Artificial Intelligence: Gender-Specific Differences in Perception, Understanding, and Training Interest

Sascha Armutat, Malte Wattenberg and Nina Mauritz
Bielefeld University of Applied Sciences and Arts, Bielefeld, Germany

sascha.armutat@hsbi.de
malte.wattenberg@hsbi.de
nina.mauritz@hsbi.de

Abstract: In light of the growing importance of Artificial Intelligence (AI) in science, business, and society, broad acceptance is crucial. However, recent studies indicate a significant underrepresentation of women in the emerging AI-driven professions of the future job market. This hampers the innovation potential of technologies due to the lack of diverse perspectives in development. Gender-specific differences also manifest in the perception of AI: Men tend to view AI applications more positively, rate their own AI competencies higher, and have more trust in the technology compared to women. However, both genders agree on the critical importance of the comprehensibility of AI decisions and are equally willing to pursue further education in the field of AI. This study aimed to investigate gender-relevant aspects in the perception and understanding of AI, as well as the need for further education and opportunities for communication and exchange on the topic of AI. To achieve this, focus groups with female students were conducted in May 2023. The analysis of the conversation data and materials used was carried out using an inductive coding method. Overall, women perceive knowledge as the key to generating more interest in AI. However, they also identify obstacles such as discrimination, gender stereotypes, and a lack of gender equality. Additionally, they desire more practical examples, improved communication regarding the advantages and disadvantages of AI, as well as more democratic and transparent decision-making processes. The paper emphasizes that an inclusive educational environment requires awareness and education for women, along with measures against discriminatory barriers and stereotypes. Furthermore, it suggests the early involvement of women in the development of AI applications and the establishment of clear rules to ensure gender equality in the workplace. These study findings provide valuable support to companies in the gender-specific planning of awareness and training processes for introducing AI.

Keywords: Artificial Intelligence, AI Gender Bias, Prevalent Stereotypes, Gender Discrimination, Need for Transparency, Knowledge Gaps, Socialisation Based Vicious Circle

1. Introduction

1.1 Problem Definition and Theoretical Background

Artificial intelligence (AI) has become a key topic in business and society. Even though there is no standardised understanding of AI in research, Baker et al. (2019, p. 10) have proposed a consensus-based, broad definition that forms the basis of this study: *"Computers which perform cognitive tasks, usually associated with human minds, particularly learning and problem-solving."* In this sense, AI is a generic term that encompasses a range of technologies and methods, such as machine learning, natural language processing, data mining, neural networks, and algorithms (Zawacki-Richter et al., 2019).

In today's world, AI already has a wide range of applications in companies, such as in robotics and the analysis of extensive data, as well as in the private sphere via for instance smart home systems and voice assistants. The ability of AI methods to handle increasingly complex computational tasks is leading to unprecedented levels of performance and making them the driving force behind the future development of our society (Crawford et al., 2018; Jobin et al., 2019).

The growing importance of AI has opened up debates about fundamental principles and values. Although AI increasingly impacts our everyday lives and economy, AI research and development is still overwhelmingly dominated by men. The "Global Gender Gap Report" indicates that women make up only about 25% of researchers in AI overall, which suggests that they are not sufficiently involved in the development of AI and the associated training datasets (World Economic Forum, 2020). This can lead to a biased and gender-unequal design of AI solutions, exacerbating social disadvantages and inequalities (Hall and Ellis, 2023).

In this context, women and men have different attitudes and perceptions of AI. Men perceive AI applications more positively than women: According to the annual "AI at Work" study, 32% of male participants rate AI in the workplace positively, compared to 23% of female participants (Oracle, 2019). The perception of AI is decisively characterised by the availability of information and knowledge about AI. People who have heard, read, or seen something about AI in the last 12 months tend to have a positive view of AI (European Union, 2017).

Among women, in particular, the less positive basic attitude toward AI is due to a lack of experience with AI and training (Appinio, 2019).

Furthermore, men rate their AI skills higher than women (Franken and Mauritz, 2021). Stereotypes continue to significantly influence the self-perception of one's own skills concerning the use of digital technologies and knowledge of technical terms. For example, women rate their understanding of the term AI and their level of knowledge lower than men (Kaspersky, 2020).

Previous research has focussed on the differences between genders regarding the perception of AI. However, it is recognisable that previous research efforts have focused on the manifestations of the differences while understanding the causes of gender-specific perspectives on the topic has been neglected. There is a lack of comprehensive findings on how women perceive and understand AI, their knowledge about it, and what causes their particular approach to this topic. However, in-depth insights into women's perspectives are crucial to ensure equality in AI development and to derive well-founded recommendations for the education system.

1.2 Research Question and Structure

This study addresses this research gap. The main objective is to analyse the attitudes and perceptions of women towards AI and to identify possible factors for a more critical and cautious attitude. On this basis, key points become clear that can be used to guide the design of training measures to contribute to strengthening equality with regard to AI technologies.

The research question is therefore: *"What perceptions do women have of the role and significance of AI, and how can women's confidence and interest in the topic of AI be strengthened?"*

The study can therefore be located in the field of tension between business management, HR policy, and business psychology approaches.

The target group consists of female students in higher semesters of various study programs at a university of applied sciences, as they have a basic understanding of the working world.

This article is structured as follows: Firstly, the method is explained in the following chapter 2. The subsequent chapter 3 is dedicated to the presentation of the results. Finally, the results are summarised in chapter 4 and discussed with regard to their practical implications.

2. Methods

In order to answer the research questions, two focus groups were conducted in May 2023, each lasting 90 minutes with 12 female students. Focus groups were used as a survey instrument because, as a social science method, they can provide deeper insights into people's opinions, attitudes, perceptions and behavior on a specific topic (Krueger and Casey, 2009). Mixed groups were avoided in order to rule out possible gender dynamics and stereotypes (Kitzinger, 1994). Apart from this, the focus groups shared comparable characteristics with regard to the participants, who were approached by posting notices and chosen based on a chronological application.

The guideline contained open questions on understanding AI, perception, interest, and participants' experiences. Each session began with an introduction by the moderator, consisting of a short presentation on AI, followed by a chaired discussion and a concluding section in which the participants summarised their impressions. A memory log then supplemented the notes taken during the implementation. In addition, the answers were collected using metaplan cards. The data was analysed using the Atlas.ti software for applying an inductive coding method. The transcripts were repeatedly coded until no new findings emerged from the data. The generated codes were then categorised into five superordinate groups to represent the main themes of the data and enable a structured analysis. These groups are:

- Knowledge and Education,
- Discrimination,
- Gender Differences (Socialization and Stereotypes),
- Communication and User-Friendliness,
- Transparency and Regulations.

3. Results on Gender-Specific AI use and Interpretation

Figure 1 shows the results of the focus groups in an aggregated way. The individual dimensions are presented in the following sections. Quotes have been translated into English by the authors.

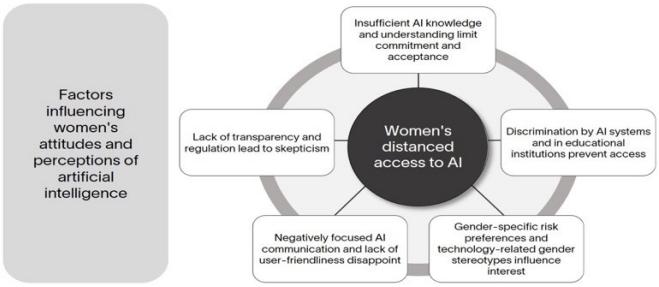

Figure 1: Categorical interconnected framework model

3.1 Knowledge and Education

In the focus groups, it became clear that knowledge about artificial intelligence, education, and information significantly influence perceptions and attitudes toward AI and are considered prerequisites for developing more interest in the topic.

3.1.1 Knowledge: Deficient AI Knowledge Goes Hand in Hand With the Perception of AI as a Male Domain and Causes Gender Inequalities in Terms of Interest and Knowledge Acquisition

The statement from one participant makes it clear that knowledge is a critical aspect in building interest: *"It's a cycle. There is not enough interest because there is not enough knowledge. There are too few women in the field, and it remains uninteresting, and then it goes round in circles."*

For example, previous research confirms that experience and knowledge in connection with technology can strengthen confidence in it (Eastin and LaRose, 2000). In addition to knowledge about the topic, it is also essential that more women are involved in development, as otherwise the area remains unattractive. It was also discussed in the focus groups that AI is dominated by men, and many female participants were discouraged from engaging further with the topic. However, education significantly influences women's attitudes toward AI, and they are more willing to use it (Brougham and Haar, 2018).

Similarly, interest plays a crucial role in expanding knowledge, as does the opposite course of action. This is because people tend to be interested in topics about which they already have a certain level of knowledge (Renninger and Hidi, 2019). Therefore, if AI systems are predominantly designed by men, these systems may reflect prejudices (Buolamwini and Gebru, 2018).

3.1.2 Understanding: Negatively Distorted Image and Understanding of AI Lead to AI Avoidance

The image of AI as a 'doomsday' technology prevalent among the participants was striking. A significant problem is that this perception represents a barrier to active participation in the design and use of AI (Franken and Mauritz, 2021). It further discourages women from engaging in these fields (Ceci and Williams, 2010). Furthermore, an overly negative perception of AI could lead to women avoiding potentially beneficial applications of AI in their daily lives and work. It also carries the risk that women withdraw from (co-)shaping AI development and that their needs and perspectives are less considered in the design and application of AI technologies. It also distracts from the need for regulation, the establishment of ethical guidelines, and discussions about standards and laws. These measures should ensure that the development and application of AI are always in line with the social good (Jobin et al., 2019).

3.1.3 Education: The Early Stages of the Educational System Lack Gender-Sensitive AI Instruction

The literature considers education to play a crucial role in shaping attitudes and broadening engagement in technological fields, particularly in the context of AI (Master et al., 2017). The results of the focus group workshops fit well into this debate, with one participant clarifying: *"AI is also interesting for women. You can see that in this group."*

This statement emphasises the potential of suitable educational measures. For example, a study showed that women have an increased interest and willingness to participate in the field of AI, provided that appropriate educational and awareness-raising measures are in place (Master et al., 2017).

Furthermore, the results clearly emphasise the relevance of early educational intervention. This finding reflects the growing consensus in the scientific literature that emphasises the need for early education in science and maths subjects to stimulate interest and increase diversity in these fields (Cheryan et al., 2017). Through early and ongoing education on AI, we can potentially positively influence women's perceptions and attitudes toward this critical technology. It is, therefore, crucial to promote knowledge about AI and education about its potential impacts and applications.

3.2 Discrimination: Gender-Based Unequal Treatment in Technology-Related Subjects in Educational Institutions Prevents the Development of Interest in AI

One participant describes a pronounced form of discrimination in the education system: *"In a project lesson at my school, which was about computer science, the teacher said that the girls could now go out and do something else."*

This type of discrimination in the education system clearly stands in the way of the goal of improving the attitudes and perceptions of women. However, in addition to the influences that prevent more women from engaging with the subject area, there are also examples of direct discrimination through AI.

The attitude of teachers also plays a decisive role in whether or not a student feels valued and supported in the respective discipline (Sabol and Pianta, 2012). Previous studies have reported that stereotypes and biases about gender roles in STEM subjects exist and are often implicitly reinforced by teachers and educational institutions (Hill et al., 2010). Such preconceptions can affect women's self-perception of their abilities and affiliation in technological and scientific disciplines (Stout et al., 2011). Therefore, it is essential to recognise and proactively address such barriers in order to create an inclusive educational environment and encourage women to succeed in technology-oriented subjects.

3.3 Gender Differences, Stereotypes, and Socialisation

It also became clear from the discussions in the focus group that men and women have different attitudes and interactions concerning AI.

3.3.1 Gender Differences: Gender-Specific Risk Preferences and Interests Cause AI Reservedness

The groups found that *"women tend to act more emotionally or socially and are more likely to seek contact with people. They, therefore, view AI more critically."* and that *"men tend to be more willing to take risks, while women are more cautious."*

These observations are consistent with various research findings that show differences in risk preferences and interests between the sexes. According to Ball et al. (2010), women generally show greater risk aversion in their decisions. In addition, women tend to have a stronger social focus and higher empathy scores (Archer, 2019). It must be questioned to what extent these differences represent the fundamental characteristics of men and women or to what extent they result from processes such as socialisation and our perceptions (Ellemers, 2018). However, knowledge of these differences can help to improve the view of AI, for example, by better tailoring AI programmes and technologies to the needs and interests of women. Furthermore, the findings could be used to change policies and practices in relation to the development and use of AI. This could lead to women perceiving AI more positively and having more confidence in AI technologies.

3.3.2 Stereotypes and Socialisation: Technology-Related Gender Stereotypes Influence Interest and Self-Assessment

One participant's statement suggests that socialisation and stereotyping play a part in these results: *"It is socially driven that there are more men in these areas; if there were more equality, people would talk about it differently."*

The quote points to the phenomenon of gender-specific socialisation, which means that men are more likely to be found in technical fields, and women are discouraged from these areas (Cheryan et al., 2013).

At the same time, women are often influenced by social norms and expectations that dictate what they should do and what they should be interested in: *"There is a certain image of women with norms of how they should be and what they are interested in that influences what they are interested in."*

Gender stereotypes not only influence how we perceive others and what opportunities we give them but also shape our self-image and behaviour (Ellemers, 2018). This stereotypical perception of gender roles can strongly influence women's interests and career paths and prevent them from entering specific fields, especially technical or scientific fields (Ceci and Williams, 2010). It is, therefore, important to raise awareness of gender stereotypes in relation to AI and to challenge stereotypes. This could help to reduce the sense of alienation that some women feel towards AI and positively influence their attitude towards AI.

3.4 Communication and User-Friendliness

The focus group discussions also revealed that the negative image of AI could be due to misguided communication and a lack of user-friendliness.

3.4.1 Communication: Negatively Focussed AI Communication Shapes Negative Perceptions of AI

How AI is discussed can significantly impact perception and acceptance: *"I have had many discussions with female friends, but they tend to be negative and more about the consequences than the function of AI. Perhaps it would be helpful to have examples in your own field."*

Participants in the focus groups would like to see more practical examples in their own field and different communication regarding the advantages and disadvantages of AI. Furthermore, this quote, in particular, shows the possibility of improving negative perceptions of AI by presenting suitable examples that correspond to women's interests. Highlighting AI potential in these areas can help to break down prejudices against AI and promote a broader understanding and engagement among women. For example, users with positive experiences with AI-driven systems tend to be more accepting of the technology and more trusting (Fast and Horvitz, 2017). Similarly, the perception of AI is improved when users see how AI can make their everyday tasks easier (Luger and Sellen, 2016). The statement of another participant also fits in with this: *"I am interested if it is helpful in solving specific tasks."*

Making successful working women more visible was the last component to ensure that additional women were inspired to enter the sector by their example.

3.4.2 User-Friendliness: Lack of Humanity and Disappointing Experiences Shape Acceptance of AI

The following quote indicates a lack of personal connection or empathy on the part of the AI, which leads to turning away from the technology: *"I didn't hear about ChatGPT and was quickly put off when it didn't work the way I hoped it would, or I can't use it the way I want to. It doesn't feel like a human, so I don't want to interact with it any longer."*

This observation is consistent with the findings of Karahasanović et al. (2021), who found that the lack of perceived humanity in AI applications can lead to mistrust and discomfort. Furthermore, the quote also illustrates the frustration caused by a failed interaction with AI. This is consistent with the findings of Luger and Sellen (2016), who emphasise that disappointing experiences with AI technologies can significantly reduce user acceptance. To address these problems, it could be helpful to include female perspectives more in the design process of AI systems to increase female usability.

3.5 Transparency and Regulations: Perceived Lack of Transparency and Insufficient Regulation Maintain AI Scepticism and Mistrust

The topic of transparency and regulations emerged most frequently within the focus groups. The following quote reveals the desire to make decision-making processes more transparent and democratic: *"You should consider whether there should be an authority that clarifies whether developments should be carried out in this way and what AI is allowed to do? Not individual [companies] should decide that."* Another issue was clearly labelling when and how to interact with AI: *"I would like to see mandatory labelling so that I know when I am interacting with AI."*

Therefore, two areas are important: first, the regulation of what AI is allowed to do and who decides on it, and second the transparency of AI systems.

Another point mentioned in the focus groups in this context was the concern about the protection of data and the improvement of data protection. All three topics correspond to the desire to *"make AI more trustworthy"*. Given the more negative attitude of women towards AI, this result is understandable. However, attempting to make AI more ethical and trustworthy is already playing an important role in the public debate (Bostrom and Yudkowsky, 2019). Trustworthy AI is a comprehensive concept that focuses on the development of AI systems that are both effective, ethical, and legally compliant. This includes considering fairness, transparency, privacy, and respect for human rights (Floridi et al., 2018). The European Union's AI Act is the latest and most comprehensive attempt to translate these ideals into law. It aims to ensure that AI technologies and applications are safe, respect fundamental rights, and do not discriminate (European Union, 2021).

4. Conclusion

4.1 Summary and Implications

This study aims to close an essential research gap by identifying factors that lead to a more critical and cautious attitude of women toward AI. On this basis, recommendations can be made to strengthen gender equality in the context of AI technologies.

Overall, the findings presented in the previous chapter with regard to the research question can be summarised as follows:

Knowledge is an essential prerequisite for trust in and a positive perception of AI. A sound understanding of AI promotes a more realistic picture of this technology, allowing opportunities and risks to be more precisely recognized. A reduction in mistrust, coupled with a sound knowledge of the topic, can increase interest in AI. This could result in a reciprocal effect in which increased interest leads to further knowledge. This additional knowledge could, in turn, help to reduce mistrust and further promote interest in the technology. In addition, a more differentiated understanding of AI helps to recognise specific problems and challenges.

Discrimination is another complex of issues. However, the focus groups were less concerned with discrimination through AI and bias in the data and more with discrimination in teaching skills and competences relating to the topic. Some participants reported experiences of discrimination in the education system. In this form, the transfer of knowledge hinders the development of interest. The education system should be one of the places to promote interest and enable a fair transfer of skills independent of personal characteristics such as gender. One of the causes of discrimination in the education system are gender stereotypes. Discrimination can reinforce or confirm these stereotypes (Ellemers, 2018). Stereotypes, in turn, lead to discrimination. Along with discouraging socialisation, they lead to less interest, resulting in a lower level of knowledge. Socialisation thus contributes to people internalising stereotypes and accepting them as valid truth (Ellemers, 2018). This can lead to a vicious circle.

The analysis is also linked to factors that can be assigned to the dimensions of communication and user-friendliness, as well as gender differences, socialisation, and stereotypes. The rather masculine connotation of STEM subjects is reinforced by the insufficient visibility of female role models. As a result, few women aspire to a career in STEM subjects and are therefore not sufficiently integrated into their development. Applications tailored to male interests can reduce interest in further engagement with the technology and worsen the general perception of AI. This can again lead to a lower level of knowledge, which in turn has a negative impact on interest and perception, which could confirm stereotypes. In addition, the identification of relevant application examples is made more difficult. More knowledge is therefore needed to recognise the benefits. However, this cannot be achieved if socialisation and discrimination contribute to the creation and continuation of limiting stereotypes. These stereotypes can only be broken if communication about AI and women in the field changes and there are equal opportunities in the education system. This example illustrates the strong interdependence of the individual factors and their mutual influence. Therefore, a successful strategy to combat these problems should aim for a holistic approach.

The focus group also raised aspects assigned to the transparency and regulations domain. The desire expressed by the study participants for more transparency regarding interaction with AI and clear guidelines on its authorisations and control mechanisms could result from the cautious attitudes. At the same time, clear regulations and their effective communication could help to minimise existing reticence. Furthermore, transparent regulations and communication could lay the foundation for a productive, society-wide discussion about AI and thus promote a more comprehensive and nuanced debate on the topic.

Overall, this study provides a deep insight into the multi-layered and interacting factors influencing women's perceptions and engagement in AI and offers practical steps to overcome these barriers. The findings emphasise the need for an inclusive, responsible, and transparent approach to AI that considers not only the interests but also the unique perspectives of women. There is a need to increase the proportion of women in AI research and development to actively address gender bias in AI systems. This requires the inclusive participation of women in technical professions and the promotion of a diverse and equitable culture in the AI community. Only through such efforts can AI technologies be made fairer and more effective in order to have a positive impact on society.

4.2 Limitations and Further Research

The following limitations can be identified in this study: The group of participants is limited to women, which means that the perspectives of other genders and gender identities were not considered. In addition, the participants volunteered to take part in the focus groups and were thus characterized by a particular thematic interest. Furthermore, the sample only included German participants and the size was limited, which restricts the generalizability of the results. Further research could compare different study programs to examine whether women on technical degree programs approach the topic differently than women in other faculties, for instance economics. It may also include quantitative research methods on the correlation and characteristics of the various dimensions to gain a deeper understanding of the problem. In addition, further research should address the effectiveness of possible measures to improve women's perceptions and attitudes towards AI.

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