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Research Article

EXPLORING THE IMPACT OF AI ON GRAPHIC DESIGN EFFICIENCY: A DUAL APPROACH THROUGH SLR AND EXPERIMENTAL COMPARATIVE TRIALS

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ABSTRACT

As artificial intelligence (AI) continues to revolutionize industries across the spectrum, the creative field of graphic design represents a particularly valuable yet underexplored research domain where the intersection of algorithmic capabilities and human creative processes offers unique insights into the changing landscape of visual communication. This research employs a dual-mixed methodology combining experimental trials and a systematic literature review (SLR) to evaluate AI's impact on workflow efficiency in Adobe applications. The SLR analyzed 14 academic articles published between 2020 and 2024, selected from 1,515 articles identified via Google Scholar, examining topic areas, methodologies, possibilities, limitations, and future recommendations. Notably, 71.43% of the reviewed articles were published in 2023–2024, reflecting growing research interest, with qualitative studies dominating (71.43%) over mixed methodology (21.43%) and quantitative research (7.14%). The experimental design compared manual and AI-assisted workflows across four specific Adobe tasks: auto-reframing, sky replacement, smart object selection, and object removal. Time tracking conducted via Clockify

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software revealed AI-assisted methods reduced task completion time by an average of 56.05%, with workflow steps decreasing from 12.14 (manual) to 4.29 (AI-assisted). Statistical analysis confirmed significant improvements in workflow efficiency when utilizing AI in these specific graphic design tasks ($p < 0.001$, Cohen's d: 2.854 for steps, 1.134 for time). While demonstrating substantial efficiency gains, the research acknowledges limitations including its narrow focus on Adobe software, specific design tasks, and reliance on a limited literature sample, suggesting the need for broader analysis incorporating more quantitative studies, longitudinal research, and ethical frameworks to address challenges in AI-human collaboration, creative authenticity, and potential biases in AI applications within graphic design.

Keywords: *AI, Graphic Design, Workflow, Time, Adobe, Creativity.*

YAPAY ZEKANIN GRAFİK TASARIM VERİMLİLİĞİNDEKİ ETKİSİNİN ARAŞTIRILMASI: DENEYSEL KARŞILAŞTIRMALI DENEMELER VE SLR İLE İKİLİ BİR YAKLAŞIM

ÖZ

Yapay zeka (YZ) teknolojilerinin çeşitli sektörleri dönüştürmeye devam ettiği günümüzde, grafik tasarım gibi yaratıcı bir alan, algoritmik yetenekler ile insan yaratıcı süreçlerinin kesişiminin görsel iletişimin değişen manzarasına benzersiz içgörüler sunduğu, özellikle değerli ancak yeterince keşfedilmemiş bir araştırma alanını temsil etmektedir. Bu araştırma, YZ'nin Adobe uygulamalarındaki iş akışı verimliliği üzerindeki etkisini değerlendirmek için deneysel çalışmalar ve sistematik literatür incelemesi (SLİ) yöntemlerini birleştiren ikili-karma bir metodoloji kullanmaktadır. SLİ, Google Scholar üzerinden belirlenen 1.515 makale arasından seçilen, 2020-2024 yılları arasında yayımlanmış 14 akademik makaleyi analiz etmiş; konu alanları, metodolojiler, olanaklar, sınırlamalar ve gelecek önerileri üzerine odaklanmıştır. İncelenen makalelerin %71,43'ünün 2023-2024 döneminde yayımlanmış olması, bu alandaki araştırma ilgisinin arttığını göstermektedir. Metodolojik eğilimler, nitel çalışmaların (%71,43) karma metodoloji (%21,43) ve nicel araştırmalara (%7,14) kıyasla baskın olduğunu ortaya koymuştur. Deneysel tasarım, dört Adobe görevini karşılaştırmıştır: otomatik yeniden çerçeveleme, gökyüzü değişimi, akıllı nesne seçimi ve nesne kaldırma. Clockify yazılımı kullanılarak yapılan zaman takibi, YZ destekli yöntemlerin görev tamamlama süresini ortalama %56,05 oranında azalttığını, iş akışı adımlarının ise 12,14'ten (manuel) 4,29'a (YZ destekli) düştüğünü göstermiştir. İstatistiksel analiz, bu belirli

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grafik tasarım görevlerinde YZ kullanımının iş akışı verimliliğinde önemli iyileştirmeler sağladığını doğrulamıştır ($p < 0,001$, Cohen's d: adımlar için 2,854, zaman için 1,134). Araştırma, önemli verimlilik artışları göstermekle birlikte, Adobe yazılımına, belirli tasarım görevlerine ve sınırlı bir literatür örneklemine odaklanma gibi kısıtlamaları kabul etmektedir. Bu durum, grafik tasarımda YZ uygulamalarındaki insan-yapay zeka işbirliği, yaratıcı özgünlük ve potansiyel önyargılar gibi zorlukları ele almak için daha fazla nicel çalışma, uzun vadeli araştırma ve etik çerçeveleri içeren daha geniş bir analiz ihtiyacını ortaya koymaktadır.

***Anahtar Kelimeler**: Yapay Zeka, Grafik Tasarım, İş Akışı, Zaman, Adobe, Yaratıcılık.*

INTRODUCTION

AI Innovations has introduced several software, techniques and tools, such as Adobe Sensei and Canva, to be integrated into graphic design to enhance workflows and brainstorming of creative processes through assisted features that offer automation for repetitive tasks like background removal, font pairing and layout optimization (Adobe, 2020) & (Blazhev, 2023). One of the significant enhancements for AI in graphic design is personalized content creation by user behavior and preferences analysis (user-generated content) to generate designs tailored to specific characteristics, leading to increased engagement rates from audiences by utilizing machine learning, natural language processing, data mining and deep learning algorithms to analyze elements of design and generate assistance and suggestions making it more accessible to both professional designers and beginners (Dehman, 2023) & (Mustafa, 2023). Techniques such as GANs (Generative Adversarial Networks) revolutionized the creative landscape, allowing machines and software to create unique designs from existing datasets, enabling and offering AI assistance to create even entire layouts, logos, etc. as new avenues for inspiration and creativity not just automating repetitive and routine tasks enabling further data-driven insights, efficient workflows and the ability to produce multiple design iterations (Li, 2024), (Engawi, 2021) & (Du, 2022).

With AI assistance and suggestions offering solutions on a larger scale and landscape, Designers can focus on creativity more than repetitive tasks, enhancing time and workflow efficiency (Tomić, 2023). Despite all these possibilities and advantages, there is a rising fear of limitations and ethical considerations regarding the potential loss of creativity and homogenization of design, where the uniqueness and emotional depth may be diminished (Elgendy, 2024) &

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(Rodriguez, 2024). Questions about Intellectual property rights and the ownership of designs generated by AI concerning the potential bias in algorithms, inequalities, and job displacements as AI day handles routine and repetitive tasks even if the workflow and time efficiency for the designer's projects as a co-creator complement and collaborating rather than replacing human creativity as the primary ethical consideration of the evolving AI and its innovations in the graphic design industry (Persson, 2023) & (Atiker, 2024).

This research evaluates AI's impact on workflow efficiency in Adobe applications through comparative experiments and a systematic literature review (SLR). The SLR analyzed 14 academic articles, while experiments tested framing, object removal, smart selection, and sky replacement manually and with AI. Time consumption and task complexity were measured, with statistical validation using SPSS and paired t-tests. Results highlight efficiency gains, limitations, and future directions, offering insights for AI-enhanced design, workflow optimization, and human-AI collaboration in media production.

METHODOLOGY AND FINDINGS

The research employs two complementary approaches through self-executed comparative experimental design to examine time and workflow efficiency between 4 different design features: Framing, Sky Replacement, Object removal and Object Selection manually and AI-assisted in Adobe applications. Secondly, a systematic literature review on the role of AI in design from 2020 to 2024. The systematic literature review aims to provide theoretical insights and a comprehensive guide of the potential possibilities, limitations, and future recommendations in the field of AI integration in graphic design by filling research gaps by analyzing existing research in Google Scholar between 2020 and 2024, yielding around 1515 articles related to keywords such as AI, and graphic design, 54 articles were specifically relevant while 14 articles heavily contributed to the AI integration in design topic.

The selected research has been analyzed through their different key findings, methodologies, possibilities, limitations and future research recommendations, answering four critical questions: Q1: What kind of academic research papers and case studies have been conducted in AI in graphic design? Q2: Which methodologies have utilized the covered academic research in the SLR? Q3: What AI tools have been used to research graphic design? Q4: Which research gaps have been found in AI in graphic design?. Combining this dual approach, the

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study aims to provide a comprehensive theoretical framework and empirical data regarding AI's role in graphic design.

Research Design

This study employs a **mixed-methodology design**, integrating both a **systematic literature review (SLR)** and **experimental trials** to comprehensively analyze AI's role in graphic design workflows. The **SLR** examines 14 relevant research articles, providing a broad analysis of key thematic areas, including **case studies, methodologies, trends, possibilities, limitations, and research gaps** in AI-assisted design. By systematically reviewing existing literature, the study establishes a theoretical foundation, identifying prevailing discussions, methodological approaches, and critical insights into AI's impact on design processes. In parallel, the **experimental component** focuses on six distinct design tasks within Adobe software: **Auto Reframing, Sky Replacement, Auto-Tone and Color Adjustment, Font Recognition and Matching, Smart Object Selection, and Object Removal**. Experimental trials were conducted to compare workflow efficiency and time consumption between manual and AI-assisted processes. Using controlled conditions, the experiment measured task completion times and work efficiency to assess AI's effectiveness in streamlining design workflows.

Sampling

The first phase involved conducting a Systematic Literature Review (SLR) to identify and analyze research articles relevant to AI integration in graphic design. A total of 1,515 studies were initially identified through Google Scholar, with a refined selection of 54 relevant papers based on their alignment with the study's objectives. Following a screening process, 14 academic articles published between 2020 and 2024 were selected for in-depth analysis. The search process utilized specific keyword combinations, including "AI in graphic design," "AI techniques in design," "machine learning in digital art," "automation in design software," and "AI-driven creativity in visual media." The selection criteria prioritized peer-reviewed journal articles and conference papers, with a focus on sources indexed in Scopus, Web of Science, and Google Scholar. Articles were further evaluated based on journal quartile rankings (Q1–Q4), citation impact, and their direct relevance to AI-driven design processes. The second phase of sampling involved comparative experimental trials, where the researcher systematically examined the impact of AI-assisted tools on workflow efficiency in Adobe software. Four specific design tasks: auto-reframing, sky replacement,

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smart object selection, and object removal, were selected based on their relevance to contemporary graphic design workflows. To ensure consistency and reliability, each task was executed twice manually and using AI-assisted tools.

Data Collection

The data collection process was structured into two distinct yet parallel streams. For the SLR, 14 academic articles were systematically reviewed based on five key thematic areas: Topic Areas, identifying primary AI applications in graphic design; Methodologies, classifying research approaches into qualitative, quantitative, and mixed-method studies; Possibilities, examining AI's potential in enhancing efficiency and creativity within design workflows; Limitations, identifying challenges such as ethical concerns, AI bias, and dependency on proprietary software; and Future Recommendations, discussing emerging trends and proposed research directions in AI-assisted design. A rigorous selection process ensured methodological transparency and replicability, with search criteria, database indexing, journal quartile rankings, and filtering conditions meticulously documented. In the experimental trials, data was collected through Clockify, a time-tracking software, on a MacBook laptop to accurately measure the time required to complete each task. Both manual execution and AI-assisted processes were tested under controlled conditions to ensure comparability. Each step and sub-task within the workflow was systematically documented, allowing for a detailed assessment of workflow complexity and perceived effort.

Data Analysis

Firstly, the SLR analysis identified common themes and trends through the Thematic analysis of the 14 selected relevant articles on AI in graphic design. These articles have been synthesized to address and answer the four research questions through the topic areas, methodologies, possibilities, limitations, and future recommendations, presented in a narrative form. Secondly, for the experimental analysis, descriptive statistics, such as mean and median times, were used to manually compare the time taken to complete each task and use AI-assisted methods. Percentage reductions, number of steps, and sub-tasks have been calculated and analyzed descriptively to show that workflow simplification has been achieved. Correlations between task time and perceived effort has been explored and assessed. Finally, A paired t-test has been conducted using SPSS statistics software to examine whether a statistically significant difference exists between the dual approaches for each task completion time.

Research Article- Submit Date: 14.01.2025, Acceptance Date: 27.03.2025
DOI NO: 10.17932/IAU.EJNM.25480200.2025/ejnm_v9i2003

SYSTEMATIC LITERATURE REVIEW FINDINGS

Table 1

Topic Areas and Methodologies

Author & Year	Topic Area and Methodologies
(Wu, 2020)	The **qualitative research** focuses on AI integration in design, comparing theoretical insights into traditional methods and AI assistance and examining multidimensional aspects, possibilities, limitations, and educational requirements for future graphic designers.
(Liu, 2021)	The **mixed methodology research** emphasizes AI integration in visual communication design in media production, focusing on color matching and image application, innovating traditional methods and enhancing effectiveness and efficiency.
(Makokha, 2022)	The **qualitative research** examines the potential of AI integration to automate repetitive design tasks and foster research collaboration between AI communities and media-design companies.
(Meron, 2022)	The **quantitative (algorithm) research** focused on enhancing (human-computer-interaction) interfaces through AI algorithms such as machine learning and NLP for enhancing graphic design tasks.
(Matthews, 2023)	The **qualitative** research focuses on the intersection of AI and digital designs, analyzing recent technological innovations, tools and techniques, their impact and effectiveness, contemporary applications, and ethical considerations of human creativity.
(Al-Dulaimi, 2023)	The **mixed methodology** article examines workflow efficiency, automation of repetitive tasks, personalization, AI-assisted generated designs, ethical considerations within the historical context of AI in designs, and future trends.

Research Article- Submit Date: 14.01.2025, Acceptance Date: 27.03.2025
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(Shallal, 2023)	The **qualitative** thesis explored the integration of AI in design, the impact of techniques and tools on generated arts, historical contexts, ethical implications and future trends in the AI-driven world.
(Ren, 2023)	The **qualitative paper** explores the areas influenced by artificial intelligence technologies, such as layout automation, design suggestions, and pattern recognition, to enhance the designer's project boundaries and creative possibilities.
(Gallardo, 2023)	The thesis used **a mixed-methodology** approach to examine generative AI techniques such as DALL-E, GPT4, and Midjourney in graphic design and their integration, impact, and effectiveness compared to human designers.
(Fatima, 2023)	The **qualitative research paper** investigates the designers' perceptions and concerns about AI integration in graphic design workflow projects, emphasizing the current challenges and the need for designers to understand future scenarios.
(Patil, 2023)	The **qualitative research paper** exploring the impact of AI in graphic design addresses possibilities (automation and productivity) and limitations (job displacement and human creativity)
(Huang, 2023)	The **qualitative research** examines the intersection of AI in graphic design through automation and enhancement, historical contexts, and future research recommendations.
(Zafar, 2024)	The **qualitative** research focused on AI integration, examining the potential impact of design in the future and the irreplaceable aspects of human creativity in design.
(Şekerli, 2024)	The **qualitative** research focused on the intersection of AI in graphics, examining current usage patterns, generated images, future directions, needs, utilization, and perception of different designers' experience levels.

Research Article- Submit Date: 14.01.2025, Acceptance Date: 27.03.2025
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Table 2

Possibilities, Limitations, and Future Recommendations

No	Possibilities, Limitations and Future Recommendations
(Wu, 2020)	The research focuses on AI and 3D design printing, enhancing visual effects through cross-media platforms. It suggests that educational development should interpret AI and several innovations like 3D paper sculptures. Limitations of missing empirical data and creativity have been addressed. Future recommendations highlight the urgent need for self-innovation and talent, balancing AI, technology, creativity, education, and graphic design.
(Liu, 2021)	The research's key findings were colour matching and image applications that improved user interaction and satisfaction. Limitations and creativity were expected. The report recommended refining AI techniques, colour and image methods, ethical implications, and improving user experience and engagement in visual design communication.
(Makokha, 2022)	Possibilities such as automation of repetitive tasks, image editing, and layout generation lead designers to focus more on complex creative brainstorming thinking. Limitations include the lack of engagement between computer scientists and designers for AI research in grasping the artistic aspects of graphics. Future recommendations, such as collaboration between designers and software developers and integration of AI in education, will prepare future designers better for the AI-driven landscape.
(Meron, 2022)	Enhancing visual effects and graphics interfaces by utilizing AI to evaluate user satisfaction and interaction improves clarity, brightness, and comfort compared to traditional methods. Future recommendations focus more on ethical standards and transparency in data management, ethical implications, and AI-enhanced tools for user experience.
(Matthews, 2023)	Smart colour and object selection, object removal, image manipulation, generative fill, quality control and automated process are the main advantages of AI integration in graphic designs, reducing time spent and enhancing brainstorming for creativity.

Research Article- Submit Date: 14.01.2025, Acceptance Date: 27.03.2025
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	Limitations include bias, depending on existing trained data on the cloud, quality inconsistencies, implementation challenges, and the learning curve of AI techniques within the cost of advanced solutions. Future recommendations to address these challenges include incorporating AI in design education, developing more advanced algorithms, and understanding the long-term effects by conducting longitudinal studies.
(Al-Dulaimi, 2023)	Enhanced workflow efficiency, automation, personalization and advanced data analysis for decisions, boosting creativity, accelerating time to market business, creating new business models, and reducing costs are the main possibilities of AI intersection in graphic design. The main limitations were integrational challenges, potential biases in algorithms, loss of human creativity and job displacement, current technological capabilities, and the need for technical skills. The recommended future research was to invest in collaborating AI to design education, establishing guidelines, advanced algorithms, long-term impact studies, and ethical concerns.
(Shallal, 2023)	In user-centred design, enhanced predictive capabilities, automation, and collaborative built-in techniques were found to be possibilities. Biases, copyright, and creativity were limitations. Balancing human creativity and AI techniques, advocating transparency, long-term studies, and creating ethical frameworks were the recommended future research.
(Ren, 2023)	Automating repetitive tasks like re-sizing, layout optimization, suggestions, and personalization were the main possibilities, allowing us to focus more on creativity by designers in different project processes. The limitations were replacing emotions, creativity and human aspects with AI, designers' need for AI education, and the dependence on trained models and data. Collaboration between designers and developers, adding AI to the education curricula, long-term studies, the development of more advanced algorithms, ethical considerations, and the augmenting of creativity were the recommended future research.
(Gallardo,	Brainstorming by utilizing AI by designers at the main first stages of design projects can be a crucial advantage of integration, where the

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DOI NO: 10.17932/IAU.EJNM.25480200.2025/ejnm_v9i2003

2023)	focus of research is on the advantage of AI integration to enhance, not replace, creativity. Future research recommendations included more comparative experimental studies, educating designers, and longitudinal impact research. The limitations were copyrights, biases in generated texts and ideas, and the production of vector graphics.
(Fatima, 2023)	Enhancing the design process through guidance, resources, automation, feedback, ideas, and suggestions could be the main advantages of the intersection of AI in graphic design. Limitations such as privacy, ethical issues, creativity, functionality and prototyping, Interdisciplinary collaboration and guidelines, integration of AI in education curricula, longitudinal studies and focus on human-centred designs were the recommended research for the future.
(Patil, 2023)	Automation and idea generation were the main possibilities identified. Job displacement, technical inconsistencies, and ownership and copyrights were the limitations. Long-term and longitudinal studies, improving algorithms and techniques, and developing ethical guidelines were the future research recommendations.
(Huang, 2023)	Automating time-consuming tasks and technologies like (GANs) realistic generated images led to new forms of visual communication, and more focus on creativity by designers were the main possibilities. In contrast, the main limitations were the lack of AI creativity, biases, trained models, authorship, over-reliance on AI, and homogenized designs. The recommended future research was integrating AI tools in education, designing projects as augmentation, and developing more advanced systems.
(Zafar, 2024)	Layout creations, streamlining editing processes, and automation were the main possibilities in enhancing productivity, time and workflow efficiency through AI-powered tools like Adobe Sensei as content aware-fill, neural filters, smart object selections, and removals were the central potential augmentation by integrating AI to graphic design allowing professionals to focus more on creativity. The main limitations were emotional intelligence, biases, trained models, cultural contexts, originality, quality control, copyrights, and ownership. Future recommendations were integrating AI into

Research Article- Submit Date: 14.01.2025, Acceptance Date: 27.03.2025
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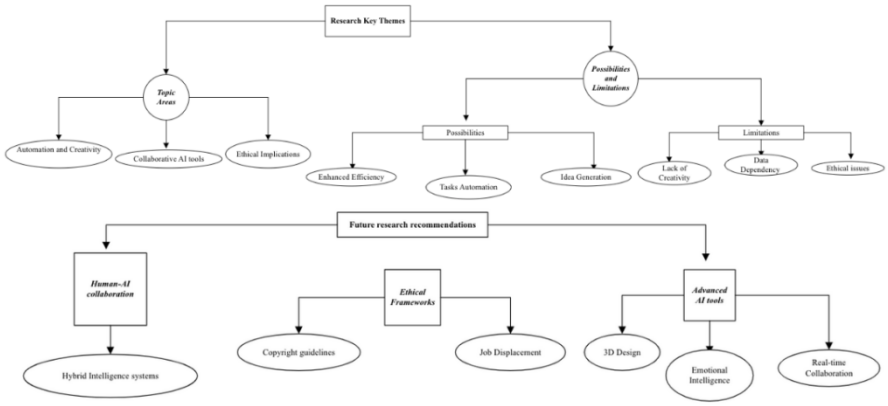
	education curricula, business and media companies, and more comparative longitudinal studies.
(Şekerli, 2024)	Diverse idea generation, suggestions, a collaboration between the designer's creativity and automation, and more efficient visualization and iteration were the main potential advantages of AI integration in graphic design. Technical aspects, over-reliance on AI tools, small samples in studies, age representation, lack of longitudinal, improving natural language processing (NLP), more advanced feedback mechanisms, investing AI and media literacy, and ethical implications of AI-contents were the main limitations leads to the suggested future research recommendations.

A notable enhancement and progression from 2023 to 2024 through the specific research distribution of the systematic literature review in the AI-assisted integration and intersection in graphic design research. In 2020 and 2021, there was a representation of single articles with 7.14% for each, followed by two articles in 2022 with a percentage of 14.29%. A substantial surge was exhibited by 10 research articles between 2023 and 2024, with a percentage of 71.43% of the systematically reviewed literature, which reveals and signifies a pivotal shift and scholarly attention towards AI tools and techniques integration in graphic design reflecting the widespread adoption of tools like Adobe Sensei showing a growing recognition by the academic community and scholars through the rapid evolving minefield of AI-enhanced graphic design projects. Ten researches in the review literature dominated qualitative methodological approaches, with a percentage of 71.43%. Three researches employed mixed methodology, with a percentage of 21.43%, and a single quantitative methodology research represented the lowest proportion, 7.14%. Emphasizing a pronounced preference for exploring the comprehensive, experiential, nuanced aspects of AI intersection and enhancing the wide variety of graphic design practices to understand the complexity of AI innovations and creative processes interplay, primarily through user experiences, interfaces, possibilities, and limitations. Meanwhile, the mixed-methodology research articles contributed more analytical frameworks, which combined quantifiable metrics with qualitative insights. The methodological distribution suggested potential opportunities for researchers and scholars to conduct more quantitative experiments while prioritizing understanding the experiential and contextual dimensions in future research.

Research Article- Submit Date: 14.01.2025, Acceptance Date: 27.03.2025
DOI NO: 10.17932/IAU.EJNM.25480200.2025/ejnm_v9i2003

Figure 1

SLR's Key Research Themes and Future Recommendations



The thematic analysis of the 14 reviewed articles revealed key research areas. For example, many articles emphasized automating routine tasks and augmenting human creativity. The potential possibilities of AI integration in design as a complementary tool rather than replacing human creativity and professional designers. Encompassing and discussing the ethical considerations and addressing concerns about intellectual property, copy and author rights, creative authenticity and job displacement. There are possibilities from the intersection of AI-assisted tools and techniques in graphic design, such as improved brainstorming ideation in the initial stages of development, automation of several sub-tasks, mass customization, and operational and workflow efficiency as documented. In parallel, several scholars have identified limitations such as ownership, training model dependency, creativity, and the over-reliance on AI to generate and develop. Several future research topics have been recommended through 3 primary areas, such as the crucial need to optimize and balance AI-assisted methods and human creativity by developing more collaborative frameworks that enhance rather than replace them. There is an urgent need to develop ethical frameworks that address and solve emerging limitations and challenges, such as the intellectual copyrights of AI-generated design content. The expanded research into AI techniques development to be more specialized and advanced, such as emotional intelligence and real-time collaborative integration, and the 3D designs to become increasingly sophisticated in the graphic design software applications.

Research Article- Submit Date: 14.01.2025, Acceptance Date: 27.03.2025
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TIME AND WORKFLOW EFFICIENCY

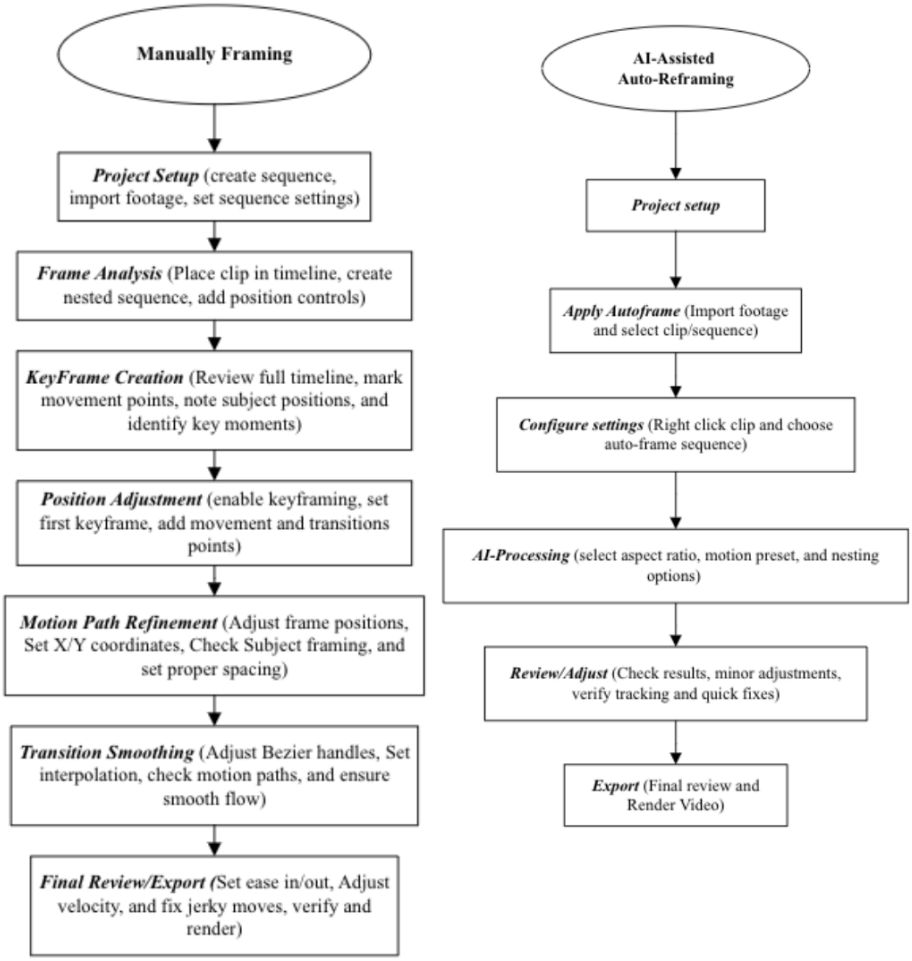
1) Manual vs AI framing

The traditional manual framing process before AI innovations and technologies included several long steps and subtasks in video editing where editors should first do the basic project setup, importing footage, creating sequences, carefully analyzing frames, then to the consuming-time process of keyframe creation, position adjustments, refining motion paths as X/Y coordinates, smoothing of transitions through Bezier handles, and conducting a thoroughly detailed review, adjusting parameters, fixing jerky movements, and the fine-tuning velocity before rendering. The flow chart illustrates the six streamlined steps for the AI-assisted auto reframing by uploading the project setup, applying the auto-frame feature, configuring simple settings, adjusting the sequence options, desired motion, and nesting option where AI handle the traditional complex work to let editors focus on quick reviews, verify tracking and any other minor adjustments as a fast check before the final step to render the videos maintaining the professional quality and easing the labor intensive traditional manual process.

Research Article- Submit Date: 14.01.2025, Acceptance Date: 27.03.2025
DOI NO: 10.17932/IAU.EJNM.25480200.2025/ejnm_v9i2003

Figure 2

Manual Framing Steps and Sub-Tasks, and AI-Auto Reframing



The application of AI-assisted auto-reframing design feature in Adobe's video editing software where the option to select between different ratios such as 1:1, 16:9 and 9:16 dynamically based on three different motion tracking options and settings as default, slower motion and faster motion to ensure smooth transitions, focus on key subjects and to adapt the uploaded video content project which is commonly used through widescreen displays and different social media platforms such as Instagram and TikTok. Reducing the required steps and sub-tasks for the

Research Article- Submit Date: 14.01.2025, Acceptance Date: 27.03.2025
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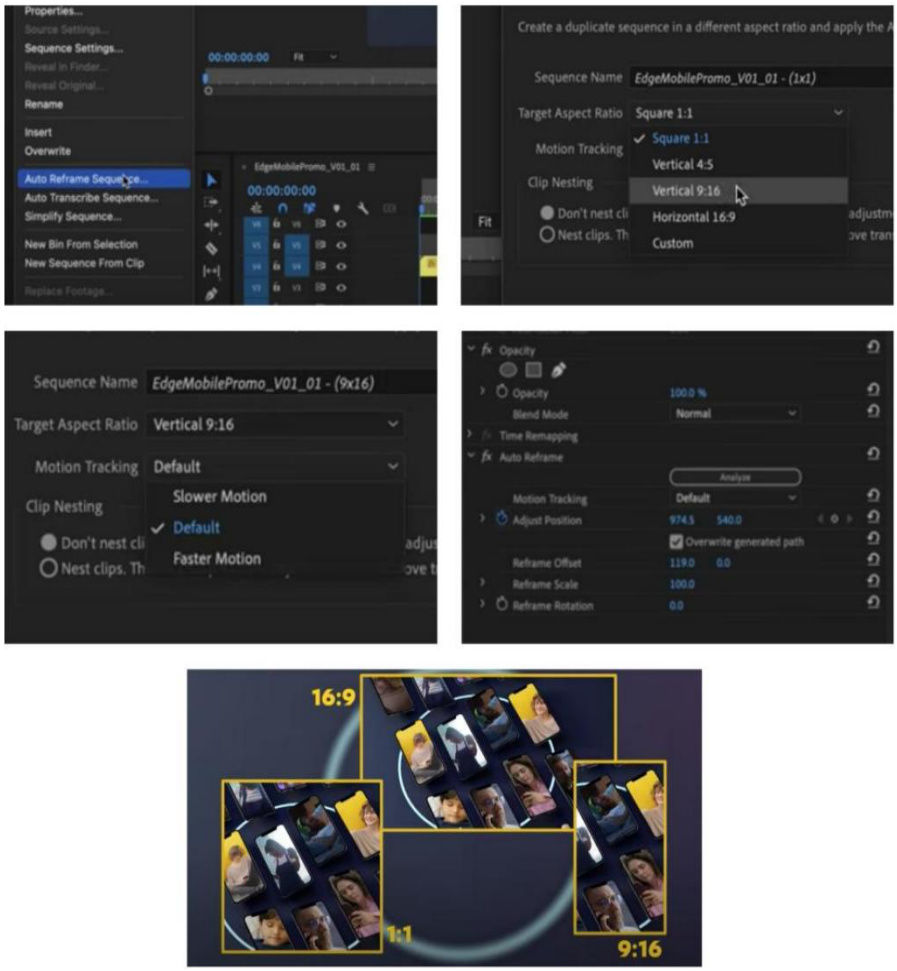
traditional manual efforts to adjust clips, crop, and reposition reveals significant possibilities to handle complex motion-tracking settings and enhance the overall workflow efficiency, minimizing the human intervention in video editing postproduction processes.

Figure 3

AI-Auto Reframing in Adobe Premier Pro



2) Manual and AI- Sky Replacement

The process of traditional manual sky replacement process in Adobe software application requires lots of attention to detail through several steps and subtasks

Research Article- Submit Date: 14.01.2025, Acceptance Date: 27.03.2025
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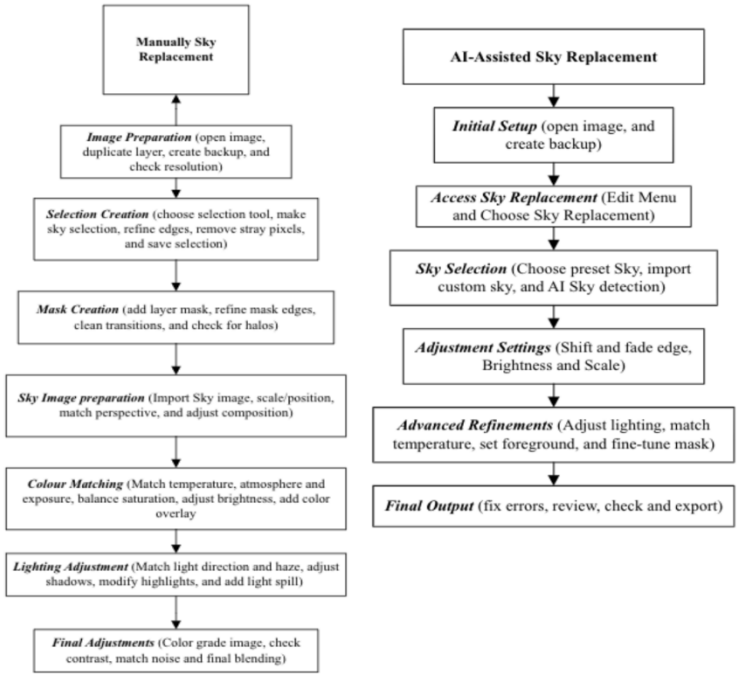
where editors would begin with uploading and image preparation, creating backups, careful sky selection, mask creation processes, positioning new sky images, colour matching, colour grading, contrast matching, adjusting lighting elements, noise balancing and fine-tuning effects to achieve natural looking output. The oppossed flow chart illustrates the streamlined seven steps for the AI Sky Replacement feature: uploading the image, creating a backup, activating the feature, choosing between skies on the Adobe Cloud or importing from a database, AI sky detection, fine-tuning (edge blending, brightness scaling), and adjusting advanced refinements such as lighting, mask details, and temperature, leading to a quick review by the editor to export professional-quality results.

Figure 4

Manually Sky Replacement and AI-Sky Replacement steps and sub-tasks



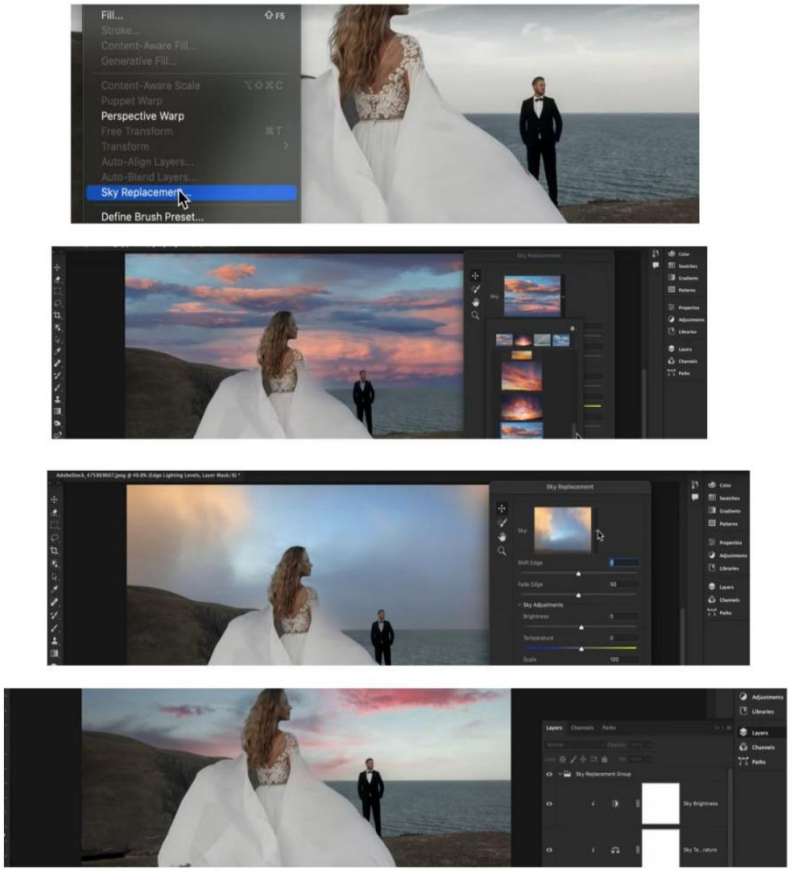
The AI-assisted Sky Replacement feature in Adobe Photoshop streamlines the process by reducing manual effort and minimizing workflow complexity. Instead of manual selection, AI automatically isolates the sky, replacing it with dynamic options while adjusting brightness, temperature, and color tones. The settings panel allows further refinements, including edge shift, fade control, and blending tweaks, ensuring seamless integration with multiple layers. This automation

Research Article- Submit Date: 14.01.2025, Acceptance Date: 27.03.2025
DOI NO: 10.17932/IAU.EJNM.25480200.2025/ejnm_v9i2003

enhances workflow efficiency, enabling designers to achieve high-quality transformations with minimal effort.

Figure 5

AI-Sky Replacement in Adobe Photoshop

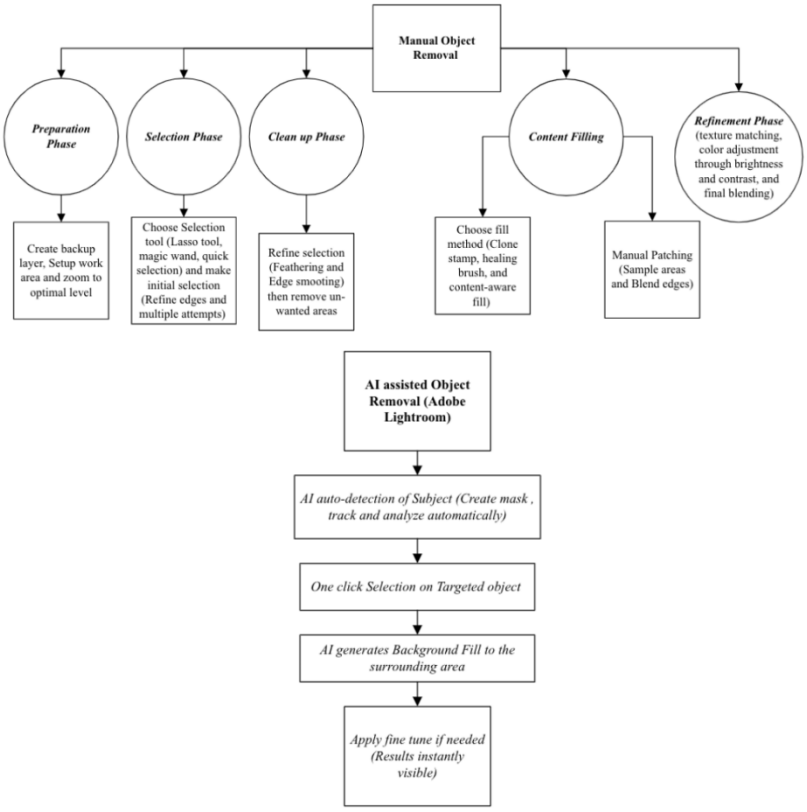


3) Manual and AI Object Removal Steps and Sub-tasks

The flowchart explains the traditional manual Object removal feature process in Adobe Photoshop or Adobe Lightroom software applications that require professional technical skills and patience beginning with creating a backup, choosing between detailed selection tools (Lasso, Quick Selection, and Magic Wand) to isolate the object, clean up phase, edge refinement, area removal, clone stamp, healing brush, content-aware fill, texture matching, colour adjustments, manual patching and lots of complex removals especially within complicated lighting conditions and backgrounds.

Figure 6

Manual Object and AI-Object Removal Steps and Sub-tasks



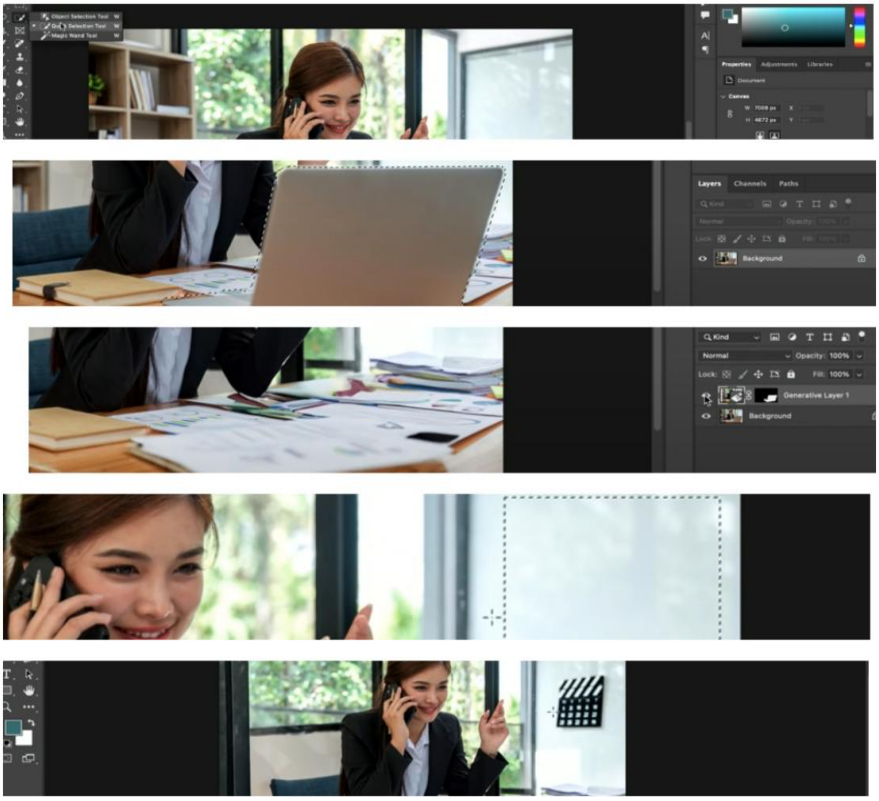
AI-assisted object removal and generative fill in Adobe Photoshop streamline the editing process with minimal manual effort. Using the

Research Article- Submit Date: 14.01.2025, Acceptance Date: 27.03.2025
DOI NO: 10.17932/IAU.EJNM.25480200.2025/ejnm_v9i2003

Object Selection Tool, AI analyzes the selection, defines the targeted area, and seamlessly removes the object while generating a contextually appropriate background. This automation ensures coherent visual composition, enhancing detail consistency with minimal professional intervention. By significantly accelerating object removal, reconstruction, and workflow efficiency, AI integration improves design quality while reducing the need for extensive manual editing.

Figure 7

AI-Object Removal in Adobe Photoshop Beta



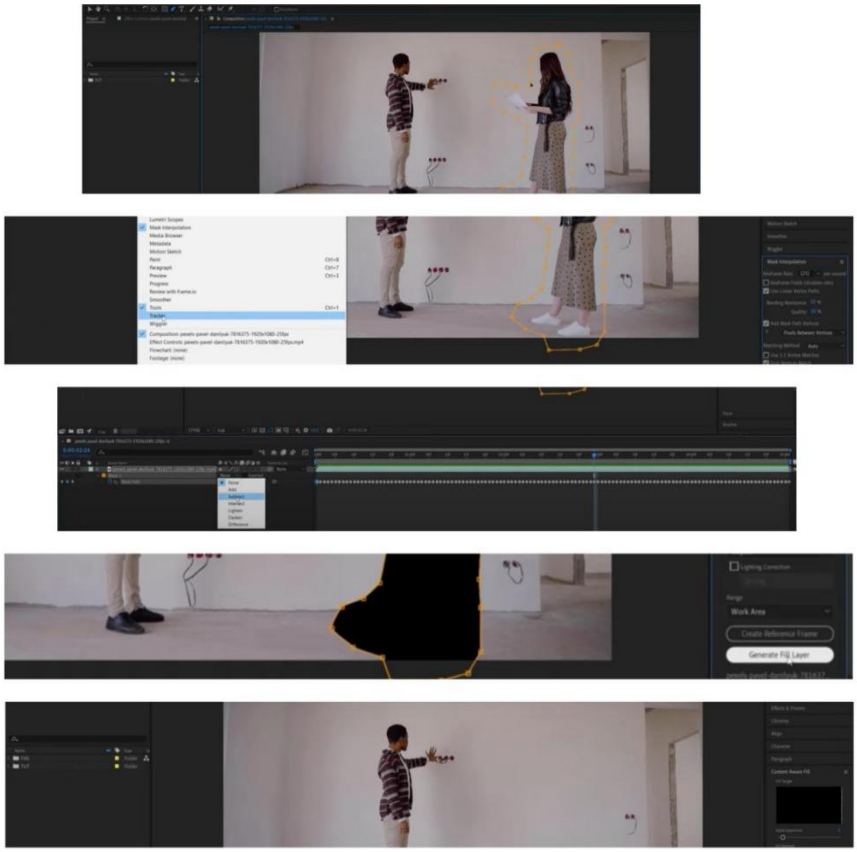
AI integration in object removal within Adobe Premiere Pro, Adobe Lightroom, and Adobe After Effects enhances efficiency through a structured five-step process. It begins with project setup, followed by object selection and mask refinement. AI then tracks the object across frames, applies the mask, and generates the final enhanced output. Advanced algorithms analyze each frame to

Research Article- Submit Date: 14.01.2025, Acceptance Date: 27.03.2025
DOI NO: 10.17932/IAU.EJNM.25480200.2025/ejnm_v9i2003

ensure precise object isolation, seamlessly replicating the surrounding environment. Additional AI-powered adjustments, such as contrast enhancement, noise balancing, and color correction, further refine the visual quality, optimizing the overall output of the project.

Figure 8

AI-Object Removal in Adobe Lightroom



4) Manual and AI Object Selection

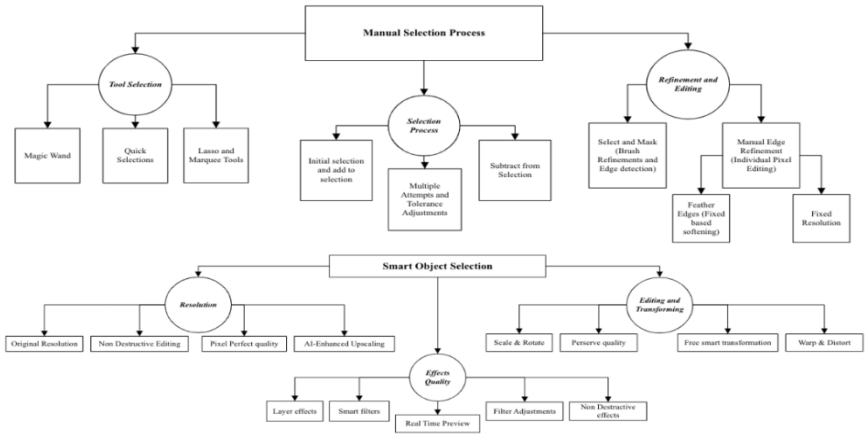
The flow chart illustrates the traditional manual object selection process in Adobe Photoshop software through a detailed multi-step workflow from choosing the selection tool Magic wand (colour-based), Quick selection (brush-based), Lasso tools (Manual tracking), adding or subtracting areas, adjusting tolerance levels, refining iterations to accurate edges, feathering for smoother edges, select & mask,

Research Article- Submit Date: 14.01.2025, Acceptance Date: 27.03.2025
DOI NO: 10.17932/IAU.EJNM.25480200.2025/ejnm_v9i2003

pixel by pixel adjustments, brush refinements, ensure clean edges and accurate isolation requiring expertise, patience for multiple attempts, considerable time, and advanced technical professionalism to develop a quality output (resolution, quality, editing and transforming). Additionally, it illustrates the smart object selection process in Adobe software, enhanced by AI tools. The workflow comprises several key components: resolution, effects quality, editing and transforming. In the Resolution phase, users can maintain the original resolution, achieve pixel-perfect quality, and apply AI-enhanced upscaling while ensuring non-destructive editing. The effects quality phase involves applying smart filters, adjusting layer effects, and previewing in real-time without compromising quality, thanks to non-destructive effects. Finally, in the Editing and Transforming phase, users can scale, rotate, warp, and distort objects freely while preserving the quality through smart transformations. This allows for flexible edits without degrading the image. The overall process enhances workflow efficiency and maintains high-quality output with AI assistance.

Figure 9

Manual and AI Object Selection Steps and Sub-Tasks

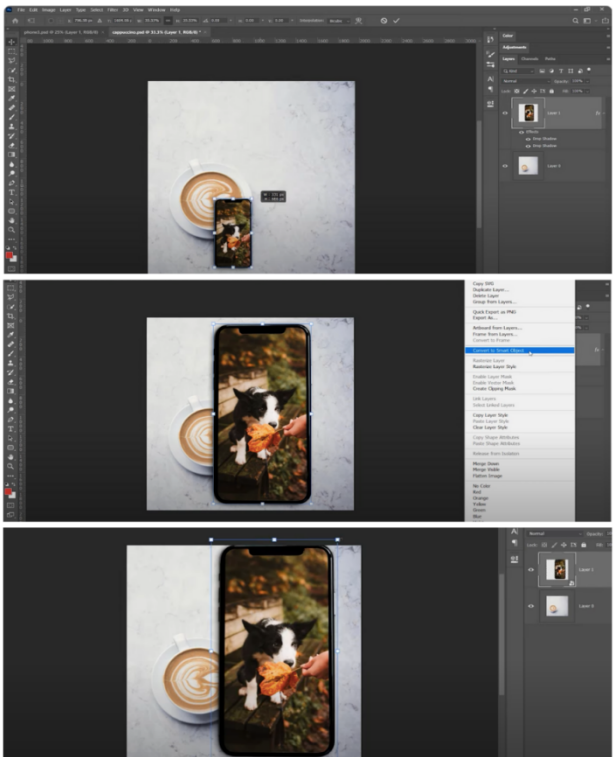


AI-assisted smart object selection in Adobe Photoshop streamlines the editing process by reducing the number of required steps. The workflow begins with subject selection, where AI identifies and isolates the object with precision. This non-destructive editing approach enhances resolution, sharpness, and clarity while minimizing the need for extensive manual intervention. Professional graphic designers can then refine, review, and finalize the output, ensuring the production of high-quality visuals and designs with greater efficiency.

Research Article- Submit Date: 14.01.2025, Acceptance Date: 27.03.2025
DOI NO: 10.17932/IAU.EJNM.25480200.2025/ejnm_v9i2003

Figure 10

AI-Smart Object Selection for Resolution Enhancement

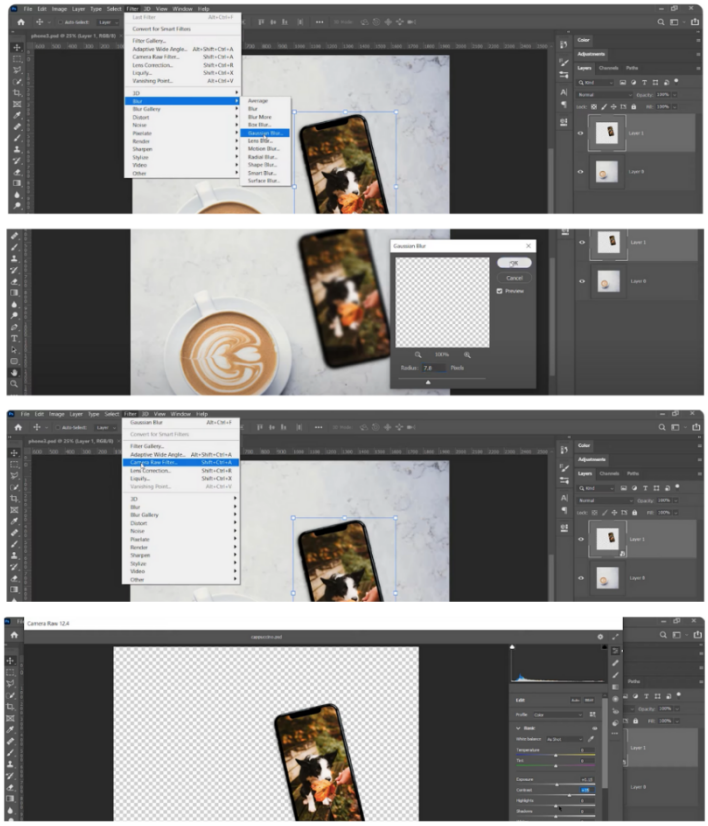


AI-driven features enable the application of effects and filters to smart objects under layers while preserving the original image's integrity. A variety of effects, such as blurs, color adjustments, and textures, can be applied non-destructively, allowing designers to experiment with different styles. This approach ensures flexibility for iterative editing while maintaining the option to revert to the original state, highlighting the transformative role of AI in design workflows.

Research Article- Submit Date: 14.01.2025, Acceptance Date: 27.03.2025
DOI NO: 10.17932/IAU.EJNM.25480200.2025/ejnm_v9i2003

Figure 11

AI-Smart Object Selection for Effects Quality

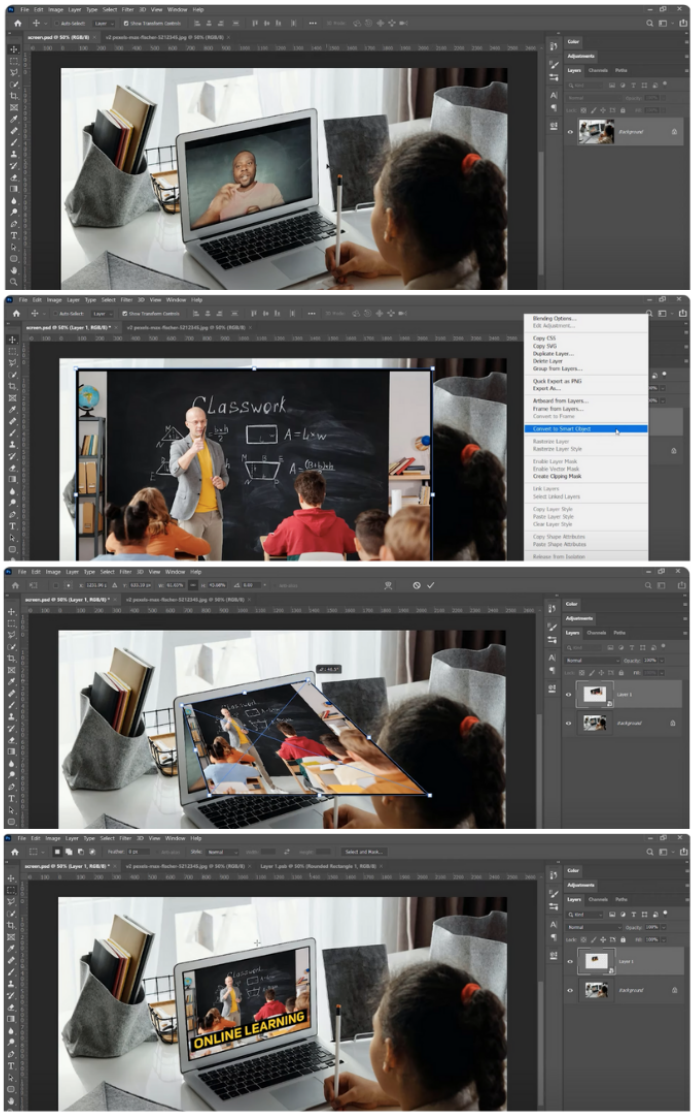


AI integration in editing and transformation enhances Adobe Photoshop workflows by enabling seamless compositing through non-destructive editing. A scene of a teacher instructing a classroom is converted into a smart object, allowing transformations without compromising image quality. The classroom scene is integrated into a laptop screen in front of a child, ensuring smooth blending between the two visuals. AI algorithms assist with contextual adjustments, scaling, and corrections, maintaining the integrity of the original images while enabling complex transformations. This approach improves efficiency, realism, and accuracy in photo editing processes.

Research Article- Submit Date: 14.01.2025, Acceptance Date: 27.03.2025
DOI NO: 10.17932/IAU.EJNM.25480200.2025/ejnm_v9i2003

Figure 12

AI-Smart Object Selection for Editing and Transforming



Research Article- Submit Date: 14.01.2025, Acceptance Date: 27.03.2025
DOI NO: 10.17932/IAU.EJNM.25480200.2025/ejnm_v9i2003

Table 3

Efficiency Comparison of Manual vs. AI-Assisted Tasks in Adobe Software

Task Type	*Manual time*	*Steps for Manual*	*AI Time*	*Steps for AI*	*Time Saved*	*Reduction Percentage*
1) Auto reframing	6 mins	12 + 8 subtasks	3 mins	4	3	50%
2) Sky Replacement	7 mins	15 + 10 sub-tasks	2 mins	3	5	71.4%
3) Smart Object Selection (resolution)	5 mins	10 + 8 sub-tasks	3 mins	4	2	40%
4) SOS (effects quality)	6 mins	8 + 10 sub-tasks	2 mins	5	2	66.7%
5) SOS (Editing & transforming)	4 mins	12+6 sub-tasks	2 mins	4	2	50%
6) Object Removal (Adobe Photoshop)	7 mins	13+12 sub-tasks	3 mins	5	4	57.1%
7) Object Removal (Adobe Lightroom)	7 mins	15+12 sub-tasks	3 mins	5	4	57.1%

The table highlights significant time and step reductions when using AI-assisted tools compared to manual methods in Adobe software. For Auto Reframing, AI saved 3 minutes, reducing the steps by 50%. Sky Replacement showed the most

Research Article- Submit Date: 14.01.2025, Acceptance Date: 27.03.2025
DOI NO: 10.17932/IAU.EJNM.25480200.2025/ejnm_v9i2003

significant improvement, with AI saving 5 minutes and reducing steps by 71.4%. Smart Object Selection (SOS) for both resolution and effects quality also benefited from AI, with 40% and 66.7% time savings, respectively. Editing and transforming with SOS showed a 50% time reduction. Object removal in Adobe Photoshop and Lightroom experienced similar improvements, with AI saving 4 minutes and reducing steps by 57.1%. Overall, AI significantly enhances workflow and time efficiency, minimizing steps and sub-tasks in half or more across various tasks.

SPSS STATISTICS

Table 4

Descriptive Statistics Results

	N	Minimum	Maximum	Mean	Std. Deviation
Time for Manual Tasks	7	4 mins	7 mins	6.00	1.155
Steps for Manual	7	8	15	12.14	2.545
AI- Driven Time	7	2 mins	3 mins	2.57	0.535
AI- Driven Steps	7	3	5	4.29	0.756
Time Saved	7	2 mins	5 mins	2.86	1.215
Reduction Percentage	7	40.000%	71.430%	56.05%	10.6654%

The average time taken for manual tasks is 6 minutes with a standard deviation of 1.144, indicating some variability in the time taken across different subs tasks and steps for different design features. In parallel, there is a significantly lower average

Research Article- Submit Date: 14.01.2025, Acceptance Date: 27.03.2025
DOI NO: 10.17932/IAU.EJNM.25480200.2025/ejnm_v9i2003

time for the AI-assisted techniques at 2.57 minutes with a standard deviation of 0.535, proving that AI-enhanced tools in Adobe software have made it faster and more consistent in performance, with a standard deviation of 2.545 and a higher average number of steps of 12.14 for manual subtasks and steps revealing that it is more complex and varied. In parallel, with a standard deviation of 0.756 and lower subtasks and steps of 4.29, there was less variability, suggesting a more streamlined process. Integrating AI techniques and tools in Adobe software applications, where the average time saved is almost 2.86 minutes, highlights and emphasizes the efficiency gained by the AI-assisted design features. Within a standard deviation of 10.67%, the average reduction percentage for the AI-assisted techniques in Adobe was almost 56.05%, revealing significant efficiency gains in the reduced time spent on design features, steps and subtasks. The descriptive statistics via SPSS reveal the significant efficiency gains in time and workflow (time savings and high percentage of reduction) of the specific examined graphic design projects by AI-assisted techniques and tools rather than the traditional manual methods, suggesting the urgent and crucial need for media professionals, media associations, researchers, universities and educative organizations to adopt AI methods in the education curriculum, development processes, and businesses for enhanced productivity in the graphic design projects.

Figure 13

Results of the paired t-test

Paired Samples Test

		Paired Differences					t	df	Significance	
					95% Confidence Interval of the Difference					
		Mean	Std. Deviation	Std. Error Mean	Lower	Upper			One-Sided p	Two-Sided p
Pair 1	StepsforManual - AISteps	7.857	2.854	1.079	5.218	10.496	7.285	6	<.001	<.001
Pair 2	ManualTime - AItime	3.429	1.134	.429	2.380	4.477	8.000	6	<.001	<.001

Paired Samples Effect Sizes

					95% Confidence Interval	
			Standardizer[a]	Point Estimate	Lower	Upper
Pair 1	StepsforManual - AISteps	Cohen's d	2.854	2.753	1.052	4.425
		Hedges' correction	3.285	2.392	.913	3.844
Pair 2	ManualTime - AItime	Cohen's d	1.134	3.024	1.190	4.832
		Hedges' correction	1.305	2.626	1.033	4.197

a. The denominator used in estimating the effect sizes.
Cohen's d uses the sample standard deviation of the mean difference.
Hedges' correction uses the sample standard deviation of the mean difference, plus a correction factor.

The SPSS Paired T-test reveals a mean difference of 7.857, a Standard deviation of 2.854, a t-value of 7.285, Degrees of freedom (df) of 6 and The Significance (Two-Sided p-value) of < 0.001 revealing a significant difference where AI-techniques and tools assistance in Adobe software applications required lower number of steps and subtasks than the traditional manual methods. A mean difference of 3.429, Standard deviation of 1.134, t-value of 8.0, Degrees of

Research Article- Submit Date: 14.01.2025, Acceptance Date: 27.03.2025
DOI NO: 10.17932/IAU.EJNM.25480200.2025/ejnm_v9i2003

freedom (df) of 6 and The Significance (Two-Sided p-value) of < 0.001 revealed significant differences where AI techniques and tools assistance in Adobe software applications helped in a faster and more consistent process in the specific examined graphic design features and projects.

The SPSS results of the Paired Sample's Effect Sizes for the steps and sub-tasks between manual and AI showed a significant effect size as Cohen's d with 2.854. Hedge's Correction with 3.285 reveals a significant difference between traditional AI and manual methods regarding the number of steps and sub-tasks through the specific examined design features in Adobe software applications. The SPSS results of the Paired Samples Effect Sizes between manual and AI showed a significant effect size as Cohen's d with 1.134, and Hedge's Correction with 1.305, revealing a significant reduction percentage between AI and Manual traditional methods in the consumed time through the specific examined design features in Adobe software applications. Overall, the results of the paired samples t-test demonstrated that AI techniques and tools enhancement for the specific examined graphic design features in Adobe software applications significantly enhanced the efficiency in time and workflow by reducing the required number of steps, sub-tasks and the consumed time where the significant effect sizes findings emphasize the practical significance supporting the adoption of AI innovations in media development, education curriculum and graphic design businesses.

Research Article- Submit Date: 14.01.2025, Acceptance Date: 27.03.2025
DOI NO: 10.17932/IAU.EJNM.25480200.2025/ejnm_v9i2003

CONCLUSION

The research employed a dual-mixed methodological approach combining a systematic literature review (SLR) and a self-executed experimental design to analyze the impact of AI integration in graphic design through time and workflow efficiency, providing a balanced view of current innovations, possibilities, limitations, and future research recommendations.

Systematic Literature Review (SLR): Possibilities and Limitations

From an initial pool of 1515 articles on Google Scholar between 2020 to 2024. The SLR focused on 14 academic articles, and over 70% of the studies emerged in the 2023-2024 phase, where possibilities such as automation, brainstorming, and workflow efficiency were commonly investigated. The predominance of qualitative research, with a percentage of 71%, suggests the need for more empirical quantitative studies within the lack of longitudinal studies and AI-human collaboration frameworks underlying the required research gaps to be addressed in understanding and measuring the impact of AI assistance on graphic design project development processes.

Experimental Design: Insights from AI-Assisted Tasks in Adobe

Comparing manual and AI-assisted workflows in Adobe software applications through self-conducted trials to 4 specific tasks such as auto-reframing, sky replacement, smart object selection, and object removal, has provided practical evidence and measurement for the AI's potential capabilities to enhance workflow efficiency, indicating a significant average reduction in time with a percentage of 56% and almost over half lower steps required using AI compared to manual traditional methods using Clockify as a real-time tracking software confirming that AI could streamline design processes by handling intensive tasks and steps with more incredible speed and consistency. The paired t-test results confirmed a statistically significant difference, with AI-assisted workflows requiring fewer steps and sub-tasks, reflecting a more efficient and consistent process. A mean difference of 7.857, a t-value of 7.285, and a significance level of $p < 0.001$ indicated that AI-driven design processes substantially minimized the complexity of design tasks. Similarly, the time efficiency analysis revealed a mean difference of 3.429, a t-value of 8.0, and a significance level of $p < 0.001$, reinforcing the transformative impact of AI on workflow optimization. The effect size calculations further validated these results, with Cohen's d and Hedge's correction revealing significant improvements in task execution speed and reduction in operational complexity.

Research Article- Submit Date: 14.01.2025, Acceptance Date: 27.03.2025
DOI NO: 10.17932/IAU.EJNM.25480200.2025/ejnm_v9i2003

The possibilities of the research can be summarized in the following: AI integration in graphic design demonstrates significant potential for transforming workflows through automation of repetitive tasks and enhanced output consistency. The research revealed that AI-assisted methods reduced task completion time by 56% on average and required approximately half the steps compared to traditional manual approaches. This efficiency was particularly evident in specific design tasks like auto-reframing, sky replacement, smart object selection, and object removal using Adobe software applications. Additionally, AI proved valuable for supporting brainstorming processes and maintaining consistency across design outputs, confirming its capability to streamline graphic design processes.

The limitations of the research can be summarized in the following: The study faced several constraints that may impact the generalizability of its findings, including the relatively small literature sample of only 14 articles and the predominance of qualitative research (71%) with limited quantitative and longitudinal studies. The experimental design examined a limited number of design features using a single software platform (Adobe), while the researcher's level of expertise may have influenced the results. Furthermore, the research identified significant challenges regarding AI's inability to replicate human creativity, cultural context, and emotional depth, along with ethical concerns related to intellectual property issues, creative homogenization, and potential biases stemming from AI's reliance on large datasets.

Both the SLR and experimental design confirmed that AI has considerable potential to transform design workflows by automating repetitive tasks and enhancing output consistency. However, ethical and creative concerns persist. The literature and experimental results highlighted AI’s limitations in replicating human creativity, cultural context, and emotional depth. Intellectual property issues and the risk of creative homogenization were critical challenges identified by the research. Additionally, AI's reliance on large datasets, which may introduce biases, underscores the need for responsible AI usage in creative fields. The research study's mixed methodology approach emphasized that AI’s integration into graphic design presents a balanced mix of possibilities and limitations. While AI offers significant workflow enhancements, its application must be approached thoughtfully to maintain the unique, creative value that professional graphic designers with advanced technical skills and knowledge can always bring to their work.

Research Article- Submit Date: 14.01.2025, Acceptance Date: 27.03.2025
DOI NO: 10.17932/IAU.EJNM.25480200.2025/ejnm_v9i2003

The following suggestions can be recommended for future research:

1) Incorporating more experimental and quantitative studies, as future research should focus more on quantifiable measures and experimental designs such as quality control, longitudinal studies, and optimized computer trials, which could provide more evidence, more precise insights, and empirical data on benefits, potential possibilities, limitations, and drawbacks over extended use on graphic design projects.

2) Integrating AI into design education curricula should include coursework that prepares future designers for a technologically driven landscape enhanced by artificial intelligence by educating students on the current tools, innovations, collaborative frameworks, and ethical considerations.

3) Developing hybrid AI-human collaborative frameworks and models where intelligence systems can integrate real-time human creativity with AI algorithm's analysis and processes could efficiently leverage designer's AI-assisted techniques and maintain control over the professional graphic designer's creativity, sensitive decisions, and emotional intelligence.

4) Ethical guidelines should be established to address issues and challenges such as authorship, copyrights, originality, bias mitigation, AI transparency, and data privacy standards that would foster trust and safeguard the unique creative contributions of professional graphic designers.

Research Article- Submit Date: 14.01.2025, Acceptance Date: 27.03.2025
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