



BLENDED EDUCATION FOR GEN Z: FUSING AI TOOLS, DESIGN THINKING, AND GENDER EQUALITY AWARENESS IN PROJECT-BASED LEARNING TO PROMOTE WOMEN IN SCIENCE AND TECHNOLOGY

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Abstract

This article introduces an innovative educational approach customised for Generation Z by merging AI tools, Design Thinking, and gender equality awareness within project-based learning settings. The research, conducted at the Department of British and American Studies, Faculty of Arts, University of Ss. Cyril and Methodius in Trnava, Slovakia, centres on a Design Thinking workshop prepared to enhance project creation and presentation for future teachers. Utilising a quantitative data collection method, the study compares the performance of male and female students in project-based learning activities. The hypothesis suggests that while women will show technical skills on the same level as men, they will demonstrate superior creativity in their projects. The results indicate that combining AI tools with Design Thinking and a focus on gender equality can effectively encourage women's involvement in science and technology. By fostering an environment that values both technical skills and creativity, the approach outlined in this article may contribute to a more inclusive and effective education system for Gen Z students.

Keywords: *Gen Z, AI tools, Design Thinking, gender equality, project-based learning*

1. Introduction

Generation Z has grown up in an environment shaped by rapid technological development, global interconnectedness, and shifting cultural and social dynamics. Their learning preferences reflect a strong emphasis on autonomy, collaboration, instant access to information, and the practical application of knowledge in real-world contexts. Research indicates that Gen Z students tend to favour interactive, visually oriented, and technology-enhanced learning experiences that allow them to participate in content creation rather than passively receive information (Henderson, 2023; Pondelíková, 2023; Wahab et al., 2017). Traditional teacher-centred instruction is therefore often perceived as insufficient, as it fails to accommodate their preference for experiential, flexible, and problem-based approaches to education.

In response to these evolving expectations, contemporary pedagogy increasingly integrates digital tools and student-centred learning models. One particularly effective approach involves connecting the use of AI tools with Design Thinking (DT) and Project-Based Learning (PBL). AI applications support idea development, visualisation, research, and iterative refinement, while Design Thinking provides a structured yet flexible framework for creative problem-solving. When combined within PBL environments, these elements encourage student autonomy, collaboration, experimentation, and reflective learning. For Gen Z, this approach not only aligns with their digital literacy but also supports the development of key transversal competencies, such as critical thinking, creativity, and intercultural communication.

At the same time, integrating gender equality awareness into project-based learning environments remains essential, particularly in fields such as science, technology, and digital innovation, where women's representation continues to lag behind. Numerous studies show that female students often demonstrate creativity, reflective engagement, and communication skills equal to or exceeding those of their male peers, yet may perceive lower confidence or belonging in technology-related contexts (Merayo & Ayuso, 2023; Beroíza-Valenzuela et al., 2024). Educational interventions that highlight positive role models, promote inclusive collaboration, and encourage reflective dialogue about gendered experiences can help address these disparities.

The presented study, therefore, examines how the combination of AI tools, Design Thinking, and gender-sensitive pedagogical strategies within a PBL framework can support student creativity and engagement, with a particular focus on female students' participation in science and technology-related project work. The research analyses student performance, learning experiences, and perceptions in blended learning environments. By doing so, it contributes to ongoing discussions about how to design inclusive, future-oriented education models that respond to the needs of Generation Z and promote equitable participation in innovative professional fields.

2. Theoretical Background

2.1. Blended Education and Gen Z Learning Preferences

Generation Z, also referred to as the Homeland Generation (Carter, 2018), iGen, post-millennials, or Zoomers (Encyclopaedia Britannica online), encompasses individuals born between 1997 and 2012. The digital age, global social shifts, the impact of COVID-19, and the pervasive influence of technology have profoundly shaped this generation. As the first “digital natives,” they have experienced the internet as an integral part of daily life since early childhood. Far from previous generational patterns, Zers are actively reshaping workplace culture by rejecting the traditional “hustle culture” and long working hours in favour of a more balanced and mindful approach to professional life (Henderson, 2023). Although some critics have misinterpreted this shift as a lack of ambition, research indicates that Generation Z demonstrates a high level of self-awareness and boundary-setting skills, understanding the value of mental health and personal well-being as integral to long-term productivity and fulfilment (Pondelíková, 2023). Their concept of success is therefore being redefined as one grounded in sustainability, personal purpose, and emotional resilience, rather than in constant competition. In the context of education, Generation Z demonstrates unique expectations and perceptions regarding the purpose and structure of learning. They advocate for educational systems that bridge theory with real-world professional applications, particularly through the integration of digital technologies, interactive and AI tools. Adapting to their learning style requires shifting from traditional teacher-centred approaches to more participatory models, where students co-create educational content and teachers assume the roles of mentors, facilitators, and coaches.

Blended or hybrid education has emerged as a direct response to the evolving needs and learning preferences of Generation Z. It represents an innovative pedagogical approach that integrates traditional face-to-face instruction with digital and online learning components, effectively combining the strengths of both modalities (Pondelíková, 2023). This dual structure enhances flexibility, accessibility, and learner autonomy, empowering students to select the learning format that best aligns with their personal and professional circumstances. In academic discourse, blended learning is most commonly defined as “a formal education program in which a student learns at least in part through online delivery of content and instruction with some element of student control over time, place, path and/or pace, and at least in part at a supervised brick-and-mortar location away from home” (Staker & Horn, 2012, p. 3). Although the conceptual roots of this approach can be traced back to the late 19th century and Helen Parkhurst's Dalton Plan, the transformative potential of mobile and digital technologies, such as tablets, laptops, and smartphones, has revolutionized the possibilities for personalized and self-directed learning in contemporary education.

Modern blended learning models are typically categorized into four primary formats (Figure 1), each varying in the proportion and sequencing of online and in-person activities. A well-designed blended course maintains an intentional balance between synchronous (real-time) and asynchronous (self-paced)

learning experiences, allowing students within the same program to navigate between coordinated live sessions and independent digital tasks.

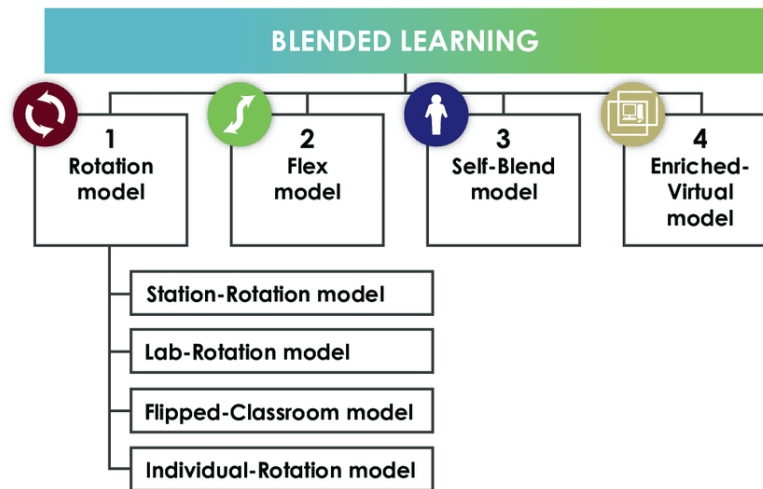


Figure 1: *Blended Learning Models*

Source: *Staker – Horn, 2012*

A comprehensive review of current scholarship reveals a growing body of evidence underscoring the positive academic impact of blended learning. Numerous empirical studies (e.g., Kazu & Yalçın, 2022; Putri, Luke & Sela, 2019; Ritella & Loperfido, 2021; Nortvig, Petersen & Balle, 2018) consistently report that adopting blended approaches improves student performance, engagement, and satisfaction. Collectively, these findings reinforce the view that blended learning constitutes one of the most effective instructional models for meeting the diverse needs of 21st-century learners. This relevance is further underscored by the profound transformation of education in the 21st century, driven by rapid technological innovation, evolving pedagogical approaches, and the continually shifting demands of contemporary society. Online learning platforms have become integral to higher education, providing unprecedented flexibility, accessibility, and diversification of learning opportunities. The rise of personalised learning allows instruction to be customised to individual learners' needs, while collaborative and project-based approaches cultivate essential competencies such as teamwork, creativity, and critical thinking.

As Robinson (2011, p. xiii) aptly notes, “*the more complex the world becomes, the more creative we need to be to meet the challenges.*” Creativity has become a cornerstone of 21st-century education, inspiring institutions to design flexible, future-oriented learning models that foster curiosity and adaptability. Online and blended workshops exemplify this shift by allowing learners to combine in-person and virtual experiences, optimising flexibility and strengthening their digital competence. Empirical research conducted in 2023 at Slovak universities involving 160 participants confirms that these shifts align with student preferences. More than 70% of Generation Z learners reported a strong inclination toward hybrid or blended forms of education, with 74.3% explicitly favouring virtual and blended learning over traditional, in-person instruction (Pondelíková, 2023). These findings illustrate that Generation Z not only adapts effortlessly to digital technologies but also perceives blended education as a natural and desirable mode of study, which harmonises with their lifestyle, communication habits, and evolving learning expectations.

2.2. AI Tools in Higher Education and Project-Based Learning

Artificial intelligence (AI) is profoundly transforming higher education by changing the ways students learn, collaborate, and express creativity. Recent reviews indicate that AI applications in universities have expanded from data-driven learning analytics to generative tools for teaching and research (Zawacki-Richter et al., 2019; Bond et al., 2024). AI supports personalised learning, intelligent tutoring, and automated feedback, enabling instructors to identify students' needs and adapt teaching

accordingly. At the same time, studies emphasise the importance of developing AI literacy, understood as both technical and ethical competence, to ensure critical and responsible use of AI in academic settings (Biagini, 2025; Ren & Wu, 2025).

In higher education, generative tools such as ChatGPT, Canva, or Gamma are increasingly used to support idea development, writing, visualisation, and presentation design (Ren & Wu, 2025; Reina Marín et al., 2025). These tools enhance engagement and creativity but also raise concerns about academic integrity, data privacy, and unequal access (Reina Marín et al., 2025). Educators, therefore, need targeted training to integrate AI responsibly into teaching practice. This aligns with the growing international consensus that universities should not only use AI tools but also teach students to understand their limitations and ethical implications (Bond et al., 2024; West et al., 2023).

The integration of AI aligns well with Project-Based Learning (PBL), a pedagogy that promotes collaboration, problem-solving, and application of knowledge to real-world contexts. Research shows that PBL improves academic achievement, motivation, and critical thinking in higher education settings (Sadji Evenddy et al., 2023; Zhong, L. et al, 2023). When enhanced by AI technologies, PBL becomes more adaptive and student-centred. For instance, Jiang, Omar, and Kamaruzaman (2025) identified key elements of AI-enhanced PBL, such as real-time feedback, adaptive learning, scaffolding, and intelligent content generation, which improve engagement and skill transfer. Similarly, Dai et al. (2025) found that Generative AI (GAI) in online PBL environments supported reflective learning and higher project quality among university students. These studies demonstrate that AI tools can act as “learning partners,” guiding students through ideation, creation, and revision processes in authentic project work.

In Slovakia, university experience also reflects these international trends. Pondelíková (2025) reports that AI tools have been successfully integrated into humanities courses, such as American literature, to enhance creativity and student reflection. Similarly, Luprichová (2025) explored AI-supported teaching in university history classes, where students used generative tools and talking avatars to critically analyse historical events and gender perspectives. Both studies show that when applied thoughtfully, AI can enrich higher education by fostering engagement, critical thinking, and digital literacy, even in disciplines traditionally less associated with technology.

Overall, merging AI tools with project-based approaches provides a promising model for modern higher education. When combined with strong ethical guidelines and educator training, this fusion can enhance student creativity, autonomy, and inclusiveness, which are key competencies for Generation Z learners preparing for a technologically mediated world.

2.3. Design Thinking as a Modern Teaching Method

Design Thinking is a human-centred approach to problem-solving that seeks to generate innovative solutions for products, services, and even entire business models that emerged in the mid-20th century. Its roots trace back to Herbert A. Simon’s *The Sciences of the Artificial* (1969), where he introduced “design sciences” as purposeful activities that transform existing situations into desired outcomes across disciplines like engineering and architecture. His ideas laid the foundation for DT as a forward-looking, innovation-driven methodology that contrasts with critical thinking by emphasising idea generation and exploration (Mayer & Schwemmler, 2024). This adaptable and iterative methodology can be effectively applied across various domains, such as:

- 1. Education** – DT supports the creation of engaging and effective learning experiences, helps tailor instruction to students’ needs, and informs the design of curricula that promote critical thinking and collaboration (Razzouk & Shute, 2012; Scheer et al., 2012).
- 2. Technology and Software Development** – DT guides the design of intuitive digital products and services, enhancing user experience and usability (Plattner, Meinel, & Leifer, 2011; Kimbell, 2011).
- 3. Business and Management** – DT is applicable to a wide range of business initiatives, emphasising a deep understanding of user needs and market dynamics to drive innovation and adaptability.

Design Thinking is an iterative, non-linear methodology that emphasises collaboration between designers and users to develop innovative solutions grounded in real user experiences, emotions, and

behaviours. Instead of a universal process, it includes multiple customizable models suitable for different project contexts. A widely recognised framework is the five-phase model developed by Stanford d.school (2018, online), consisting of **Empathise, Define, Ideate, Prototype, and Test**. This model underscores understanding users, framing problems, generating ideas, developing prototypes, and refining solutions through testing. An alternative model, proposed by Lewrick, Link, and Leifer in *The Design Thinking Toolbox* (2020), expands the process into seven phases: **Understand, Observe, Define, Ideate, Prototype, Test, and Reflect**, adding greater depth to problem exploration and incorporating reflection for continuous learning. In *An Introduction to Design Thinking*, Plattner (2010) explains that understanding the target group is essential for defining problems and seeking optimal solutions, which are subsequently tested and validated. The Design Thinking process involves four key principles that underpin the Design Thinking process:

- 1. Human rule:** DT is inherently user-centred. Its purpose is to understand and meet the needs of specific individuals, ensuring that the focus consistently remains on human expectations and experiences.
- 2. Ambiguity rule:** Designers should avoid making assumptions when observing users. Since personal knowledge and experiences can bias perception, it is essential to approach each situation with empathy and openness, striving to understand users' perspectives and continuously validate findings.
- 3. Re-designing rule:** Every new solution can be seen as an evolution of an existing one. While technologies change, human needs remain relatively constant. Rather than attempting to invent entirely new concepts, designers should analyse existing solutions, refine them, and adapt them to particular contexts.
- 4. Tangibility rule:** All ideas and potential solutions should be made tangible through prototypes that users can test and evaluate. This process facilitates communication, enables feedback, and minimises the risk of failure.

When these principles are applied to education, they enable ongoing monitoring of students' needs, the identification of emerging challenges, and the continuous validation of implemented solutions. By involving learners directly, educators can customise the learning process to the specific characteristics of the target group.

Design Thinking has been applied across a wide range of disciplines, in literature (Pondelíková, 2022; Brooks, 2022), foreign language education where it fosters deeper engagement with target cultures (Sperling, 2022), art where it has evolved into art thinking (Robins, 2018), translation to enrich the repertoire of a contemporary translator teacher (Klimkowski & Klimkowska, 2021), as well as in music (Badizadegan, 2019). When combined with project-based learning methods, the Design Thinking approach creates a comprehensive and dynamic framework that supports students in achieving their learning objectives (Maknuunah et al., 2021). Beyond education, Design Thinking holds a pivotal role in science, industry, engineering, and business, where its primary goal is to uncover innovative strategies and solutions that transcend initial assumptions and conventional modes of thinking.

2.4. Gender Equality in Higher Education

Research shows persistent gender imbalances across technical disciplines in higher education and research. For example, the She Figures 2024 report indicates that women represent roughly 41% of scientists and engineers across the EU in 2022 (Eurostat, 2024). More specifically, in Slovakia, studies reveal that while women make up about 45% of researchers overall, in the engineering and technology fields, the share of women drops to around 28% (Zendulková et al, 2022). The lower representation of women persists despite near-parity in doctoral graduation rates (women ~49 %) in Slovakia (European Commission, 2025).

Why does this gap remain? Extensive literature points to several interlinked factors: masculine-dominated field cultures that reduce a sense of belonging, lower self-efficacy among female students in technical domains despite equivalent performance, and early exposure differences in STEM pathways. For instance, Whitcomb et al. (2020) found that undergraduate engineering women earned grades comparable to or higher than those of men but reported significantly lower self-efficacy. Reviews further

emphasise that solutions need to address structural, cultural and lifecycle dynamics, not just individual abilities.

Strategies to support women in IT, AI and engineering:

- 1. Institutional Change via Gender Equality Plans (GEPs):** Structural interventions such as Gender Equality Plans (GEPs), now required for institutions seeking Horizon Europe funding, help tackle systemic biases in academia (EIGE, 2022). Tools like the EIGE GEAR Tool provide structured guidance for designing and monitoring institutional change, including baseline assessment, SMART goals, and gender-sensitive recruitment and leadership policies (EIGE, 2022). Evaluations of similar frameworks, such as the Athena SWAN Charter, show that institutions engaging in structured gender-equality planning witness improvements in women's representation in STEM leadership roles (Xiao et al., 2020).
- 2. Curricular and Pedagogical Redesign:** Evidence suggests that curricular models that integrate real-world problem-solving, team learning, and early research exposure can significantly boost women's retention in computer science and engineering (Alvarado et al., 2012). A prominent example is Harvey Mudd College, where revised introductory computer science courses, paired with structured mentoring and conference participation, increased female representation in CS majors from 10% to over 40% (Klawe, 2015). Meta-analyses confirm that such multi-component interventions combining curriculum redesign, mentoring, and policy adjustments are more effective than isolated activities (Yu et al., 2024).
- 3. Early Exposure, Mentoring and Role Models:** Since gendered interest gaps begin early in the educational pipeline, initiatives like coding camps, STEM clubs, and digital storytelling programs for girls have been shown to increase interest, confidence, and persistence in STEM fields (Master et al., 2021). Near-peer mentoring and visible female role models further strengthen identity formation and persistence among women in technical majors (Dennehy & Dasgupta, 2017).
- 4. Technology/AI-Specific Actions:** As women remain significantly underrepresented in AI-specific careers, targeted strategies include providing AI and digital literacy training, designing inclusive hiring pipelines, and addressing algorithmic bias in AI-based recruitment and evaluation tools (OECD, 2024). Flexible re-entry pathways and upskilling programs for women returning from career breaks also show promise in reducing gender gaps in tech and AI sectors (UNESCO & OECD & IDB, 2022).

In Slovakia, recent data show that only about 15% of female students enrol in IT-related university programmes, below the European average of approximately 17% (AmCham Slovakia, 2023). National analyses further reveal that women represent just around 28% of researchers in technical and engineering fields, despite higher participation in other scientific disciplines (Zendulková et al., 2022). Educational research also suggests that targeted projects and gender-sensitive interventions in schools can help strengthen girls' confidence and interest in STEM, although their effectiveness depends on early exposure and consistent support from teachers and institutions (Gyurák Babel'ová et al., 2024). These findings indicate that while incremental progress is being made, cultural stereotypes, unequal pathways into technical fields, and limited early engagement remain significant obstacles to gender parity in Slovak STEM and ICT education.

3. Research Methodology and Research Sample

This study employed a quantitative method, integrated within a Project-Based Learning (PBL) framework. The research was designed to explore the intersection of Design Thinking, gender equality awareness, and the use of AI tools to promote women's engagement and creativity in science and technology domains. The study was embedded in the subject *Creation and Presentation of Professional Projects*, offered by the Department of British and American Studies, Faculty of Arts, University of Ss. Cyril and Methodius in Trnava, Slovakia. The subject was delivered in a blended learning format, combining in-person sessions with online instruction. This design supported flexibility and inclusivity,

enabling diverse learning experiences and effective use of digital technologies. The study involved 50 participants enrolled in bachelor's and master's programs in British and American Studies and related fields. Of these, 33 were female and 17 were male students. The majority of participants were Slovak, supplemented by 5 Erasmus students from Turkey and 5 students from Ukraine studying in Slovakia. The students have been taught by the instructors for three years, and most of them had previously participated in earlier research activities within the program. Throughout this period, none of the students identified as non-binary or other gender identities, nor expressed a preference to refrain from gender classification. Therefore, for this study, gender-related comparisons were conducted using the categories of female and male students.

Learning activities were structured around Project-Based Learning principles, where students collaborated to design, develop, and present professional projects that applied Design Thinking methodologies. Two online Design Thinking workshops were organised, each involving 25 participants, which is the optimal size for effective engagement and mentoring. Workshops were conducted via Microsoft Teams, utilising breakout rooms to facilitate small-group collaboration. This setup enabled efficient teamwork, minimised distractions, and encouraged the use of **AI tools** such as brainstorming aids, language models, and creative design platforms for idea generation and prototyping. The **in-person sessions** were devoted to project consultation, feedback, and presentation rehearsals, while **online sessions** focused on ideation, empathy mapping, and problem-solving activities characteristic of the Design Thinking process. Throughout the course, **gender equality awareness** was explicitly addressed through discussions, case studies, and reflection exercises, highlighting women's participation and representation in science and technology.

A **questionnaire survey** served as the main instrument for data collection. It was administered at the conclusion of the workshops and was divided into four sections:

- 1. Demographic Information:** Captured basic participant data, including gender, nationality, level of study, and academic background.
- 2. Emotional Assessment:** Measured students' sentiments, attitudes, and experiences related to the workshops.
- 3. Prior Knowledge Assessment:** Evaluated participants' understanding and familiarity with the Design Thinking methodology before attending the course.
- 4. Learning Outcomes and Performance Evaluation:** Focused on assessing project outcomes and comparing the performance of male and female students, particularly in terms of technical skills, creativity, and innovation.

Quantitative data from the questionnaires were examined to explore gender-related similarities and differences in participant responses. The key **hypothesis (H1)** assumes that **while women would demonstrate technical skills at the same level as men, they would exhibit higher levels of creativity and innovation in their project outcomes**. Insights from post-workshop discussions with students suggest that incorporating Design Thinking and AI-supported Project-Based Learning contributes to fostering gender equality awareness and active engagement.

4. Interpretation of the Research Results

The interpretation of the research findings is structured around three principal components: **(1)** emotional assessment focusing on students' sentiments and experiences, **(2)** prior knowledge of Design Thinking, and **(3)** monitoring of learning outcomes. This tripartite framework provides a comprehensive view of how students engaged with the DT methodology and how their perceptions evolved throughout the learning process.

Motivation is a key factor in the educational process, as it directly shapes students' engagement, persistence, and overall learning outcomes. Motivated learners are more likely to take an active role in their education, set challenging goals, embrace difficulties, and ultimately achieve higher levels of success. To cultivate motivation, educators can employ a range of strategies, such as designing meaningful and stimulating tasks, promoting learner autonomy and choice, setting explicit goals and expectations, offering constructive feedback, and fostering a supportive and inclusive classroom environment. By recognising and responding to their students' diverse needs and interests, teachers can

customise their instructional practices to strengthen motivation and create a more engaging learning experience. In this context, Design Thinking emerged as an effective and motivating pedagogical approach. The findings revealed largely positive attitudes, with 88.2% of male and 84.8% of female participants indicating that Design Thinking enhanced their motivation. All male respondents perceived the workshop as highly relevant to their academic disciplines, particularly those centred on communication. Conversely, 13% of female students expressed uncertainty or disagreement about the suitability of Design Thinking for communication-oriented fields (Figure 2).

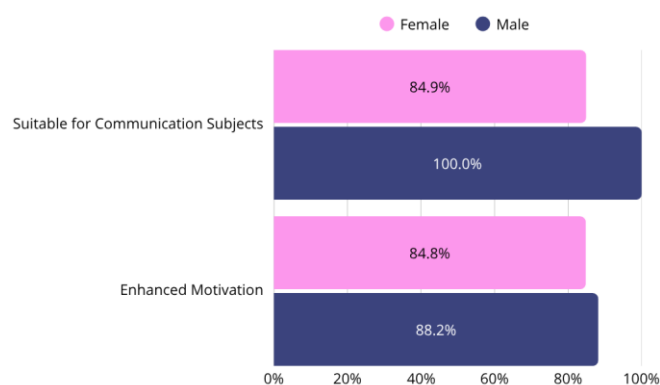


Figure 2: *Participants' perceptions of how DT enhanced motivation and support communication-related subjects*

Source: *own processing based on the obtained data*

Given the presence of international participants, the study also investigated students' confidence in communicating with individuals from diverse cultural backgrounds after the workshop. Results showed that 75.7% of female and 70.6% of male students felt more comfortable engaging in intercultural communication. Similarly, both groups acknowledged that the workshop increased awareness of potential cultural misunderstandings in academic and social contexts, as confirmed by 75.7% of female and 70.6% of male respondents. Besides this, the applicability of knowledge and skills gained during the workshop was highly rated by students. Positive responses were reported by 94.1% of male and 87.8% of female participants, indicating that the majority perceived Design Thinking as a valuable and transferable learning experience.

The second part of the questionnaire examined participants' prior knowledge of the Design Thinking methodology and related technological competencies. The results indicate a moderate level of familiarity among students before attending the workshop. Specifically, 48.5% of female and 41.2% of male participants reported having some prior knowledge of the DT approach. When focusing on specific terminology and key concepts, 57.6% of female and 64.7% of male respondents reported being already acquainted with the main ideas and topics discussed during the workshop (Figure 3). These findings suggest that male students demonstrated slightly higher conceptual awareness of DT before participation, while overall familiarity across both groups remained relatively balanced.

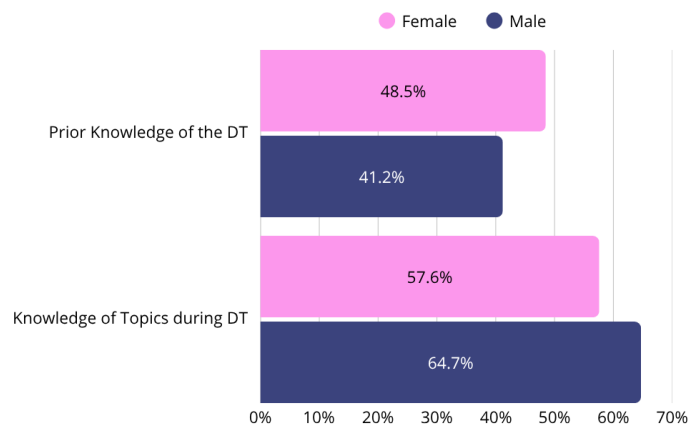


Figure 3: Participants' prior knowledge of the DT and topics discussed during the workshop

Source: own processing based on the obtained data

In recent years, the role of artificial intelligence (AI) in education has attracted considerable scholarly attention. Although the integration of AI into educational settings has progressed gradually, research points to continuous development, particularly through the adoption of virtual assistant applications and intelligent tutoring systems. Bates et al. (2020) describe AI as a “sleeping giant” within education, acknowledging its transformative potential while noting its limited practical application to date. Similarly, Buckingham Shum and McKay (2018) highlight that the practical implementation of AI in education often falls short of its anticipated impact, a gap attributed mainly to structural and technological challenges, including inadequate infrastructure and a shortage of skilled personnel (Ifenthaler, 2017). Nevertheless, the ongoing advancement of AI technologies and growing institutional investments in educational innovation suggest that this divide between potential and practice may gradually narrow in the near future. In relation to this, the study explored participants' familiarity with the use of AI in academic projects. The results revealed that 69.7% of female and 58.9% of male respondents had prior knowledge of AI applications in education. Moreover, awareness of digital tools and technologies for enhancing communication and project collaboration in multicultural contexts was confirmed by 75.8% of female and 76.4% of male participants (Figure 4). These findings indicate that both genders possess substantial prior experience with technology-supported learning environments, suggesting a solid foundation for adopting Design Thinking and related innovative methodologies in academic practice.

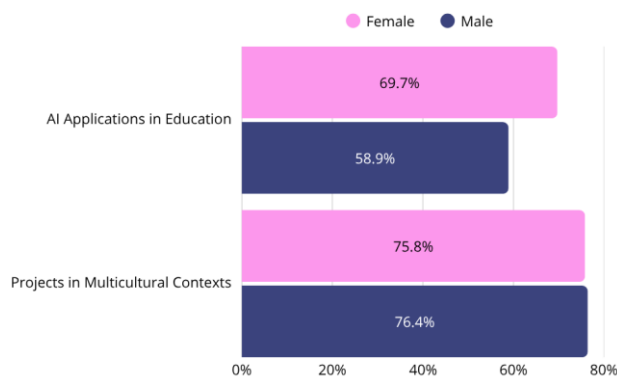


Figure 4: Participants' experiences with AI applications in education and in projects within multicultural contexts

Source: own processing based on the obtained data

The final part of the study focused on evaluating the learning outcomes achieved through participation in the DT workshop. One of the primary areas of interest was students' ability to cooperate effectively in an online environment. As members of Generation Z, the participants demonstrated a natural fluency with digital tools, reflecting their early and sustained exposure to technology. The use of online breakout rooms during the workshop fostered focused engagement, collaboration, and efficient content presentation. These findings align with the notion that for Generation Z learners, hybrid and online formats are not merely emergency measures but represent an evolutionary direction in education. This preference is supported by research conducted by Pondelíková (2023), where over 70% of students identified the hybrid teaching model as the most suitable for their learning needs.

Consistent with this trend, the results revealed that 94% of both male and female participants effectively collaborated with their peers on workshop-related projects. Improvement in presentation skills was reported by 87.9% of female and 82.4% of male students. Both groups confirmed the timely completion of tasks and their active contribution to successful project outcomes, highlighting the workshop's role in promoting accountability, teamwork, and goal-oriented learning behaviours.

Creativity emerged as another significant outcome of the workshop. As noted by Rauth, Köppen, Jobst, and Meinel (2010), Design Thinking provides educators with a flexible and accessible framework to address practical challenges while stimulating creative potential. Similarly, Mishra and Mehta (2017), Robinson (2011), and Pendleton-Jullian and Brown (2015) emphasise that creativity represents a core competence of 21st-century education and that Design Thinking skills have become essential literacies for fostering innovative and adaptive mindsets. In accordance with these findings, the workshop effectively fostered creative awareness among students. Previously unrealised creativity was identified by 66.7% of female and 41% of male participants, supporting Hypothesis (H1) that female students exhibit higher levels of creativity and innovation in their project outcomes (Figure 5). Beyond creativity, the workshop enhanced students' technical skills. Similar percentages of male (82.4%) and female (81.8%) participants noted increased confidence in using AI applications and digital tools, indicating gender-balanced benefits and supporting (H1) (Figure 5).

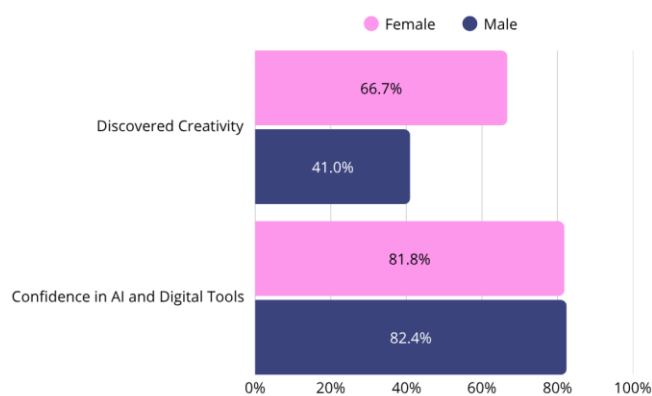


Figure 5: Participants' confidence in AI and digital tools and the emergence of new creativity

Source: own processing based on the obtained data

Furthermore, post-workshop reflections indicated increased confidence in collaboration across genders, with 75.7% of female and 70.6% of male respondents expressing greater comfort in working with peers regardless of gender. This outcome highlights the workshop's contribution not only to digital and creative literacy but also to social and gender awareness, reinforcing its value as a holistic learning experience that cultivates both technical and interpersonal competencies.

5. Evaluation of the Research Results

The research confirmed that combining AI tools, Design Thinking, and gender-sensitive pedagogical strategies within a Project-Based Learning framework can effectively enhance student engagement, creativity, and digital competence among Generation Z learners. The findings demonstrated that both male and female participants benefitted from the blended workshop structure, reporting improved technical proficiency, collaboration skills, and intercultural awareness.

A particularly significant outcome was the confirmation of the hypothesis (**H1**); while female students performed at comparable levels of technical proficiency to their male peers, they demonstrated higher levels of creativity and innovation in their project outcomes. This supports the argument that, when given equitable opportunities and inclusive pedagogical support, female students can thrive in technology-related educational environments that are traditionally perceived as male-dominated.

Moreover, the study showed that Design Thinking provided an effective motivational framework, with over 85% of respondents describing the workshop as inspiring, relevant, and useful for real-life applications. The integration of AI-supported collaborative tools was especially beneficial for enhancing efficiency, fostering reflective thinking, and encouraging peer learning. Students appreciated the combination of structured guidance and creative autonomy, which aligns well with Gen Z's preference for participatory, flexible, and visually oriented learning environments.

Overall, the results suggest that the fusion of AI tools, Design Thinking, and gender awareness principles contributes to a more inclusive and future-ready educational model. It helps build confidence, promote creativity, and support equal participation of women in science and technology, which remains a key challenge in higher education.

6. Research Limitations

Despite its promising findings, this study has several limitations that should be acknowledged; however, each limitation also points to valuable directions for further development. First, the research was conducted with a relatively small and homogeneous sample of 50 students from one Slovak university, primarily within humanities and language-related programs. Although this limits generalisability to the wider Gen Z student population, it enabled close mentoring, in-depth observation, and consistent implementation of the blended workshop methodology. Moreover, the inclusion of Erasmus students introduced an element of international diversity, providing initial insight into intercultural collaboration and adaptability of the approach across linguistic and cultural contexts.

Second, the study relied on self-reported data collected through questionnaires, which may be subject to response bias or overestimation of positive experiences. Nevertheless, this method effectively captured students' authentic reflections, emotions, and self-perceived progress immediately after the workshops. The high response rate and detailed feedback strengthened the validity of the findings and revealed genuine enthusiasm toward AI- and DT-based learning. Future research could complement this quantitative approach with qualitative methods such as interviews, focus groups, or longitudinal observations to gain deeper interpretive insight.

Third, while the workshop included gender-related reflections and discussions, the research design did not allow for long-term tracking of how such interventions influence participants' career choices or sustained engagement in science and technology. However, the short-term results provided encouraging evidence that gender-sensitive educational design can immediately enhance confidence, motivation, and creative participation among female students. These findings form a strong foundation for longitudinal studies that could explore the long-term impact of inclusive pedagogies.

Additionally, the integration of AI tools was limited to freely available applications, which may not fully reflect the potential of more advanced or discipline-specific technologies. On the other hand, this approach demonstrated that accessible, low-cost AI tools can already provide meaningful learning outcomes, making the methodology replicable for institutions with limited resources. It also showcased the practical feasibility of AI-enhanced education without requiring complex infrastructure.

Finally, contextual factors such as varying levels of digital access, prior experience with AI tools, and differing perceptions of gender roles across cultures may have influenced participants' responses. Yet, these differences also represent a realistic and valuable aspect of the research, illustrating the

diverse conditions under which Generation Z learners study. The variability underscores the adaptability of the blended, design-thinking-based model, which proved effective even within heterogeneous groups.

Overall, while these limitations indicate areas for refinement, they simultaneously highlight the flexibility, inclusiveness, and scalability of the proposed approach, offering a robust foundation for future cross-institutional and comparative research.

7. Recommendations

Based on the findings, several recommendations can be proposed for educators, policymakers, and researchers. Universities should integrate AI literacy across disciplines to strengthen students' understanding of both the technical and ethical dimensions of artificial intelligence. The Design Thinking framework should be systematically embedded in higher education as an effective method for developing creativity, empathy, and problem-solving skills across STEM and humanities disciplines. To foster equity and inclusiveness, educational programs are encouraged to incorporate gender-sensitive learning environments that highlight women's contributions to science and technology and promote visible female role models. Furthermore, teacher training should equip educators with the competencies to apply AI tools and Design Thinking strategies effectively in blended and project-based learning contexts. Future research should aim to expand the scope of inquiry by including larger and more diverse samples as well as longitudinal studies to examine the long-term impact of such interventions on gender representation and career development in various fields. Finally, international collaboration, particularly through Erasmus+ and related initiatives, should be leveraged to share and disseminate inclusive, AI-enhanced pedagogical models across European higher education institutions.

8. Conclusion

Considering the rapid digital transformation shaping contemporary education, the intersection of artificial intelligence, creativity, and inclusiveness has become a defining challenge for universities worldwide. Preparing Generation Z students for a future increasingly mediated by technology requires more than technical proficiency. It demands empathy, adaptability, and ethical awareness. The presented study addressed this need by exploring how AI tools, Design Thinking, and gender equality awareness can be combined to create a learning environment that not only enhances academic performance but also fosters critical and creative engagement.

The results demonstrated that both male and female students benefit from such learning designs, but that female students, in particular, show strong creative performance and reflective engagement when supported by inclusive pedagogical strategies. By creating environments that value both technical skills and creative expression, educators can promote equitable participation and challenge gender stereotypes in digital and technological domains.

This research thus contributes to ongoing efforts in higher education to design inclusive, innovative, and ethically grounded teaching models that prepare students for the rapidly evolving landscape of AI-enhanced professions. The outcomes align with the broader goals of European educational initiatives promoting digital transformation, gender equality, and sustainability in education.

Acknowledgement

This paper was created within the project KEGA No. 012UCM-4/2024 *Women in science and technology – raising the awareness of male and female students in the field of gender equality*.

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