EU REPORT

Fostering young women's employability by promoting Sustainable Development Goals through Artificial Intelligence (WISE-AI)

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Introduction

The Sustainable Development Goals (SDGs) represent the most pressing priorities set by the United Nations, with the overarching objective of achieving a significant number by the end of 2030. Several studies have indicated that AI could play a significant role in achieving most of the SDGs. This technology has the potential to become a vital tool for enabling a circular economy and the development of smart cities that utilise their resources efficiently. However, there is a **concerning lack of female participation and advancement in AI careers,** with no signs of improvement in recent years. This reflects a broader issue of **unequal opportunities and inclusion** in the tech sector.

WISE-AI is the inaugural project to integrate these three domains in an interconnected way, exploring the benefits of AI for the realisation of the SDGs through the lens of youth, with a particular focus on young women. The objective is to narrow the discrepancy in women's AI education, enhancing their employability and boosting their active involvement in this pivotal sector. To this end, the project is adopting an innovative approach that integrates technical training with interactive educational games, facilitating the introduction of complex concepts in an inclusive, accessible, and engaging manner.

The primary objectives are to equip young women with the entrepreneurial and technical skills required to excel in the field of AI, while fostering an inclusive and equitable environment. Additionally, the initiative aims to foster innovation and sustainability in alignment with the SDGs, while creating a stimulating, positive, and dynamic learning environment. This project proposes an innovative methodology that aims to include women from diverse backgrounds, including rural areas, offering them access to the world of AI and promoting essential digital skills for the future.

The project will also result in the creation of a comprehensive, multidisciplinary pedagogical package comprising detailed lesson plans, engaging interactive challenges, quizzes and other resources that will facilitate the acquisition of new skills in an attractive and engaging manner. In this context, the Minecraft platform will be used as a central educational tool, allowing participants to learn the fundamentals of AI, its branches and practical applications, as well as the benefits of its integration for the realisation of the SDGs. This approach aims to combine critical learning, socialisation, cognitive development and active involvement in technology through an engaging and accessible medium.

Furthermore, the provision and implementation of digital tools for educational purposes will enhance students' digital capabilities and facilitate the integration of digital transformation within the context of traditional curricula. Besides, the project will facilitate collaboration between diverse stakeholders, including academia, industry, and civil society, to advance a multidisciplinary and inclusive approach to AI education.

This report is part of Work Package from WISE-AI project and is instrumental in the development of the Knowledge Portal, which will serve as the project's central repository of materials and content. The portal will include comprehensive guidance on the nature of AI, its underlying principles, its various applications, its potential for interaction with humans, and its societal impact. Furthermore, the practical applications of AI in everyday life and its relationship with the SDGs will be investigated. One of the portal's key differentiators will be the WISE-AI Community, an interactive space where women and students can exchange experiences, share advances such as codes developed and collaborate on educational practices.

To guarantee an integrated and inclusive approach, the report examines existing literature on AI and inclusion, as well as data gathered through focus groups and questionnaires conducted by project partners. This analysis is further enhanced by the examination of platforms such as ONET, which enables the identification of the core competencies required for success in the AI sector. Based on this data, specific recommendations will be made regarding skills gaps, interests and priority topics in AI that should be addressed in the development of the portal's modules.

Furthermore, the Knowledge Portal will be translated into the languages of the partner countries, ensuring global accessibility. The primary objective of this project is to inspire and empower young women, facilitating their involvement in a rapidly evolving field and encouraging a significant contribution to sustainability and inclusion, in line with the Sustainable Development Goals. WISE-AI's objective is twofold: to increase female participation in AI and to reinforce the importance of this technology as a tool for transforming the world in a more just, equitable and sustainable way.

Concept of AI and Its Popularity Among Young Women

Artificial Intelligence (AI) is a transformative technology that is enabling people to rethink how we integrate information, analyse data and use the resulting insights to improve decision-making. It is already transforming every aspect of life. As AI technologies continue to advance at an unprecedented rate, they are revolutionising complex problem-solving, automating tedious tasks and creating unprecedented opportunities for human progress. There is a growing consensus that AI will shape the future of our way of life. This demand also requires a highly skilled and engaged workforce.

Jobs in the STEM (Science, Technology, Engineering and Mathematics) sector represent a significant proportion of the available professions in Europe and worldwide. This is due to the fact that the sector forms the basis of many rapidly advancing technologies which are helping to solve humanity's problems. It provides a solid foundation for learning about computers, science, engineering, and other related subjects (Center for Women in Business, 2015).

Historically, there has been a notable under-representation of women in STEM fields and professions, a trend that has persisted over time. The latest figures show that women now make up 52 percent of the European population. However, they account for only 2 out of 5 scientists and engineers, and only 18 percent of Europe's Information and Communications Technology (ICT) professionals are women. The gender gap is also evident in the AI sector, where women account for only 22% of the global workforce in this field. These discrepancies result in a missed opportunity to leverage women's creativity and entrepreneurial potential as a source of economic growth and job creation (EPP Group, 2023).

Our future will largely be digital and its innovation is by no means complete. Not involving women equates to a situation in which innovations, projects, and research are largely done without their participation. Moreover, this means that they are not part of important decisions and that funding will not be awarded to them. In addition, studies show that employees with diverse backgrounds, interests, or cultures leads to better results , i.e. better product quality, and they come up with more "neutral" or "critical" perspectives (Roopaeiet al., 2021; Spieler et al., 2018) .

To increase the representation of women in critical technical AI roles, it is essential to implement strategies that extend beyond recruitment efforts. Fostering an inclusive culture and improving access to growth and progression opportunities are crucial initial steps (Simonite, 2020). Research indicates that opportunities for girls to engage with science are closely tied to their interest levels, while boys have access to these opportunities regardless (Diekman et al., 2015). It is crucial to motivate and encourage girls to pursue STEM studies from an early age, as this will facilitate their access to career opportunities in AI. Therefore, STEM education tailored to girls will be pivotal in increasing the number of female-identified professionals in the AI sector in the future (Roopaei et al., 2021).

Skills Gaps and Interests in the Field of AI

As previously stated, there is a notable lack of female representation in the STEM and AI sectors, which presents a significant challenge for the industry. It is crucial to gain insight into the factors that contribute to this situation to drive meaningful change. This gender disparity is not only an issue of equity but also represents a missed opportunity to optimise innovation and technological advancement. It is well documented that diverse perspectives are essential for creating more effective and creative solutions. It is therefore vital that we address these challenges if we are to foster inclusivity, enhance creativity in problem-solving and ensure that the benefits of technological advancements reflect the needs and contributions of all members of society. The following section explores the key factors contributing to this imbalance, highlighting the systemic barriers women face.

Influence of Gender Stereotypes

It is evident that gender stereotypes have a detrimental impact on women's career choices, particularly in the fields of AI and STEM. From an early age, societal norms and media portrayals often associate technology with masculinity, while encouraging girls to consider careers in caregiving or humanistic fields. These stereotypes are further reinforced by cultural messages and a lack of representation of women in technological roles (Gibert & Valls, 2022). The gender-specific distribution of toys and educational materials also contributes to a lower proportion of women aspiring to careers in engineering and computer science (Roopaei et al., 2021).

Lack of Female Role Models

The lack of female role models in AI and STEM fields represents a significant obstacle to greater gender diversity. When women are not exposed to prominent or successful role models, it becomes more challenging for them to envision similar achievements. This lack of representation reinforces the perception that these fields are not welcoming or suitable for women (Gibert & Valls, 2022). Furthermore, the lack of female representation in leadership roles and as mentors limits the guidance and support that young women may require to navigate these male-dominated sectors (Roopaei et al., 2021). This creates a vicious cycle where women feel isolated and less inclined to pursue or persist in such careers, perpetuating the underrepresentation across generations.

Social and Cultural Pressures

Societal expectations frequently influence women to pursue careers in sectors perceived as socially meaningful, such as healthcare and education, as opposed to technology (Gibert & Valls, 2022).

It is also evident that parental biases play a significant role in this context, with many families dismissing fields such as computing or engineering as viable career paths for their daughters. Research indicates that teenage girls are less likely to select STEM subjects unless they receive encouragement from their parents, teachers, or peers. A strong sense of belonging is identified as a key factor in this decision (Spieler et al., 2018). Social identity theory provides further insight into how societal beliefs influence women's occupational choices (Del Carpio & Guadalupe, 2018).

Another challenge is the misconception that AI and computing are not socially relevant. Many women do not perceive these fields as avenues for improving quality of life or addressing societal challenges, which reduces their interest in pursuing such careers.

Educational and Employment Disparities
The gender gap in STEM subjects can also be attributed in part to shortcomings in the way that these subjects are presented in the educational system, which often fails to engage women in these fields. The European Commission reports that men are four times more likely than women to enrol in ICT courses, which has resulted in a workforce that is disproportionately represented (Gibert & Valls, 2022). Just 13% of female university graduates choose to specialise in STEM subjects, compared to 29% of men. Furthermore, the lack of inclusivity in academic and professional environments hinders women's ability to pursue and advance in AI-related careers (Roopaei et al., 2021).

Personal Barriers
It is not uncommon for women to face personal challenges such as a lack of confidence and feelings of inadequacy in comparison to their male counterparts. Negative experiences, such as criticism from instructors, can result in a fear of making mistakes and disengagement from STEM fields. Conversely, positive experiences, such as successfully mastering challenging topics, can have a positive impact on self-esteem and motivation (Kunz & Steffen, 2024). The lack of access to supportive networks and mentorship opportunities presents a significant obstacle to women's advancement, particularly in rapidly evolving fields like AI (Roopaei et al., 2021).

Workplace Discrimination
Biases in the labour market represent an additional challenge to achieving greater representation of women in AI. It is a common misconception among employers that women prioritise family responsibilities over career advancement, this can lead to the exclusion of women from leadership roles (Roopaei et al., 2021). The prevalence of male teams in AI development perpetuates unconscious biases, resulting in the creation of products that fail to address diverse needs (Del Carpio & Guadalupe, 2018; Roopaei et al., 2021).

Other Factors

Another significant factor contributing to this underrepresentation is the phenomenon of the "leaky pipeline" (Diekman et al., 2015; Speer, 2023), which highlights how women are more likely than men to abandon STEM fields at various stages, from education to career progression. While many young women initially demonstrate proficiency in STEM disciplines, their interest often decreases over time, resulting in a lower representation in professional roles and leadership (Kunz & Steffen, 2024). This demonstrates that the issue is not limited to the initial entry into these fields, but also encompasses challenges related to retention and progression.

In addition to the pipeline issue, women face structural barriers identified by the European Commission (González et al., 2018), such as unconscious biases, tokenism, weak professional networks, and limited transparency in organizational policies. These obstacles are compounded by societal expectations, stereotypes, and difficulties balancing professional and personal responsibilities. Collectively, these factors create a systemic imbalance that requires targeted interventions to address and resolve.

To conclude, the underrepresentation of women in AI and STEM is the result of a combination of societal, cultural, educational and organizational barriers. To overcome these challenges, targeted measures are required to dismantle stereotypes, provide mentorship, foster inclusive educational environments and eliminate workplace discrimination. By embracing diversity, the AI field can leverage a broader range of perspectives and fully realise its potential for innovation and societal impact.

Building Confidence and Skills for the Future

It is crucial to cultivate interest and confidence in STEM and AI among girls to foster a more diverse and inclusive technological landscape. These efforts are designed to equip girls with the essential technological skills that will be increasingly vital in the future workforce. By establishing a robust foundation, these initiatives empower girls to explore careers in STEM, AI, and innovation while also breaking down barriers and creating equitable opportunities in these fields.

Starting Early: The Power of Early Education

It is vital to introduce AI concepts at an early stage in the education system in order to develop a robust talent pipeline. Integrating AI-focused curricula into primary and secondary education ensures that students, particularly girls, are exposed to fundamental concepts such as machine learning, data science, and algorithmic thinking (Roopaei et al., 2021; Spieler et al., 2018). This early exposure is particularly impactful during critical developmental years, between 12 and 15, when career aspirations begin to take shape (Roopaei et al., 2021; Spieler et al., 2018).

Practical projects and hands-on activities that demonstrate real-world AI applications provide girls with a clear understanding of how AI affects industries and society. Such projects demonstrate the practical relevance of AI, fostering confidence and sustained interest (Roopaei et al., 2021).

Mentorship Matters: Role Models for Inspiration

Mentorship represents a key strategy for empowering girls in AI. By showcasing the achievements of successful women in AI, we can demonstrate that the field is open to all and accessible to anyone with the right skills and qualifications. Role models provide inspiration and tangible examples of achievement, while structured mentorship programmes ensure consistent guidance throughout the academic and early career stages (González et al., 2018; Roopaei et al., 2021).

Networks that connect girls with experienced AI professionals have been shown to foster confidence, provide career insights and help navigate challenges. This continuity of support ensures that young women remain engaged and motivated to pursue AI careers (Buckles, 2019; Roopaei et al., 2021).

Creating Inclusive and Bias-Free Learning Environments

It is crucial to make AI education inclusive and engaging to reduce barriers to entry. It has been demonstrated that curricula which link AI concepts to meaningful, real-world challenges resonate with many girls, who often value applications that address social or community issues (Konrad et al., 2000, cited in Diekman et al., 2015; Roopaei et al., 2021).

It is equally vital to provide educators with the tools to create bias-free classrooms and to challenge stereotypes in teaching materials, media, and societal narratives surrounding technology. Educators trained to promote gender equity and foster inclusive environments are instrumental in encouraging girls to participate and excel in AI (Buckles, 2019; Roopaei et al., 2021).

Extracurricular Opportunities to Spark Engagement

Extracurricular programmes designed specifically for AI provide girls with opportunities to explore and innovate in a collaborative environment. Initiatives such as AI workshops, coding boot camps and competitions provide an excellent opportunity for young women to gain practical experience of AI applications while simultaneously developing their technical skills (Spieler et al., 2018; Roopaei et al., 2021).

Hackathons and AI challenges, particularly those that focus on solving societal issues, provide an opportunity to showcase achievements, develop teamwork and problem-solving abilities, and demonstrate the potential of AI in addressing real-world challenges. Such events provide motivation for participants and facilitate the development of confidence in their AI expertise (González et al., 2018; Roopaei et al., 2021).

Accessible Resources: Removing Barriers to Entry
It is crucial to guarantee that all individuals have access to high-quality, inclusive learning resources in order to promote equitable outcomes in AI education. Free online platforms offering AI courses, tutorials, and projects tailored to different skill levels provide girls with the opportunity to learn at their own pace (Buckles, 2019; Roopaei et al., 2021).
Additionally, practical AI toolkits designed for use in educational or domestic contexts facilitate hands-on exploration of concepts such as neural networks, data analytics, and predictive modelling. These resources facilitate the transition from theoretical understanding to practical application, ensuring that learners from all backgrounds can access AI.

ODS Paving the Access to AI with Young Females

Building on the previous discussion of the essential skills women need to enter and succeed in the field of Artificial Intelligence, it is equally important to explore how this technologyitself can serve as a catalyst for achieving the Sustainable Development Goals (SDGs). By addressing systemic challenges and harnessing its transformative potential, AI can drive progress across various dimensions of sustainable development.

Research indicates that AI has the capacity to impact 79% of the SDGs, positioning it as a powerful tool to tackle global challenges. AI's applications span numerous scientific fields, demonstrating significant potential in addressing climate change, broader environmental concerns, and promoting equality and inclusion (UNDP, 2019). Moreover, AI plays a critical role in advancing the specific SDGs that this project focuses on, namely:

Gender Equality (SDG 5)
AI is a valuable tool in the pursuit of gender equality. By identifying and mitigating biases in recruitment and decision-making systems, AI can help ensure greater fairness in algorithms (Palomares et al., 2021; Vinuesa et al., 2020). Tools developed with AI monitor discriminatory practices and amplify women's voices on digital platforms, thereby contributing to the creation of more inclusive digital spaces (Vinuesa et al., 2020). However, biases resulting from unrepresentative training data and limited diversity in the AI workforce present a significant challenge (Palomares et al., 2021).

Clean Water and Sanitation (SDG 6)
AI optimises the sustainable management of water resources by enabling smart water distribution systems that minimise waste and improve efficiency (Palomares et al., 2021). Real-time monitoring powered by IoT and AI ensures water quality through predictive analytics, preventing contamination and ensuring equitable access to clean water (Vinuesaet al., 2020). In particular, machine learning models based on artificial neural networks (ANNs) have proven highly effective in predicting water-related issues, optimising distribution and detecting leaks. This has made a significant contribution to water conservation efforts (Fan et al., 2023; Gue et al., 2020; Yeh et al., 2021).

Affordable and Clean Energy (SDG 7)

AI is playing a key role in the transition to affordable and clean energy by optimising smart grids that integrate renewable energy sources and ensure efficient distribution (Vinuesa et al., 2020). AI-driven solutions are able to enhance low-carbon systems and improve energy efficiency through the use of advanced modelling techniques (Palomares et al., 2021). Furthermore, deep learning methods optimise the performance of renewable energy sources, assist in the detection of faults and enable predictive maintenance. These developments result in reduced costs, enhanced system reliability and an accelerated uptake of clean energy technologies (Fan et al., 2023; Morton et al., 2017).

Climate Action (SDG 13)

Artificial intelligence makes a notable contribution to climate action through advanced climate modelling and optimised resource utilisation. By analysing satellite imagery and environmental data, AI is playing an instrumental role in efforts to combat deforestation, desertification and other environmental challenges (Vinuesa et al., 2020). Machine learning models provide invaluable insights into climate patterns, enabling the development of effective strategies to mitigate risks and adapt to changes. The use of AI-driven tools for resource management has been shown to further enhance land use optimisation and support sustainable development efforts (Miller et al., 2020; Yeh et al., 2021).

Global Partnerships for Sustainable Development (SDG 17)

Artificial intelligence facilitates global collaboration by enabling knowledge sharing through platforms that leverage big data for development analysis (Palomares et al., 2021; Vinuesa et al., 2020). These tools facilitate inclusive decision-making, ensure equitable access to technology, and drive innovation. Initiatives such as AI for Social Good (AI4SG) and platforms like SustainBench facilitate interdisciplinary collaboration in order to monitor SDG progress and develop effective solutions (Tomašev et al., 2020; Del Río Castro et al., 2021; Yeh et al., 2021).

Methodology

Focus Groups

Six focus groups, i.e. informal discussions among selected individuals about specific topics (Beck et al., 1986: 73). The selection of this method was based on its suitability for exploring the nuances of reality, which in turn facilitates a more comprehensive understanding of opinions, attitudes and motivations (Bryman, 2012). The focus was semi-structured (Appendix 1), as this format allows participants to express themselves more freely and encourages a relaxed and collaborative atmosphere between them and the moderator(s) (Cohen and Manion, 1992). Furthermore, participants are able to highlight issues related to topics they consider important and significant, thereby meeting the objectives of the study.

The focus groups were conducted to gain insight into women's awareness of AI technology and its potential impact on achieving the SDG goals. The semi-structured interview scriptconsisted of 4 sections designed to assess participants' views on general AI knowledge, stressors and support systems, challenges in participation in AI sciences and, finally, community and community and support.

The focus groups were conducted between August and September 2024 and lasted between 25 minutes and an hour. They were held in person and remotely to accommodate a wider geographical distribution. The focus groups were conducted in the partner countries (Lithuania, Spain, Portugal, Greece, the Netherlands and Cyprus) with a total of 32 participants aged between 16 and 32, all of whom were female.

To ensure compliance with ethical and legal standards, participants were presented with an informed consent document before the interviews commenced. They were asked to sign the document (see Appendix 4) or indicate their consent to a recorded informed consent form in the case of the online focus groups. The informed consent document provided information about the general aim of the study, details of who to contact with any queries, and the inclusion criteria, namely women aged between 15 and 29. It also included additional information relevant to participation. Furthermore, participants were informed that their involvement was entirely voluntary and that the audio would be recorded and anonymised for transcription and subsequent analysis.

In this project, we followed Cyr's (2019) protocol with an interpretive approach, assuming that reality is socially constructed and that individuals actively attribute meaning to their experiences. The focus groups were designed to ascertain participants' motivations, beliefs and interpretations, rather than to collate objective facts or statistical data. The objective was to gain insight into individual and collectively shared perceptions, which are fundamental to understanding the social dynamics of the issues under study. This was done without assessing whether or not these perceptions correspond to objective evidence.
To extract meaning from the narratives produced by the participants, a deductive thematic content analysis was conducted, with categories and subcategories/codes taken from previous literature relevant to the project.

Surveys

To conduct a comprehensive quantitative analysis of the survey data, the responses collected by each project partner were systematically consolidated, aggregated, and statistically processed. This methodical approach facilitated the precise calculation of response frequencies and corresponding percentage distributions. To enhance data comprehension and visual interpretation, each survey question will be accompanied by an appropriate graphical representation, thereby facilitating a more nuanced understanding of the research findings.

A total of 170 individuals completed the survey. All participants confirmed that they were women between the ages of 15 and 29, and reside in European Union.

The largest age group was 18–22 years, representing 37.6% of the sample, followed by the 23–26 years group (24.7%) and the 27–29 years group (19.4%). The survey results indicated that 15–18-year-old participants accounted for 18.2% of the total sample size.

In terms of educational qualifications, the majority of respondents reported having completed a Bachelor's degree, while 26.5% held a Master's degree and 2.9% had obtained a PhD.

In terms of employment status, 38.8% of participants were employed, 28.2% were students, 10.0% were self-employed, and 2.9% were classified as NEET (Not in Employment, Education, or Training).

Finally, 78.2% of respondents indicated no affiliation with youth organisations, whereas 21.8% reported active membership.
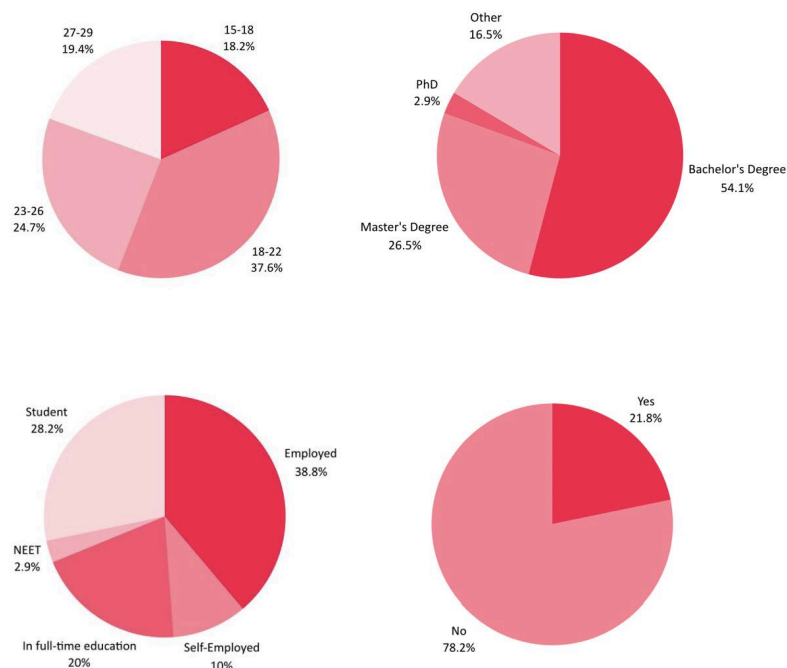

Figure 1: Demographics

Results

Stressors

Societal/Cultural Barriers

The participants responses revealed that a predominant issue is the male dominance in technology-related spaces and gaming, where women feel excluded or discouraged, particularly during early socialization. Many participants emphasized that traditional gender norms, reinforced through childhood activities, create biases that steer women away from gaming and therefore technical/STEM fields. This extends into adult experiences, where women face scepticism, bias, and even hostility in male-dominated environments such as gaming and STEM education.

Participants also discussed other cultural stereotypes, such as the perception that women are less capable in areas related to STEM, or the societal expectation that women prioritise caring roles over professional development, which is reflected in their childhood play, resulting in less exposure to games. Some gave personal accounts of experiencing sexism in educational and professional contexts, such as being the only woman in a class or being turned down for internships solely on the basis of gender. In addition, family and social pressures, including parents' concerns about their daughters entering male-dominated sectors, perpetuate these barriers.

Additionally, one of the participants touched on the idea that women "become their own enemies" due to internalized societal beliefs. This could be expanded to reflect how early socialization and repeated biases shape not only external barriers but also women's self-perception and confidence.

These stereotypes can create a sense of alienation, making technology seem inaccessible or "not for them." These findings underscore the need for proactive strategies to dismantle stereotypes, foster inclusive environments, and encourage women's participation in AI and technology from an early age.

On the other hand, some participants noted that while younger generations are more open-minded, systemic barriers persist, especially in traditional workplace structures and family dynamics. While many participants detailed significant obstacles rooted in gender norms and biases, others expressed more optimistic views, asserting that such barriers are less prevalent today. Some participants emphasized that families now tend to support women's career choices, including in male-dominated fields like technology, and even encourage them to pursue these areas due to better job prospects. Others mentioned never experiencing gender-based discrimination in their professional environments, highlighting that respect and equal treatment are becoming more common in workplaces. However, these perspectives often pointed to variability depending on the sector or individual experiences; sectors dominated by men were still perceived as having greater challenges due to cultural norms and individual biases encountered "along the way."

Stereotypes
It was observed that participants held the perception that men are innately suited to technology, whereas women are regarded as external entities who must invest additional effort to demonstrate their capabilities. The participants considered how hobbies, interests and even early exposure to technology are gendered, creating barriers that subtly discourage women from fully engaging in areas such as programming, gaming and AI.

Moreover, the stereotypes go beyond access and opportunity. Women are often held to different standards, feeling the need to strive for perfection and experiencing heightened anxiety about their abilities. These pressures can perpetuate self-doubt and reinforce the idea that technology is a male-dominated space. Such biases, whether explicit or implicit, continue to shape societal attitudes and influence the confidence and aspirations of women in tech. It was also suggested that men tend to approach technology in a more relaxed and practical way, while women feel the need to prove themselves or aim for unattainable perfection, which can lead to higher levels of anxiety and fear of failure. Some remarks mentioned how societal norms still associate gaming with boys and the idea that boys naturally acquire familiarity with technology through early exposure, leaving women with the impression that they must work harder to reach the same level of ease.

Lack of Resources
Participants expressed concerns about inadequate training and lack of support, particularly when attempting to navigate complex technical tasks such as coding or utilising AI tools. This has led to feelings of stress and a sense of being ill-prepared. Many respondents indicated that they were frequently assigned tasks without adequate training, which has a detrimental impact on their confidence. Furthermore, many participants highlighted the lack of role models and mentorship opportunities, particularly the absence of female figures in AI and technology, which intensified their sense of isolation. Furthermore, the male-dominated environment in technology and AI was highlighted, with several participants indicating difficulty in aligning with the cultural and social norms that shape these fields, such as the traditionally male-dominated activities of gaming and coding.

The use of games to promote AI skills and knowledge.
AI/Technology Knowledge
It was observed that engaging in game-based experimentation can help to demystify coding, thereby facilitating greater knowledge acquisition among girls in the fields of AI and technology. This approach offers a practical and accessible avenue for learning. Minecraft's neutral commands and the ability to create and install modifications (mods) were identified as tools that facilitate the introduction to technical concepts and foster an understanding of how to implement new elements into existing systems. While boys may engage with such games more frequently, participants emphasised that girls also find them appealing. This suggests that games like Minecraft could serve as effective stepping stones into the world of technology. Furthermore, the completion of coding-related tasks in these environments was linked to a sense of accomplishment, which can enhance confidence and foster sustained interest in technology-related fields.

AI Sciences Attraction

The responses underscore the significance of game-based learning in facilitating greater accessibility to programming and AI sciences, particularly for women. It was observed that games such as Minecraft and Roblox facilitate an interactive and hands-on approach to learning coding, which helps to demystify complex concepts that are often perceived as intimidating. The integration of coding into playful and creative environments serves to reduce the barriers to entry, thereby rendering technical skills more accessible. Programmes and hackathons that utilise such tools were identified as effective methods for fostering early interest in STEM and creating supportive, engaging environments for young girls. Furthermore, participants emphasised the necessity to challenge the perception of technology as a domain predominantly occupied by males, advocating for initiatives that make programming and AI sciences feel inclusive and appealing to diverse groups.

Affective Learning

The responses of the participants revealed a combination of challenges and opportunities associated with learning through the use of gaming and artificial intelligence (AI) tools. The participants considered the possibility that a lack of early exposure to programming or technical tools might impede enthusiasm for AI, given that engagement often requires familiarity with foundational concepts such as coding. Some participants expressed the view that AI technologies and tools are overly complex and accessible mainly to those in specialised research fields, which further alienates individuals without a technical background.

The issue of stress was identified as a recurring theme, often associated with a lack of clear instructions, glitches, or AI systems providing abstract or irrelevant information. Participants expressed frustration when attempting to obtain specific outcomes from AI tools, citing instances where the systems generated generic or emotionless results. Furthermore, instances of feeling "observed" or overwhelmed by unexpected AI predictions intensified feelings of anxiety, particularly when coupled with a sense of lack of knowledge or guidance.

Cognitive Learning

The responses yielded two primary themes. Firstly, there is a discrepancy between the perceptions of women and those of the wider industry, with the former viewing programming and AI technologies as inherently complex and inaccessible. This discourages their engagement. This perception is partly attributable to a lack of early exposure and the way computer science concepts are presented. It was noted by participants that the incorporation of creative and interactive methods, such as gamified learning with tools like Minecraft, could make programming more appealing and less intimidating for girls. By enabling students to explore creative modifications and apply their imagination, these tools can cultivate interest and self-confidence in technical skills.

Secondly, there is a discrepancy in the ways in which men and women interact with gaming and learning environments. It is possible that women may be more inclined to engage in physical, everyday interactions than in online interactions, which are often emphasised in games like Minecraft. However, participants suggest that girls can still benefit from such platforms if they are given guided and relatable entry points into programming. The fear of falling behind or being overwhelmed by technical challenges is also noted, emphasising the importance of structured and incremental learning. This aligns with broader calls for accessible and inclusive education that empowers women to bridge gaps in cognitive learning and explore how AI can drive sustainable development, aligning with SDG goals such as quality education and gender equality.

Surveys

Behaviour/Familiarity with AI
Level of Knowledge
Figure 1 presents the self-assessment of respondents in concert with the level of their familiarity with AI technologies, which was on a Likert scale from 1 to 5. 37.6% of the participants identified their level of familiarity as 3, followed by 23.5% at level 2. In addition, 25.3% rated their knowledge at level 4. This means that most of the participants considers themselves at the intermediate and above-average level of knowledge of AI technologies.

Figure 2: Personal Level of Knowledge of AI Technologies

AI in Educational Contexts
The following table shows what the participants perceive as relevant when it comes to AI in education. Most of the participants have already considered AI and have started experimenting with it in an educational context, showing a very strong orientation toward the use of AI for personal and professional purposes, very low in integration into the classroom.

	%
I am not interested in learning about AI in education	17.1
I am considering AI and have started to experiment with it (i.e., reading about, downloading etc)	31.2
I am using AI educational material for enhancing my knowledge (i.e., reading, etc)	29.4
I have been experimenting with AIEdu applications for quite some time	24.7
I am using AI educational material in my class	13.5
I am using AIEdu applications and tools (AI for exams, AI for presentation preparation, AI application for data visualization (graphs, charts, etc.), AI for learning (e.g. Chat GPT), AI for Analyzing Student Success Metrics, AI for tutoring outside the classroom, etc)	30

Frequency of AI Usage for Work/Study

Only 14.7 per cent of participants say they don't use AI at all. The results show that most participants use this tool moderately each week.
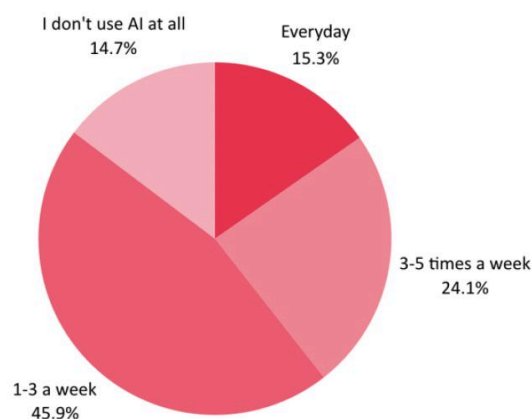
Figure 3: Frequency of AI Usage for Work/Study

Enjoyment Experienced by Participants When Working with AI[11]

Figure 4 illustrates the level of enjoyment experienced by participants when working with AI. It can be observed that the majority of the participants assign a rating of 3 or above, indicating a positive attitude towards AI.
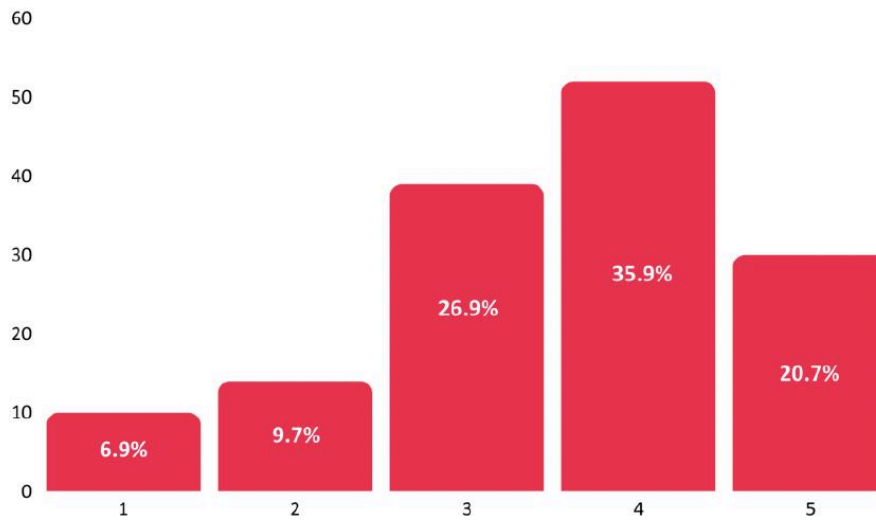
Figure 4: Enjoyment experienced by participants when working with AI

AI and Sustainability Goals

Figure 5 shows the degree to which the participants believe that AI can be used to achieve sustainability goals, and it can be seen that the majority of the participants give a rating of 3 or higher, indicating that they believe AI can have a positive effect on achieving these objectives.
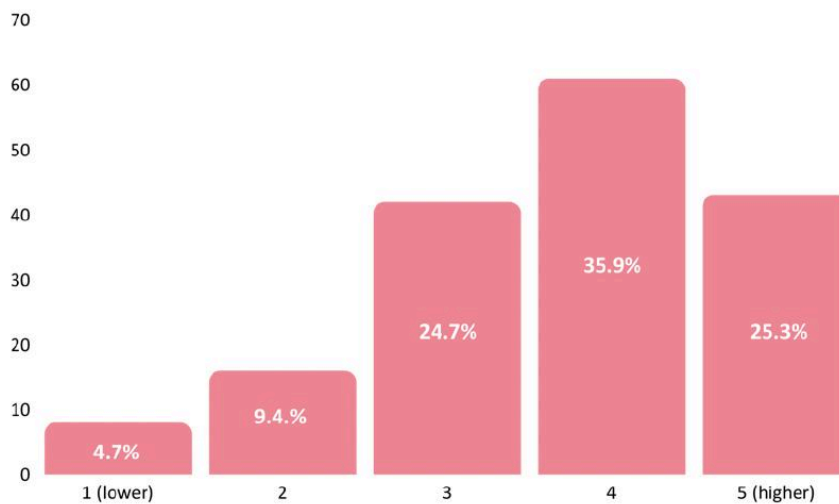
Perceived Level of AI Skills[1]

Figure 6 shows the perceived level of AI skills. The majority of participants identified their level as between 2 and 4 (22.8%; 36.6%; 24.1%, respectively), showing that they perceive their skills as moderate.

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[1] The results reported below are based on the responses from 145 respondents.

Figure 6: Perceived Level of AI Skills

Willingness To Attend An AI Course[1]

Figure 7 shows the degree to which participants would be willing to attend an AI course. It can be seen that the majority of participants give a rating of 4 or higher, indicating that they would like to attend an AI course.
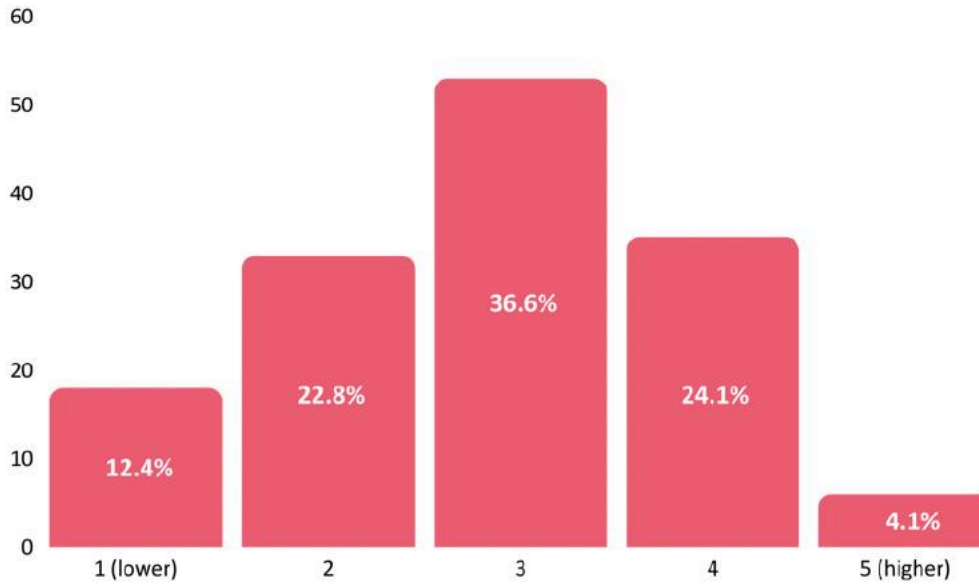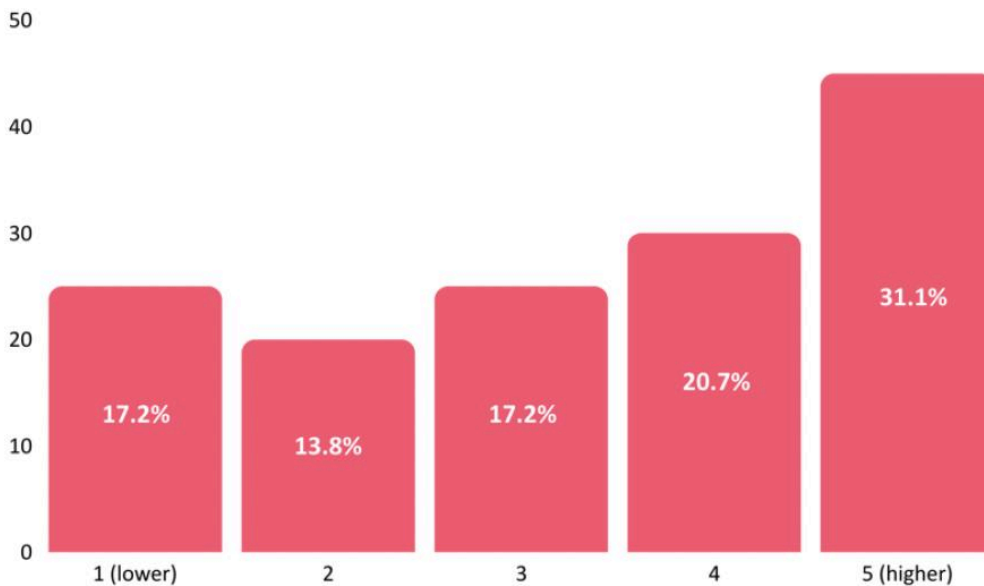

Figure 7: Willingness To Attend An AI Course

AI and Employability1

Figure 8 shows the degree to which participants believe that AI can make them more employable, and most participants give a rating of 4 or higher, indicating that they strongly believe that AI can have a positive effect.
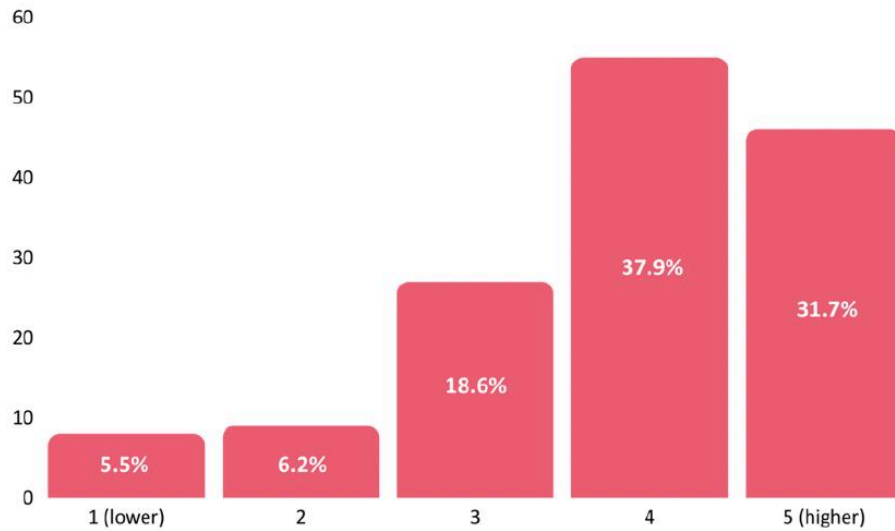
Figure 8: AI and Employability

What is AI?

The following table provides an overview of what the participants believe AI is. These results show that most participants associate AI with deepfake technology, machine learning, and computer vision, while more traditional or less advanced technologies are not as associated with this tool.

Table 2: "What is AI?"

	%
Human intelligence and consciousness	29.4
Mechanical devices (e.g., a bicycle, a windmill)	14.1
Machine Learning Algorithms (e.g., neural networks, decision trees)	72.4
Computer Vision (e.g., facial recognition, image classification)	69.4
Basic electronic devices (e.g., a flashlight, a basic thermostat)	12.35
Robotics	52.35
Personalized Learning Platforms (e.g., adaptive learning software for education)	62.35
Deepfake Technology (e.g., AI-generated videos or voices)	73.5
Simple machines (e.g., a lever, a pulley)	6.5
Non-computational mathematical calculations (e.g., solving equations by hand)	12.9

AI Overall Impact1

Figure 9 illustrates the proportion of participants who believe that AI will have a positive or negative overall impact. The figure demonstrates that the majority of participants anticipate that this technology will have a positive or neutral overall impact.
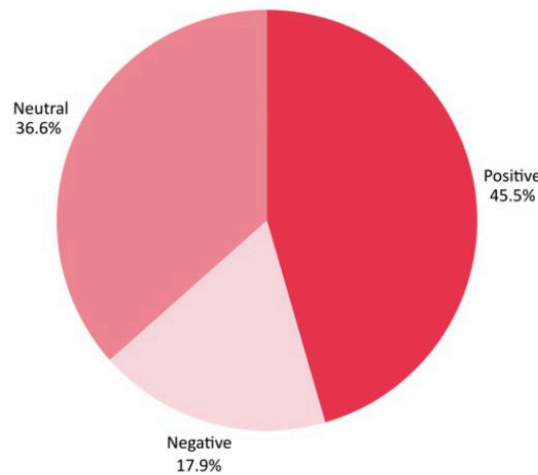
Figure 9: AI overall impact

Next, as can be seen in table 4, the participants gave short examples of how AI could be applied in everyday life.

Table 3: short examples of how AI could be applied in everyday life.

Use of data to optimize bureaucratic processes
Fully personalized precision medicine
Development of cost containment plans for various governmental responsibilities
Efficient land management
Summarization/classification of documents, translation
When Netflix gives us suggestions of what we might want to watch based on what we've already seen, advertisements on websites, music recommendations on YouTube or Spotify
Can be used to search for information to complete schoolwork
Can assist with any questions/doubts we have in our daily lives
Search for information faster; design PowerPoint structures
Research and facilitate accessibility of certain aspects
Basic questions where I need quick and simple answers
To choose clothing for the user based on the weather and their schedule
Study
Gain knowledge about a subject of interest
AI can use platforms for personalized recommendations and fraud detection
Facilitate employee time tracking for companies and organizations
Studies, data collection, virtual assistance
Help with decision-making
Improve the online browsing experience
Write a boring email for me
Make programming more accessible

In educational, professional, and personal contexts

Calculate food portions

Calculations

In carrying out simple tasks at home e.g. smart appliances

mostly in the workplace for research purposes or automation of processes

Smartphone use daily

help with writing an email, guiding to fix a small problem with computers

By giving it a list of important tasks to be done and asking to organize and prioritise it.

Making it easier to gain knowledge in a new area.

I have a robot vacuum cleaner which is an example of AI usage in daily life

simplify tasks—like organizing schedules

Customer Support Chatbots: Many businesses use AI chatbots on websites and messaging apps to assist with queries, track orders, and provide 24/7 customer service

AI-powered apps can translate spoken or typed text instantly, making it easier to communicate in different languages.

As an assistant to every daily task

Language and Communication Enhancement: Beyond grammar checks, AI in tools like Grammarly can improve your writing style, clarity, and tone. This is helpful for emails, reports, or even messaging on social platforms where clear communication matters

Many websites use AI-driven chatbots to assist with frequently asked questions, reducing wait times for customer support.

In school works

Deep fake

Smart Home Devices: AI-powered thermostats (like Nest), lights, and security cameras learn your preferences and adjust settings automatically for comfort, energy savings, and security. Social

Media Algorithms: Platforms like Facebook, Instagram, and TikTok use AI to curate your feed, suggesting content and ads based on your activity and interests.

AI tools are accessible and available 24/7, providing support whenever you need it. This is

especially valuable for those with irregular schedules or time constraints. AI encourages to continuously improve your skills and knowledge. By engaging with it regularly, you stay updated on trends and enhance your expertise. that AI can adapt to your preferences and learning style, making it a personalized tool that can grow with you over time.

home automation and general shopping assistance (e.g. targeted ads on devices, apps etc)

Facial Detection and Recognition

To make plans for examle for a joyrney, for a lesson

AI has drastically improved traveling, the facial Detection and Recognition, theText Editors and the Autocorrect.

Every day's problem solving like measuring,rating, cleaning

Helping in chores, driving, decision making

Text Editors or Autocorrect, and Search Algorithms.

I use AI to analyze real-time traffic data, suggest optimal routes, and predict arrival times.

Perhaps Robots with AI skills will be created that help people as assistants (help mothers in chore, help teachers with nutrition challenge for children with disabilities)

AI it's already a significant part of our daily routine. From entertainment to safety, AI's invisible hand is continuously working to enhance, streamline, and personalize our experiences.

AI help us the way we entertain ourselves, interact with our mobile devices, to even driving vehicles for us

Universities in general and especially in medicine for positive purposes

As a tool to help humans organize their ideas and find new ones

AI tools are extremely efficient and can help to plan daily habits and simplify everyday life. With machine learning algorithms and natural language processing capabilities, AI applications, virtual assistants, and smart home devices add hours of free time to week

AI applications can greatly enhance your marketing campaigns by providing more customer information

AI technology can have vast application throughout life but I am not familiar enough with specific forms of it to say. It could range from everything around us being automated to simply google searches being more personalised/accurate

AI algorithms use machine learning, deep learning, and natural language processing to identify incorrect usage of language and suggest corrections in word processors, texting apps, and every other written medium.

Image creation, search, visuals

remake texts, correct texts, correct images, learn more

Course Writing

Understanding Complex Topics

Productivity

Report Writing

Interview Preparation

Research

Meal Plans

Workouts

What the Participants Believe Coding Is1

The following table provides an overview of what the participants believe coding is. These results show that the majority of participants associate coding with "Building software applications by writing, testing, and maintaining code.", "Analyzing and evaluating code written by others to ensure quality, efficiency, and correctness.", and "Writing tests to verify that the code works as expected and does not introduce new bugs".

Table 4: Overview Of What The Participants Believe Coding Is

	%
Building software applications by writing, testing, and maintaining code.	72.4
Managing changes to code using tools like Git, enabling collaboration and tracking revisions.	47.6
Managing schedules, meetings, or project management activities	16.6
Analyzing and evaluating code written by others to ensure quality, efficiency, and correctness	60.0
Creating visual content using tools like Photoshop or Illustrator	18.6
Writing tests to verify that the code works as expected and does not introduce new bugs	49.7
Operating software applications (e.g., word processors, spreadsheets) without modifying or creating code.	26.2
Performing manual or calculator-based math calculations without programming them.	11.7
Working with Integrated Development Environments (IDEs) or text editors to write, edit, and manage code.	49.0
Analyzing data using non-programmatic methods, such as through Excel formulas without writing scripts.	18.6

Impact of AI in Career Success1

Figure 10 shows the degree to which participants think AI could be important for their career success, and most participants think this technology will be important for their career success.
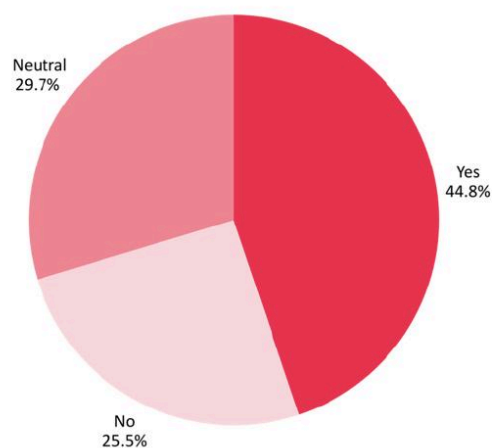
Figure 10: Impact of AI in Career Success

Lack of Knowledge in AI lead to feeling behind1

Figure 11 shows the degree to which participants have considered themselves to have been left behind by a lack of knowledge in AI, and it can be seen that the majority of participants (81.4%) do not think that this lack of knowledge has left them behind.
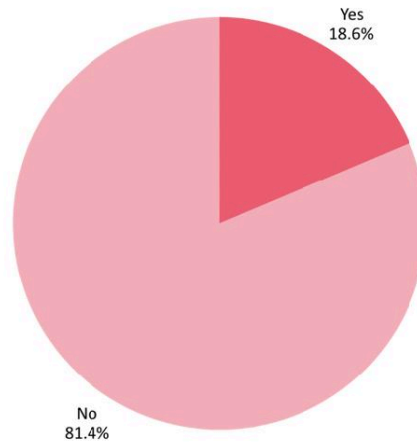
Figure 11: Lack of Knowledge in AI lead to feeling behind

School's/ Organisation's Engagement/Familiarity with AI

Knowledge of AI by work/education institutions

Figure 12 illustrates the extent to which participants believe their educational or professional institutions possess knowledge and awareness of AI technologies. Most participants indicated that their institutions have a moderate understanding of AI.
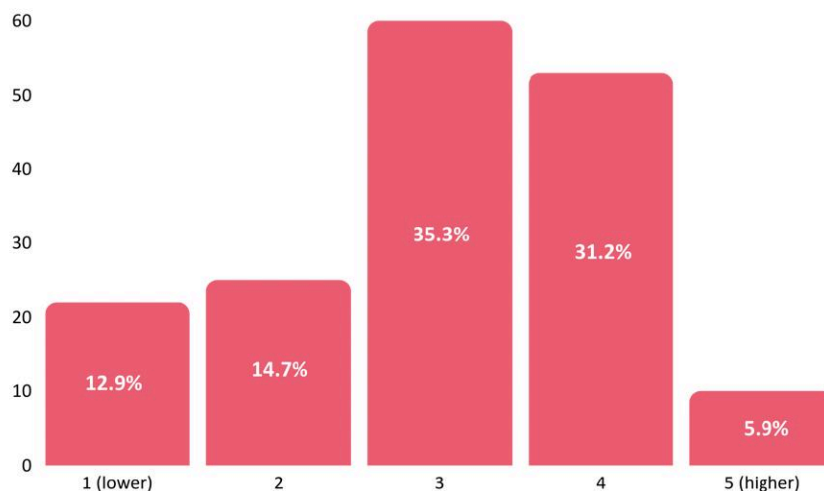
Figure 12: Knowledge of AI by work/education institutions

Current State of AI in the Educational Process

Table 5 illustrates the current state of AI technologies in the educational process of the aforementioned institution.

Table 5: Current State of AI in the Educational Process

	%
It has not been considered	13.1
It is not of interest for the school	12.7
We are considering/evaluating a number of AI edu applications to be adopted	19.2
We have already integrated a few aiedu applications (AI for exams, AI for learning (e.G. Chat GPT), AI for analyzing student success metrics, etc)	20.2
Teachers/employees decide on their own, what aiedu applications and tools to use (AI for presentation preparation, For data visualization (graphs, charts, etc.), Etc)	22.1
The school/organisation has a regulation and/or guidelines for the use of AI technologies and generative AI as part of the educational process	9.4
Other	3.3

Impact of AI (Opportunities/Challenges)

Impact of AI in Participants' Profession

Figure 13 illustrates the way the participants perceive the impact of AI on their profession. The participants indicated that the tool had a relatively positive or neutral impact on their work.
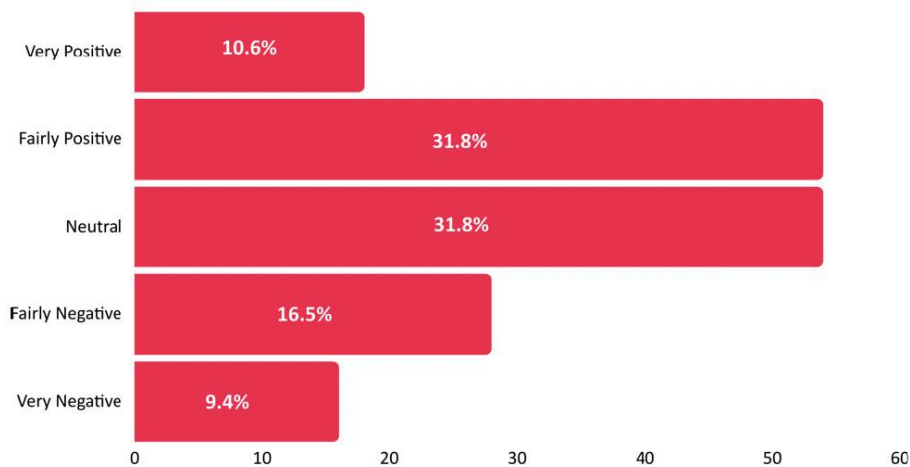
Impact of AI on Learning1

Figure 14 illustrates the manner in which the participants perceive the impact of AI on learning. The respondents indicated that the tool had a relatively positive or neutral impact on learning.
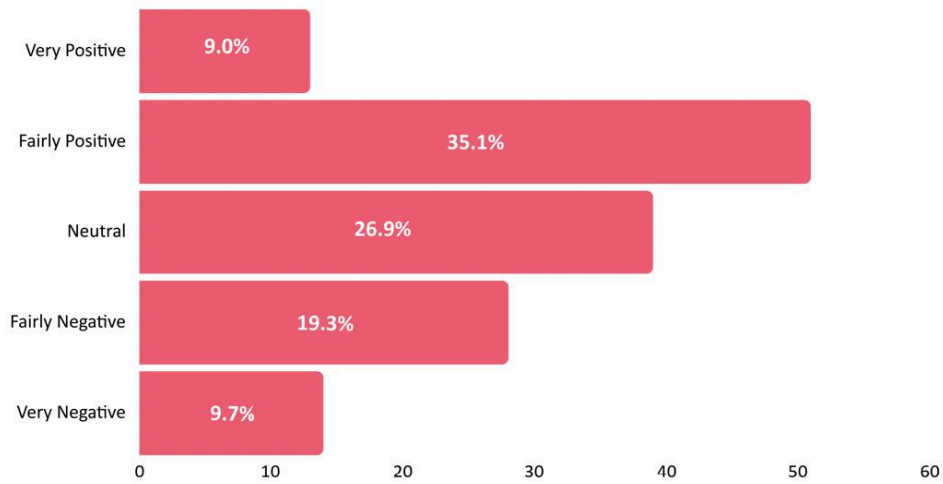
Figure 14: Impact of AI on learning

Challenges in Using AI

The following table presents the challenges faced by employees, teachers and educators in utilising AI applications and tools during their teaching, practice and educational processes. Participants were invited to select the five most significant reasons, and it was observed that "Lack of suitable training programs to acquire or enhance AI-related skills", "Difficulty understanding the benefits of using AI applications & tools", "Lack of interest to acquire or enhance AI-related skills.", and "Lack of interest to acquire or enhance AI-related skills" were the top challenges faced by these professionals.

Table 6: Challenges for Employees/Teachers/Educators

	%
Lack of suitable training programs to acquire or enhance AI-related skills	56.5
Lack of interest to acquire or enhance AI-related skills	51.2
Lack of time to acquire or enhance AI-related skills	51.2
Difficulty understanding the benefits of using AI applications & tools	52.4
Inaccurate information about them, poor image quality, etc.for data visualization (graphs, charts, etc.)	37.6
Organizational challenges	28.8
Ethical issues	54.1
The AI applications and tools use is costly	21.8
Lack of trust assurance mechanisms for the AIEdu applications and tools	42.4
Other	0.59

Long-Term Risks For Employees/Teachers/Educators

Table 7 illustrates the long-term risks that participants perceive to be associated with the pervasive use of AI in the context of teaching, education, and the workplace. Cognitive challenges were identified by a majority of participants as a long-term risk associated with widespread use of AI.

Table 7: Long-Term Risks For Employees/Teachers/Educators

	%
Cognitive challenges (i.e., human intellectual development, decrease of reading and/or researching skills, decrease in concentration spam, insufficient cognitive stimulation, etc)	58.2
Human rights (privacy, equality, democracy, freedom, etc)	45.3
Pedagogical challenges (i.e. excessive use of AI tools, underestimation of the teacher's role)	47.1
Impact on human connection, human interaction, social learning	49.4
Discrimination and bias (i.e., cyberbullying, decreasing tolerance of ambiguity, etc)	21.2
Psychological impact (i.e., unknown psychological impacts, etc)	32.4
Impact on privacy, data security, student safety, data transfer and ownership	46.5
Other unforeseen consequences (i.e., overall impact on learning and personal development, etc)	30.6

O*NET

The table below outlines the key skills and their descriptions for roles that are equivalent to those of AI professionals. These include data scientists, computer and information research scientists, software developers, database administrators and computer network architects. The information presented was sourced from O*NET, which provides comprehensive insights into the competencies and expertise required for success in these professions. The information was selected as a point of reference to identify the skills women need to develop to gain entry to and succeed in these fields.

Table 8: ONET

Skills	Description
Complex Problem Solving	Identifying complex problems and reviewing related information to develop and evaluate options and implement solutions.
Critical Thinking	Using logic and reasoning to identify the strengths and weaknesses of alternative solutions, conclusions, or approaches to problems.
Judgment and Decision Making	Considering the relative costs and benefits of potential actions to choose the most appropriate one.
Active Listening	Giving full attention to what other people are saying, taking time to understand the points being made, asking questions as appropriate, and not interrupting at inappropriate times.
Reading Comprehension	Understanding written sentences and paragraphs in work-related documents.
Systems Analysis	Determining how a system should work and how changes in conditions, operations, and the environment will affect outcomes.
Programming	Writing computer programs for various purposes.
Systems Evaluation	Identifying measures or indicators of system performance and the actions needed to improve or correct performance, relative to the goals of the system.

Discussion

The findings of the current report indicate that, while many young women may not yet be directly coding or working with AI at a deeper technical level, they are significantly interacting with AI-powered systems in their day-to-day lives, primarily through tools and platforms that enhance productivity, learning, and personal enjoyment.

The results of the report indicate that young women interact with AI in a variety of ways as part of their daily routines, particularly through educational tools and platforms. Most participants utilize AI-driven applications to assist with specific educational tasks, including the preparation of presentations, the writing of essays, and the generation of project ideas. Approximately 46.1% of respondents indicated that they utilize AI between one and three times per week, suggesting that AI-driven applications in domains such as social media, online shopping, and entertainment have become a regular aspect of their experience. Many young women employ AI-based systems, such as chatbots and virtual assistants, to enhance their communication skills, whether for organizing schedules, answering questions, or assisting with personal tasks. Another area where girls interact with AI daily is through social media algorithms, which use AI to tailor content and recommendations.

The results indicate that AI is used to provide personalized recommendations for entertainment (e.g., Netflix or Spotify suggestions) and to assist with problem-solving tasks, such as searching for information, writing emails, or addressing homework-related challenges.

The report highlights the moral and practical necessity of achieving gender equality in AI for innovation. By addressing skill gaps, dismantling systemic barriers, and aligning AI applications with SDGs, the initiative paves the way for women to excel in AI. This not only promotes inclusion but also amplifies the sector's potential to drive sustainable development.
Table 1 illustrates that stereotypes frequently originate in childhood, where societal norms establish arbitrary distinctions between traditionally "male" and "female" interests. There is a tendency for women to be socialized to view AI as a domain that is typically associated with men, which can act as a deterrent for them from pursuing careers in this field (Gibert & Valls, 2022). The lack of role models in this field is a significant obstacle. The absence of visible female role models in AI leaves young women without relatable figures in the field, further dissuading them from pursuing these careers (Roopaei et al., 2021). The absence of mentorship also contributes to this challenge. Many women report experiencing discrimination in the workplace. This can manifest as biases that favor male employees for promotions, leadership roles, or involvement in cutting-edge projects. This results in what is known as the "leaky pipeline," whereby women leave the field due to systemic barriers (Del Carpio & Guadalupe, 2018). Access to AI education and resources remains a significant challenge for many women. Those in rural areas, for instance, often have limited access to educational tools, scholarships, or networking opportunities that could help them advance in the AI field.

A recurring topic of discussion in the focus groups was the tendency for young women, particularly in male-dominated fields such as AI, to question their abilities and grapple with imposter syndrome. Such self-doubt can result in a lack of persistence and disengagement. Schools often fail to proactively encourage female students to engage with technical subjects, and AI topics are often presented as too challenging or unsuitable for female students. The educational environment may inadvertently reinforce traditional gender roles, perpetuating the cycle of underrepresentation. Women may encounter subtle obstacles to career advancement in AI, including restricted access to leadership roles and lower performance expectations (Kunz & Steffen, 2024). This perpetuates the existing gender imbalance in senior roles within the AI sector. The lack of extracurricular AI-focused activities, such as coding camps or hackathons, limits young women's exposure to practical AI applications. This obstacle is particularly prevalent in rural or underserved areas, where these opportunities are frequently unavailable.

Table 9: Barriers to Women's Participation in AI

Barrier	Description	Impact/Examples	Frequency (Focus Groups)
Gender Stereotypes	Gender stereotypes often associate technology, engineering, and AI with masculinity. These cultural beliefs discourage young women from pursuing STEM or AI-related careers.	Women are often not encouraged to explore AI from an early age, leading to a lack of confidence and interest in technology. Societal norms link tech with "male" activities like gaming.	High
Lack of Role Models	The underrepresentation of women in AI fields results in few female role models who can inspire young women to enter the field. Lack of mentorship from successful women in tech.	Young women lack visible examples of women succeeding in AI, leading to feelings of isolation and uncertainty about career paths in the field.	High
Workplace Discrimination	Biases in hiring, promotion, and workplace environments result in fewer opportunities for women in AI. This includes unconscious biases and expectations that women prioritize family.	Female employees in AI often face discrimination, such as being excluded from leadership positions or critical projects, reinforcing gender inequality in the workforce.	Moderate
Resource Constraints	Limited access to training, learning resources, and funding for women interested in AI. Many women, especially in rural areas, lack the necessary infrastructure to pursue AI education.	Many women are unable to access formal training in AI, with fewer scholarships, mentorships, and opportunities for skill-building available to them, leading to missed career opportunities.	High
Societal and Cultural Barriers	Societal expectations push women toward "feminine" roles in caregiving or	Women may feel pressure from family or society to pursue non-technical	High

	humanities, discouraging their involvement in tech and AI.	careers, or may even experience discouragement from male peers when showing interest in AI.	
Personal Confidence Issues	Many women lack confidence in their technical abilities, often doubting their skills compared to their male counterparts, leading to self-doubt.	Low self-esteem can prevent women from pursuing or persevering in AI careers, as they may feel out of place or inadequate in male-dominated spaces.	Moderate
Stereotypical Educational Environment	Educational systems may unintentionally perpetuate gender biases by not encouraging girls to engage with AI-related subjects or by reinforcing the notion that STEM is for boys.	Girls may not receive the encouragement to pursue STEM subjects, and AI topics may be framed as too complex or male-oriented, leading to lower participation rates.	High
Lack of Extracurricular Engagement	Many young women lack access to extracurricular activities that could expose them to AI concepts and coding skills, especially in rural areas.	Without extracurricular initiatives, girls miss opportunities to engage in coding clubs, hackathons, or AI-based projects that could spark interest and confidence in AI fields.	Moderate

Practical implications

The findings in the project suggest several practical implications, including a possible attempt to create a game-based learning experience for teaching and engaging players-managed, young women about the accomplishment of certain SDGs viewed through the lens of artificial intelligence (UNDP, 2019). Table 2 displays a few suggestions that can be considered in developing a gamified proposal. This includes detailing clear objectives focused on various SDGs like gender equality, water conservation, clean energy, and climate action, and integrating AI competency-building activities with the storyline of empowerment where a woman is the central figure in the story (Palomares et al., 2021; Vinuesa et al., 2020). Examples of gameplay challenges include real-world issues in the SDGs, like running a virtual water purification plant for SDG 6 or using AI to optimize renewable energy systems for SDG 7. The players will be guided by NPCs modeled after female AI pioneers, with special attention to mentorship and role modeling.

Table 10: Practical Guidelines for Minecraft Development to Promote Women in AI

Guideline	Details	Supporting Quotes from Findings
Define Objectives and Target Outcomes	Focus on SDGs such as Gender Equality (SDG 5), Clean Energy (SDG 7), and Climate Action (SDG 13). Highlight women role models and AI's role in tackling challenges.	"Highlighting women role models is important to combat stereotypes and make AI careers feel accessible."
Design the Game Environment	Create realistic challenges, such as AI labs and simulations for SDG tasks. Incorporate female NPC role models inspired by real-life AI pioneers.	"Games like Minecraft offer tools that can help demystify AI concepts and make coding engaging."
Gamify Learning with AI Applications	Include mini projects to teach AI concepts like coding or training AI models. Reward players with achievements for solving AI-based challenges.	"Using gamified environments has been shown to sustain interest and build confidence in technology."
Promote Collaboration and Social Engagement	Foster teamwork by assigning AI-related roles (e.g., programmer, analyst). Use multiplayer modes to encourage collaboration on SDG solutions.	"Collaborative gaming environments create a sense of community and align with real-world AI teamwork dynamics."
Include Accessible Resources and Mentorship	Provide step-by-step AI tutorials and integrate a virtual mentorship space. Use NPCs to guide players and connect them to real-world mentors.	"Mentorship and accessible resources play a critical role in supporting women's participation in AI."
Ensure Inclusivity and Engagement	Ensure representation of women in leadership roles and cultural diversity. Offer customizable learning paths to cater to varying skill levels.	"Inclusive designs encourage engagement by reflecting diverse identities and providing equal opportunities."
Evaluate Impact and Iterate	Include in-game surveys for feedback and refine gameplay through iterative updates. Conduct pilot testing with diverse participants, especially young women.	"Feedback loops help ensure the game remains relevant and effective in achieving its objectives."

In Table 3 we propose a realistic AI-driven game mechanics, active learning components, Minecraft mods in coding, problem-solving, and task completions, all intended to mimic real-world workflow related to AI, as well as collaborative work of community events and/or multi-user engagement to foster a strong sense of teamwork (Buckles, 2019; González et al., 2018; Roopaei et al., 2021). A diverse range of relatable characters from different walks of life with flexible, nonlinear learning paths allows skill sets to progress at varied, self-managed times. Continuous feedback loops, piloting, and iterative updates will ensure that the game continuously stays impactful, accessible, and aligned not only with educational goals but also with progress toward SDGs. Immersive yet empowering, this approach will be bridging AI learning with global challenges for the inspiration of the next generation of innovators.

Table 11: Gamified mechanisms to improve young female competences in AI.

Define Objectives and Target Outcomes	**SDG 5 (Gender Equality):** Showcase women-led stories about AI initiatives. **SDG 6:** Design challenges around AI solutions for the purpose of water conservation. **SDG 7:** Missions involving systems of renewable energy, AI optimization. **SDG 13:** This is a simulation of AI acting in environmental monitoring and protection. **AI Skill Building:** Include coding activities, algorithmic thinking, or problem-solving challenges that introduce the player to AI. Empowerment Narrative: Women must be the protagonists of this story, emphasizing their leading role in AI and in the achievement of the SDGs.
Game Environment Design	**Create Realistic Challenges:** Design activities for each SDG, like running a virtual water purification plant for SDG 6. Introduce AI-driven mechanisms for data analytics tools or machine learning simulations. **Role models:** Add NPCs modeled after real-life female AI pioneers that would coach and mentor the players. Include a storyline where players solve challenges along with role models in the process. **Employ Minecraft Mods:** Integration of mods with AI, such as *OpenComputers* or *ComputerCraft*, will enable coding and simulate applications in AI. Use Redstone mechanisms to demonstrate logical thought and automation.
AI Applications used for Learning through Gamification	Create "AI labs" where players would just do mini-projects, for example, coding algorithms and training AI models in the game. Use simple programming rules/ logic with if-then actions with visual outcomes in the Minecraft world. **Quests and Rewards:** Design gameplay around quests that solve problems related to SDGs using AI. This could be by rewarding players with achievements, badges, or in-game resources that represent their progress: for example, energy-efficient materials for challenges regarding SDG 7.
Encourage Collaboration and Social Engagement	**Emphasis on Teamwork:** Design tasks players would need to collaborate on, effectively mimicking real-world like AI project workflows. In the project, there is a need to assign roles for AI-related jobs: Data Analyst, Programmer, and Project Manager. Community Challenges Encourage multiplayer configurations where players contribute together in solving SDGs. Host events such as hackathons or competitions for better engagement and motivational activities.

Resource Availability and Mentorship	**Incorporating step-by-step guides within the game on AI concepts and SDG topics**. To explain complex ideas through visual storytelling or NPCs in a way that is easy to understand. **Mentorship platforms** In-game access to a virtual mentorship space where players can learn from NPCs or connect to real-world mentors via embedded links.
Ensure Inclusivity and Engagement	**Diverse Representation:** Provide representation to women from different walks of life in game leadership. Include cultural diversity in the game so as to be relatable to many peoples. **Flexible Learning Paths:** Provide special game play modes according to various levels of player experience with either AI or SDGs. Visual and Audio Appeal: Use colourful visuals and rich audio to make this both engaging and a positive experience.
Test Impact, Iterate	Conduct trials with diverse groups, especially young women, to refine gameplay and ensure accessibility.
	Iterative Development: o Regularly update the game with new challenges, features, and insights based on user input and SDG progress. Include in-game surveys or other prompts to query players on their experience and learning outcome. • Pilot Testing

Example of a Mission for SDG 13: Climate Action

Objective: Players must use AI to monitor deforestation and prevent further damage.
Scenario: A virtual forest under threat from deforestation.
Tasks:
1. Analyze satellite images using in-game AI tools to identify high-risk areas.
2. Develop sustainable forestry plans using Redstone automation.
3. Collaborate with NPCs to deploy AI-driven drones to replant trees in degraded areas.
Reward: Unlock a virtual AI research lab for future missions.

Limitations and Future Studies

This study is not without limitations. First, the focus groups and surveys, though representative, were limited to participants in specific EU countries (Lithuania, Spain, Portugal, Greece, the Netherlands and Cyprus). Broader insights might be achieved with a more global dataset. Second, the study's findings are based on data collected over a relatively short timeframe, which may not fully capture long-term trends or evolving attitudes toward AI and SDG integration. Future studies in other countries should explore the long-term impact of AI-focused educational programs and mentorship initiatives on career trajectories for women.

Third, while the study successfully highlights barriers and opportunities, it places greater emphasis on perceptions rather than quantifiable outcomes of initiatives promoting women in AI. Therefore, future studies should consider investigating how additional factors (Cohen and Manion, 1992), such as ethnicity, socioeconomic status, and geographic location, intersect with gender to influence participation in AI.

Lastly, the application of educational tools like Minecraft for AI skill development was discussed theoretically but lacked long-term pilot studies or impact assessments. Therefore, we suggest that future studies should consider developing case studies on gamified AI learning tools, such as Minecraft, to assess their practical impact on skills acquisition and engagement. Analyze the outcomes of gender-equity policies in AI workplaces and educational institutions to identify best practices and areas needing improvement. We are convincing that further researchers should consider specific AI projects linked to SDGs to quantify their social and environmental impact, thereby strengthening the case for integrating women in these roles.

Conclusions

This report underlines the fact that gender-equal opportunities in AI are some of the strategic drivers that mean a lot for society on the path to realizing the SDGs (OpenAccessGov, 2021). Thus, the WISE-AI project has been proudly supported by Erasmus+ as one representative example of inclusive and cross-border innovation addressing the development of entrepreneurial and technical skills which young women really need to be successful in AI. On specific lines, WISE-AI integrates education, sustainability with technological empowerment through its ground breaker methodologies, while the latter works within the bigger vision that Erasmus+ fosters of equity and digital transformation (Diekman et al., 2015; Speer, 2023).

One important strength of this initiative involves the combined knowledge and commitment introduced by the WISE-AI consortium combining in their diversity from the points of view of academia, industry segments, and civil society-large in several European countries-such that it contributed to such a multidisciplinary road to address the systemic barriers levelled against women in AI applications. By pooling their resources, information, and best practices across diverse contexts, the consortium managed to illustrate better the potential that collaborative frameworks really bring about change.

The WISE-AI project: Erasmus+ Project: 2023-2-CY02-KA220-YOU-000183669 will also make efforts to strengthen the alignment of AI-driven innovation with sustainable development goals, besides acting to boost the representation and participation of women in this subsector through targeted interventions: gamified learning tools, mentoring programs, and policy advocacy. This twin focus on inclusion-sustainability underlines the very transformative potential of Erasmus+ initiatives and places the Consortium's work as a model for many future projects to come in bridging gap skills and fostering equity across high-demand sectors.

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Appendix 1: Focus Group Interview Script

General questions: Probe for responses specific to AI context

1. What is Artificial Intelligence (AI)?
2. What factors influence your engagement with technologies and AI?
3. What are effective ways to promote engagement with AI field of women in our societies?
4. How interested are you in developing your coding skills?
5. To what extent do you find the training opportunities for coding skills engaging and relevant?
a. And how is learning with Minecraft that can appeal to you to enhance your coding skills?
6. How will the participants be able to transfer the coding skills they acquire in Minecraft to real-life applications?
7. What aspects of Minecraft appeal to female players? (e.g., creativity, exploration, problem-solving elements, etc.)
8. What are the difficulties women face in comparison with men using AI?
9. How would you rate your knowledge on technologies and AI and why?

Questions about stressors & supports

10. What are common sources of support for women while using AI? [encourage them to generate any kind of support for home, school, peer group, community, environment]
11. How do you know when you are feeling 'stressed' while using technologies?
12. How do women feel and what meaning do they associate with successfully coding a solution or creating something in Minecraft?
13. In what ways do feelings of inclusion and belonging impact women engagement in coding and Minecraft communities?

Questions about challenges in participation in AI sciences

14. What challenges/difficulties do women face in using technologies and AI? How do you deal with these challenges?
15. What is your approach to use them efficiently?
16. What other support do you have (in family, community, from school)? Where can you go for help in coping with AI sciences?
17. What societal or cultural barriers do women face when pursuing STEM fields/gaming?
18. Are there any stereotypes associated with women in STEM/gaming?
a. How can organizations and educational institutions address obstacles like lack of resources or gender bias to support female involvement in STEM?

Questions about Community and Support:

19. How can we foster a supportive community for female players interested in both Minecraft and coding?
20. Are there any existing initiatives that have successfully encouraged female participation in STEM fields through Minecraft? .

21. Conclude with open-ended question; "Is there anything else on this topic that you would like to share that we have not covered?"
Close session with thank you to all participants.

Appendix 2: Participant Information Sheet: Phase 1 (survey)

Welcome and thank you for participating! As we have shown above women's participation and pursuance of a career in AI is lacking and does not show any signs of improvement in the past few years. While experts are optimistic, our goal is to enhance their participation by starting to include young women in the field of AI and making an introductory and inclusive educational material. By helping young women meet-and-greet with AI for a greater sustainable outcome we hope to motivate them in pursuing such careers and also improve the field of AI pertaining to the SDG goals. In order to counteract the low participation of women in AI sciences and to help the implementation of the SDG goals, this project aims to develop an innovative approach, combining training with educational play, so as to:
- help young women explore their entrepreneurship skills and capabilities relating to the field of AI and bridge the gap of inclusion and equality;
- encourage the innovation and sustainability of the SDG goals, based on a fun, engaging, and positive game environment.

Your participation is completely voluntary. You can withdraw at any time, and for any reason, simply by closing your browser. The completion of the anonymous questionnaire will take around 10 minutes.

No identifiable data will be collected from you as part of this study. This means that once your responses have been submitted to the research team, it will not be possible to withdraw this data as your individual responses cannot be identified.

If you require further information, please contact the Cordinate Organisation of the Project:
Organization: G.P. MIND THE GAME DEVELOPMENT LTD
Name: Ed Evanson
Email:e.evanson@mindthegame.ltd
Thank you for taking the time to read this concise Participant Information Leaflet.

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Appendix 3: Participant information Leaflet Sheet: Phase 2 (Focus Groups)

(WISE-AI) Fostering young women's employability by promoting Sustainable Development Goals through Artificial Intelligence

You are invited to take part in a research study. Before you decide, you need to understand why the research is being done and what it would involve for you. Please take the time to read the following information carefully. Talk to others about the study if you wish.

Please ask us if there is anything that is not clear or if you would like more information. Take time to decide whether or not you wish to take part.

Who is organizing and funding the study?

Erasmus+ Program

KA220-YOU - Cooperation partnerships in youth

Co-founded by the European Commission

What is the study about?

As we have shown above women's participation and pursuance of a career in AI is lacking and does not show any signs of improvement in the past few years. While experts are optimistic, our goal is to enhance their participation by starting to include young women in the field of AI and making an introductory and inclusive educational material (Institute, 2021). By helping young women meet-and-greet with AI for a greater sustainable outcome we hope to motivate them in pursuing such careers and also improve the field of AI pertaining to the SDG goals. The SDG goals are undoubtedly the greatest priority set by the United Nations with the ultimate goal of achieving a great amount by the end of 2030. With the disruptions caused by the pandemic and now with the war on Ukraine this task is proven more and more difficult to achieve (AI4SDGs, 2021). Studies have shown that AI is a great tool that can be used for the promotion and greater achievement of the SDGs in many fields of science. In particular, it is shown that AI can benefit climate change and broader environmental issues as well as equality and inclusion (UNDP, 2019).

In order to counteract the low participation of women in AI sciences and to help the implementation of the SDG goals, this project aims to develop an innovative approach, combining training with educational play, so as to: • help young women explore their entrepreneurship skills and capabilities relating to the field of AI and bridge the gap of inclusion and equality;

• encourage the innovation and sustainability of the SDG goals, based on a fun, engaging, and positive game environment.

What would taking part involve?

Participation in a focus work discussion concerning women's awareness on AI technology and how AI technology can impact change by focusing on the SDG goals.

Completion will take between 60 minutes. Focus group discussions will be audio recorded through Microsoft Teams or other related softwear.

Do I have to take part?
No. Participation in this study is completely voluntary and choosing not to take part will not affect you or your child in any way. You can also choose to withdraw your participation at any time, without giving a reason by contacting one of the research team. Further details about withdrawing from the study are provided later on in this document.

What are the possible benefits of taking part in this study?
This is the first time a project has a threefold aim of combining AI, young women's employability, and the SDG goals because as we have seen they are all interconnected subjects that are deemed necessary in the current era. To be more specific, through the Minecraft world that will be developed these young women (15 – 29 years old) will have the chance to learn what is AI, its' branches, as well as implement Basic AI skills and the benefits AI can have on the successful implementation of targeted SDG goals.

The project will introduce a differentiated methodology that aims in including women even from rural areas to have access in the field of AI and promote digital skills. Additionally, the project can encourage collaboration among different stakeholders, such as academia, industry, and civil society, to promote a multidisciplinary and inclusive approach to AI education.

Moreover, youth organizations and educators will be able to exchange educational and training approaches with their counterparts, with a view to help young women in the field of computer science and machine learning for the greater good of achieving the SDG goals.
What are the possible disadvantages, side effects or risks, of taking part in this study?
There are no possible disadvantages, side effects or risks of taking part in this study.

Will my taking part be kept confidential?
Data will be collected through webform or paper form if you wish to. Data will be processed only for the purposes of the specific study. All data will be de-identified. Participants will be given a study number to protect their identity and the code linking this will be stored separately to the research data. Data will be stored securely; The data will be stored for 10 years. No personal data will be transferred or shared to other organisations that are not participating in the study.

What will happen if I don't want to carry on being part of the study?
Participation in the study is entirely voluntary, and a decision to withdraw participation from the study without giving a reason, would not affect them in any way. If at any point you wish to withdraw participation, please email the research team. Please note withdrawing participation is separate to withdrawing data that has already been collected during the study..
Who should I contact if I want further information?

Organization: G.P. MIND THE GAME DEVELOPMENT LTD
Name: Ed Evanson
Email:e.evanson@mindthegame.ltd
Thank you for taking the time to read this Participant Information Leaflet

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Appendix 4: Participant Consent form

Title of Project: Fostering young women's employability by promoting Sustainable Development Goals through Artificial Intelligence
Name of Researcher(s): _ _ _ _ _ _ _ _ _ _ _ _ _
Please initial all boxes

	NO	YES
1. I confirm that I have read and understand the information sheet (*Participant Information Sheet*) for the above study. I have had the opportunity to consider the information, ask questions and have had these answered satisfactorily.		
2. I understand that my participation is voluntary and that I am free to withdraw at any time without giving any reason, without my education rights being affected.		
3. I understand that data collected during the study, may be looked at by individuals from the organisations participating in the project and from regulatory authorities, where it is relevant to my taking part in this study. I give permission for these individuals to have access to my data.		
4. I consent to audio/video record the focus group I will be participating		
5. I consent to use (anonymised) of verbatim quotations.		
6. I agree to take part in the above study.		

Name of Participant   Date   Signature

Appendix 5: Survey

Dear participant,
Thank you for your will to participate in the following survey.
Women's participation and pursuance of a career in AI is lacking and does not show any signs of improvement in the past few years. While experts are optimistic, our goal is to enhance their participation by starting to include young women in the field of AI and making an introductory and inclusive educational material. By helping young women meet-and-greet with AI for a greater sustainable outcome we hope to motivate them in pursuing such careers and also improve the field of AI pertaining to the SDG goals.
It takes approximately 7-10 minutes and it aims to explore your understanding and preconceptions of AI and its potential use in the field of education.
This survey is anonymous and your participation remains voluntary, which means that you are free to quit any time you wish.
We greatly appreciate your contribution!
Consent: I have read and understand the above form. By proceeding to the survey's questions, I indicate my willingness to voluntarily take part in this study.
Questions: If you have any questions or comments about this study, you may contact Mr. Ed Evanson (e.evanson@mindthegame.ltd)

A. Demographics

Please confirm you are a Woman 15 - 29 years old	I confirm

	Cyprus

What is your country of residence?	Greece
	Lithuania
	Netherlands
	Portugal
	Spain

What is your age?	15-18
	19-22
	23-26
	27-29

What is the level of education you have completed?	Bachelor's Degree
	Master's Degree
	PhD
	Other: _____

I am _____	Employed
	Self - Employed
	In full time Education
	NEET (not in Education, Employment or Training)
	A student

Are you a member of a Youth organization?	Yes
	No

B. Behaviour/Familiarity with AI

How would you rate your personal level of knowledge of AI technology?	1 (lower)
	2
	3
	4
	5 (higher)

	I am not interested in learning about AI in education

Which of the following are relevant for you?	I am considering AI and have started to experiment with it (i.e., reading about, downloading etc)
	I am using AI educational material for enhancing my knowledge (i.e., reading, etc)
	I have been experimenting with AIEdu applications for quite some time
	I am using AI educational material in my class
	I am using AIEdu applications and tools (AI for exams, AI for presentation preparation, AI application for data visualization (graphs, charts, etc.), AI for learning (e.g. Chat GPT), AI for Analyzing Student Success Metrics, AI for tutoring outside the classroom, etc)

How often do you use AI for work/study?	Every day
	3-5 times a week
	1-3 times a week
	I don't use AI at all

How do you use AI for work/study?	_____

Please, rate the extent to which you agree with the given statements using a 5-point Likert scale, ranging from 1 (strongly disagree) to 5 (strongly agree). Do you enjoy working with AI?	1	2	3	4	5
Do you believe AI could be used to achieve sustainability goals?					
How would you rate your AI skills?					
Do you want to take a course in AI?					
Do you think having AI skills would make you more employable?					

What do you believe AI is? (Choose 5)	Human intelligence and consciousness
	Mechanical devices (e.g., a bicycle, a windmill)
	Machine Learning Algorithms (e.g., neural networks, decision trees)
	Computer Vision (e.g., facial recognition, image classification)
	Basic electronic devices (e.g., a flashlight, a basic thermostat)
	Robotics
	Personalized Learning Platforms (e.g., adaptive learning software for education)
	Deepfake Technology (e.g., AI-generated videos or voices)
	Simple machines (e.g., a lever, a pulley)
	Non-computational mathematical calculations (e.g., solving equations by hand)

Do you perceive AI to have a positive or negative impact overall?	Positive
	Negative
	Neutral

Please give short examples of how AI can be applied to daily life	_____

What do you believe Coding is? (Choose 5)	Building software applications by writing, testing, and maintaining code.
	Managing changes to code using tools like Git, enabling collaboration and tracking revisions.
	Managing schedules, meetings, or project management activities
	Analyzing and evaluating code written by others to ensure quality, efficiency, and correctness.
	Creating visual content using tools like Photoshop or Illustrator
	Writing tests to verify that the code works as expected and does not introduce new bugs.
	Operating software applications (e.g., word processors, spreadsheets) without modifying or creating code.
	Performing manual or calculator-based math calculations without programming them.

	Working with Integrated Development Environments (IDEs) or text editors to write, edit, and manage code.
	Analyzing data using non-programmatic methods, such as through Excel formulas without writing scripts.

Do you consider AI to be important to your career success?	Yes
	No
	Neutral

Have you ever considered yourself left behind because of a lack of knowledge in AI?	Yes
	No

If YES, Please describe in a few words the situation when you considered yourself left behind because of a lack of knowledge in AI.	_____

C. School's/ organisation's engagement/familiarity with AI

How would you rate the	1 (lower)
	2
	3
	4
	5 (higher)

What is the current state of AI technologies in the educational process of your own institution?	it has not been considered
	it is not of interest for the school
	we are considering/evaluating a number of AIEdu applications to be adopted
	we have already integrated a few AIEdu applications (AI for exams, AI for learning (e.g. Chat GPT), AI for Analyzing Student Success Metrics, etc)

	teachers/employees decide on their own, what AIEdu applications and tools to use (AI for presentation preparation, for data visualization (graphs, charts, etc.), etc)
	the school/organisation has a Regulation and/or guidelines for the use of AI technologies and Generative AI as part of the educational process
	Other: _____

How would you rate the overall impact of AI on your profession?	1 (very positive)
	2 (fairly positive)
	3 (neutral)
	4 (fairly negative)
	5 (very negative)

How would you rate the overall impact of AI on learning?	1 (very positive)
	2 (fairly positive)
	3 (neutral)
	4 (fairly negative)
	5 (very negative)

What do you think are the **challenges for employees/teachers/educators** in using AI applications and tools during their teaching/practice/educational process? (***Rate the top 5 reasons***)	Lack of suitable training programs to acquire or enhance AI-related skills
	Lack of interest to acquire or enhance AI-related skills
	Lack of time to acquire or enhance AI-related skills
	Difficulty understanding the benefits of using AI applications & tools
	Inaccurate information about them, poor image quality, etc.
	Organizational challenges
	Ethical issues
	The AI applications and tools use is costly

| | Lack of trust assurance mechanisms for the AIEdu applications and tools |
| | Other: _____ |

What do you think are the **long-term risks** associated with the widespread use of AI in the teaching/educational/working process?	Cognitive challenges (i.e., human intellectual development, decrease of reading and/or researching skills, decrease in concentration spam, insufficient cognitive stimulation, etc)
	Human rights (privacy, equality, democracy, freedom, etc)
	Pedagogical challenges (i.e. excessive use of AI tools, underestimation of the teacher's role)
	Impact on human connection, human interaction, social learning
	Discrimination and bias (i.e.,cyberbullying, decreasing tolerance of ambiguity, etc)
	Psychological impact (i.e., unknown psychological impacts, etc)
	Impact on privacy, data security, student safety, data transfer and ownership
	Other unforeseen consequences (i.e., overall impact on learning and personal development, ect)

| Please add any thoughts/suggestions that you may have. | _____ |

Thank you for your time! Your contribution is valuable!