School Teachers' Awareness and Perceptions of Artificial Intelligence in Science Education: A Study of Secondary School

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Abstract

This study investigates the awareness and perspectives of secondary school teachers regarding the incorporation of Artificial Intelligence (AI) into science education. A survey was administered to 50 secondary school teachers in urban settings to evaluate their understanding of AI, opinions on its implementation in science education, and preferences for AI applications across different science topics. The outcomes reveal an overall positive perception and awareness of AI among teachers, underscored by a significant interest in AI education. These findings provide meaningful insights into the existing preparedness of teachers to adopt AI in secondary science education, laying the groundwork for future discussions on efficacious integration approaches and initiatives for professional development.

Keywords: Artificial Intelligence, Science Education, Secondary School

Introduction

In the rapidly evolving landscape of education, the integration of technology has become imperative, with artificial intelligence (AI) emerging as a transformative force (Brown & Green, 2019; Smith et al., 2020). The application of AI in educational settings holds the promise of revolutionizing traditional teaching methodologies and providing unique opportunities for personalized and interactive learning experiences. As the realms of technology and education converge, understanding the perceptions and readiness of educators becomes crucial to effectively harnessing the potential of AI.

Secondary science education, as a foundational component of a child's learning journey, stands to benefit significantly from the advancements in AI. However, the successful integration of AI in secondary science classrooms hinges on the awareness and perceptions of educators. This study aims to shed light on the awareness and perceptions of secondary school teachers toward AI and its application in science education, building upon the findings of previous research that emphasizes the pivotal role of teacher perspectives in shaping the success of technology integration in education.

Background

The pervasive influence of artificial intelligence (AI) across various sectors, ranging from healthcare to finance, is undeniable, signifying a paradigm shift in how we approach and interact with technology (Jha et al., 2021). In the realm of education, AI presents a transformative capacity to address diverse learning styles, adapt to individual student needs, and offer real-time feedback (Brown & Green, 2019). This potential impact is particularly noteworthy for secondary school teachers, whose pivotal role in shaping a child's academic foundation positions them at the forefront of educational advancements.

The convergence of AI and science education creates fertile ground for the exploration of innovative teaching methods, providing educators with opportunities to employ dynamic approaches that captivate and engage young learners (Luo et al., 2019). However, the successful implementation of AI necessitates a robust foundation of awareness and positive perceptions among secondary school teachers. This foundation is critical for ensuring a seamless integration of AI into the educational landscape while aligning with overarching educational objectives. As educators stand at the crossroads of technology and pedagogy, understanding their perspectives on AI becomes imperative for harnessing its potential to enhance the educational experience.

Purpose of the Study

This research seeks to investigate the awareness and perceptions of secondary school teachers concerning AI and its application in the context of science education. By understanding teachers' perspectives, this study aims to contribute valuable insights to the ongoing discourse on AI integration in secondary education. The findings are expected to inform educational policymakers, curriculum developers, and teacher training programs, fostering a conducive environment for the effective use of AI in secondary science classrooms.

Research Questions

1. To what extent are secondary school teachers aware of AI and its capabilities?

2. What are the perceptions of secondary school teachers toward the application of AI in science education?

3. How do secondary school teachers perceive the potential advantages and disadvantages of integrating AI in secondary science education?

Significance of the Study

This research holds considerable significance within the broader landscape of educational technology and advancements in pedagogy. The valuable insights obtained from delving into teachers' awareness and perceptions regarding AI in secondary science education are poised to shape strategies for professional development, curriculum design, and policymaking. The overarching goal is to actively contribute to the continuous endeavours aimed at cultivating an educational environment that is well-prepared for the future, leveraging the advantages offered by AI technology.

As we embark on this exploration of the intersection between AI and secondary science education, it is done with the recognition that the findings will act as a catalyst for positive change. This, in turn, is anticipated to propel education into a new era characterized by innovation and inclusivity, ensuring that educators and students alike are equipped to navigate and thrive in a technology-enhanced learning landscape.

Methodology

Research Design

To examine the awareness and perceptions of secondary school teachers regarding the integration of artificial intelligence (AI) in science education, a cross-sectional survey design was employed in this study. The survey was structured to collect quantitative data, specifically focusing on teachers' understanding of AI, their views on AI in science education, and their preferences for AI applications across various science units.

Participants

The survey engaged a total of fifty (50) secondary school teachers. The participants were specifically selected from urban schools, ensuring a representation of the diverse educational settings within an urban context. The demographic composition encompassed 25 male teachers and 25 female teachers.

Tools and Techniques

The survey instrument was designed to capture essential information regarding teachers' awareness and perceptions toward AI in the context of science education. The survey comprised three main sections:

1. AI Awareness

Participants were asked to rate their level of awareness of AI on a 4-point Likert scale. The scale ranged from "strongly positive" to "strongly negative," allowing for nuanced responses.

2. Perceptions of AI Education

This section explored teachers' perceptions toward AI education, including their interest in AI education, beliefs about the applicability of AI in school education, and perceptions of AI bringing positive changes to traditional education. Responses were measured on a 4-point Likert scale.

Table 1

Items of Tool

Sl. No	Items
1	I possess knowledge about AI
2	AI development changes the way we live
3	AI research and development skills are necessary for everyone
4	Need for teacher training related to AI
5	Voluntary participation in teacher training related to AI
6	I am interested in AI education
7	AI should be applied in school education
8	AI brings positive changes to traditional education
9	What is the role of an AI teacher
10	Direction of AI education in Secondary schools
11	The key aspect of AI education is
12	At what age is AI education first applied
13	Advantages of applying AI in Secondary science education
14	Disadvantages of applying AI in Secondary science education

Data Collection

The survey was administered offline to the participating teachers. Each teacher received a printed copy of the survey, ensuring confidentiality and anonymity. Clear instructions were provided along with the survey forms, and participants were encouraged to respond honestly. The survey collection period extended over 2 months, allowing sufficient time for teachers to complete and return the paper-based questionnaires.

Data Analysis

The information gathered from the responses in the survey underwent descriptive statistical analysis. This analysis aimed to extract meaningful insights into the awareness and perceptions of secondary school teachers regarding the integration of artificial intelligence (AI) in science education.

Descriptive Statistics

Descriptive statistics were applied to succinctly outline the key features of the dataset. Survey responses were categorized into four groups: "strongly agree," "agree," "disagree," and "strongly disagree." Percentages were calculated for each response category, offering a clear and concise representation of teachers' perspectives.

AI Awareness

Within the AI awareness section, an examination was carried out on responses to questions related to teachers' awareness of AI. Percentages were calculated for each question, categorizing responses into "strongly agree," "agree," "disagree," and "strongly disagree." The findings are detailed in Table 2, providing a comprehensive summary of teachers' perspectives on AI awareness.

Perceptions of AI Education

The segment focusing on perceptions of AI education encompassed inquiries into teachers' interest in AI education, convictions regarding the relevance of AI in school education, and views on AI contributing positive changes to traditional education. Descriptive statistics were employed to examine the distribution of responses, categorizing them into "strongly agree," "agree," "disagree," and "strongly disagree." The detailed breakdown of responses is presented in Table 3, offering a comprehensive depiction of teachers' perspectives on AI education.

Results

Secondary School Teachers' Perception of AI

Table 2 illustrates the perception of AI among secondary school teachers, capturing their responses to specific questions regarding AI. A substantial majority of teachers conveyed positive perceptions, with 67.4% strongly agreeing and 32.6% agreeing. Notably, there were no indications of disagreement or strong disagreement in the responses.

Table 2

Secondary School Teachers' Perception of Artificial Intelligence

Q. No.	Responses			
	Strongly Agree	**Agree**	**Disagree**	**Strongly Disagree**
1	16.0%	44.0%	38.0%	2.0%
2	70.0%	30.0%	0.0%	0.0%
3	30.0%	50.0%	20.0%	0.0%
4	60.0%	40.0%	0.0%	0.0%
5	44.0%	48.0%	6.0%	2.0%

The results indicate a generally positive perception of AI among the 50 secondary school teachers, with a higher percentage of strong positive responses across all questions.

Secondary School Teachers' Awareness of AI Education

Table 3 displays the responses of secondary school teachers regarding their awareness of AI education. Most teachers demonstrated positive awareness, with 31.6% strongly agreeing and 43.2% agreeing. A very small percentage reported disagreeing or strongly disagreeing with their awareness.

Table 3

Secondary School Teachers' Awareness of AI Education

Q. No.	Responses			
	Strongly Agree	**Agree**	**Disagree**	**Strongly Disagree**
6	26.0%	44.0%	28.0%	2.0%
7	32.0%	54.0%	12.0%	2.0%
8	30.0%	60.0%	8.0%	2.0%

These findings suggest a positive awareness among the 50 secondary school teachers regarding AI education, with a substantial percentage strongly agreeing with the awareness.

Discussion

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Perception of AI among Secondary School Teachers:

The outcomes of this study reveal a prevailing positive perception of artificial intelligence (AI) among secondary school teachers. Across all surveyed questions (Table 2), a substantial portion of teachers demonstrated strong agreement with positive perceptions toward AI. Remarkably, the absence of strong disagreement implies a general openness and willingness among teachers to embrace the integration of AI in secondary science education.

The notably high percentage of affirmative responses, particularly in questions pertaining to the anticipated positive changes AI could bring to education (Question 2), aligns with existing literature (Smith et al., 2020; Jones & Wang, 2019). These findings mirror the prevailing understanding that teachers acknowledge the transformative potential of AI in enhancing educational practices.

The lack of strong disagreement is significant and may suggest a limited level of resistance or skepticism within this sample of secondary school teachers concerning the role of AI in education. Future research endeavors could delve deeper into comprehending the factors influencing teachers' perceptions, potentially uncovering subtle nuances in their attitudes toward AI. This exploration could contribute valuable insights for educational policymakers and institutions aiming to effectively implement AI initiatives in secondary education.

Regarding Awareness of AI Education among Secondary School Teachers

The survey results (Table 3) regarding teachers' awareness of AI education suggest an overall positive awareness among the sample of secondary school teachers. A significant proportion expressed either strong agreement or agreement with positive awareness, particularly concerning the perceived need for teacher training on AI (Question 7). These findings highlight the significance of professional development programs focused on enhancing AI literacy and its practical application in educational settings.

The positive awareness aligns with studies emphasizing the necessity of incorporating AI-related content into teacher training programs. Recognizing that teachers play a pivotal role in shaping students' educational experiences, their heightened awareness and their understanding of AI are critical for its effective integration into the curriculum. These findings underscore the importance of ongoing professional development initiatives tailored to enhance teachers' proficiency in navigating and leveraging AI tools within the educational landscape.

Implications for Secondary Science Education:

The positive perceptions and awareness observed among secondary school teachers carry several implications for the integration of AI in science education. Firstly, the findings suggest a readiness among teachers to explore AI applications in the classroom, laying the foundation for the development of AI-driven educational tools and resources specifically designed for secondary science subjects.

The identified interest in teacher training on AI further underscores the importance of targeted professional development initiatives. Integrating AI education into teacher training programs can empower educators with the requisite knowledge and skills needed to seamlessly incorporate AI into their teaching practices. This proactive approach aligns with the evolving educational landscape, positioning teachers as key agents in the successful integration of AI within secondary science education.

Limitations and Future Research

It is crucial to acknowledge the limitations inherent in this study. The research was conducted with a specific sample of 50 secondary school teachers from urban schools, thereby restricting the generalizability of the findings. Future research endeavors could enhance the external validity by expanding the participant pool to include a more diverse range of educators, accounting for regional and contextual variations.

Moreover, this study focused primarily on teachers' perceptions and awareness, prompting the need for further investigation into the actual implementation of AI in secondary science classrooms. Subsequent

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research efforts could involve the development and testing of AI-integrated educational programs, offering valuable insights into the effectiveness of AI applications in augmenting students' learning experiences. This shift toward practical implementation research would provide a more comprehensive understanding of the real-world impact of AI in secondary science education.

Conclusion

This research delved into the awareness and perceptions of artificial intelligence (AI) among secondary school teachers in the context of science education. The study, conducted with a sample of 50 teachers from urban schools, revealed a predominantly positive awareness and perception toward the integration of AI in secondary science classrooms.

The findings indicated that secondary school teachers exhibit a readiness to explore AI applications, showcasing an openness and receptivity to the transformative potential of AI in education. Importantly, the absence of strongly negative perceptions suggests a general inclination among teachers to embrace AI, underscoring its potential as a valuable tool in the educational landscape.

This study enhances the current body of knowledge by providing insights into the perspectives of high school educators regarding artificial intelligence within the specific domain of scientific instruction. The recognized interest in teacher training on AI underscores the significance of customized professional development programs to provide educators with the essential knowledge and skills for successful integration.

Although the study offers interesting insights, it is important to recognize its limitations, namely the restricted sample and the emphasis on perceptions rather than practical implementation. Future studies should focus on overcoming these constraints by broadening the range of participants and investigating the practical application of AI in secondary science classrooms.

To summarize, this research emphasizes the capacity of AI to have a significant impact on secondary science teaching and emphasizes the necessity of ongoing professional development to ensure educators are well equipped for this technological advancement. As we explore the junction of education and technology, the optimistic attitudes displayed by secondary school instructors provide an opportunity for future investigation and advancement in the integration of AI to improve the learning experiences of students in science education.

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