stable Diffusion, and Midjourney, generative image models that operate based on prompts, descriptions that specify the elements forming the image through the dataset each technology has available.

In addition to generative models, the development of AI ecosystems for visual communication has led to several tools such as Canva and Microsoft Designer. These are web applications that allow the creation and editing of graphics with tools available for online manipulation and, although they do not yet reach the capacity of technical possibilities such as a professional design program, they do represent alternatives for the manipulation of images and texts with the assistance of AI.

In this environment of innovation and possibilities for the creation of multimedia content, Firefly, developed by the software company Adobe, emerges as an AI model focused on the creative field. Its launch after a testing period in September 2023 (Adobe, 2023b) implies a major foray into AI image generation and editing. One of its main advantages as a content-generating technology is its integration into specialized programs in the handling of images, both in bitmap and vector images, within Photoshop and Illustrator. This integration expands creative possibilities in conjunction with the available tools of each respective software.

According to *Adobe Firefly Security Fact Sheet* (Adobe, 2023a), a document that describes the security principles and capability of the technology, Firefly contains image creation or processing tools based on the field of computer vision. The text-to-image function, one of the most widely used features in other software within the field, enables the generation of unique images based on prompts (see Figure 1). Meanwhile, generative fill creates content through visual reasoning of the image's elements, and generative recoloring in vector graphics offers tonal variations through text-based prompts (see Figure 2). In addition, Firefly offers the expansion of the image outside the artboard with greater interpretability (see Figure 3), as well as the ability to add styles and textures to existing text.

Figure 1. *Generative Fill function in Photoshop. On a blank workspace, the prompt 'Red sunrise in the desert, telephoto capture' was used.*
Source: Samuel Roberto Mote Hernández.

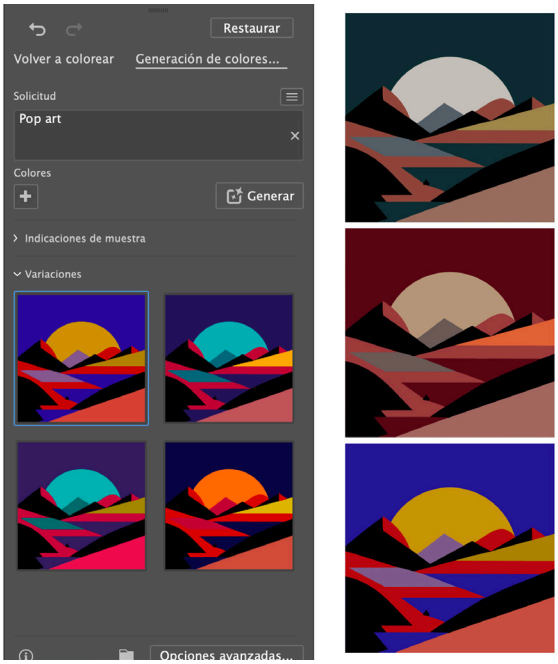

Figure 2. *Color generation function in Illustrator. The proms "Terracotta Desert" and "Pop Art" were used.*
Source: Samuel Roberto Mote Hernández.

Figure 3. *Generative magnification function in Photoshop. The working table was expanded without indication in text.*
Source: Own elaboration based on a photo by Antonio González García.

Although text-to-image functionality existed in other systems before, the introduction of AI generative technology in specialized software marks a significant shift for Graphic Design. Teaching, particularly that which seeks to teach digital tools, now requires a deeper understanding of a new paradigm between the correct execution in the editing of a file and the possibilities of making operational processes more efficient, which can be considerably reduced through AI functions.

Therefore, Generative Artificial Intelligence needs to be included in the teaching-learning processes. It is mainly indispensable in the field of knowledge of the discipline's specialized software, but it is also necessary due to the increase in students who use this type of technology, as discussed in GenAI in higher education fall 2023 (Shaw et al., 2023).

The report highlights GenAI, along with its discussion of ethical dilemmas in its use, as a key piece in increasing efficiency and productivity for teachers, especially activities such as grading, course management, and other time-consuming tasks, as well as students as digital natives get better instruction in the digital realm. This dynamic in higher and professional studies has allowed, according to the study, to find more enriching aspects in the teaching and learning processes.

It is clear that the advancement and innovation of GenAI and other technologies in the field of computer vision open up a range of possibilities in the discipline in their professional practice. The introduction of these technologies implies the need to understand their relevance, ethics and

potential use for the strengthening of technological reasoning skills in teaching and learning processes.

Methodology

The methodology used was a cross-sectional qualitative study on the use of GenAI tools in the teaching-learning process from an ethnographic approach, through participant observation of teachers with recent experience in Learning Units (LUS) within the field of Informatics. This focus emphasizes the teaching of technological tools and specialized software in Graphic Design as part of the curriculum for the Bachelor's degree in Graphic Design at the Universidad Autónoma del Estado de México.

For this purpose, an online questionnaire designed to know, in a first approach, the teaching knowledge about the incursion of new AI tools in graphic design software, along with the challenges they face in their teaching, was used as an instrument, to possibly take up the GenAI tools within the contents and practices in class. Likewise, the possibility of incorporating these technological tools in the curricular contents, absent in most academic programs of Graphic Design, was questioned, with the purpose that students know and value the scope of this technology and can use it in a conscious and ethically responsible way.

It is worth mentioning that the curricular area of Computer Science of the Bachelor's Degree in Graphic Design of the Autonomous University of the State of Mexico (UAEM) has as a general objective "Diseñar, modificar, editar y producir imágenes digitales, mediante la aplicación de las tecnologías de la información y comunicación, con el fin de generar mensajes audiovisuales masivos.[Design, modify, edit and produce digital images, through the application of information and communication technologies, to generate mass audiovisual messages.]" (UAEM, 2015, p. 150, own translation). In this sense, the use and mastery of specialized software in graphic design is emphasized to instruct skills in the technical knowledge of the use of the technological tools of the discipline and, in turn, to assist other curricular areas in the development of projects.

It is essential to note, for the purposes of this article, that the reflections and positions of the teachers are based on their recent classroom experiences in relation to an emerging phenomenon involving the evolution of generative technologies and the latest updates to specialized programs that integrate them. These perspectives, in addition to offering a valuable view from the teacher, reveal the diversity of approaches in adapting to and understanding AI within the academic-technological context of the discipline.

Results

Among the participating teachers, all of whom have current experience teaching specialized graphic design software, the majority are active in

the Learning Units Vector Drawing and Digital Image Editing (see Figure 1). These study programs include instruction on vector manipulation and bitmap image editing, using Adobe Illustrator and Adobe Photoshop, respectively, and their latest update includes the integration of GenAI technology.

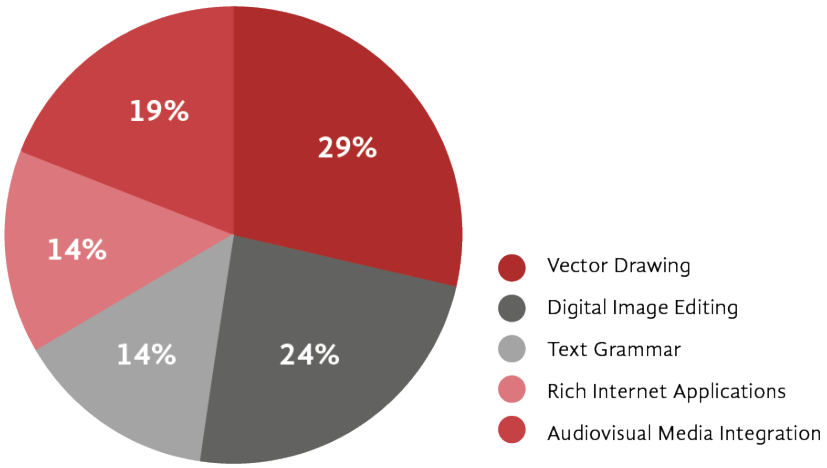

Chart 1. *Mention of learning units with teacher participation in the curricular area of Computer Science, with emphasis on the use of specialized software.*
Source: Authors.

This allows us to understand that both LUs, with the integration of Firefly in Illustrator and Photoshop, also impact the operational processes of other programs of the same Adobe suite and that they complement each other for the management, for example, of editorial documents of wide length in the editorial field or multimedia products with a greater degree of complexity.

In addition to the Adobe suite, the questionnaire mentioned the use of various specialized software from other companies, such as Affinity, which offers packages for vector handling, image editing, and editorial document design; and Figma, which focuses on web design and interaction. Although the vast majority of teachers are familiar with GenAI tools within the practice of the discipline, only half reported having used them in their teaching activities.

In the same trend, only half of the teachers mentioned having knowledge of the recent integration of Firefly. In addition, participants commented on other GenAI technology platforms that are considered within the framework of the discipline, but are not necessarily taught in class, such as Da Vinci, Dall-E, and Stable Diffusion.

From this context, the teachers recognized coincidences and differences according to the performance in the teaching of their LUs. On the

perspective of the delivery of generative AI-assisted tools in specialized design software, the following common points are identified:

- Efficiency. AI can be a tool that streamlines design workflows, as well as reduces repetitive tasks within the software.
- Future. The incorporation of GenAI is recognized as an emerging technology with implications in the labor market.
- Creativity. AI will not replace creativity in design processes, although it will facilitate work as a complement to exploration and diversify resources for the generation of proposals.
- Mastery. The designer must have control and knowledge of software tools to ensure the quality of the final product.
- Criteria. The indiscriminate use of generative tools may give unsatisfactory results and may be contrary to design principles.

On the other hand, we found views that differ or question the relevance in the general consensus on the use of GenAI technologies in LUS:

- Legality. It is considered important to take into consideration the legal implications derived from the use of AI in graphic design, such as the handling of protected documents or the property rights of contents generated by GenAI.
- Present. GenAI is perceived to still be in an experimental phase, despite the fact that its use is becoming more common.
- Professionalism. It is pertinent to find the balance between the content generated by Design professionals through a methodological construction, the advanced use of software and the facilities provided by AI-assisted tools.
- Teaching. The introduction of GenAI in the early stages of learning with software and the fundamentals of Design is considered counterproductive, some consider its implementation from intermediate levels.
- Creativity. Poorly instructed, AI does pose a risk or limitation to students' creative capacity by bypassing the design due process.

It is evident that there is no common position regarding the integration of AI in the teaching-learning processes of specialized software in graphic design, due to different factors in professional experience and teaching practice. However, it is understood that AI can result in a tool that is widely requested in the labor market in the face of the increase

in platforms and mainly its use within and outside the field of Graphic Design, so the demand for AI skills will be inevitable.

In this scenario, various challenges arise for teaching AI knowledge in graphic design software, not only in terms of practice and instructor training but also regarding the acquisition of updated licenses supported by adequate classroom technology infrastructure. Additionally, it is important to note that the Firefly update in Illustrator and Photoshop is recent (September 2023) and requires the incorporation of new knowledge into the curriculum content.

Finally, the great challenge of integrating AI knowledge in the management of software is evident, for the benefit of the student's professional training, by promoting critical thinking in the technical execution of their projects. These tools, which are constantly evolving, must be integrated as a complement in the creation of design proposals according to a methodological and systematic logic in the use of technology, based on the fundamentals of Design.

Conclusions

This paper represents an initial approach from the teacher's perspective to the phenomenon of AI-assisted technologies, particularly the recent presence of GenAI tools in specialized design software. This integration implies a new variable to the teaching and learning processes in vocational training. From this, the following appreciations of teacher participation can be deduced.

First, it is essential to raise awareness that the use of AI tools in Graphic Design and the visual proposals that derive from this process must be done with responsibility and professional ethics. Its integration, apparently inevitable, requires a critical sense in its use, prioritizing methodological training and promoting the creative skills of the student for the solution of problems that society demands.

AI in the field of computer vision, particularly in the GenAI category, makes it possible to speed up the execution of technical procedures in the development of design objects configured through software such as Photoshop and Illustrator. Given the constant evolution of its functions, it is crucial to understand the results derived from its application and to develop the ability to discern between efficiency and technical quality in the teaching and learning of specialized software (as can be seen in Figure 4). This with the aim of taking advantage of the transformative potential of these tools in education and ensuring their positive impact on the development of students' skills and competencies.

Figure 4. *The generative magnification feature in Photoshop produced three variations with poor results in image interpretation and extension.*
Source: Authors' elaboration based on a photograph by Antonio González García.

Therefore, the set of perspectives that emerged from teaching practice and their adaptation to emerging AI technologies, which contrast to a certain extent with previous processes of digital image creation, is enriching. It is considered relevant to delve deeper into the appropriate techniques for producing graphic design objects with AI assistance and to add the perspective of the student as a digital native to the discussion.

In this way, a more complex approach is envisioned for LUS related to software instruction, transcending their technical nature and expanding their knowledge to aesthetic and methodological dimensions in the digital treatment of design, which consists of a challenge for the curricular strategies of the study programs: to provide a constant capacity for adaptation to the contents of the UAS with a technological focus and thus strengthen the validity of Graphic Design in the face of the digital innovation of the discipline.

The reflections result from teachers' resilience in the face of constant change and the dizzying growth of AI. Despite the uncertainty generated by its progress, it presents a significant opportunity to harness academic benefits in developing new teaching and learning strategies.

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