DEPARTMENT OF EDUCATION, COMMUNICATION AND LEARNING

Title: Artificial Intelligence in Education

Swedish Secondary School Students' Perceptions of Fairness Regarding The Potential Use and Implication of Artificial Intelligence In their Classrooms.

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Abstract

Education has played a crucial role in technological advancements like artificial intelligence (AI), leading to significant changes in different aspects of life (Borbajo, Malbas, & Dacanay, 2023; Chen, Chen, & Lin, 2020). AI has the potential to meet up with 21st-century learning, such as helping students become more creative, critical thinkers, and problem solvers rather than relying solely on remote memorization for exams (Chembe, Nasilele, & Msendo, 2023). The practical use of AI in classrooms is rapidly becoming a reality (Selwyn, 2024), which makes it not surprising that the rise of AI has impacted the educational sector.

Keywords: Artificial Intelligence, Swedish secondary school, students, classroom, teachers, fairness

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Purpose: This study aims to understand Swedish secondary school students' perspectives of fairness regarding AI's potential use and implications in their classrooms. The study also delves into how students view the role of AI in tailoring learning experiences and including their thoughts on privacy and data protection.

Theory: The theoretical lens takes grounded theory methodology as its point of departure better understand how Swedish secondary school students perceive fairness regarding AI potential use and implications in their classrooms.

Method: This qualitative study used a case study design to explore Swedish secondary school students' perspectives of fairness regarding AI's potential use and implications in their classrooms. Data was collected through focus group discussion and analyzed using the Grounded theory as the theoretical framework

Results: This study found that using AI in education has benefits and challenges hence, there is a need to exercise caution and awareness of the significance and ethical implications that need to be navigated,

Foreword

All the glory, honor, and majesty be unto God for making it possible for me to participate in this program. Almighty God, you alone receive all the adoration. I offer this thesis in dedication to my late parents, who prioritized their children's education irrespective of gender.

I am also thankful to my supervisor, Marie Utterberg Moden, a lecturer at Gothenburg University. She was an incredible source as I worked to complete my thesis dissertation. Her support, guidance, and perceptive criticism were of tremendous value.

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List of Abbreviations

AI Artificial intelligence

AIED Artificial Intelligence in Education

ITS Intelligent Tutoring Systems

GT Grounded theory

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Introduction

Chapter One

1.1 Background

Education is essential to any society because it gives individuals the necessary skills to succeed in a fast-changing world. Over the years, technological progress has shaped various fields, including education (Kamalov et al., 2023). The focus of 21st-century education is no longer on students engaging in remote memorization for examination but on students' abilities to develop thinking and problem-solving skills. This is to say that education is changing, just as the world is changing. Education has played a crucial role in technological advancements like artificial intelligence, leading to significant changes in different aspects of life (Borbajo et al., 2023; Chen et al., 2020). Traditional educational institutions (teacher-centered and teachers are the major source of knowledge), although traditionally rigid (Sadiku et al., 2021), are now adapting to the prevalent technological advancements in today's world. “As a fundamental component to societal evolution and individual development, education has had significant benefits from AI breakthroughs” (Sadiku et al., 2021p. 22). The implication of this is that education is one of several sectors profoundly impacted by the rapid rise of artificial intelligence (AI). The breakthroughs and developments brought about by the development of AI have touched many areas of human existence (Kamalov, Santandreu Calonge, & Gurrib, 2023). In the last year, the area of AI has seen unprecedented levels of attention from both the public and government leaders that the field has rarely seen in its sixty-year history (Selwyn, 2024).

Artificial intelligence is amongst the technological developments, and it has “emerged as a key technology in the industrial transformation of the next generation by integrating a large number of new technologies and theoretical accomplishments” such as automated recognition, providing feedback to learning tasks, promoting the development of adaptive learning to mention a few (Huang, 2023, p. 2578). Park et al. (2023) mentioned in a study that we are currently in the midst of the Fourth Industrial Revolution, characterized by enhanced connectivity and automation driven by technologies like AI. “With Artificial Intelligence (AI) consistently penetrating all domains of human life, recent years have witnessed the dramatic growth of AI in education (AIEd). Specifically, AIEd is anticipated to grow by 43% from 2018 to 2022, and AI teaching and learning applications will develop even more significantly” (Jiang, 2022, p. 1). In addition, research has shown that the ability of AI to customize learning experiences and make administrative work easier indicates that using AI in education can change teaching experiences (Chembe et al., 2023; Velander et al., 2022). Adapting to different digital world requirements requires using AI in education (Ma & Jiang, 2023).

The majority of recent studies, such as Sperling et al. 2022; Kamalov et al., 2023 Jiang, 2022 to mention a few, have investigated how AI can play a transformative role in the educational sphere, stating that its prevalence has brought it to the limelight of education policies and practices. Some studies have also examined the increasing use of AI in education, stating that the intention is not to replace teachers in schools; hence, for decades, AI researchers have significantly focused on AI-supported one-on-one teaching (Borbajo et al., 2023; Kamalov et al., 2023; Sperling, Stenliden, et al., 2022). Previous research has also established that in these days of increased use of intelligent machines, it is no news that AI in education can automate teaching. Intelligent tutoring systems powered by AI can transform, providing personalized learning and feedback and decreasing the need for individual teacher involvement, with few studies examining the implications of customized student learning and addressing students' diverse learning needs (Chembe et al., 2023; Mouta et al., 2023; Park et al., 2023; Zawacki-Richter et al., 2019; Sperling, Stenliden, et al., 2022). So far, however, there have not been many studies on the challenges associated with using AI technologies in schools, such as protecting students' personal information, bias, and fairness (Kamalov et al., 2023; Ferrara, 2023; Chembe et al., 2023). Further empirical studies are needed to understand the negative impacts of bias in schools' use of AI technologies. For example, AI bias can "perpetuate and even amplify existing inequalities, leading to discrimination against marginalized groups and limiting their access to essential services" (Ferrara, p, 4. 2023). Another reason for further empirical studies is that AI systems rely on the algorithms and data used to train them. When algorithms or underlying data are biased, they may produce unjust results or worsen existing inequities, hence the need to check for biases often and remove them to ensure fairness in AI technology use (Kamalov et al., 2023). If the data used to train the AI system is biased, then it will not be easy to eliminate prejudice in the AI system itself (Chembe et al., 2023). Numerous empirical studies are needed to understand data privacy issues. Since using AI includes the extensive collection and use of student data, it can be a source of privacy concerns because AI-powered chatbots collect students' personal information, such as names and email addresses, which can be used to monitor students' online activities. There is a need to protect student data to avoid data breaches and unauthorized access (Chembe et al., 2023). The lack of human involvement in school work, especially regarding automated assessment, can limit meaningful teacher-student interactions. It can also deprive students of personalized feedback and teacher guidance (Kamalov et al., 2023)

1:2 Problem Statement

The reason for using AI in education is multidimensional. One objective is to improve the efficiency of teaching and learning processes while enhancing fairness in using AI technologies for all students (Zawacki Richter et al., 2019). In Sweden, where ensuring fairness in education is highly valued, using AI technologies in the classroom offers an opportunity to further this objective (Bäcklund & Hugo, 2018). Nevertheless, despite the advantages of using AI in education, risks and ethical dilemmas also need to be handled. Handling the risks and challenges associated with AI's use in classrooms is essential to achieving its full potential. These challenges include protecting student data, ensuring fairness, sustaining meaningful student-teacher interaction, and eliminating algorithm bias.

Swedish secondary school students have witnessed the use of AI technologies in their classrooms because Sweden has incorporated AI technologies into its educational framework for a long time (Bäcklund & Hugo, 2018). Understanding how Swedish secondary school students perceive fairness regarding AI's potential use in their classrooms is crucial. Understanding students' perception of using AI in education "will inspire more critical analysis on the ethical risks of educational application of artificial intelligence" (Cheng, 2023, p. 2476). Also, by understanding how AI is used in education and the advantages and disadvantages associated with using AI in education, individuals will gain more knowledge about the state of AI in education (Huang et al., 2021). This study aims to understand Swedish secondary school students' perspectives of fairness regarding AI's potential use in their classrooms. The study also delves into how students view the role of AI in tailoring learning experiences, its influence on their involvement, and their thoughts on privacy and data protection.

1: 3 Research Question

How do Swedish secondary school students perceive fairness regarding the potential use of artificial intelligence in their classrooms?
Sub-question

What are Swedish secondary school students' perceptions of the impact of artificial intelligence in their classrooms?

1:4 Significance of the study

Despite good predictive statements, such as AI's potential to customize student learning, address students' diverse learning needs, and improve students' learning outcomes, there is still much to learn about fairness from students' viewpoints. Reiss (2021) questions whether AI tools can deliver learning without widening gaps or introducing new biases (Reiss, 2021). This study would be significant by contributing to discussions about AI in education while providing information to policymakers and educational technologists about AI ethical considerations. It also guides the development of AI tools that resonate with Sweden's educational values of fairness in AI technology. Fairness and equity in education is an aspect of Swedish educational value that makes it stand out at the forefront of incorporating AI into its educational framework. This study focuses on understanding how students view fairness regarding using AI in classrooms.

1.5 Literature Review

This study uses Jesson and Lacey's (2006) six vital steps to conduct a systemic literature review on AI's potential use and implication in education. These critical steps are scoping review, comprehensive search, quality assessment, data extraction, synthesis, and write-up.

Step one:

The first phase, known as the scoping study, and the first thing the writer does here is review existing literature to discover what is known about AI's potential use and implication in education. Finding out what has been written on the research topic will help to identify the knowledge gap in the potential use and implication of AI in the education use of AI. It will also form the background and justification for the research project. Again, through a scoping review, the researcher can identify areas of study, determine if a systematic review is feasible, and summarize and share the research findings (Jesson & Lacey, 2006; Arkseley & O'Malley, 2005).

Step two: Comprehensive Search

This stage comes after identifying the research question. For example, keywords like using AI in education, AI in Swedish secondary school classrooms, using AI in education to ensure fairness, and using AI in schools to search for articles in different electronic databases such as Google Scholar, Scopus, Educational Research Complete and Gothenburg University. According to Arksey and O'Malley (2005), identifying the research topic comes into play here, as it helps lay the foundation for the literature review. Following the database search, this review aims to explore research on student perceptions of the potential use and implication of AI in education.

The study focus is on the use of artificial intelligence in schools, specifically secondary schools, and Sweden is the country of focus. This prompted the use of this tabulated format to help with a better database search.

Data Base	Artificial intelligence in education	Using AI in Swedish secondary school classrooms	Using AI in education to ensure fairness	Artificial intelligence in schools
Google Scholar	4 880 000	28 300	123 000	1 840 000
Educational Research Complete	4 695	5	25	2 879
Gothenburg University	307 938	577	6 310	213 882
Scopus	5 043	12	31	5 000

Step three: Quality assessment

The search for relevant scientific journals tends to "pick up" journals outside the study focus. In such a situation, the researcher used the "hierarchy of search" to assess the quality and "establish their appropriateness and reject those that do not fit" (Bryman, pg. 99, 2016). In other words, after quickly reading the abstracts, conclusions, sometimes reading some articles using a read aloud application, the inclusion and exclusion of relevant articles followed this format:

Inclusion Criteria	Exclusion Criteria
Peer-reviewed scientific journal	Articles not found in a database
Journals written in English language	Articles written in other languages
Articles published from 2017 to 2024	Articles published earlier than 2017
Articles related to AI in education/school	Articles related to AI in workplaces and the health sector

Step four: Data Extraction

A systematic literature review in this phase requires extracting data from relevant scientific articles on the research scope, aim, and findings. Through data extraction, the researcher can explore the data features in a study report (Booth et al., 2016). Data extraction includes the process of "systematically identifying information relevant to a review's research questions" (Booth et al., 2016, p.218). In this process, the researcher constantly looks at different studies and different study designs to know what data to extract by reviewing the articles' ideas or concepts, which will later be a template in the form of matrices, chats, or networks (Booth et al., 2016).

Step five: Synthesis

Each article in Phase 5 was analyzed to determine what is known, unknown, and learned about AI in education. This study's corpus comprised 30 scientific articles selected after reading relevant articles. Thorough reading of the selected scientific journals is necessary to understand what the articles say and draw conclusions. This takes the form of looking out for repetitions, weighing the evidence, replicating a finding, triangulation to mention a few.

Step six: The write-up

The task at this stage involves analyzing, discussing, and reaching conclusions about the articles in the corpus. For example, in this study, the reviewed sources show that AI applications are rapidly emerging in the education sector, and these rapid advancements in AI are transforming education. Eleven of the articles present perspectives on using AI to ensure fairness, and nine journals discuss more of the benefits of using AI in education.

1:6 Thesis structure

This thesis dissertation comes in seven chapters. The first chapter covers the introduction and presents a general thesis overview and the literature review. The second chapter consists of the theoretical concept found appropriate for explaining the use of AI in secondary school education and the description of key terms used in the study. The third chapter concerns methodology, which gives an insight into collecting data and explains the chosen data collection method. Chapter four presents the research findings, followed by chapter five, which includes the discussions based on the study's findings. In contrast, the last chapter (chapter 7) deals with conclusions, limitations, and recommendations for further research.

Chapter Two

This chapter describes/defines the study's significant concepts. Part two reviews the literature on students' perceptions of fairness regarding AI's potential use in education.

Explanation of concepts

2.1 Artificial Intelligence

Although AI has roots in engineering and computer science, it has also drawn heavily from economics, philosophy, cognitive psychology, and neuroscience (Zawacki-Richter et al., 2019). Artificial intelligence is "Computers which perform cognitive tasks, usually associated with human minds, particularly learning and problem-solving." (Zawacki-Richter et al., 2019, p, 3). AI encompasses a range of technologies and is a broad term encompassing various technologies and methods, including machine learning, natural language processing, data mining, neural networks, and algorithms (Zawacki-Richter et al., 2019).

The initial definition of AI in 1956 described it as "the science and engineering of creating intelligent machines." (Ng et al., p. 1, 2021). During the 21st century, AI has advanced into intelligent machines and sophisticated algorithms that can reason and adapt like humans. Ng et al. (2021) further expanded the definition of AI to include technical developments like machine learning, natural language processing, and neural networks that allow AI to do cognitive tasks like learning and problem-solving. The fast development of computer technology has made applications of Artificial Intelligence in Education (AIED) possible. AIED is the implementation of AI systems or software applications into educational contexts to enhance instruction, assessment, or decision-making (Hwang et al., 2020). Hamal, et al. (2022) also mentioned that AIED is concerned with problems of theories of human learning and the use of AI in productive learning environments and systems of instruction.

2.2 Fairness

The concept of fairness has various interpretations, and it is particularly significant in AI because the absence of bias is necessary to achieve fairness, so fairness and bias are interconnected (Ferrara, 2023). Another thing that makes the concept of fairness important in AI is that “without a view of fairness, one would be in the dark as to what should be done about the reproduction of social inequality through education, or whether or not anything should be done at all” (Utterberg Modén et al., 2024, p. 2). Several researchers have defined fairness differently, such as demographic parity, equal opportunity, and equal chances (Bohdal et al., 2023). This study looks at fairness from Ferrara’s (2023) point of view, which states that “fairness refers to the absence of bias or discrimination in AI systems” (Ferrara, 2023, p. 8). In the same article,” bias refers to the systematic errors that occur in decision-making processes, leading to unfair outcomes.” (Ferrara, 2023, p.2). Even though AI can change education, bias affects its development.

This study discusses fairness by examining the bias that AI technologies can introduce. For example, AI bias can lead to unfair treatment. “AI systems have also been shown to harm parts of the population due to biased predictions” (Bohdal et al., p. 1, 2023). It is not easy to achieve fairness when implementing AI in education due to the many biases that may develop in AI systems, and thus, finding strategies to prevent them can be challenging (Ferrara, 2023). Bias occurs in AI when machine-learning models are trained with under-representative data. The disadvantage of inadequate data is that it produces biased output due to its incompleteness. Another way in which bias occurs is through algorithms. On the other hand, this algorithm bias results from existing bias found in the machine learning models. Again, bias occurs through users’ bias. This is a situation where users intentionally or unintentionally introduce their own bias based on their prejudice in the system (Ferrara, p. 2, 2023).

When AI systems are biased, it can lead to more biased outcomes. When this continues over a long time, it can lead to “increasingly systemic social and economic marginalization of parts of the population” (Bohdal et al., p. 4, 2023). The result of this form of marginalization is that it can also become a stressful situation, trigger protests, and cause social unrest. AI fairness reduces such biases to guarantee that AI decision-making does not discriminate against certain groups (Bohdal et al., 2023).

2.3 The background of AI integration in education

Before the wide availability of personal computers and other digital learning aids, mechanical learning, which includes remote memorization for examination, was the standard in the classroom. The market for mass-produced electronic computers underwent a significant transformation with the introduction of microcomputers and personal computers in the 1970s. The introduction of personal computers enabled non-governmental entities to own and use them for various purposes. Due to these changes, computers have permeated many parts of society and the economy; hence, AI is a product of the ever-changing nature of computers and information communication technologies (Chen et al., 2020).

Computers are conventionally linked to AI. It is expanding beyond the confines of computers and their equipment in education. The transfer of AI to machines, buildings, and robots has been made easier with the help of embedded computers, sensors, and other emerging technologies (Chen et al., 2020). AI is the creation of computer systems that can perform tasks typically done by humans. These tasks include speech recognition, visual perception, problem-solving, and decision-making (Borbajo et al., 2023).

Although there are challenges like privacy concerns and biases, Chembe et al. (2023) description of AI tools states that using AI technologies in education aims to enhance educational experiences by allowing customized learning experiences based on each student's needs and preferences, improving administrative tasks, and optimizing educational outcomes. This statement forms the basis of this study.

Since the 1950s and 1960s, AI has been integrated into education, when trailblazers like Alan Turing imagined computers with the ability to learn and understand. (Du Boulay, Mitrovic, & Yacef, 2023). AI has come a long way, providing efficient and tailored solutions to improve students' educational experiences. Computer innovations have made it easier to use AI in the classroom, which has led to a dramatic increase in its use for bettering instruction, assessment, and decision-making (Flogie & Krabonja, 2023; Ouyang & Jiao, 2021).

The 1970s marked the first era of AI in education as it emerged from different sub-disciplines, including knowledge representation and reasoning, comprehending natural language, problem-solving and searching, and machine learning (Du Boulay, Mitrovic & Yacef, 2023). 1982-1995 witnessed the second era of AIED research in which AI emerged as a discipline. A commonly used intelligent tutoring systems (ITS) architecture was developed in the second era. These systems included a variety of modules, such as domain knowledge, student modeling, pedagogy, communication, and control. During the second era, the emphasis was mainly on "hard science" domains in high school or university, although there were other domains as well (Du Boulay, Mitrovic, & Yacef, 2023, pg, 19). These systems were also designed to provide immediate and personalized feedback to learners, much like a human tutor. ITS can assess the student's knowledge level and adapt the complexity of problems to suit their learning needs. Systems like Carnegie Mellon's Cognitive Tutor and the Andes Physics Tutoring System are notable examples from this era, showing substantial benefits in personalized learning. (Du Boulay, Mitrovic, & Yacef, 2023).

The 2000s witnessed the era of an increase in data-driven education

The 2000s witnessed a significant surge in data-driven approaches to education, facilitated by the internet and digital technologies. Learning Management Systems (LMS) like Moodle and Blackboard started leveraging data analytics to monitor student advancement and enhance educational content (Huang et al., 2021; Hamal et al., 2022). Concurrently, the era saw the emergence of Massive Open Online Courses (MOOCs) such as Coursera and edX, to mention a few, effectively employing AI to handle extensive data from numerous students globally (Liu & Baucham, 2023).

The 2010s, the era of machine learning

Integrating machine learning techniques in the 2010s significantly advanced AI's impact on education (Harry, 2023). These advancements enabled algorithms to predict student dropouts, personalize learning experiences on a large scale, and offer in-depth insights into learning patterns with unprecedented accuracy (Thimmanna et al., 2024).

2.4 Benefits of AI tools in education

AI technology can be a tool for empowering education professionals. For example, learning analytics can support personalized education by diagnosing individual students' learning status, offering immediate feedback, and customizing learning materials. Data mining also helps analyze instructional data for improved educational administration and decision-making (Cheng, 2023). Below are some advantages of using AI technology in Swedish secondary school classrooms.

Personalized learning

AI is designed to facilitate personalized learning by adapting educational content and experiences to match each student's unique needs, learning styles, and preferences (Jiang, 2022; Zawacki-Richter et al., 2019; Kamalov et al., 2023). This approach allows students to progress at their own pace, ensuring a deeper understanding of the subject taught and improving engagement and learning outcomes because the teaching follows the student's academic ability. Personalized learning is achieved through Intelligent Tutoring Systems (ITS) and adaptive learning platforms, which have the ability to analyze a student's performance and provide customized recommendations, allowing for tailored educational experiences that suit individual learning trajectories (Zawacki-Richter et al., 2019; Kamalov et al., 2023). ITS are AI-powered platforms that mimic human tutoring by providing one-on-one instructional guidance tailored to students' needs. These systems use machine learning and natural language processing to diagnose student misunderstandings and offer specific help, enhancing learning experience and outcomes (Zawacki-Richter et al., 2019; Kamalov et al., 2023; Jiang, 2022).

Enhanced Student Engagement

AI-driven educational tools can significantly boost student engagement. By providing learning experiences tailored to each student's interests and needs, these tools intend to keep students motivated and more invested in their learning process. Engaging methods like gamified learning and interactive content further enhances this effect, making learning more enjoyable and effective (Maia et al., 2023).

Enhances diverse learning

Students' abilities and learning rates vary widely in diverse classrooms. AI technology helps address these differences by offering scalable and individualized learning solutions that adjust to each student's needs in real-time. This capability is crucial for supporting learners who might struggle or get left behind in traditional educational settings (Chen et al., 2020).

Data-driven insights and intervention

AI in education is not just about delivering content; it is also about leveraging data to enhance the educational process. Through educational data analytics, AI can process vast amounts of information to identify trends, predict student performance, and inform curriculum adjustments.

This could lead to more informed teaching strategies and targeted interventions, which can help improve academic outcomes (Cheng, 2023; Harry, 2023; Sanabria-Navarro et al., 2023).

Automation of administrative tasks

AI can streamline administrative duties like grading, tracking, and scheduling. This automation might free educators to spend more time on pedagogical activities and less on bureaucratic tasks, enhancing overall efficiency and allowing them to focus on student interaction and personalized teaching (Chen et al., 2020).

Improved Accessibility

AI technologies can help break down barriers to education through tools like translation services, speech-to-text capabilities, and personalized learning platforms accessible to students with disabilities. Moreover, AI can extend educational opportunities to underserved or remote populations by providing high-quality, scalable learning solutions not bound by geographic constraints (Chembe et al., 2023).

Lifelong Learning and Professional Development

The future of AI in education has the potential for further innovations, including using AI technology to support lifelong learning and adapt to the evolving educational needs of societies in the 21st century (Hamal et al., 2022). AI technologies also aid in professional development by identifying educators' skills gaps and offering customized training or feedback (Buiten, 2019).

2.5 Challenges of AI Technology in Education

While AI technology in education may seem appealing, it is essential to recognize the possible dangers associated with introducing autonomous systems (Selwyn, 2024). Several ethical concerns arise when considering AI technologies in the classroom. These include ensuring that students' data is used responsibly, having transparent algorithms and decision-making procedures, and ensuring students' safety and autonomy are not compromised, to mention a few (Chembe et al., 2023; Kamalov et al., 2023).

Security and privacy of student data

The rapid advancement of intelligent processing technology poses risks, such as privacy infringement and data leakage, which could expose students' personal information through data misuse and network frauds stemming from data trafficking (Huang, 2023). AI systems in education rely heavily on collecting and analyzing personal student data to provide personalized learning experiences. This raises significant privacy concerns, as the security of this data is paramount (Maia et al., 2023; Ganesan et al., 2023). Ensuring robust data protection measures and compliance with privacy laws is essential for safeguarding student information (Ganesan et al., 2023).

Bias and discrimination

AI systems can inadvertently perpetuate existing biases if they are trained on unrepresentative datasets or if the algorithms themselves are flawed. This can lead to discrimination in educational settings, where certain groups of students might receive less favorable treatment or biased educational content (Williamson & Eynon, 2020). Addressing these biases requires careful design, continuous monitoring, and adjustment of AI systems. AI systems must operate accurately, especially in assessing student performance and providing feedback (Bohdal et al., 2023). Errors in AI assessments can lead to misjudgments about a student's capabilities and needs, potentially impacting their educational progress. Rigorous testing and validation of AI systems are necessary to ensure their reliability (Ferrara, 2023).

Impact on student-teacher relationship

Using AI, particularly in the form of Intelligent Tutoring Systems (ITS), may alter the traditional teacher-student dynamic. Students may become more reliant on AI for guidance and instruction, potentially diminishing the role of teachers and reducing valuable human interaction (Zawacki-Richter et al., 2019). Maintaining a balance where AI supports rather than replaces human interaction is crucial. Again, while AI tools can enhance educational experiences by providing personalized learning paths and immediate feedback, they cannot fully replicate the nuanced interactions between teachers and students. Excessive reliance on AI could decrease meaningful human engagement, which is essential for emotional support and social skills development. Ensuring that AI complements rather than replaces human interaction is necessary (Kamalov et al., 2023).

Ethical Considerations and Fairness

The use of AI in education raises several ethical issues, including the potential for increased surveillance through monitoring student activities and behaviors. There is also a concern about how decisions made by AI could affect students' educational pathways and outcomes (Cheng, 2023). Ensuring transparency in how AI systems make decisions and allowing human oversight is necessary to maintain ethical standards. Ensuring the fairness of AI systems and that they do not exacerbate existing educational disparities is a significant challenge (Frase, 2023). Errors in AI assessments can lead to misjudgments about a student's capabilities and needs, potentially impacting their educational progress. Rigorous testing and validation of AI systems are necessary to ensure their reliability (Frase, 2023).

Chapter Three

Theoretical Framework

This section provides an overview of the study's theoretical lens. Using grounded theory methodology as its point of departure supports the study's goal of better understanding how Swedish secondary school students perceive fairness regarding AI's potential use and implications in their classrooms based on the empirical data collected.

3:1 Grounded Theory

Grounded theory (GT) originates in the social sciences and focuses on the data that generates it. The research participants' perspectives help explain the phenomenon (Turner & Astin, 2021). Barney Glaser and Anselm Strauss developed a grounded theory research methodology in 1967. The basis of this theory is to create an innovative method that leads to "the discovery of theory from data" (Dunne, 2011, pg., 111). The implication of developing a theory from data is that the researcher focuses not on testing hypotheses drawn from an existing theoretical framework but on creating a new theory from the empirical data collected (Dunne, 2011).

Using grounded theory methodology in this study comes with several benefits. For example, the researcher can systematically generate theories from the data collected. This is a bottom-up approach that allows the researcher to experience real-world situations. Again, generating theories from data gives the researcher intrinsic flexibility, allowing the researcher to change and modify methodologies (Dunne, 2011). In the data collection process, the researcher develops new concepts that will enable the building of theories, which further helps the researcher explain the emerging phenomena. Grounded theory increases the credibility and validity of a study because the theories that emerged were based on actual happenings.

3:2 Features of Grounded Theory

Consequently, grounded theory comprises unique features, such as an inductive research process, theoretical sampling, coding process, and systematic data analysis. One feature of grounded theory is that it involves an inductive research process. An inductive approach implies that the researcher aims not to test a theory but to develop one "and must therefore remain open throughout the study" (Turner & Astin, 2021, p. 286). The researcher can create a theory by systematically collecting and analyzing data on the studied situation. This process includes not considering theoretical preconceptions but considering sampling strategies. Also, it is an iterative process because the data collection procedure, the data analysis, and the theory's development go hand in hand and happen simultaneously (Turner & Astin, 2021; Dunne, 2011). Another feature of grounded theory is its iterative nature: The iterative process includes a procedure where the data collection procedure, the data analysis, and the theory's development go hand in hand and happen simultaneously (Turner & Astin, 2021). The coding process is also a feature of grounded theory. In this process, coding is initially employed in data analysis to break down and label data components. Before merging the codes into more generalized categories, they are compared to gain insight into and explain data variance (Turner & Astin, 2021).

3.3 Limitations of Grounded Theory

Despite the benefits of using Grounded Theory in a study, it has its limitations. The possibility of researchers putting in abeyance their knowledge of relevant theories or concepts and using them later during analysis can be problematic. In GT data analysis, researchers stick to the emerging properties of the data, thus making researchers "suppress their own ideas about what the data means" (Clark et al., A. 2021, p.532). In addition, sometimes advisors/supervisors encourage researchers to articulate the implications of their intended study before collecting data, especially when applying for research funding or writing a student thesis proposal. In such a situation, one is expected to state previous research knowledge, which is not encouraged in Grounded Theory. Another limitation of using the Grounded Theory methodology is that it is painstaking to come up with concepts; however, it is not certain that it develops theories. Transcribing the data is time-consuming, making it difficult for researchers to achieve constant comparison and saturation of data.

3.4 The relevance of Grounded Theory to this study

The inspiration for understanding how Swedish secondary school students perceive fairness regarding AI's potential use and implications in their classrooms was born out of being accepted as an intern to be part of The Missing Teacher In AI: Involving Teachers in the Meta-design of AI to Ensure Fairness project, at the beginning of the 2023 fall semester. The Project focuses on analyzing the benefits and drawbacks of AI-powered digital curriculum. It is intended that educators take part in designing, meta-designing, and using these systems. This will cause systems that are more just and suited to the classroom setting. The Project examines the opportunities and difficulties present by AI-based, digital pedagogical resources. The goal is for educators to participate in the systems' conception, meta-conception, and operation. This should make the systems fairer and more conducive to the classroom setting (Lundin et al., 2023).

In addition, grounded theory can be applied to this qualitative study due to its flexibility. The data collection method, such as open-ended questions in focus group discussions, makes it a good choice for this study. Some of the data was already collected, and the author of this study took part in some data collection sessions, hence the use of Grounded Theory as this study's theoretical framework.

Chapter Four

Methodological Framework

This chapter provides an overview of the qualitative methodology used in this study, including the research design, study area, data collection methods, sampling methods, and research ethics. The study explores how Swedish high school students perceive fairness regarding AI's potential use and implications in their classrooms.

4.1 Research Design

The research design refers to all the methods used to combine the study's components and adequately address the studied phenomenon (Cohen, Manion, & Morrison, 2018). This study employed a single case study design approach to help answer the research questions. A case study design approach includes a comprehensive analysis of a single case (Clark, Bryman, Foster, & Sloan, 2022). Instead of only providing abstract theories or principles, a case study gives readers a distinct example of actual people in actual circumstances, which helps them to grasp the concepts better (Cohen et al., 2018). A case study can help readers understand the link between ideas and abstract principles. Also, an advantage of a case study is that "it observes effects in real contexts, recognizing that context is a powerful determinant of both causes and effects and that in-depth understanding is required to do justice to the case" (Cohen et al., 2018, p. 376). This single case study is both a descriptive and interpretative case study, and it helps to understand Swedish high school students' perception of fairness regarding AI's potential use and implication in their classrooms. An advantage of adopting a case study is that it allows the researcher to examine a small sample to study the phenomenon. It is a descriptive case study in the sense that it presents the research participants' narrative accounts. It is also an interpretative case study in the sense that through the data analysis, the researcher can develop conceptual categories inductively to examine initial assumptions (Cohen et al., 2018). This qualitative study used a case study design to explore how Swedish high school students perceive fairness regarding AI's potential use and implications in their classrooms.

4.2 Sampling

The data used in this study was obtained from The Missing Teacher In AI: Involving Teachers in The Meta-design of AI to Ensure Fairness project. One of the project's goals is to involve teachers in the meta-design of AI to ensure fairness. Six lecturers from the Department of Applied IT, University of Gothenburg, Sweden, organized it, and the Marianne and Marcus Wallenberg Foundation funded it. It is a three-year project that will end in December 2024. This study employed a purposeful sampling due to students' availability and interest in exploring AI in education. This will help the researcher understand Swedish secondary school students' perception of fairness regarding AI's potential use and implications in their classrooms (Creswell & Creswell, 2023). The sample is made up of ten secondary school students.

4.3 Data Collection Method

4.3.1 Interviews

As stated earlier, the data used in this study was from The Missing Teacher In AI: Involving Teachers in The Meta-design of AI to Ensure Fairness project. The data obtained for this thesis study was obtained through semi-structured interviews with secondary school students who have experienced the use of AI in education. This is to say that Swedish secondary school students were the research participants. A semi-structured interview involves the researcher bringing in an interview guide with predetermined questions or topics to cover while maintaining a conversational atmosphere (Bryman, Bell, Reck, & Fields, 2022).

Semi-structured interviews also allow the researcher "to address more specific issues" (Bryman et al., 2022, p. 198). Conducting an interview is not only for the sole purpose of data collection exercise but also involves a social and interpersonal encounter. Using interviews as a data collection method enhances diverse sensory ways in terms of verbal and non-verbal, creating room for spontaneity and making it an essential tool in the hands of the researcher. The researcher used a semi-structured interview to gain more knowledge of the discussed topic through the participants' responses (Cohen et al., 2018). The interview with secondary school students occurred at the Gothenburg University Department of Applied IT. Through interviews, the researcher can explore various issues, producing insights into participants' perceptions of the studied phenomenon—the interview aimed to understand high school students' perspectives regarding the use of AI in education.

4.3.2 Focus Group Discussions.

Ten students interested in exploring the use of AI in education participated in the focus group discussion in The Missing Teacher In AI: Involving Teachers in the Meta-design of AI to Ensure Fairness project. The rationale for using these specific students was that the participants did not have a voice in designing AI technologies. Two focused group discussions were held, and each lasted about an hour. The focus group discussion was audio recorded at Gothenburg University in the Department of Applied IT.

The researcher also used focus group discussions to collect data. Focus group discussions involve a researcher interviewing multiple people about a particular topic or question. This method has long been used in marketing and social science research (Bryman & Nilsson, 2018). According to Cohen et al. (2018), researchers rely on group dynamics to generate collective rather than individual perspectives when discussing the studied phenomenon in focus group interviews. Also, this method allows the participant's perspectives, rather than the researcher's, to shine through when participants converse with one another rather than with the interviewer. The group's interaction gives rise to the data (Cohen et al., 2018). The focus group interview emphasizes a topic the researcher craves in-depth knowledge about. One primary advantage of focus group discussions is that they consume less time and are cost-effective (Bryman & Nilsson, 2018). Another advantage is that the moderator/facilitator (researcher) can take control of the questioning. However, the researcher's presence might produce biased responses (Creswell & Creswell, 2018). Another disadvantage of focus group discussions is that they do not produce/generate measurable or generalizable data (Cohen et al., 2018).

4.3.3 Research Settings

Forty research participants, including teachers, students, principals, and pedagogical developers, participated in The Missing Teacher In AI: Involving Teachers in the Meta-design of AI to Ensure Fairness project. The participants are regarded as indirect users of AI tools; each category comprises ten people. Ahead of the focus group discussions, the researchers invited students to respond to three prototypes and simultaneously create prototypes by giving their perception of the advantages and disadvantages of the prototypes. The prototypes aim to produce an extensive prototype design.

The data was obtained through the focus group discussions (based on the prototype-stimulated discussions) about the students' comparison of two AI systems for individualization from May 2023. The second students' group discussion on implementing AI in education focusing on fairness and equity occurred on August 24th, 2023, at the Department of Applied IT, University of Gothenburg, Sweden. Secondary school students constitute the research population. Out of the ten students interested in exploring the use of AI in education in The Missing Teacher In AI: Involving Teachers in the Meta-design of AI to Ensure Fairness project, only six students turned up for the two focus group sessions. To safeguard the participants and prevent harm, their names were intentionally withheld in this thesis. Instead, they go by pseudonyms like student participant one. Participants in the first group interview will be referred to as Participants 1, 2, and 3, while participants in the second interview will be referred to as Participants 4, 5, and 6.

4.3.4 Data Analysis Procedures

Using Grounded Theory as the theoretical framework of this study has not only helped to guide the data collection method but also influenced the data analysis. Consequently, the data analysis went "through a systematic series of analyses, including coding and categorization" (Cohen et al., 2018, p.539).

Qualitative data analysis helps to make sense of the collected information by classifying and interpreting the data in light of the participant's perceptions of the situation and drawing attention to recurring themes, patterns, and regularities. This is to say that this process includes organizing, accounting for, and explaining the data (Cohen et al., 2018). Qualitative data analysis requires the researcher's immersion in data to uncover, interpret, and understand the participants' experiences by delving deeply into the collected information. This discovery process also allows the researcher to stay connected to the data and gain evidence-based knowledge of the studied phenomenon (Hennink et al., 2011).

Furthermore, using interviews as a data collection tool generates textual data, such as written scripts. This study's approach to data analysis follows the principle of grounded theory, which develops theories/categories inductively from textual data. Grounded theory involves an iterative data analysis process, producing a robust theoretical account firmly based on empirical data (Hennink et al., 2011).

Research Participants:

Using the purposive sampling method, ten secondary school students aged eighteen and nineteen from a particular secondary school in Gothenburg City, Sweden, formed the research participants. The participants were recruited based on their willingness to participate in the study and interest in exploring AI tools in education.

In this study, the data analysis took the following process:

Data Familiarization and Transcription: The data analysis was text-based, using transcripts of interviews from participants, initially in Swedish. This was done by listening to the interview transcript multiple times to become familiar with it and jotting down initial observations and thoughts before transcribing the audio interview recording using Microsoft transcription and putting it verbatim in Word format. For example, the researcher observed how the main interviewer conversed with the students about other aspects of life, creating a relaxed atmosphere for the students. Besides serving the students light refreshments, the main interviewer always asked the participants if they understood the questions before proceeding to the next group discussion stage. However, the first translation was to produce a verbatim translation in Swedish, the original language, before making a second translation in English. The transcribing and summarization of the data will enable the researcher to analyze the data.

Step Two: Data organization/initial coding.

Another step that helps establish the findings' results is the data organization/initial coding process. This process focuses on organizing the transcript for easy reference. For example, the participants were neither labeled nor numbered; instead, the focus was on the discussed subject matter to capture the participants' statements. This study employed grounded theory's three distinct coding strategies—open, axial, and selective coding. These coding strategies aim to break down data and enable the researcher to understand the studied phenomenon better. For example, in open coding, the researcher searches for data for analytical units that code meaning, emotion, behavior, and events. While coding, the researcher generates concepts and establishes connections between them. This step uses the initial text/open coding to compare the codes. To code the material, the researcher highlighted essential words or sentences and assigned them unique codes to represent their meaning (Cohen et al., 2018). Also, in this segment, the initial text coding was done by assigning labels to segments of text that relate to the specific topic and concept. One of the main aims of open coding is to facilitate concepts that represent data and phenomena and to achieve this aim; data is initially disentangled/segmented (Flick, 2006). According to Hennink et al. (2011), "coding is not simply a clerical task of labeling data; it also involves interpretation" (Hennink et al., p.226. 2011). After the initial coding, the researcher divided the transcript into manageable segments of the text by putting them in long sentences and paragraphs to later apply the codes created to the relevant part of the text (Cohen et al., 2018).

Table 1

Initial coding took this format derived from two topics

Topic	Examples from the data	Highlighted Essential words.	Description of Categories	Codes
Student's comparison of two AI systems for individualization	There are many teachers there who control and put in much the teacher can choose if they want AI to base their. As a teacher, you can sort of control what should be done… One is more independent. It changes depending on the teacher. AI takes on the role of a teacher, sort of planning the tasks based on the student's interests..	Teachers control of AI system. An AI system can function independently. Teachers preparedness. New teaching method.	AI use in school environment Functionality of AI Teachers' Competence in AL Capability of AI Easier teaching tasks	Teachers' new roles/benefits of AI Pedagogical shift
	Because now they get everything on a plate. University has only had this AI system as their source of information, then it becomes problematic because then they get a lot of information on a plate. Yes, so you only get one source of information and that's it. This system can be abused. You can easily become this controlling state.	New learning method Skeptical about AI	Critical about new learning method	Ethical concern/Fairness

	There should be slightly stricter laws around such. What company can get a monopoly on this? And so they control the entire school system. How dangerous		Critical about AI use	Ethical concern

Figure 01 From texts to memos to codes

Topic	Examples from data	Highlighted Essential words. Description of categories	Description of Categories	Codes
AI systems in education with a focus on fairness and equity	They (students) can only get access to simpler tasks that AI consider to be at their level so it has to be adopted according to their development as well	New learning method	Easier teaching tasks	Pedagogical shift
	Those students with concentration problems, for example, Attention Deficient Hyperactivity Disorder (ADHD), will be treated unfairly. These students do something else when they are bored and then return to their school work and do it all over again. Coming in contact with AI it will reflect an unserious student	Possibility of AI bias	Critical about AI	Disdvantage of AI technology

Figure 02

Step three: Constant comparison: This process necessitates a constant comparison of the coded phenomenon by the researcher to build a theoretical understanding of the category. The researcher also looks for emerging contrasts between categories and codes (Bryman et al., 2022). Open, axial, and selective coding all use the strategy of continual comparison in their implementation. To ensure that the categories match the data, the researcher constantly analyzes new data with current data and categories (Cohen et al., 2018). For example, after the second group discussion, the researcher compared the data with existing codes from the first group discussion on the student's comparison of two AI system prototypes for individualization. The researcher identified similarities in terms of AI taking on the role of a teacher and planning the tasks based on the student's interests, which indicates that the new data fit into the existing categories.

Step Four Segmentation of the initial coding:

Axial coding segments initial coding and establishes connections between categories and codes by organizing them around central categories. These steps often intertwine and converge during implementation as the theory development process unfolds iteratively (Cohen et al., 2018). After the open coding phase, this stage involves combining data in new ways to establish links between categories. Codes are linked to contexts, consequences, patterns of interactions, and causes (Bryman, 2016). For example, this stage involves linking codes such as teachers' control of the AI system to teachers' new roles/benefits of AI. This linkage allows the researcher to identify central categories such as pedagogical shifts.

Step Five: Develop Categories

The grounded theory naturally emerges from the data through theoretical sampling, coding, constant comparison, and data saturation (Cohen et al., 2018). However, in this stage, similar codes are put into well-defined categories. This stage employs the use of selective coding to identify a central code. This step often intertwines and converges during implementation as the theory development process unfolds iteratively (Cohen et al., 2018). When coding is complete, the researcher has reviewed all the data, adding new codes, categories, and subcategories as needed and merging codes where applicable. By adopting the inductive data analysis process, the researcher can quickly identify basic types, patterns, and relationships and draw meaningful findings and concepts from the data (Cohen et al., 2018). This step also led to a coding system with categories. For example, these categories include student concerns about AI and ethical concerns about AI data analysis, to mention a few. Example from Figure 01 depicts the development of categories: The researcher developed categories from the initial coding by breaking the data into smaller segments by identifying key phrases such as "teachers control of AI system." The next stage was the identification of similarities in the student discussion on AI for individualization and AI systems with a focus on fairness and equity. Segmentation linked codes such as teachers' control of AI system to teachers' new roles/benefits of AI, bringing it into categories like a pedagogical shift. The last stage is to develop categories like the pedagogical shift to a well-defined category like ethical concerns about AI.

Memo writing

Having a memo as a researcher helps to generate concepts and categories. A memo is a researcher's writing note that helps the researcher "pierce different themes together under a larger thematic code" (Bryman et al., p. 527, 2022). This memo contains the researcher's record of the meaning of terms like AI fairness, the possibility of AI bias, teachers control of AI system to mention a few. Memo is also a guide for putting together thematic codes such as pedagogical shift and ethical concern of AI use in education.

Memo for AI usage

After listening to the focus group discussion on students comparing two AI systems prototypes for individualization, the researcher's memo was able to outline the concept of AI use in the school environment. Using AI technology in the classroom has its positive and negative sides. AI usage features include: AI technology can improve student learning outcomes, it reduces teachers' workload, and it can be biased against students with disabilities.

4.4.4 How the categories were achieved

Developing concepts

This study employed grounded theory's three distinct coding strategies: open, axial, and selective coding. These strategies aim to break down data and enable the researcher to understand the studied phenomenon better. Since the data was text-based, the researcher transcribed the focus group discussion from Swedish to English and analyzed the comments line by line based on the research questions. The focus group discussion on students' comparison of two AI systems for individualization and fairness and equity of AI systems in education data was organized and coded using the rounded theory's three distinct coding strategies, which include open, axial, and selective coding.

The process	First step Open coding
Excerpts from the focus group discussion on Student's comparison of two AI systems for individualization data Excerpts from the focus group discussion on fairness and equity of AI systems in education	The meaning, events, emotions generated to identify the topic includes: There are many teachers there who control and put in much the teacher can choose if they want AI to base their." "As a teacher, you can sort of control what should be done… One is more independent. It changes depending on the teacher." "AI takes on the role of a teacher, sort of planning the tasks based on the student's interests" "They (students) can only get access to simpler tasks that AI consider to be at their level so it has to be adopted according to their development as well" "Those students with concentration problems, for example, Attention Deficient Hyperactivity Disorder (ADHD), will be treated unfairly. These students do something else when they are bored and then return to their school work and do it all over again. Coming in contact with AI it will reflect an unserious student"
Examples of highlighted essential words	The essence of identifying keywords and phrases is to capture the essence of the data. For example: "Teachers control of AI system." "An AI system can function independently." "Teachers preparedness." "New teaching method." "Possibility of AI bias" "Critical about AI technology
Describing the categories	The potential categories that these essential words might fit into include: "AI use in the school environment" "Functionality of AI" "Teachers' Competence in AI" "Capability of AI" "Easier teaching tasks" "Ethical implication of AI"
Codes	The above descriptions are summarized into specific codes such as "Teachers' new roles/benefits of AI" "Pedagogical shift" "Ethical ethical implications of AI in education"

The process	Second Step Axial coding
The researcher re-organizes the initial codes by establishing connections, often around central categories.	The codes are linked to contexts, consequences, patterns of interactions, and causes. For example, “Teachers control of AI system” might be linked to “Functionality of AI” and “Teachers’ Competence in AI.” Also, “Pedagogical shift” might be a central category that can form several initial codes.

The Process	Third Step Selective Coding
This process brings to light the refining of the categories and identifying a central code that represents the core of the research findings	The researcher identifies a central code that ties all categories together. For example, “Ethical concern/Fairness” might be a central code that links several categories about AI use in education.
	The researcher groups similar codes such as “Teachers control of AI system” “Functionality of AI” “AI use in school environment” “Easier teaching tasks” into a well defined categories and new codes such as “Teachers’ new roles/benefits of AI” “Pedagogical shift”
	Through this coding system the researcher came up with clear categories. For example: “Student concerns about AI” “Ethical concerns about AI data analysis”

4.5 Ethical Considerations

The data for this study were obtained through focus group discussions in the Missing Teacher In AI: Involving Teachers in the Meta-design of AI to Ensure Fairness project. Participants consented to participate in the project. The researchers followed the principles of ethical conduct, such as informed consent, non-maleficence, anonymity, and confidentiality.

Informed consent: The researchers provide detailed information about the project, and participants will not be coerced into participating. Participation is voluntary, and students have the right to withdraw from the study at any time. Informed consent involves respecting "the right of individuals to exert control over their lives and to take decisions for themselves" (Cohen et al., 2018, p.123). Each participant signed the consent form before participating in the project.

Non-maleficence refers to the situation where the researchers safeguard against conduct or actions that will harm the participants, such as physical injury, emotional damage, and so forth.

Anonymity and confidentiality: As earlier stated, to ensure anonymity, the researcher's participants' information did not reveal their identity, hence the use of pseudonyms like student participant one and so on. Participants in the first group interview were referred to as Participants 1, 2, and 3, while participants in the second interview were referred to as participants 4, 5, and 6. The research participants were also assured confidentiality by not revealing their individual identities to anyone or making individual identities traceable.

Chapter Five

Findings

Presentation of Research Results

This chapter focuses on the study findings regarding Swedish secondary school students' perceptions of fairness regarding AI's potential use and implications in their classrooms. The data analysis led to the following categories: pedagogical shift, ethical implications of AI in education, and individualized learning.

5.1 Pedagogical Shift

The data shows that AI could assist teachers in providing extra support in lesson preparation. The students expressed that AI technologies can enrich the educational experience without replacing teachers, who are an essential part of learning. However, the students also articulated that AI cannot easily replicate the human aspects of education, such as knowing when a student is facing a distraction or needs a pause from studies. The students said that AI in education can reduce teachers' responsibilities, thus making teachers focus on teaching the subject matter and providing guidance. The students also agreed that AI can alter teachers' ability to manage classrooms and redefine teachers' traditional classroom role in selecting and adapting tasks for students.

Some participants commented on teachers' new roles as a result of using AI in education in this manner:

"The AI takes on the role of a teacher by sort of planning the tasks based on the student's interests." Student Participant 1

Student Participant 2 adds, *"Teachers can decide to use AI to generate assignments/school work based on student's interests and future plans."*

"Use it as a tool to facilitate learning because how do you do it? Use this system, which under facilitates, and this thing about doing a home exam is no longer on the map. You can not do homework anymore, then you get over it in another way."

"Now it's more about an AI system that puts in tasks and puts out tasks based on what level the students are in"

"While Student Participant 3 added *" You can also ask the AI to help you. "*

Participant 4 puts it this way: *They can only get access to simpler tasks that AI consider to be at their level so it has to be adopted according to their development as well*

Moving on to students' roles, key findings illustrate that the impact of AI in education is not only peculiar to changes in teachers' traditional teaching but also to students' new learning methods. All the student participants agree that AI in education will impact how they learn. Some students commented on students' method of learning in this manner:

"I think all students will be doing different things at different levels." Student Participant 2

In agreement with this statement, Student Participant 3 added:

" Yes, students will be working with different tasks at different levels."

"In the AI system, students will be working on different tasks." Student Participant 1.

Student Participant 2 went further to explain that *"But on the other, the AI will adapt bright/difficult tasks to all students, regardless of whether you can do it or not"*

Student Participant 2 explained that

"Because you are working on an individual task, you can no longer ask your friend about it."

This statement is corroborated by Student Participant 3 in this manner:

"As you usually are, if you understand that task, you know what you are doing because everyone is different. You can not argue."

Student participant 3 added that :

"It is excellent for the very talented students. Those who are not so good will not be at all; there is no one; you need someone in."

The students explore the balance between maintaining group processes in education alongside individualized learning. They acknowledge that while individualized learning is essential, the group dynamics and what students do together as a group are equally vital

The students highlighted the danger of generative AI use in this way:

" But if a student from first year until the end of university studies has only had this AI system as their source of information, then it becomes problematic because then they get a lot of information from one plate" Student Participant 1

In support of this Student Participant 2 added:

"That student has not learned anything."

5.2 Ethical Implications of Fairness of AI in Education

The students' perspectives reflect the advantages and disadvantages of using AI in classrooms. Their perspectives show a need to design AI tools that consider algorithmic bias and consent issues. The use of AI in Swedish secondary school classrooms has advantages, such as the ability to monitor student performance, which can lead to improved learning outcomes.

A downside of AI in the classroom is privacy and ethical concerns, especially when faced with an unfair, biased judgment against certain groups, such as people with attention deficit hyperactivity disorder (ADHD). AI might assign more manageable tasks to some students and more difficult ones to others. Such bias can impact students' grades and learning outcomes. This is to say that there is a fear of AI making incorrect judgments.

Student participant 4 highlighted this in this manner:

"*This student who has worked hard may have studied for a very long time while all the students just did not work as hard as the other students and got the easier text, so maybe you don't get the same grade. That's totally fair, right?"*

In the student group discussion on comparing AI systems on individualization, some students commented on the issue of ethical use of AI in education in this manner:

"This system can be abused. You can easily be in this controlled state. They check how long you sit; how can you check?" Student 3

Student 2 added:

"What company can get a monopoly on this? And so they control the entire school—a school that develops these programs for another company. Then they have control over the school. We look out for the school. How dangerous."

There is the risk of an AI system fostering a controlling environment within educational settings. A company could gain a monopoly on educational AI systems, thereby controlling an entire school system. There is a political concern that AI in schools could be used as a tool for propaganda.

One of the significant concerns raised by the participants is that the potential for an AI system to be the sole source of information for students can limit their perspectives.

Student Participant 1 says: *"But if a student has only had this AI system as their source of information from the first year until the end of university studies, then it becomes problematic because then they get a lot of information from one plate."*

Again, one area of concern is who will have access to AI-collected data and how it will be used.

Participants are worried about how students, particularly those with (ADHD) or learning difficulties, may be affected by new technologies. While they agree that technology may enhance education, they also worry that it might lead to unequal treatment if not appropriately controlled. In this regard Participant 5 in the focus group discussion on AI Fairness explained it as follows:

"Those students with concentration problems, for example, Attention Deficient Hyperactivity Disorder (ADHD), will be treated unfairly. These students do something else when they are bored and then return to their school work and do it all over again. Coming in contact with AI it will reflect an unserious student"

Participants 6 puts it this way: *"Yes if you think that AI decides which tasks will go to each student? It is known that different students in a classroom have different conditions and different ways of learning things".*

This further supported by Participant 4 *"One and the same assignment including the information and not all students have an easy time learning this text, but you have to get help and the problem is that not all students can get help"*

AI unfairness is not only limited to students who currently have learning disabilities but also to students who have received treatment and longer have such learning problem. Participant 6 explains it in this manner: *"For example the teacher knows that a student have ADHD, maybe* *he shows a certificate/evidence of his learning disorder earlier but have now received treatment. The AI technology will still program the student as having learning difficulties which will not be fair to him"*

The participants confirmed that AI systems often require collecting and processing large amounts of student data, raising concerns about privacy and security. There's a risk of sensitive student information being exposed, misused, or breached sensitive student information. Student participants 2 and 3 complained about surveillance cameras as follows:

"Not having the surveillance in the classroom"

This statement is supported by Student participant 3: *"Students do not want any kind of monitoring at all in the classroom. Yes, in the classrooms, yes, exactly, but they still have some surveillance cameras in corridors and things like that"*

On the contrary, Student Participant 1 disagreed on the usefulness versus the invasiveness of such a system, which was communicated in this manner:

"There is a big hole in the middle of the school where people tend to throw things, which *is a serious issue. If someone drops a pumpkin at some point, the surveillance TV will capture it. It is a safety thing. So I would understand why they did that"*

Student Participant 3 went further to comment that:

"But there you get to feel like it is a prison that you need to be monitored because this way you think you are free."

Another concern raised by the students is the ethical implications of monitoring, questioning its role and whether it turns the educational setting into a "factory" or even a surveillance state reminiscent of a book. The development of AI in education raises ethical questions about who controls the technology and for what purposes. The risk of commercial interests overriding educational goals is a significant concern. The idea of being under perpetual scrutiny by AI raises concerns about privacy and the psychological impact of being watched continuously. Participants expressed regarding

"This student who has worked hard may have studied long. With all the students just did not work as hard as the other student and got the easier text, maybe you don't get the same grade. That's totally fair, right?"

Chapter Six
Discussions of the findings

How do Swedish secondary school students perceive fairness regarding the potential use and implication of artificial intelligence in their classrooms?

6.1 Discussions of the findings

The findings of this study shed more light on how Swedish secondary school students perceive fairness regarding the potential use of AI technology in their classrooms. Students gave two viewpoints of fairness, thus reflecting the complexities of their views. These different viewpoints show how these students think about the potential impact of AI, either making things fairer or worsening existing inequalities. This study has also found that despite Swedish secondary school students being optimistic about AI's potential to improve learning outcomes, they also express serious concerns about privacy, bias, and the ethical use of AI.

There is interest and hope in using AI in education due to AI's potential to change how students learn and teachers teach. Using AI in education has benefits and challenges; hence, there is a need to exercise caution and awareness of the significance and ethical challenges that need to be navigated. Using the theoretical orientation of grounded theory, the study results suggest that the Swedish secondary school students presented fairness in using artificial intelligence in their classrooms from "both sides of the coin." This is to say that fairness in using AI is discussed from two angles, which includes what makes it fair and unfair. The first angle deals with the fairness of AI in education, and the second one deals with AI's unfairness in education. It is presented in a tabulated format to understand the participant's perception properly.

Fairness of AI in education	The unfairness of AI in education
The participants acknowledge that in the absence of experts, AI can assist teachers by providing additional support, thus enhancing the educational experience.	For instance, when AI assigns more manageable tasks to some students and more difficult ones to others, it might impact their grades and learning outcomes.

Using AI in education makes it fair when the valuable insights ITS provides are transparent in reaching conclusions based on AI recommendations.	Constant monitoring might affect students, particularly those with learning disabilities like ADHD.
Using cameras to monitor students might be necessary for school safety, but schools must be transparent about data use and for what purpose.	Students acknowledge that collecting sensitive data creates the potential feeling of being in a "prison" due to excessive surveillance.
When an AI system is designed to address students' diverse challenges and considerations,	There is the risk of AI systems perpetuating algorithmic bias, leading to unfair treatment, by not adequately accounting for students' diverse challenges.

What are Swedish high school students' perceptions of the impact of artificial intelligence in their classrooms?

The above findings state what makes AI fair and unfair when envisioned to be used in education. There is the fear that AI might not keep student information safe, and an unauthorized person can accidentally make the data available to the public. Moreover, AI could be unfair by making decisions based on wrong ideas learned from the data it was trained on. Using AI in education needs to work correctly for everyone to ensure that it is not unfair and hurts society instead of helping (Kamalov et al., 2023; Popenci & Kerr, 2017).

Students' perceptions of using AI in education also fall into two categories. Category one includes the benefits of education. One benefit is the promise of individualized learning. AI has the potential to customize students' learning that suits their needs and learning styles. The study findings point out this approach's advantages and corroborate the literature reviewed that the Intelligent Tutoring Systems, which are the engine behind training and developing students' skills, are designed to promote personal teaching and enhance learning based on students' learning abilities. It helps students learn at their own pace and simultaneously delivers feedback to students (Ganesan et al., 2023; Jiang, 2022; Kamalov et al., 2023).

The study findings also point out that the benefits of AI in education are not only seen in the aspect of its potential to tailor a student's learning pattern; it also includes enhanced student engagement, data-driven insights and intervention, automation of administrative tasks, improved accessibility, and lifelong and professional development. (Maia et al., 2023; Zawacki-Richter et al., 2019; Kamalov et al., 2023; Jiang, 2022). Through the lens of grounded theory, the analysis suggests that the research participants acknowledged that using AI in the classroom would redefine teachers' traditional roles. It is not only teachers who dispense knowledge and facilitators of learning. Instead, their new roles involve putting more attention to pedagogical strategies and student engagement than administrative tasks. Despite AI's potential to customize students' learning experiences to their individual needs, special needs students, such as ADHA, should not be overlooked.

The second category concerns the challenges of using AI in education. Through the lens of grounded theory, the findings revealed that AI in the classroom has great promise, but many questions and obstacles still need to be answered. There are worries concerning the ethical use of AI technology are paramount. Managing data privacy, security, and algorithmic bias is necessary to guarantee fair and ethical deployment.

The challenges of AI in education include the security and privacy of student data, bias, changes in student-teacher dynamics, decreased human engagement, bias, and ethical consideration. The privacy concern hinges on the ability of AI to ensure data protection measures and compliance with privacy laws since AI depends on collecting and analyzing students' data to provide tailored learning experiences (Zawacki-Richter et al., 2019). AI cannot replicate human interaction, and the reliance on AI guidance and instruction reduces human interaction. There is the tendency for AI systems to be biased and unfair if the algorithm is faulty; it can perpetuate inequalities, leading to discrimination (Ma & Jiang, 2023).

6.2 Limitations

One significant limitation of this study is that it focuses on students' perspectives on using AI in classrooms. It does not include the perspectives of teachers, school principals, or AI designers, to mention a few. Getting the viewpoints from other stakeholders might have given more nuanced perspectives on using AI in education. In addition to not including interviews with different stakeholders, the study result was based on a small sample population because some of the research participants forgot the scheduled date for the group discussion or had other engagements that might have affected the data collected. Having more research participants might have added more richness to the data and comprehensiveness of the study. The research participants were from a particular secondary school in Gothenburg. Adding two to three other high schools would have provided more insights into the studied phenomenon.

Consequently, the nature of the study, its design (case study), and the findings are limited to a particular high school in Gothenburg and not applicable to other school contexts, making it non-generalizable. Another limitation has to do with language translation. The original data was in Swedish, and some meaning might have been lost when translating the data into English.

Chapter Seven

Conclusions and Implications

This chapter concludes the study. It also suggests a further study.

As mentioned earlier, the motivation to carry out this study was the internship opportunity in the Missing Teacher In AI: Involving Teachers in the Meta-design of AI to Ensure Fairness project. One of the aims of this project is to ensure that the secondary users of AI in education, including teachers, principals, students, and pedagogical developers, are involved in the design of AL tools to ensure fairness in using these tools. The study contributes to our understanding of students' perception of fairness regarding the use of AI in schools, which in turn could be helpful to to pedagogical developers in terms of designing AI tools to ensure fairness for all users.

The current study aimed to understand Swedish secondary school students' perceptions of fairness regarding using AI in their classrooms. The two major questions that guided this research are as follows:

How do Swedish secondary school students perceive fairness regarding the potential use and implication of artificial intelligence in their classrooms?

What are Swedish secondary school students' perceptions of the impact of artificial intelligence in their classrooms?

Findings from the reviewed literature and analysis using grounded theory theoretical framework found that using AI technologies in Swedish secondary school classrooms presents challenges and can be important in enhancing fairness in education. AI technology can transform education with flexibility and customization and streamline administrative processes, thus contributing to a much fairer educational environment. However, the emerging issues of algorithmic bias, the need for algorithmic transparency, and the imperative for ethical oversight highlight the complexities of ensuring fairness in the age of AI.

Recommendations for further studies

Based on the findings of this study, exploring the use of AI in Swedish secondary school classrooms reveals the interaction between technical advancement and pedagogical methods, which creates a fertile ground for academic inquiry. In addition to illuminating pedagogical adjustments, ethical ramifications, and the possibility of personalized learning using AI, this study opens the doors to numerous further studies. These recommendations attempt to fill the gaps left by the present research and discover more about AI's role in schools. The ethical concerns highlighted by this study underscore the essence of developing robust ethical frameworks and policies to guide AI's use in education. Eliminating bias in AI use in education is an important issue for future research. Future studies could focus on creating and implementing such frameworks, including data privacy, consent, algorithmic transparency, and bias prevention. Future research should consider students' perspectives and needs when designing and implementing AI educational tools. Studies could investigate student attitudes towards AI in learning, how AI can enhance student engagement and motivation, and the types of AI features that students find most beneficial for their learning. As a suggestion for further research, there should be an avenue to explore new dimensions of AI in education to ensure a comprehensive understanding of its long-term impacts. There is a need for longitudinal studies that track the long-term effects of AI use in classrooms on students' academic performance, social skills, and emotional well-being. Such research could provide valuable data on the sustainability of AI's educational benefits and its impact on students' development.

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Appendix

Informed Consent Form

University of Gothenburg

Information Till Deltagare

Vad handlar studien om?
Denna information gäller forskningsprojektet: *The missing teacher in AI: Involving Teachers In Metadesign of AI to Ensure Fairness*. Projektet bedrivs av en forskningsgrupp vid Göteborgs universitet på Institutionen för Tillämpad IT. Syftet med projektet är att undersöka vilka följder användning av artificiell intelligens, AI, kan få i skolan och hur AI kan stödja en likvärdig skola och agera rättvist.

Hur kommer studien att genomföras?
Expertgrupper bestående av rektorer, verksamhetsutvecklare, lärare och elever kommer att delta i workshops för att undersöka och ge förslag på hur AI i digitala läromedel bör designas för att de ska agera rättvist. Detta görs genom olika aktiviteter som till exempel diskussioner, dilemman och designarbete. Aktiviteterna kommer att dokumenteras med ljudinspelning och i vissa fall med videoinspelning.

Hur kan jag få information om resultaten av studien?
Du är alltid välkommen att kontakta oss i projektet (se kontaktuppgift nedan) för att diskutera projektens resultat. Information och publikationer från projektet kommer att finnas tillgängliga på webbsidor som tillhör Göteborgs universitets och Institutionen för Tillämpad IT.

Vad kommer att hända med insamlat material?
Alla uppgifter som samlas in kommer att hanteras i enlighet med den allmänna dataskyddsförordningen (EU 2016/679). Inspelningar och material från studien kommer att lagras på ett sådant sätt att inga obehöriga personer kan få till gång till dem. Den personliga integriteten hos deltagarna kommer att skyddas och enskilda personer kommer inte att kunna identifieras i publicerade rapporter.

I enlighet med den allmänna dataskyddsförordningen har du rätt att begära tillgång till de uppgifter som samlats in om dig i studien och att begära att de raderas. Om du vill ha tillgång till dina uppgifter, kontakta dataskyddsombud vid Göteborgs universitet (dataskydd@gu.se), som också kan kontaktas om du har funderingar kring hur dina uppgifter hanteras. Om du är missnöjd med hur dina personuppgifter hanteras har du också rätt att rapportera dina problem till Integritetsskyddsmyndigheten, som är den aktuella tillsynsmyndigheten.

Deltagandet är frivilligt
Ditt deltagande i denna studie är frivilligt. Det är upp till dig att avgöra om du ska delta i denna studie eller inte. Om du väljer att delta blir du ombedd att underteckna ett samtyckesformulär. När du har registrerat samtyckesformuläret är du fortfarande fri att återkalla när som helst och utan att ange något skäl. Om du vill dra dig ur studien, kontakta forskarna i projektet.

Kontaktuppgifter
Marie Utterberg Modén, marie.utterberg@ait.gu.se
Projektledare: Professor Johan Lundin
Institutionen för Tillämpad IT, Göteborgs universitet

Samtycke till att delta i projektet

Jag har fått muntlig och skriftlig information om studien och har haft möjlighet att ställa frågor. Jag får behålla den skriftliga information som getts till mig.

- Jag samtycker till att delta i studien som ingår i projektet, *The missing teacher in AI: Involving Teachers In Metadesign of AI to Ensure Fairness*.
- Jag samtycker till insamling och hantering av forskningsdata på sättet som beskrivs i informationen till deltagare.

Plats och datum	Underskrift
	Namnförtydligande