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Research Article

Integrating AI into instructional design: A case study on digital photography education in higher education

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ABSTRACT

This study investigates the impact of artificial intelligence (AI)-supported education in higher education, specifically examining its integration into a digital photography course and its effects on both students and instructors. A qualitative research methodology was employed, and participants were selected through purposive sampling. The study involved one instructor and 38 students, with data collected through semi-structured interviews and analyzed using content analysis within a qualitative case study design. The findings indicate that AI enhances educational processes by facilitating individualized learning, improving instructional effectiveness, supporting digital content development, and advancing academic language proficiency. Students demonstrated improvements in critical evaluation and technological adaptability. Additionally, the study revealed that AI-supported tools contributed to the development of students' technical skills and promoted active engagement in learning processes. The immediate feedback provided by AI tools aided students' understanding of fundamental photography principles. However, some students expressed concerns about potential risks associated with AI, including decreased engagement, learner passivity, and exposure to misinformation or contradictory content. The study highlights the importance of integrating AI within a sound pedagogical framework to ensure its effective application in educational contexts. Drawing on the experiences of both students and the instructor, the findings suggest that AI-supported educational models can enhance learning efficiency, while also emphasizing the need to bolster information reliability and foster critical thinking skills.

Keywords: artificial intelligence, education, integration, instructional design, higher education

INTRODUCTION

Artificial intelligence (AI) has emerged as one of the most transformative technological advancements of the 21st century, reshaping industries by enhancing efficiency, automating complex tasks, and improving decision-making processes (Al Samman, 2024; Mai & Li, 2024). AI refers broadly to computer systems and algorithms designed to emulate human cognitive functions, including reasoning, problem-solving, and learning. By analyzing large volumes of data, AI can make decisions, generate predictions, and even engage in creative processes (Bui et al., 2024; Jin et al., 2023). The impact of AI spans a wide range of fields—including healthcare, finance, engineering, manufacturing, and cybersecurity—where it supports automation, increases operational efficiency, and enhances predictive analytics (Altaleb et al., 2023; Gupta & Srivastava, 2024; Sundaram, 2022). The education sector has likewise experienced significant benefits from AI-driven technologies, which facilitate adaptive learning systems, intelligent tutoring, automated assessment, and personalized content delivery (Trivedi, 2023; Vrana, 2024).

In the field of education, AI plays an increasingly prominent role in enhancing learning processes and improving accessibility. Through adaptive learning materials, real-time analysis of student performance, and data-driven insights provided to educators, AI technologies significantly contribute to making education systems more effective and personalized (Adiguzel et al., 2023; Fonseca et al., 2018; Namjoo et al., 2023). Research indicates that AI-supported teaching systems enable students to engage more actively in lessons and improve learning outcomes (Filiz et al., 2025; Luckin & Holmes, 2016). These systems also equip teachers with the ability to monitor students' learning processes and intervene when necessary (Fonseca et al., 2018). AI-driven assessment and feedback tools allow educators to refine their instructional strategies and provide more accurate evaluations of student performance (Ikhsan et al., 2024). The impact of AI on student achievement and motivation is particularly noteworthy (Amdan et al., 2024; Mallillin, 2024). Moreover, AI-based feedback mechanisms enable students to identify their weaknesses more efficiently, thereby optimizing their learning processes (Anuyahong et al., 2023; Kuzminykh et al., 2024). Virtual teaching assistants and automated feedback systems further support learning by providing continuous assistance, fostering a more engaging and interactive educational environment (Cheung et al., 2022; Filiz et al., 2025; Sagala et al., 2019). Additionally, AI facilitates the development of instructional materials through content-generation tools, allowing educators to focus on higher-order teaching strategies (Adiguzel et al., 2023; Liu, 2024; Monser, 2023). However, these technologies should complement rather than replace human instruction, as pedagogical decision-making remains central to achieving effective learning outcomes (Dai et al., 2023; Taufikin et al., 2024). AI-enhanced tools not only improve access to educational resources but also support personalized learning pathways tailored to students' individual learning styles (Sternberg, 2024; Yuldashev et al., 2024).

While AI-supported learning processes offer significant advantages—such as facilitating access to information—they also require careful consideration of the reliability of that information (Adiguzel et al., 2023). For example, Zhou et al. (2023) emphasize that in AI-based educational environments, students who utilize information without verifying its accuracy may become vulnerable to academic errors and the spread of misinformation. Similarly, Anjum et al. (2023) contend that although AI systems can be reliable in certain contexts, their accuracy rates may vary. This variability highlights the need to cultivate strong information verification practices to ensure the credibility and validity of learning sources. Despite its many advantages, AI-supported education also presents notable risks that require critical examination. Overreliance on AI tools may diminish student agency, as learners risk becoming passive recipients of AI-generated content rather than active participants in the educational process. Although automated feedback systems offer efficiency, they may constrain students' capacity for independent analysis and critical reflection, potentially promoting surface-level learning rather than fostering deep understanding (Darvishi et al., 2023). Furthermore, AI-generated outputs are susceptible to misinformation, hallucinations, and biases, which can mislead students if not critically assessed (Kamel, 2024). In creative disciplines such as visual arts and photography, concerns have been raised that AI may standardize expression and constrain originality by reinforcing predefined templates and aesthetic norms (Khadake, 2024). Additionally, disparities in access to high-speed internet, digital devices, and premium AI services risk exacerbating existing educational inequalities (Mafara & Abdullahi, 2024). These challenges underscore the necessity of robust pedagogical oversight, critical digital literacy education, and equitable technological infrastructure in the responsible integration of AI into educational settings.

Digital photography provides a particularly suitable context for exploring AI-supported instructional design due to its unique integration of technical precision, artistic expression, and real-time feedback requirements (Salameh, 2025). Unlike more abstract or theory-oriented disciplines, photography education relies heavily on visual analysis, iterative practice, and immediate critique—elements that align well with AI capabilities such as image recognition, composition analysis, and adaptive feedback. AI tools can assist learners in adjusting lighting, framing, exposure, and focus, while simultaneously encouraging experimentation and reflective practice. Moreover, the inherently digital nature of photography enables seamless integration with AI platforms, facilitating dynamic interactions between learner inputs and system-generated insights. These features make digital photography an ideal domain for examining how AI can support both technical skill development and creative autonomy within a structured pedagogical framework (Gross, 2024; Wang, 2024; Zhang, 2024).

The impact of AI on students' independent learning abilities remains a contested issue in the literature. While some studies highlight AI's potential to promote learner autonomy through personalized feedback and opportunities for self-paced exploration (Gervacio, 2024), others caution that excessive reliance on AI tools may hinder the development of critical thinking and independent problem-solving skills (Çela et al., 2024). Kazemitabaar et al. (2024) observed that AI systems can encourage surface-level engagement by simplifying tasks and reducing the need for cognitive effort. In contrast, Alm (2024) argues that, when integrated thoughtfully, AI can serve as a scaffold that gradually fosters learner independence. These divergent perspectives underscore the importance of considering contextual factors, instructional design, and individual learner characteristics when evaluating the effects of AI on self-directed learning. In the present study, while students reported improvements in technical competence and efficiency, concerns were also expressed regarding diminished initiative and an uncritical acceptance of AI-generated feedback. This duality suggests that AI integration must be carefully calibrated to support learner autonomy without undermining analytical depth and critical engagement.

From the perspective of educators, while the potential of AI tools offers significant opportunities, effective implementation requires teachers to enhance their competencies and adapt to emerging technologies (Arvin et al., 2024; Jegede, 2024). Although AI can facilitate various aspects of teaching, challenges related to technological proficiency and the adaptation process remain pressing concerns (Dei, 2025). Moreover, the successful integration of AI in education is contingent upon the availability of robust technological infrastructure and the provision of comprehensive professional development programs for educators (Fošner, 2024; Tammets & Ley, 2023). For example, Ning et al. (2024) stress the importance of educators acquiring both pedagogical and technical skills to implement AI tools effectively. Similarly, Wang et al. (2022) found that improving AI competencies among both students and instructors enhances the overall quality of the learning experience. These findings, alongside evolving educator perceptions of AI in the classroom, underscore the shifting role of technology in instructional practice and highlight the need for continuous capacity-building efforts within educational systems. Compared to traditional education, AI-supported learning environments offer distinct advantages in terms of personalization, adaptability, and feedback. Traditional instructional methods typically follow a one-size-fits-all approach, characterized by uniform content delivery and delayed or generalized feedback. In contrast, AI-supported systems can tailor instruction to individual learners' needs, provide real-time and targeted feedback, and facilitate self-paced learning (Salameh, 2025; Qushwa & Onia, 2024). Furthermore, while traditional education relies heavily on the instructor for both content delivery and assessment, AI tools can automate routine tasks, thereby allowing instructors to concentrate on higher-order pedagogical strategies. These distinctions are especially significant in applied disciplines such as digital photography, where immediate visual feedback and precise technical analysis are essential for effective skill development (Hamdi, 2024; Murgai et al., 2024). **Figure 1** presents a comparative overview of traditional and AI-supported education across multiple instructional dimensions.

At the university level, AI applications are increasingly being employed across a range of disciplines—from course design to assessment—enhancing the experiences of both educators and students (Hammad et al., 2024; Schleiss et al., 2023; Song, 2024). The integration of AI into instructional design holds substantial potential for improving student achievement and optimizing teaching processes (Dickey et al., 2023; Legowo et al., 2024; Song, 2024; Trivedi, 2023). One of AI's most significant contributions in higher education is its ability to make course design more dynamic, data-driven, and responsive to learners' needs (Blagoev et al., 2023; Song, 2024). However, research indicates that the unstructured or indiscriminate use of AI tools in educational settings does not necessarily yield positive learning outcomes; rather, it may result in superficial student engagement and diminished critical thinking (Xu & Li, 2024; Zhu, 2018). Therefore, an AI-enhanced and pedagogically informed approach to integration is essential to ensure the successful and meaningful application of AI in education (Dei, 2025; Popenici & Kerr, 2017). Recent advancements in educational technology have led to the development of various AI-supported learning models, each offering distinct pedagogical advantages. Intelligent Tutoring Systems (ITS), for instance, deliver real-time, one-on-one adaptive instruction by analyzing students' responses and dynamically adjusting content (Gyonyoru & Katona, 2024). AI-based Adaptive Learning Systems utilize learning analytics to tailor learning pathways based on individual student performance, pacing, and preferences (Gupta, 2024). AI-generated Content Platforms assist educators in developing customized instructional materials, thereby enhancing both teaching efficiency and

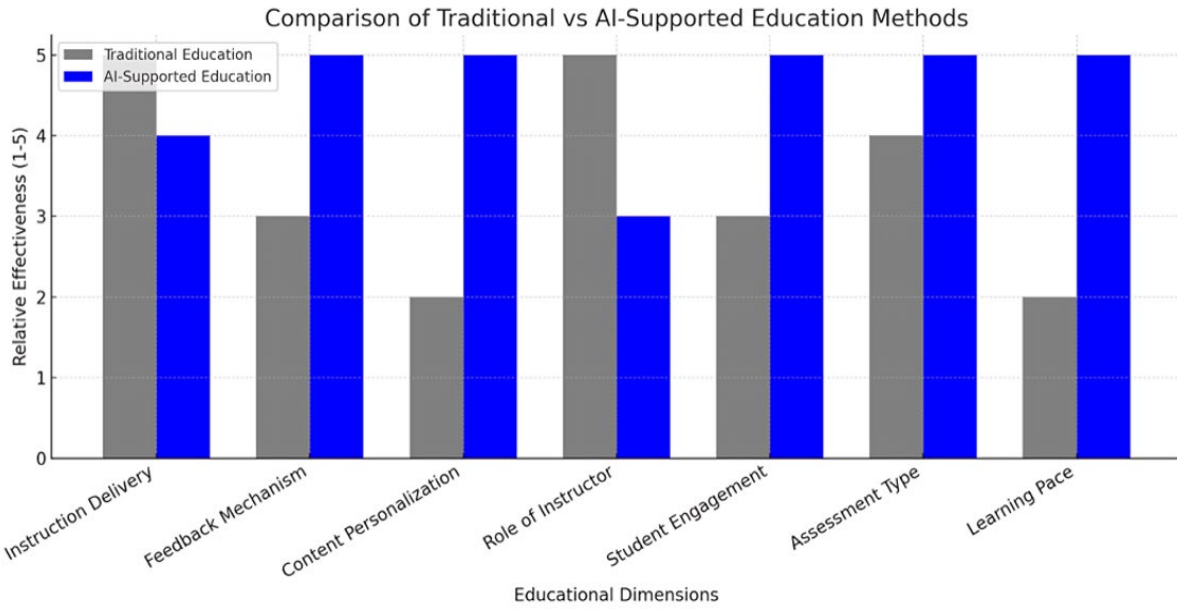

Figure 1. Comparison of traditional vs. AI-supported education (Source: Authors' own elaboration)

student engagement (Liu, 2024). Virtual Teaching Assistants—such as ChatGPT or Claude—support learners through conversational feedback and real-time query responses, promoting self-paced and autonomous learning (Ali et al., 2024). Each model addresses distinct pedagogical objectives: ITS emphasizes structured and guided instruction; adaptive systems foster learner autonomy; content-generation tools enhance instructional design; and virtual assistants facilitate interaction and flexibility. Understanding these distinctions is essential for educators in selecting AI tools that align with specific course designs and learning outcomes (Gross, 2024; Jegede, 2024).

To conceptualize the role of AI in education, this study draws upon the Technological Pedagogical Content Knowledge (TPACK) framework (Mishra & Koehler, 2006), which emphasizes the integration of technology, pedagogy, and content knowledge as essential for effective instructional practices. The integration of AI in digital photography education aligns with this framework by requiring educators to make informed pedagogical decisions regarding the use of AI tools, while also considering subject-specific content and the diverse needs of learners. Additionally, the study is grounded in constructivist learning theory (Vygotsky, 1978), which views learners as active agents in the construction of knowledge through interaction, reflection, and experiential learning. When implemented within project-based and collaborative environments, AI tools can support constructivist principles by offering personalized feedback and adaptive guidance that align with learners' evolving understanding (Filiz et al., 2025). Together, these theoretical frameworks provide a foundational lens through which the pedagogical value of AI in higher education can be examined—particularly in applied and creative disciplines such as photography, where technical proficiency and creative autonomy are both critical learning outcomes.

The integration of AI into instructional design—particularly through the MRK instructional design process—has significantly transformed learning experiences by enabling personalized content adaptation, real-time feedback, and interactive engagement (Gross, 2024; Song, 2024). The MRK model's task-centered approach, sequential learning structure, and holistic course design provide a robust foundation for AI-enhanced education, fostering adaptive learning environments and optimizing pedagogical strategies (Zhao, 2024). Compared to other instructional design models, the MRK model offers flexibility, allowing instructional designers to initiate the process at any desired stage due to its oval structure, while also incorporating continuous feedback and iterative revisions at each phase (Morrison et al., 2012; Rewatkar, 2024). Moreover, the model is particularly well-suited for the integration of modern technologies, including AI-supported applications. By considering learner characteristics and being adaptable to applied courses, the MRK model enhances educational outcomes. Its holistic structure supports both theoretical and practical components of coursework by aligning learning objectives, instructional content, and assessment tools (Morrison et al., 2012).

AI-driven platforms complement this framework by personalizing assignments, analyzing photographic elements such as composition and exposure, and offering instant feedback, thereby helping students refine their artistic and technical skills (Zhou et al., 2023). Furthermore, AI-enhanced feedback mechanisms provide continuous guidance, enabling a structured and iterative learning experience that promotes both creative development and skill mastery (Dönmez, 2024). This integration not only boosts student engagement and performance but also bridges the gap between technological advancement and creative expression, ensuring that applied photography education evolves in tandem with AI innovations (Das & Rani, 2024; Hasibuan & Azizah, 2023). Despite AI's growing presence in education, its comprehensive integration into applied creative disciplines remains an underexplored area (Coeckelbergh, 2023; Wan et al., 2024). While existing studies highlight AI's influence on instructional design and adaptive learning, few have examined its full-course implementation within hands-on, practice-based disciplines—particularly in creative fields such as digital photography and visual arts (Bourgault, 2023; Del Valle et al., 2024; Zailuddin et al., 2024).

The integration of AI into higher education has become an area of increasing academic interest, with numerous studies investigating its impact on student engagement, pedagogical approaches, and institutional policies. However, much of the existing research primarily emphasizes the broad effects of AI in education, its applications across diverse disciplines, and the perceptions of students and educators regarding AI-driven learning environments (Ezeoguine & Eteng-Uket, 2024; Sternberg, 2024). Several recent studies have conducted direct comparisons between traditional and AI-supported instructional methods, highlighting significant pedagogical differences. For instance, Otto et al. (2023) found that AI-enhanced courses led to substantially higher levels of student engagement and more personalized learning outcomes compared to conventional lecture-based instruction. Similarly, Zhou and Lee (2024) reported that students in AI-supported learning environments exhibited enhanced problem-solving and self-regulation skills, whereas those in traditional classrooms remained more reliant on instructor guidance. In creative disciplines such as digital arts and photography, Gross (2024) emphasized that AI tools not only improved students' technical proficiency but also promoted iterative exploration—an element often constrained by the time limitations of traditional teaching. Moreover, Englmeier (2024) demonstrated that adaptive AI systems enabled learners to progress at their own pace, in contrast to the fixed pacing characteristic of conventional instruction. While traditional methods continue to offer valuable human interaction and structured content delivery, these comparative studies suggest that AI-supported approaches provide greater flexibility, more immediate feedback, and enhanced learner autonomy. Integrating such findings into course design can assist educators in making more informed decisions about the optimal balance between conventional pedagogy and emerging AI technologies.

While AI significantly contributes to the evolution of instructional design in applied and creative disciplines, most existing studies focus primarily on its role in supporting individualized learning, rather than its broader pedagogical implications. In fields such as visual arts and digital photography, AI-supported tools foster creativity, enhance technical competencies, and refine students' aesthetic judgment (Elenain et al., 2024; Liu et al., 2023; Wang & Zhang, 2024). Despite these advancements, a notable gap remains in the literature concerning the comprehensive integration of AI across all phases of an applied, university-level course—particularly within creative and technical disciplines such as digital photography. Given the hands-on, creativity-driven nature of such courses, AI offers a valuable opportunity to further investigate its transformative impact on educational practices and learning outcomes (Hanh, 2024; Louly, 2024; Trisnawati et al., 2023).

Studies highlight the necessity of establishing clear guidelines and policies to support educators in effectively incorporating AI into curriculum development (Aberbach et al., 2021; Roopaei & Dehbozorgi, 2024). However, while these studies offer valuable insights into AI adoption in education, they often fall short of addressing its specific impact on creativity, technical skill development, and course design in applied, hands-on disciplines (Hasibuan & Azizah, 2023). The integration of AI into instructional design has emerged as a transformative force in higher education, enhancing personalized learning experiences, increasing student engagement, and optimizing course delivery. Research suggests that AI-supported course implementation enables more tailored educational experiences, aligning with students' individual learning needs and promoting improved academic outcomes (Song, 2024). In courses related to visual arts and other creativity-driven domains, AI tools have been shown to enrich students' aesthetic perception and stimulate creative

expression. Nevertheless, researchers stress that AI should be integrated in ways that enhance the quality of education without diminishing the essential human dimension (Hanh, 2024). Similarly, Ifenthaler and Schumacher (2019) contend that although AI-based systems can effectively facilitate learning, pedagogical decision-making must carefully balance automation with human intervention to preserve instructional effectiveness.

Despite the growing presence of AI in higher education, its comprehensive integration into creative courses—particularly digital photography—remains underexplored. While AI has been successfully implemented in related disciplines, its full potential in photography education and other hands-on creative fields has yet to be thoroughly examined. AI-enhanced tools have already transformed design education, influencing domains such as production design, fine arts, and digital artistry, suggesting that similar applications could also revolutionize photography education (Zailuddin et al., 2024). Although existing research confirms AI's positive impact on instructional design and its selective use in certain creative courses, a significant gap persists in understanding its holistic integration into applied and creative disciplines such as digital photography.

To address this gap, the present study aims to provide a comprehensive analysis of AI integration across all phases of an applied university-level course. Specifically, it investigates AI's impact on creativity and technical skill development in applied higher education contexts, explores educators' experiences in designing and implementing AI-supported creative courses, and proposes a framework for the effective and ethical integration of AI in hands-on disciplines. Furthermore, the findings are intended to guide higher education institutions in developing best practices for incorporating AI into both theoretical and practical learning processes. By addressing these underexplored dimensions, this study seeks to contribute to a more nuanced understanding of AI's role in education and to serve as a valuable resource for academics, curriculum designers, and policymakers aiming to implement AI-driven pedagogical strategies effectively.

The aim of this study is to conduct an in-depth examination of the effects of AI integration across all phases of a university-level course on both students and educators. While the existing literature includes numerous studies on the general impact of AI in education and its applications across various disciplines, relatively few studies comprehensively explore AI integration throughout all stages of an applied course, such as digital photography. Specifically, this study seeks to investigate AI's impact on students' creativity and technical skill development, as well as instructors' experiences in course design and implementation. Addressing this gap in the literature will offer a broader perspective on AI's role in education and provide practical guidance for academics on the integration of technology in applied and creative disciplines. The findings are expected to contribute to the field by offering valuable insights into the effective and ethical use of AI in higher education. In this context, the study is guided by the following research questions:

1. How does the instructor experience the design, implementation, and evaluation processes of an AI-supported course?
2. How do students experience the course process within an AI-supported learning environment?

METHODOLOGY

This section discusses the research design, participants, instruments, trustworthiness of the interviews, procedures, and data analysis.

Research Design

This study employs a **case study design**, a qualitative research method that facilitates an in-depth examination within a bounded system. The case study approach is particularly suited to exploring individuals' experiences and the impact of specific processes within a defined context (Creswell, 2020; Merriam, 2018). Unlike ethnographic research, which emphasizes long-term cultural immersion, this case study focuses on the detailed analysis of a specific educational setting. In contrast to phenomenology, which centers exclusively on individuals' lived experiences, the case study adopts a more holistic perspective by examining the broader processes and interactions through which these experiences are shaped (Creswell, 2018).

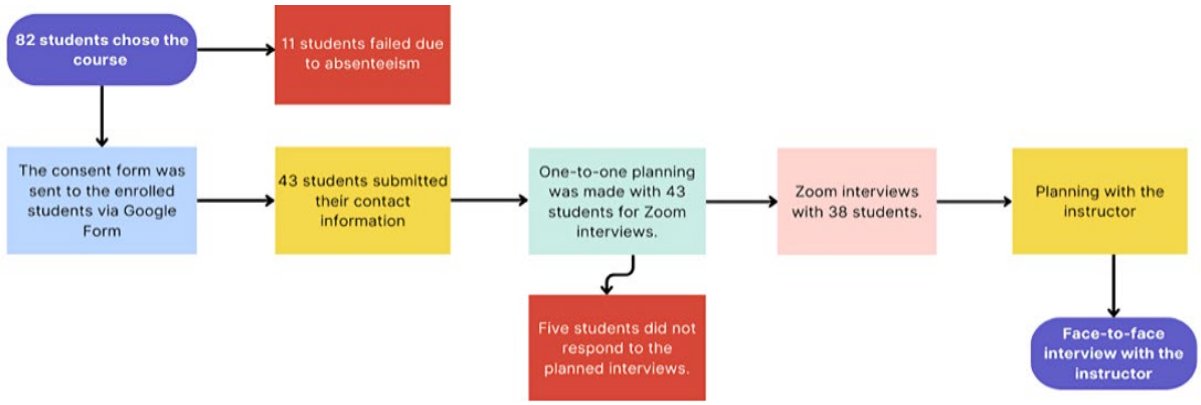

Figure 2. Participant selection process (Source: Authors' own elaboration)

The case study design was selected due to the rich content of the *Digital Photography in Nature* course at the university level, which provided an appropriate setting for a detailed investigation of both student and instructor experiences within an AI-supported, project-based instructional framework. This design enabled a comprehensive exploration of AI integration in higher education, particularly within applied and creative disciplines such as digital photography.

The case study approach is well-suited to analyzing complex and dynamic educational processes, understanding participant experiences, and evaluating the effects of these experiences on learning outcomes. As illustrated in **Figure 2**, participants were identified in stages, and the data collection process was planned and executed accordingly. Online and face-to-face interviews were conducted with participants. The data obtained were systematically coded using content analysis and examined in depth through thematic and categorical structuring.

Participants

The participants of this study consist of 38 associate degree students enrolled in the *Digital Photography in Nature* course at a public university in eastern Turkey, along with the instructor responsible for teaching the course. The course is offered as an elective within the university's general elective pool and is available to students from various academic programs. It is delivered during the third semester of associate degree programs and includes specific requirements for successful completion. First, due to its face-to-face format, students are required to attend at least 70% of the 15-week sessions. Second, students must achieve a minimum average score of 60 across midterm and final assessments.

Participants were selected using criterion sampling, a type of purposive sampling method (Creswell, 2020), from among students who successfully completed the course. A total of 82 students were initially enrolled, including 30 in the regular education program and 52 in the evening education program. Eleven students failed the course due to inadequate attendance, resulting in 71 eligible students. From this pool, 38 students voluntarily agreed to participate in online interviews conducted via Zoom. Among the participants, 25 were female and 13 were male. Female students were labeled S1 to S25, while male students were labeled S26 to S38. Of the 38 participants, 36 were between the ages of 20 and 23. The remaining two students—one female and one male—were over the age of 40. The male student had previous experience working in a photography studio, where he was involved in analog darkroom processes such as printing and developing photographs; however, he had not received formal photography education. The remaining students had no prior formal training in photography. Two students owned professional DSLR cameras, while the rest primarily engaged in mobile photography using their smartphones. In terms of prior exposure to AI tools, students reported varying levels of experience. Three students (8%) encountered the concept of AI for the first time during the course. Twenty-four students (63%) had never used AI tools before enrolling. Ten students (26%) had used AI tools occasionally, while one student (3%) had downloaded an AI application and regularly used the free version of ChatGPT. By the end of the course, all students had downloaded and actively begun using AI tools as part of their learning experience.

The course instructor is an academic with over eight years of experience in higher education. She has been teaching the *Digital Photography in Nature* course for two years and, in the current term, has integrated AI technologies at a micro level. The instructor, who completed her postgraduate education in the field of Educational Sciences, has taken various courses related to learning and teaching processes, with a particular emphasis on instructional design. Adopting a constructivist approach to education, she emphasizes collaborative learning methods in her courses. In previous academic terms, she effectively implemented technology-supported instructional practices such as the flipped classroom model. Over the past year, she has integrated AI-based tools into her teaching processes. She has completed several online training programs focused on AI and actively follows current research and innovations related to AI tools in education. The instructor also possesses comprehensive technical equipment for photography. In addition to her academic background, she has been actively engaged in photography for approximately 14 years and has participated in various photography competitions.

Instruments

As part of this study, data were collected using a semi-structured interview form, a widely accepted qualitative data collection method that allows for flexibility based on participant experiences while remaining guided by core questions (Creswell, 2020). This method was chosen to gain an in-depth and contextually rich understanding of participant experiences with AI-supported teaching processes. The semi-structured interview questions were developed based on a review of current research focused on AI integration in instructional design. Specifically, the questions were informed by instructional design themes identified in Kim et al.'s (2022) study, the pedagogical contributions of AI tools as discussed in Lin and Chen's (2024) research, and the AI integration framework outlined in Chen's (2024) doctoral dissertation. Additionally, the works of Gross (2024), Wang (2024), and Zhang (2024), which focus on AI use in the field of photography, were consulted to ensure relevance to the context of this study. The interview protocol was further refined based on feedback from four academic experts in relevant fields. Two of the experts hold doctoral degrees in educational technology and have been serving as university lecturers for over seven years. A third expert, specializing in literature education, has over five years of teaching experience at the university level and has worked as a language editor for two academic journals. The fourth expert is a professor in the field of educational sciences and has served as a department chair at a public university for several years. Two distinct interview forms were used as data collection instruments: one designed to explore students' experiences and another to gather the instructor's perspectives. The interview forms are provided in **Appendix A**.

Procedure

The consent form prepared by the researchers was distributed to students enrolled in the *Digital Photography in Nature* course via a Google Form link. A total of 43 students who completed the consent form and provided their contact information were contacted individually via phone or WhatsApp to schedule interview appointments. During the scheduling process, students' course timetables were considered to identify suitable time slots. Interview details were communicated to each student through the Zoom platform. However, five students did not respond at their scheduled interview times and could not be reached. As a result, online one-on-one interviews were successfully conducted with 38 students using a semi-structured interview form. All interviews took place via Zoom, with each session lasting approximately 40 minutes on average. At the request of the participants, interviews were recorded with cameras turned off to ensure comfort and privacy. The interview with the course instructor was scheduled outside of teaching hours on a mutually convenient day and conducted in the instructor's office to ensure a quiet, distraction-free environment. A day when students had no classes was deliberately chosen to facilitate an uninterrupted and focused discussion. This semi-structured interview lasted approximately 1 hour and 20 minutes and was recorded using the voice recording function of a mobile phone. Throughout the interview, the instructor's experiences and perspectives regarding AI-supported teaching were prioritized, and active listening techniques were employed to elicit detailed and reflective responses. To ensure informed consent, the transcripts of both the instructor's and students' interviews were returned to participants for review. Following their approval, the data analysis process commenced (Merriam, 2018). In line with participants' explicit consent, the interviews were recorded via the Zoom platform for online sessions and using mobile devices

Table 1. Themes and codes related to the instructor's experiences in the design, implementation, and evaluation of an AI-supported course

Theme	Code
Instructional design process	Problem identification Learner analysis Instructional goals and learning outcomes Learning and teaching strategies Assessment
Contributions to the educational process	Academic language Personalized learning AI tools
Risks encountered in the educational process	Insufficient infrastructure Hallucination

for face-to-face interviews. All recordings were encrypted and stored in a secure digital environment accessible only to the research team. Identifying information was anonymized during transcription; students were coded as S1, S2, etc., and the instructor was referred to as Instructor. The study was conducted with the approval of the university's ethics committee, and all ethical responsibilities related to participant confidentiality and data protection were fully observed.

Data Analysis

In qualitative research, the process of making sense of individuals' or groups' experiences is fundamental. Addressing research questions through a theoretical framework that supports the interpretation of these experiences is therefore essential (Creswell, 2020). In this study, content analysis was employed to analyze the interviews conducted with both the instructor and the students regarding their experiences with AI-supported education. The data analysis process was guided by the trustworthiness criteria outlined by Lincoln and Guba (1985), specifically: credibility, transferability, dependability, and confirmability. These criteria ensured that the analysis was conducted rigorously and that the findings accurately reflect participants' perspectives within the context of AI integration in higher education.

To ensure credibility (Creswell, 2020; Lincoln & Guba, 1985; Merriam, 2018), interview data were transcribed and sent to participants within 48 hours for verification of accuracy. Additionally, the data analysis process was conducted concurrently with data collection, rather than being deferred until the conclusion of the study. This approach helped maintain consistency between the data and the participant context while minimizing the risk of meaning loss. As part of triangulation, the study employed both data source diversity and a combination of manual coding and the use of MAXQDA 2020 software. Data were collected from two distinct participant groups—students and the instructor—to allow for the integration of multiple perspectives into the analysis. The use of both manual coding and MAXQDA software enabled a complementary approach that enhanced the reliability of the findings. For peer debriefing and to increase the objectivity of the coding process, 25% of the raw data were sent to an independent researcher with a PhD in educational technology for blind coding. Following this, Zoom meetings were held to compare coding outputs, and discrepancies were discussed until consensus was reached on five overarching themes and 18 codes. Subsequently, the codebook was reviewed by a third independent researcher with a PhD in curriculum studies to evaluate the appropriateness of the codes and themes. Based on this evaluation, it was recommended that one of the 18 codes be merged with another. Necessary revisions were made accordingly, resulting in a final structure consisting of 17 codes and five themes.

To ensure transferability (Creswell, 2020), detailed descriptions of the data collection process, participant profiles, analysis stages, and coding procedures were provided to preserve the contextual integrity of the research findings. The themes and codes that emerged in response to the research questions—three themes and ten codes for the instructor, and two themes and six codes for the students—are presented clearly and transparently in **Table 1** and **Table 2**. This level of detail enables comparisons with findings from similar studies and supports the broader applicability of the results.

To ensure dependability, a multi-stage coding process was implemented, following the guidelines of Creswell (2020), Lincoln and Guba (1985), and drawing upon Saldaña's (2019) coding methodology. In the first

Table 2. Themes and codes related to students' experiences during the course process in an AI-supported learning environment

Theme	Code
Advantages in the educational process	Role definition Technical knowledge Time efficiency and convenience feedback Awareness
Disadvantages of the educational process	Passivity and over-reliance Misinformation and contradictions

cycle, the coding was conducted manually. The data were read multiple times, analyzed, and preliminarily coded using Google Drive. Structural coding was applied during this phase, allowing researchers to align segments of text with specific research questions. Structural coding involves assigning content-based or conceptual labels to data segments that correspond to particular topics of inquiry or thematic areas (Saldaña, 2019). Each section of the interview transcript was coded according to the sub-question or thematic area it addressed, enabling the identification of recurring patterns and focused responses. This stage resulted in the generation of approximately 55 initial codes. In the second cycle, coding was conducted using MAXQDA 2020 software. The data were re-analyzed within the software, and broader themes were identified. During this phase, the first researcher refined and consolidated the codes, reducing them to 22 codes and six themes. The resulting coding structure was then reviewed by the second researcher and an independent expert. Necessary adjustments were made based on their feedback to finalize the thematic framework.

To ensure confirmability, the study incorporated detailed methodological descriptions (Creswell, 2020; Lincoln & Guba, 1985; Saldaña, 2019), and participants' direct statements were frequently included in the findings section to accurately reflect their perspectives. Multiple validation strategies were employed to minimize the influence of the researchers' subjective interpretations. Decisions made throughout the analysis process, including coding procedures, were systematically documented. The methods used in coding, along with the rationale for decisions and any modifications made, were explicitly outlined to maintain transparency. Furthermore, the coding scheme was shared with independent researchers and subjected to critical review. This process supported an objective and rigorous analysis, enhancing the trustworthiness of the findings and reducing potential bias in the interpretation of experiences related to AI-supported instruction.

FINDINGS AND DISCUSSION

This section presents the main themes derived from the findings obtained through content analysis.

Findings Related to the First Sub-Research Question

"How are the design, implementation, and evaluation processes of an AI-supported course experienced by the instructor?"

Three main themes emerged from the data:

1. Instructional design process
2. Contributions to the educational process
3. Risks encountered in the educational process

The specific codes identified under each theme are presented below, accompanied by illustrative quotations from the participant to support and contextualize the findings.

Instructional design process

The *Digital Photography in Nature* course, a university-wide elective with no prerequisites, was redesigned by the instructor in response to the limited effectiveness of traditional teacher-centered methods observed in previous years. Given the course's technical nature and the requirement for specialized equipment—often inaccessible to students due to socioeconomic constraints—the instructor adopted a micro-level technology integration strategy, incorporating AI into the instructional design process. As the instructor noted,

> "Since the course involves both practical applications and technical knowledge, and considering that students' socioeconomic conditions often prevent them from accessing photography equipment, I developed alternative solutions. I integrated AI into my course and reflected this in my instructional design process."

This decision aligns with recent research emphasizing the pedagogical benefits of AI in higher education. For example, Mai and Li (2024) found that AI-based instructional design enhances learning by enabling personalized learning pathways. Similarly, Jin et al. (2023) highlighted the value of AI-driven analytical tools in providing precise technical feedback in photography education. The instructor's approach reflects a structured instructional design model that encompasses four key components: problem identification, learner-centered design, instructional goals, and learning and teaching strategies. Identifying the limitations of conventional approaches in applied courses was a critical first step. This is consistent with findings by Altaleb et al. (2023), who argue that AI-powered tools enable instructors to assess learners' needs more effectively and tailor content to meet those needs. Consequently, this study highlights problem identification as a foundational phase in AI-supported course design, ensuring that instructional strategies are aligned with both technical demands and issues of learner accessibility. During the learner analysis phase, the instructor identified that students had limited prior knowledge of AI, which emerged as a critical challenge in the integration of AI-supported learning. As the instructor explained:

> "This decision marked a critical turning point for me because, during the learner analysis phase, I realized that students had never taken an AI-supported course in higher education before. Some students even mentioned that they had never heard of AI-supported tools and did not know how to use them."

This observation highlights students' low awareness and limited familiarity with AI-supported tools and technologies, a finding that aligns with existing research. Vrana (2024) similarly reported that most students at Zagreb University had not received formal education on AI-supported learning and lacked sufficient knowledge to engage with these technologies effectively. Likewise, Namjoo et al. (2023) examined students' experiences with AI tools in individual learning contexts and concluded that learners require structured guidance and training to use such tools successfully. While the present study corroborates these findings, it further underscores that a lack of AI awareness among students may constitute a significant barrier to the effective integration of AI-based learning processes. Addressing this gap through targeted instructional strategies and supportive training programs is therefore essential to ensure the successful adoption and meaningful use of AI in higher education settings.

Regarding instructional goals, the instructor emphasized that the primary objective was to enable students to learn fundamental photography principles through AI-supported tools while simultaneously developing their technical skills. As the instructor explained:

> "The main purpose of this integration was to enable students to evaluate their photographs using AI tools. Additionally, by providing personalized feedback, students could identify and improve their weaknesses in areas such as fundamental photography principles, lighting, composition, focus settings, and the rule of thirds. AI tools offered analytical insights based on specific criteria, allowing students to recognize their mistakes more consciously. This process not only enhanced their technical proficiency but also fostered their critical thinking and visual analysis skills."

This finding aligns with previous research emphasizing the role of AI in shaping instructional goals that correspond to students' competency levels. Luckin and Holmes (2016) suggested that AI-supported systems assist educators in defining clearer learning outcomes by refining the goal-setting process. In applied courses, Amdan et al. (2024) similarly found that AI tools positively influence the development of customized learning objectives based on students' technical skills. AI systems can analyze students' prior work and generate personalized learning goals, thereby accelerating the learning process and enhancing learner motivation (Anuyahong et al., 2023). However, some studies—such as Zhou et al. (2023)—argue that AI-based systems may lack sufficient flexibility in defining instructional objectives, potentially limiting instructors' ability to adapt pedagogical strategies to dynamic classroom needs. While the findings of the present study underscore the

considerable advantages AI offers in instructional goal-setting—particularly through its ability to deliver precise feedback and create personalized learning pathways—it is equally important to acknowledge its potential constraints in terms of pedagogical adaptability.

In terms of learning and teaching strategies, the instructor adopted a constructivist approach by integrating the flipped classroom model and project-based collaborative learning to enhance student engagement with AI-supported tools. As the instructor explained:

> "To support this process, I implemented the Flipped Classroom method. First, I shared relevant YouTube videos with my students to help them acquire preliminary knowledge. Then, I identified the gaps in their understanding and addressed these deficiencies through classroom discussions. This approach not only enhanced their AI literacy but also provided them with detailed knowledge about how AI hallucinations could negatively impact educational processes."

Additionally, project-based and collaborative learning methods were incorporated into the course, requiring students to work in groups of five to develop projects while utilizing AI tools. As the instructor elaborated:

> "I created one-minute videos using Flikia AI. This helped students become familiar with the topic and listen with greater motivation and interest. Additionally, I developed flashcards covering fundamental photography terms, which I shared via Cloud."

This study found that by structuring learning objectives around students' cognitive and psychomotor skills, the instructor enabled them to refine fundamental photography principles using AI-supported tools. The existing literature supports these findings, particularly in relation to learning and teaching strategies. Sagala et al. (2019) found that AI-supported project-based learning environments enhanced students' collaborative skills and team communication. Similarly, Monser (2023) demonstrated that AI-based tools foster creativity in visual arts and design projects while promoting effective teamwork. However, some studies also caution that AI-supported teaching strategies do not always produce the intended learning outcomes. For example, Dai et al. (2023) raised concerns about the potential impact of AI on students' independent learning abilities, noting that while AI-based methods can enhance engagement and skill acquisition, they may also lead to overreliance on technological guidance. The present study thus highlights both the opportunities and limitations of integrating AI into constructivist teaching methods, emphasizing the need to balance technological support with strategies that encourage learner autonomy.

As part of the assessment process, the instructor required students to participate in weekly group assignments, capturing photographs aligned with specific compositional themes and receiving AI-generated feedback. This approach was designed to enhance students' technical and artistic analytical skills through structured evaluation. Describing this process, the instructor stated:

> "I asked students to take photographs each week based on the assigned theme. They uploaded their photos to their phones and analyzed them using Gemini and ChatGPT. Through AI-generated feedback, they identified errors related to lighting, composition, shutter speed, ISO, aperture settings, and the rule of thirds. This process helped them recognize and correct their mistakes, preventing them from repeating them in future shoots."

Peer discussions in class further reinforced students' learning by providing an additional layer of critique and reflection.

During the midterm process, students conducted literature reviews using AI tools as part of their group projects and compiled written reports. To ensure systematic and objective evaluation, the instructor developed assessment criteria and rubrics using Claude. For the final project, student groups captured photographs based on assigned themes, analyzed them using AI tools, and prepared AI-supported research presentations. As part of this process, students selected six to ten photographs and conducted comparative technical and artistic analyses against award-winning images. Additionally, the instructor monitored students' progress by comparing their initial and final photographs, emphasizing the role of peer discussions in reinforcing learning outcomes. The notably high midterm and final project averages suggested a positive

contribution of AI-supported assessments to the overall learning process. This study found that the integration of AI tools into the assessment process made evaluation more systematic, objective, and pedagogically meaningful. Existing literature supports these findings. Adiguzel et al. (2023) noted that assessment processes become more structured and efficient with the integration of AI. Similarly, Yuldashev et al. (2024) emphasized that AI-supported assessment systems provide objective feedback and accelerate the evaluation process, offering significant pedagogical advantages. Bruce (2024) further argued that AI-generated rubrics increase efficiency for instructors while allowing students to better monitor their own progress. In the context of art and design education, Lyanda et al. (2024) demonstrated that AI-supported assessment systems facilitate objective evaluations of student work and improve the quality and clarity of feedback. Based on these findings, AI-supported assessment tools appear to offer several key benefits, including faster evaluation, more objective feedback, and a reduced workload for instructors. However, while AI facilitates structured and data-driven assessment, maintaining a balance between automated evaluations and human judgment remains essential to ensure feedback that is both comprehensive and meaningful.

Contribution to the educational process

Another theme identified in this study is AI's contribution to the educational process, which was categorized into three key aspects: academic language, personalized learning, and AI tools. The instructor observed a noticeable improvement in students' use of academic language over the duration of the course, attributing this progress to AI's role in refining their technical and discipline-specific writing skills. As the instructor explained:

> "In recent years, university students have been reading fewer books and spending more time on social media, leading to frequent grammatical errors, particularly in sentence structure and verb usage. After incorporating AI, I observed that students began using technical language in a more academic manner during class discussions."

This finding suggests that AI-supported tools can enhance students' ability to structure their writing in a more precise and discipline-appropriate manner.

Existing research supports this observation, emphasizing AI's role in academic language development. Tran (2024) concluded that AI-supported writing tools help students reduce grammatical and syntactical errors, resulting in more coherent and precise academic texts. However, while AI facilitates linguistic accuracy, some studies highlight potential drawbacks. Chen et al. (2014) cautioned that AI-based language systems may impose formulaic structures, potentially limiting students' ability to develop individual writing styles. Similarly, Sternberg (2024) argued that in creative writing and artistic disciplines, AI may reinforce standardized narrative patterns, thereby constraining students' originality. Therefore, while AI contributes significantly to improving academic language proficiency, it is essential to maintain a balanced approach to avoid over-reliance on AI-generated expressions. Combining AI-driven feedback with human critical thinking and creativity allows students to improve both the accuracy and originality of their academic writing. Although AI may enhance students' awareness of technical terminology and improve their academic language use, the generation of entire sentences by AI may also lead to passivity and, in some cases, excessive dependence on the technology. This reliance can result in students avoiding independent research and critical engagement with course content. Thus, while AI supports academic development, it may simultaneously hinder students' research capabilities and critical thinking skills if not implemented thoughtfully.

The instructor further observed that AI-supported tools significantly enhanced students' personalized learning experiences by providing tailored feedback, enabling them to identify and address their individual weaknesses more effectively. As the instructor explained:

> "AI's ability to provide continuous feedback allowed students to recognize their deficiencies and work on improving them throughout the learning process."

This finding underscores the role of AI in fostering adaptive learning environments, enabling students to progress according to their individual learning styles, needs, and paces.

Existing research supports these observations, emphasizing AI's contribution to learning efficiency and real-time feedback mechanisms. Jegede (2024) noted that AI tools facilitate more effective learning by enabling students to track their progress and receive individualized feedback. Additionally, AI-based learning systems assist instructors in identifying students' weaknesses more efficiently and in providing customized instructional content, as demonstrated in studies by Filiz et al. (2025), Song (2024), Fošner (2024), Sternberg (2024), and Al Samman (2024). Benayache and Mourad (2024) further found that AI-supported education promotes individualized learning pathways, allowing students to engage more effectively with complex topics. However, while AI enhances personalization and efficiency in education, it also introduces potential challenges. Some studies suggest that students may become overly reliant on AI-guided learning systems, which could impede the development of independent problem-solving skills (Adiguzel et al., 2023; Dickey et al., 2023). Additionally, Zhu (2018) warned that the accelerated nature of AI-assisted learning may encourage a superficial focus on acquiring knowledge rather than promoting deep comprehension. Therefore, although AI tools offer considerable advantages in adapting learning content to individual needs, a balanced pedagogical approach is essential to ensure that increased efficiency does not come at the expense of critical thinking and deep learning.

The instructor emphasized the pedagogical and intentional integration of AI tools throughout the course, leveraging various AI-supported applications to enhance both instructional design and student engagement. As the instructor explained:

> "The multifunctionality of ChatGPT significantly improved the accuracy of our photo analysis results."

Claude was employed to structure course objectives and articulate learning outcomes more comprehensively, while Flikia AI played a key role in capturing students' attention and increasing motivation. Krea AI was used for photo editing, and Data Analysis Report AI supported learner analysis by providing insights into student progress. The integration of ChatGPT Plus with other GPT models allowed for the seamless use of multiple tools within a unified platform, ensuring a cohesive and streamlined learning experience. The instructor also noted that the Gamma App enhanced the dynamism and interactivity of presentation materials, and that ChatGPT was particularly effective in analyzing the technical dimensions of photography.

This study found that the instructor's approach to AI integration was pedagogically informed, ensuring that technology functioned not as a supplementary tool but as an integral component of the instructional strategy. Research corroborates the view that AI-supported tools in applied courses not only accelerate learning but also enhance classroom interaction (Bui et al., 2024; Filiz et al., 2024). Gross (2024) emphasized that Claude was particularly effective in fostering the development of technical language and contributed meaningfully to the cultivation of artistic perspectives in photography education. By strategically employing these AI applications, the instructor created a more interactive and dynamic learning environment, demonstrating how AI can be effectively integrated into applied courses to support both technical skill development and student engagement.

Risks encountered in the educational process

Technological infrastructure limitations within the institution—such as intermittent connectivity issues and students' lack of access to necessary technological equipment—were identified as significant barriers to the effective implementation of the AI-supported course. As the instructor explained:

> "In some classrooms, insufficient internet connectivity and students' lack of equipment made it difficult to conduct lessons efficiently. To minimize accessibility issues, I developed alternative solutions. For instance, I opted for classrooms with stronger internet connections. Additionally, since students could not afford the paid version of ChatGPT Plus, they were unable to use this AI tool. To address this, I projected my own Plus version onto the board, allowing students to benefit from it during class. Similarly, due to the high cost of Photoshop, students preferred using free alternatives. However, these alternatives did not always accurately reflect technical elements in photographs."

This study highlights that one of the key risks associated with AI integration in education is the presence of technological infrastructure deficiencies, which can hinder the effective implementation of AI-supported learning. Existing research supports this finding, emphasizing that robust technical infrastructure—including high-performance servers, stable internet connectivity, and user-friendly software—is essential for the successful deployment of AI-based educational tools (Al Samman, 2024). Similarly, Sternberg (2024) reported that inadequate infrastructure negatively affects learning processes in AI-supported courses, reducing both instructional efficiency and student accessibility. Given these findings, it is evident that technological infrastructure is a critical determinant in the successful integration of AI tools into educational settings. While AI offers significant benefits in enhancing learning outcomes, its effectiveness is contingent upon the availability of reliable and accessible technological resources. Therefore, higher education institutions must prioritize infrastructure investments to ensure that both students and instructors can fully leverage AI-supported educational tools without facing technological barriers.

The instructor highlighted the risk of AI generating hallucinations—instances where non-existent or misleading information is presented as factual—emphasizing the importance of maintaining human oversight in AI-assisted learning. As the instructor explained:

> "For this reason, I never used AI to upload documents within the course. Instead, I provided the content, and AI merely expedited the process. The source of knowledge remained with me, not AI."

Additionally, the instructor noted that students' reliance on the limited capabilities of free AI versions increased the likelihood of encountering hallucinations:

> "When students used the free versions of AI tools, they often faced daily document upload limits, preventing them from integrating course materials into the system. As a result, I observed that AI sometimes provided incorrect feedback regarding the technical aspects of photography. Some students accepted this feedback without critically evaluating or verifying it, which became evident when they analyzed award-winning photographs from an artistic perspective."

This study underscores the risks associated with AI hallucinations in educational contexts, particularly in applied courses where accurate and reliable information is essential. Existing literature supports these concerns, emphasizing the need for instructors to validate AI-generated content using academic and verified sources. Saqib and Zia (2024) stressed the importance of cross-referencing AI outputs to prevent misinformation, while Wan et al. (2024) found that AI-supported research tools occasionally produce misleading or decontextualized examples, potentially confusing students. Similarly, Al Samman (2024) identified that AI-based systems may generate incorrect or incomplete data, leading to misguided learning outcomes. In applied courses such as photography, Rewatkar (2024) cautioned that AI-driven analysis may occasionally result in inaccurate or misleading suggestions regarding technical aspects, further reinforcing the importance of critical evaluation and human oversight. Therefore, while AI-supported tools offer enhanced efficiency and accessibility in learning environments, ensuring the accuracy and reliability of AI-generated content remains a critical challenge in the successful implementation of AI-based educational strategies. Beyond identifying the benefits and risks, it is also important to consider the instructor's professional journey in integrating AI into educational practice. The instructor demonstrated a proactive and reflective approach to AI adoption, selecting tools not merely based on popularity but according to their pedagogical relevance and alignment with student needs. This process involved continuous self-training, exploration of various platforms (e.g., ChatGPT Plus, Claude, and Flikia), and adaptation of these tools to meet the technical and creative demands of the course. Throughout the semester, the instructor reported adjusting lesson plans and assessment strategies based on student progress and feedback derived from AI-supported analysis. By combining the flipped classroom model with AI tools, the instructor positioned technology as a scaffold for deeper learning, rather than as a substitute for instruction. This approach required not only technological competence but also pedagogical flexibility and a willingness to engage in iterative experimentation. The instructor's experience highlights the dynamic and evolving nature of AI integration, emphasizing that its successful implementation depends on the educator's capacity to reflect, adapt, and maintain pedagogical intentionality throughout the process.

Findings Related to the Second Sub-Research Question

"How do students experience the course process in an AI-supported learning environment?"

Two main themes emerged in response to the second sub-research question:

1. Advantages in the educational process
2. Disadvantages in the educational process

The codes associated with these themes, along with supporting student quotations, are presented in detail.

Advantages in the educational process

From students' experiences, several key advantages of AI-supported learning emerged. These advantages are categorized into the following codes: awareness, technical knowledge, feedback, role definition, time efficiency, and ease of use. Students demonstrated notable progress in acquiring technical knowledge (n = 6) through AI-supported learning, particularly in their ability to apply theoretical concepts and accurately use technical terminology. This improvement was evident in student reflections. As S3 explained:

> "Although we theoretically knew certain concepts, we didn't understand how to apply them or use the technical language correctly. AI provided substantial support in this regard."

Similarly, S18 highlighted the role of AI in refining their photography skills:

> "Before this course, I had very little technical knowledge about photography. We asked AI about the angles we used to take photos, the angles we should have used, and how lighting should be adjusted. AI provided us with relevant information. Then, we took new photos with these insights, and I believe we improved our framing. AI helped us refine our photography skills by filling in our knowledge gaps and guiding us correctly."

These findings are consistent with existing research on AI-supported education, which suggests that AI-based tools facilitate technical learning in a systematic and personalized manner. In applied courses such as digital photography, AI-driven analysis tools provide real-time feedback on composition, lighting, and color usage, supporting students' technical development (Sternberg, 2024). Research by Ko et al. (2024) on AI integration in photography education indicates that students benefit significantly from AI-assisted adjustments in lighting, composition analysis, and shooting angles. Additionally, Amdan et al. (2024) found that AI-supported visual arts courses accelerate the acquisition of technical skills, allowing students to develop proficiency more efficiently. However, while AI enhances technical learning and offers valuable guidance, some studies caution that automated AI feedback may limit students' creative thinking by promoting standardized approaches (Fleckenstein et al., 2023). Therefore, although AI is effective in strengthening technical competencies, it is essential to maintain a balance between structured guidance and creative exploration to foster both technical mastery and artistic individuality in photography education. The findings suggest that the instructor effectively integrated AI tools into the course to help students analyze their photographs and identify technical errors. This practice not only enhanced students' technical proficiency but also contributed to the development of their critical thinking skills. Students reported that AI provided useful guidance and was effective in addressing their technical knowledge gaps.

Interviews with students revealed that AI played multiple roles in the educational process (n = 9), with participants primarily perceiving it as an assistant, guide, teacher, and a tool that fosters critical thinking. As S17 described:

> "AI felt like a teacher to me. You provide the information, and it gives you a detailed response, expanding on the topic."

Similarly, S32 viewed AI as an assistant:

> "First and foremost, it acted as an assistant. I gave it commands, and it conducted research accordingly before providing feedback."

However, S3 offered a contrasting perspective, emphasizing AI's limitations in fully replacing human instructors:

> "Even though some say AI will take over the role of teachers in the future, I disagree. It can never be compared to a human teacher because it sometimes provides incorrect information."

These findings indicate that while students recognize AI as a valuable tool in their learning process, they are also aware of its limitations, particularly regarding reliability and the potential for misinformation. Existing research supports these observations, highlighting AI's adaptability in assuming various educational roles. Wang et al. (2024) noted that AI enhances learning effectiveness by serving as a versatile instructional aid. Al Samman (2024) similarly reported that AI-supported simulations in engineering courses and AI-assisted diagnostic tools in medical education function as valuable learning assistants. However, some studies caution against the overuse of AI, warning that its role as a guide or assistant may weaken students' independent learning skills. Over-reliance on AI-generated direction can make the learning experience more mechanical, diminishing exploratory and critical engagement (Fonseca et al., 2018). While AI offers considerable advantages in facilitating learning, its integration must be carefully managed to ensure that it supplements rather than replaces human instruction and student-driven inquiry. The observed differences in students' experiences with AI can be attributed to several factors, including individual learner characteristics, prior familiarity with AI tools, and personal learning preferences. Students with previous exposure to AI or higher levels of digital literacy were more likely to engage with AI critically and selectively, leading to enhanced technical skill development and greater learning autonomy. In contrast, students with limited technological proficiency or those who preferred structured, instructor-led environments tended to over-rely on AI outputs, potentially resulting in passivity and reduced critical engagement. Motivational and self-regulatory factors also played a significant role. Learners with stronger intrinsic motivation appeared to integrate AI as a supportive tool to deepen understanding, while extrinsically motivated students were more inclined to use it as a shortcut to complete tasks. These variations suggest that the effectiveness of AI-supported learning environments depends not only on the technological affordances of the tools themselves but also on learners' readiness, mindset, and the broader educational context. The findings also indicate that the instructor positioned AI as a teaching aid and supportive guide, rather than as a replacement for the teacher. However, students held differing views on this matter: while some perceived AI as a teacher, others regarded it merely as an assistant. It is likely that AI's occasional inaccuracies contributed to the perception that it could not fully substitute for human instruction.

Student interviews revealed that AI technologies significantly contributed to time efficiency and ease of use (n = 29) in the learning process, while also enhancing the depth and objectivity of feedback. As S10 noted:

> "AI accelerated access to information, saving us time."

S13 similarly emphasized its efficiency:

> "Since it provides quick responses, it is highly convenient. I believe it helped us save a lot of time."

Beyond time efficiency, AI-supported feedback played a multidimensional role in students' learning experiences, particularly benefiting those who were hesitant to ask questions during class. The ability of AI to deliver objective critiques and detailed insights was perceived as a strong motivational factor. As S32 explained:

> "AI points out aspects of our photos that we hadn't noticed. It provides more detailed insights and objective critiques, helping us recognize and improve our weaknesses."

S35 similarly remarked:

> "AI helps us identify intricate details in our photos. It critiques both the strengths and weaknesses of our images, showing us what to focus on in our next shoot."

While AI feedback was generally appreciated, some students preferred more concise responses. For instance, S19 noted:

> "I think AI is great, but the responses should be shorter and more to the point. For me, a concise explanation would be better."

The findings indicate that the instructor observed a notable increase in students' awareness and literacy regarding AI tools. The integration of AI into the course enabled students to receive timely and effective feedback, while also facilitating faster access to relevant information—thereby enhancing time efficiency. Although students expressed initial hesitancy toward using AI, by the end of the course, many had recognized its benefits and had begun applying AI tools in other academic contexts as well. These findings align with existing literature on AI-supported learning, which emphasizes that AI-based tools systematically improve students' technical skills by providing real-time feedback on critical visual elements such as composition, lighting, and angles (Ko et al., 2024; Sternberg, 2024). Amdan et al. (2024) found that AI-assisted visual arts courses accelerate the acquisition of technical skills, allowing students to refine their abilities more efficiently. Furthermore, AI-supported feedback enables students to immediately identify and correct mistakes, thereby improving learning outcomes in applied courses (Allen & Kim, 2023; Zhou et al., 2023). However, some studies caution that AI-generated feedback may lack depth, potentially leading students to focus on surface-level revisions rather than promoting deeper understanding (Al Samman, 2024). In photography education specifically, AI-assisted feedback may also reinforce rigid adherence to predefined technical standards, which could inhibit creative exploration and expression (Gross, 2024). While AI provides significant advantages in accelerating learning and offering structured, objective feedback, these tools must be balanced with opportunities for independent artistic interpretation. Maintaining this balance is essential to fostering both technical accuracy and creative freedom in photography education.

Interviews highlighted that the course played a crucial role in raising students' awareness of AI (n = 32), particularly among those who had not previously received formal education on the subject. Initially skeptical about AI, students became more engaged with the technology and recognized its potential benefits for learning. As S17 stated:

> "Using AI in the *Digital Photography in Nature* course was very beneficial. This experience helped us learn how to use AI effectively."

Similarly, S24 noted:

> "We used AI tools to evaluate different aspects of photography. This made the classes more engaging and enjoyable."

Beyond the immediate scope of the course, some students reported that their experience with AI in photography education encouraged them to integrate AI tools into other subjects. As S17 explained:

> "After this course, I started using AI tools in other classes as well."

These findings align with existing research suggesting that AI-supported courses enhance students' learning awareness by enabling them to adapt their learning processes to their own pace and access personalized content (Aberbach et al., 2021). The impact of AI on learning awareness is particularly pronounced in applied and creative courses, where AI-powered content analysis tools support students' composition skills and technical understanding (Monser, 2023). However, some studies caution that over-reliance on AI-assisted guidance may hinder students' ability to develop their own artistic perspectives, potentially limiting creative exploration (Bourgault, 2023). While AI integration in education fosters engagement and supports skill development, ensuring a balance between AI-driven insights and independent artistic growth remains essential for maintaining both technical proficiency and creative autonomy.

Disadvantages in the educational process

Although students expressed generally positive views on the use of AI in courses, they also acknowledged certain disadvantages associated with its integration into the learning process.

While AI-supported learning enhances efficiency and facilitates access to information, student interviews revealed concerns that it may reduce active engagement, encourage passivity, and foster over-reliance (n = 6). As S21 noted:

> "Now, since tasks can be completed with a single click, nearly all the work is left to AI. It constructs entire sentences, which inevitably makes us more passive."

Similarly, S3 observed that some classmates relied solely on AI rather than engaging with course materials or conducting independent research:

> "For example, some of my classmates, when required to conduct a technical evaluation of photographs, preferred the easy route instead of engaging with course materials and conducting research. They relied solely on AI for answers."

Additionally, S1 expressed concerns regarding AI's influence on originality:

> "AI guided us toward taking better, more structured photos, and using it allowed us to develop clearer ideas… However, I think the downside is that it encourages borrowed ideas. People have started using AI instead of expressing their own thoughts."

These statements suggest that while AI offers valuable guidance, its convenience may lead to over-reliance, diminishing students' engagement in critical thinking and independent learning. The impact of AI on students' creativity appears closely linked to individual learning styles and cognitive preferences. Students with exploratory or imaginative learning styles often felt constrained by AI's structured outputs, expressing concerns that the tools reduced originality by providing ready-made compositions and suggestions. These students preferred open-ended tasks and valued spontaneity in their creative processes, which they believed AI sometimes inhibited. In contrast, students with analytical or sequential learning preferences found AI to be a supportive scaffold that helped them organize ideas, evaluate options, and improve technical execution. For these students, AI functioned more as a productivity enhancer than a creative barrier. These contrasting perspectives suggest that AI's influence on creativity is not uniform; rather, it interacts with how students process, internalize, and express information. Therefore, instructional strategies involving AI in creative fields must be sufficiently flexible to accommodate diverse learner profiles to avoid stifling the very creativity they seek to nurture. In addition to concerns about passivity, differences in technological access also influenced how students engaged with AI tools. While some students had access to personal laptops, stable internet connections, and premium AI versions, others depended solely on limited-functionality free tools or encountered connectivity issues, especially during class sessions. These technological limitations affected the frequency, quality, and confidence with which students interacted with AI. For instance, students unable to access ChatGPT Plus or similar upgraded applications reported slower responses, lower accuracy, and more limited feedback. This disparity not only impacted learning outcomes but also contributed to inconsistent levels of motivation and reliance on AI tools. These findings suggest that infrastructural inequalities must be considered when evaluating the overall effectiveness of AI-supported learning environments.

Existing literature supports these concerns, indicating that AI's capacity to provide easily accessible, pre-structured content can diminish students' independent research habits and weaken analytical thinking skills (Filiz et al., 2025; Trisnawati et al., 2023; Wang et al., 2024). In creative disciplines, AI-generated content may discourage originality and limit artistic exploration (Zhou & Lee, 2024). Louly (2024) further noted that AI tools, by offering structured responses, may restrict students from developing unique solutions. However, some researchers argue that, when used appropriately, AI can introduce students to new techniques and enhance creativity by broadening their exposure to diverse approaches and perspectives (Hasibuan & Azizah, 2023). Therefore, while AI presents opportunities for efficiency and structured learning, careful implementation is necessary to ensure that it complements rather than replaces active engagement, independent inquiry, and creative expression.

A key disadvantage highlighted by students was AI's tendency to generate misinformation and contradictory responses (n = 14), leading to concerns about its reliability. Initially, some students perceived AI as highly accurate, but over time, they became more aware of its limitations. As S2 explained:

> "At first, it seems like AI always provides accurate information, but after using it for a while, you start noticing errors."

Many students emphasized the importance of maintaining a critical and analytical approach when using AI. As S1 noted:

> "AI doesn't always provide completely accurate information, so we shouldn't blindly trust everything it says. We need to question and verify its outputs."

Additionally, students observed that AI-generated responses could be inconsistent across different platforms. S27 described:

> "AI provides comprehensive answers to my questions, but its responses often contradict those of other AI programs."

These findings suggest that, while AI can serve as a valuable educational tool, its outputs require careful scrutiny to ensure accuracy and consistency. The instructor observed that AI does not always provide accurate information, particularly in free versions, where technical errors may occur. Furthermore, students sometimes accepted incorrect information without questioning it. Initially, students perceived AI-generated responses as entirely accurate; however, over time, they began to recognize errors and emphasized the importance of critically evaluating AI outputs. This underscores the necessity of adopting a critical perspective toward AI in educational contexts.

Research supports these concerns, highlighting that AI-supported systems are prone to generating inaccurate or contradictory information, which can mislead students if they do not critically evaluate the content (Al Samman, 2024; Zhou et al., 2023). This issue is particularly pertinent in technical and creative courses, where AI-generated recommendations may adhere to established rules but do not always yield optimal or contextually appropriate outcomes (Salvaggio, 2023). For example, in photography education, AI can suggest composition techniques that align with conventional principles but may not necessarily enhance artistic expression. Therefore, it is essential for students to develop critical thinking skills to assess AI-generated content rather than accepting it uncritically. Instructors play a crucial role in helping students recognize AI's limitations and reinforcing that AI-generated recommendations should not be regarded as absolute truths, especially in subjective disciplines such as the arts (Coeckelbergh, 2023). To mitigate these risks, students should be encouraged to cross-reference multiple sources, verify AI-generated information, and engage in reflective analysis (Del Valle et al., 2024). By fostering an educational environment that prioritizes critical inquiry, AI can serve as a supportive tool without compromising information accuracy or independent reasoning.

CONCLUSION

AI-supported education has emerged as a learning model that has been increasingly adopted in higher education in recent years. The integration of this technology into educational processes provides individualized learning opportunities for students while enabling instructors to design more effective and dynamic course materials (Jiao, 2024; Otto et al., 2023). However, to fully understand how AI-based systems are transforming education, it is essential to consider both the opportunities and challenges associated with this technology in a balanced and critical manner. The findings of this study illuminate how AI-supported courses are experienced by both students and instructors, offering a comprehensive analysis of the key advantages and limitations encountered throughout the process. Notably, the study also reveals several potential negative effects, including reduced student engagement, concerns regarding information reliability, and the possible weakening of critical thinking skills.

In summary, AI-supported education offers substantial advantages in learning and teaching strategies, the development of personalized learning environments, the improvement of academic language proficiency, and the enhancement of systematic assessment processes. However, it is also essential to consider challenges such as infrastructure limitations, concerns about information accuracy, weakened independent learning skills, and the risk of over-reliance on AI. To mitigate these potential drawbacks, several strategic measures

are recommended. First, educators should implement structured training in AI literacy that promotes critical thinking and self-regulation skills, thereby reducing the likelihood of passive use. Second, integrating reflection-based assignments and human-led feedback mechanisms within AI-supported courses can help preserve originality and foster independent analysis. Third, institutions should ensure equitable access to digital resources—including AI tools—by offering support services, alternative platforms, or offline options for students with limited technological access. Finally, cultivating a classroom culture that emphasizes critical evaluation, questioning, and ethical use of AI outputs will empower students to become more active and discerning users. By implementing these strategies, higher education institutions can enhance the long-term pedagogical value of AI integration while minimizing unintended consequences.

The integration of AI into educational processes should be implemented within a clear pedagogical framework, ensuring that its use is both intentional and balanced. Furthermore, aligning AI integration with relevant theoretical frameworks—such as constructivist approaches and inquiry-based learning—can enhance pedagogical coherence and support deeper, more meaningful learning experiences. Educators must equip students with critical thinking skills, enabling them to use AI tools effectively and responsibly. To develop students' AI literacy, higher education institutions should implement structured educational strategies that address not only the technical aspects of AI use but also ethical considerations and critical thinking. Such strategies may include embedding AI literacy modules into existing courses, offering workshops focused on evaluating AI outputs, and designing guided assignments that require students to reflect on the reliability and relevance of AI-generated content. Additionally, educators can create comparative activities involving analysis of feedback from both human and AI sources, thereby promoting critical judgment. Collaborative group tasks that include peer review of AI-assisted work can further foster collective awareness and responsible use. Importantly, developing AI literacy goes beyond tool mastery; it requires pedagogically grounded instruction that helps students become analytical, ethical, and self-regulated users of AI technologies. Therefore, the effective and well-balanced use of AI-based systems is essential for maximizing positive learning outcomes while minimizing potential risks within student learning processes.

In addition to the immediate instructional benefits and challenges, it is important to consider the potential long-term effects of AI-supported education. Prolonged reliance on AI tools may gradually reshape how students acquire, process, and apply knowledge, potentially leading to a decline in deep learning habits if not carefully guided. Over time, students may begin to prioritize efficiency and accuracy over originality and critical analysis, which could negatively impact their problem-solving capacities and creative autonomy in future academic and professional contexts. Conversely, when integrated within a pedagogically sound framework, long-term exposure to AI tools has the potential to enhance learners' metacognitive awareness, adaptability, and digital literacy. These possible outcomes underscore the need for longitudinal studies that investigate how repeated engagement with AI systems influences student behavior, academic identity, and orientations toward lifelong learning. Therefore, the integration of AI into education should be continuously monitored and adapted to ensure sustainable and meaningful learning trajectories.

For practitioners, it is essential to approach AI integration as a pedagogical process rather than a technological shortcut. Instructors should receive targeted training on how to align AI tools with specific learning outcomes and foster student autonomy through guided and reflective AI use. Institutions are encouraged to establish robust support mechanisms that ensure equitable access, ongoing evaluation, and the implementation of ethical safeguards in AI-assisted learning environments. Future research should explore the long-term effects of AI-supported learning on student autonomy, critical thinking, and creativity across a range of disciplines and educational levels. Comparative studies examining the effectiveness of different AI tools based on learning styles, cultural contexts, or instructional strategies would yield valuable insights. Furthermore, longitudinal investigations are needed to assess the sustained pedagogical impact of AI integration in higher education.

Limitations

Despite its contributions to understanding AI integration in applied university courses, this study has certain limitations that should be acknowledged:

1. This study focuses on a single course—*Digital Photography in Nature*—offered at a public university in eastern Turkey. While the findings provide valuable insights, they may not be generalizable to other courses, institutions, or educational settings.
2. The study is based on the experiences of one instructor. Although this allows for an in-depth exploration of AI integration in course design and implementation, the findings may not reflect the diversity of instructional practices and perspectives among other educators.
3. The research primarily employs qualitative methods, including interviews and content analysis. While these approaches yield rich, descriptive insights, the absence of quantitative data limits the ability to statistically validate the impact of AI on learning outcomes.
4. The study does not include a control group, making it difficult to determine whether the observed positive outcomes are directly attributable to AI-supported instruction or influenced by other contextual or pedagogical factors.

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Ethics declaration: This study was approved by the Ethics Committee at Beykoz University on 5 February 2025 with approval number E-45152895-299-2500002055. After informing the individuals participating in the study about the purpose and scope of the research, the principles of voluntariness, how the data would be used, and their right to withdraw from the study at any time, a written informed consent form was obtained. This form clearly stated that the participants' data would be used solely for scientific purposes and anonymously. No elements that could be linked to personal identification information were recorded during data collection; interview and survey recordings were stored with randomly assigned codes. All digital recordings were stored in encrypted storage tools and kept accessible only to the research team. During the data reporting phase, anonymity and privacy principles were strictly adhered to.

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APPENDIX A

Semi-Structured Interview Questions (Students)

1. What was your experience like in a digitally enhanced *Digital Photography in Nature* course that incorporated AI? What are your thoughts on this approach?
   a. How would you compare this course to a traditional course without technology integration? Could you share your views on this comparison?
2. How was your experience using AI tools while preparing your projects in this course? How would you evaluate this experience?
   a. Could you share your experiences regarding the impact of AI tools on the photography process?
3. In your opinion, what roles do AI technologies play in the educational process? Could you describe your interaction with these technologies?
4. What were the positive and negative aspects you encountered while using AI tools? Could you share your experiences regarding this?

Semi-Structured Interview Questions (Instructor)

1. How did you decide to incorporate AI tools into the teaching process? Could you share your experiences regarding this decision?
2. At which stages of the course did you utilize AI technologies? Could you share your experiences with integrating technology into the course?
3. Which AI tools did you use in the course? Could you share your views on the specific purposes for which you selected these tools?
4. How did AI tools influence your role as an instructor? Could you share your experiences on this matter?
5. How did students' use of AI tools in their projects impact the course's assessment process? What are your views on this?
   a. What opportunities and challenges did you encounter during this process? Could you share your experiences regarding this aspect?