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Students' cognition of artificial intelligence in education

Jingdong Xu

Mathematics, Stony Brook University, Stony Brook, New York, United States, 11794-3651

justin331331@gmail.com

Abstract. As artificial intelligence (AI) becomes more widely used in classrooms, it is important to learn more about students' perspectives on its usefulness and the factors that affect their performance. In order to better understand how students think about AI in the classroom, this experiment builds a more precise random forest model to foretell how they will do on AI-related tasks. Kaggle's "Students' Perceptions of AI Survey Analysis" dataset was used in the study as it contained important information about students' AI-related attitudes, expertise, and learning objectives. Engineering techniques were incorporated into the methodology as part of the feature selection process once the data had been collected and preprocessed. In order to process, visualize, and model the data, we used data analytic tools including Pandas, Matplotlib, Seaborn, and Scikit-learn. Students' AI knowledge, information availability, attitudes, and recognition of AI's impact on many sectors were all exposed through exploratory data analysis. The results were interpreted and analyzed in the debate, which also highlighted the merits and shortcomings of the approach and its possible limitations. Notably, the random forest model outperformed other methods in forecasting students' performance on the AI exam task.

Keywords: artificial intelligence, student perceptions, knowledge level.

1. Introduction

Artificial intelligence (AI) has garnered significant interest in numerous industries, including education [1]. In order to develop effective AI teaching strategies, the purpose of this study is to examine how students view AI in relation to education. Numerous studies have examined students' AI knowledge, attitudes, and impressions as part of the progression of research in this field. Both "Understanding user perception toward AI enabled e-learning" and "Artificial intelligence for education: Knowledge and its assessment in AI-enabled learning ecologies" are pertinent publications in this field. The research titled "Understanding user perception toward AI enabled e-learning" investigates how students perceive AI and its educational applications. It examines factors such as students' exposure to AI technologies and their educational experiences, which may influence their perceptions and attitudes toward AI [2]. The study casts significant light on students' perspectives and highlights the need for AI education in the curriculum. In contrast, "Artificial intelligence for education: Knowledge and its assessment in AI-enabled learning ecologies" focuses on assessing students' understanding of AI concepts and their educational implications. It assesses the efficacy of alternative AI instructional pedagogies and the AI proficiency of students using a variety of assessment methods [3]. The study emphasizes the significance of developing accurate evaluation instruments to assess students' AI skills.

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In contrast to these papers, this study contributes to the corpus of knowledge by combining techniques for data collection, preprocessing, and feature engineering. In addition, the author constructs and improves a random forest model to predict students' performance on AI-related tasks. This study also casts light on students' awareness of AI, information sources, and perspectives on AI's impact on a variety of industries, including the arts. In addition, we offer specific recommendations for expanding AI education, such as organizing AI lectures, activities, and competitions and investing in laboratories and equipment to pique students' daily interest. By providing students with future-relevant knowledge and skills, this research supports effective AI education. Overall, by combining predictive modeling techniques with an examination of students' attitudes and perspectives, this study contributes to existing research in the field of AI education and offers a unique perspective.

2. Methodology

2.1. Data collection and preprocessing

The Kaggle dataset "Students' Perceptions of AI Survey Analysis" was utilized to investigate Students' Perceptions of AI. This dataset was a valuable resource because it comprised comprehensive survey data regarding students' perceptions of AI, including their attitudes, levels of knowledge, and educational requirements. Given the close alignment of this dataset's topic with our research field, it provided a solid basis for a more in-depth examination of students' AI cognition.

In the data preprocessing phase, specific operations were performed on the dataset to improve its suitability for analysis. The Q6.Domains column, which contained categorical information about AI-related domains, was an essential component of the dataset. To facilitate further analysis, we implemented one-hot encoding on the Q6.Domains column using the pandas.get_dummies() function. This transformation enabled us to convert the categorical data into a numerical representation, thereby effectively encoding the distinct AI domains. This preprocessing phase ensured that the data were encoded correctly and prepared for subsequent analyses.

This phase of meticulous data collection and preprocessing established the groundwork for our in-depth investigation into Students' Perceptions of AI. We were able to deduce meaningful conclusions and contribute to the understanding of students' cognitive processes and attitudes toward AI in an educational context by leveraging the valuable insights provided by the dataset and employing appropriate preprocessing techniques.

2.2. Selection of data analysis tools

In this study, a variety of data analysis tools were utilized to effectively process, analyze, and visualize the collected data, allowing us to delve deeper into students' perceptions of AI and obtain valuable insights into their perspectives, trends, and patterns. The following tools were crucial to our analysis:

1) Pandas: The foundation for our data processing and transformation dutieswas the Python library for manipulating data, Pandas [4]. We effortlessly inserted raw data into Pandas and performed crucial data pre-processing steps, such as handling missing values, cleaning the data, and structuring it in a format suitable for subsequent analysis. We were able to efficiently manage large datasets while maintaining data integrity due to the adaptability and efficacy of Pandas.

2) Matplotlib: Matplotlib is a widely-used data visualization library that has proven indispensable for the creation of a wide variety of charts and graphs [5]. Therefore, we utilized Matplotlib's extensive capabilities to construct various types of visualizations, such as line graphs, bar graphs, and scatter plots. We utilized the library to visualize the data's distribution, trends, and relationships, enabling us to discover insightful insights and effectively communicate our findings.

3) Seaborn: Seaborn provided us with sophisticated statistical data visualization capabilities by building upon Matplotlib. This library allowed us to generate visually appealing and informative visualizations, including advanced statistical plots, heatmaps, and categorical plots [6]. Seaborn's user-friendly interface and plethora of visualization options facilitated the investigation of complex

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relationships, allowing us to present data in a visually appealing manner while maintaining statistical rigor.

4) Scikit-learn: Scikit-learn, a well-known machine learning library, was instrumental in our data modeling and analysis [7]. Using Scikit-learn, we implemented the Random Forest algorithm to determine the complex relationship between students' AI perceptions and other variables. To determine what makes students like or dislike AI, we applied machine learning methods. The extensive collection of machine learning algorithms and tools provided by Scikit-learn enabled us to conduct robust data analysis and modeling, resulting in enhanced predictive capabilities.

It is crucial to note that the selection of these data analysis tools was influenced by their functionality, adaptability, and widespread applicability in the field of data science. Each instrument complemented the others, allowing us to capitalize on their respective strengths to accomplish our research objectives and satisfy our data analysis requirements. By leveraging the power of these tools, we were able to unleash the true potential of the collected data and extract valuable information about students' perceptions of artificial intelligence.

3. Results

3.1. Results of students' cognition of artificial intelligence in education

3.1.1. The proportion of understanding of artificial intelligence knowledge.

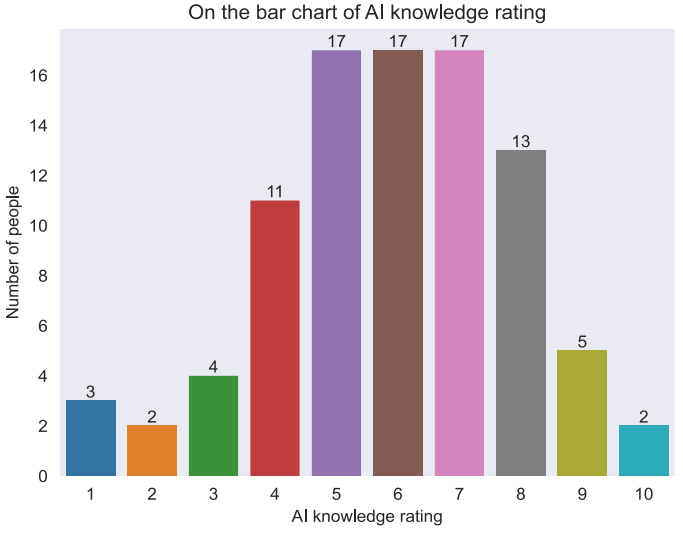

Figure 1. A Histogram on AI knowledge rating (original).

Using pandas to perform frequency statistics on the Q1.AI_knowledge column of the data set and matplotlib and seaborn to generate a histogram (figure 1), it is possible to infer that the majority of students have a moderate understanding of artificial intelligence knowledge. The graph plainly illustrates the knowledge level distribution among students. According to the results of the data analysis, the bar chart depicts the frequency distribution of various levels of knowledge comprehension. A relatively large number of students exhibit ordinary knowledge comprehension, as observed. This indicates that these students have a typical understanding of artificial intelligence.

Educators and policymakers can better comprehend the current state of AI education among students by analyzing the distribution of knowledge levels. This understanding informs the creation of targeted interventions and educational strategies to improve students' knowledge and close any gaps [8]. It emphasizes the significance of providing a comprehensive AI education that caters to both novice and advanced pupils, ensuring a well-rounded approach to AI literacy [9]. Ideally, the findings will serve as

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a valuable foundation for further analysis and the development of effective educational programs that improve students' understanding of and engagement with artificial intelligence.

3.1.2. The proportion of access to AI knowledge.

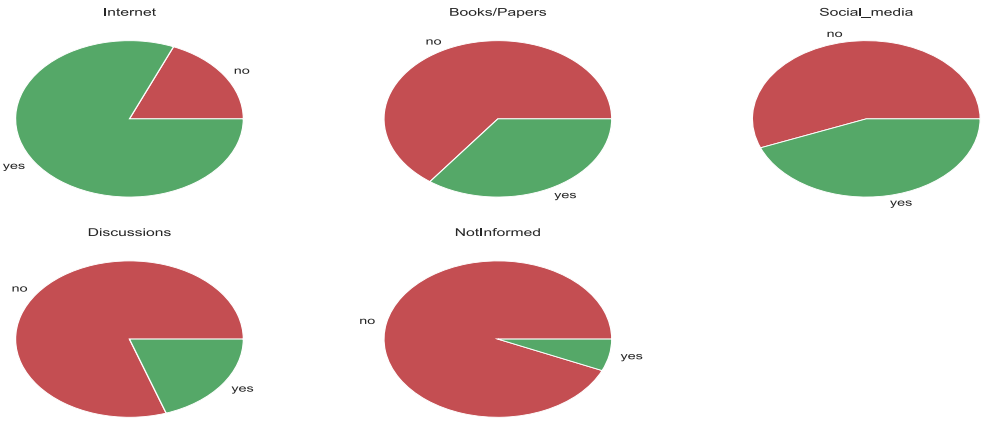

Figure 2. Access to AI Knowledge (original).

According to the results of the analysis depicted in Figure 2, the majority of students acquire knowledge of artificial intelligence through the Internet and discussion, while few students report not understanding it. From the perspective of the trend, it appears that student knowledge and comprehension of AI are progressing in the correct direction.

The findings of the analysis emphasize the need for continuous initiatives to advance AI education and provide students with more opportunities to engage with AI-related subjects. Educators and policymakers can positively influence students' AI cognition and comprehension, enabling them to become informed and accountable members of the future AI-driven society [8]. Creating a supportive learning environment and utilizing online resources and collaborative discussions can accomplish this.

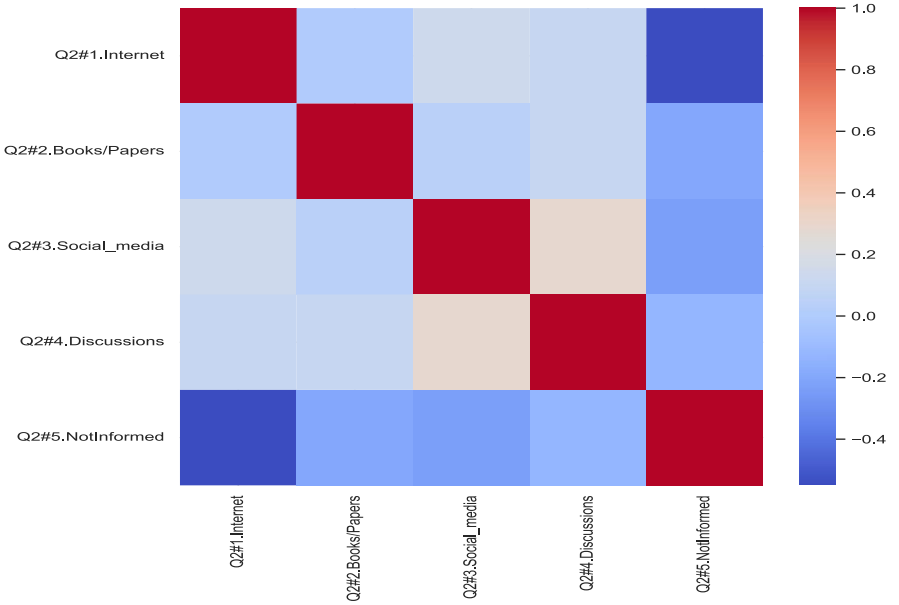

Figure 3. Acquisition of artificial intelligence knowledge (original).

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The data analysis revealed a strong correlation between "students who do not use the Internet" and "students who don't know" (Figure 3). The correlation coefficient is -0.55, indicating a strong negative correlation between the two variables. The correlation suggests that pupils without Internet access are more likely to report having less knowledge, demonstrating the educational value of the Internet.

These findings highlight the importance of having Internet access and utilizing it for knowledge acquisition, particularly in AI education. It is necessary to promote resources and equal Internet access for online AI education. This can assist students in bridging knowledge gaps and enhancing their comprehension of AI issues [10]. Educators and policymakers, including pertinent stakeholders, can therefore develop targeted strategies to enhance AI education [11]. The objective is to ensure that every pupil has equal access to information.

3.1.3. Students' attitude towards artificial intelligence.

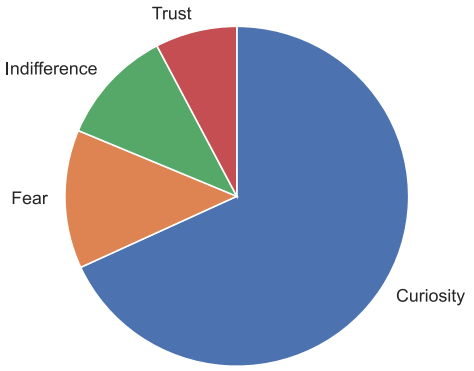

Figure 4. Attitude towards AI (original).

By utilizing the matplotlib library to create a pie chart (figure 4), students' attitudes toward artificial intelligence can be depicted in an intuitive manner. The majority of students, 68.14 percent, exhibited an inquisitive attitude toward AI, according to the findings of the study. Simultaneously, the proportion of students who are frightened, persuaded, and skeptical about artificial intelligence is relatively close. In particular, 13.19% of students have a panicked attitude toward artificial intelligence, 10.99% are unsure about artificial intelligence, and 7.69% have a strong belief in artificial intelligence.

This variety of AI-related perspectives exemplifies the complexity of the perspectives held by students. To foster a comprehensive comprehension of AI among students, it is essential to identify and address these diverse perspectives. Educators and policymakers must therefore acknowledge these attitudes in order to develop educational strategies and initiatives that address the particular needs and concerns of students. Understanding students' attitudes toward AI is crucial, particularly when devising effective educational programs and promoting the development of AI in a responsible manner [12]. This ensures that students are endowed with the necessary knowledge and skills to navigate a world dominated by artificial intelligence [13]. With these findings, educators can tailor their approaches to promote curiosity, allay fears, resolve uncertainties, and cultivate a balanced and knowledgeable perspective on artificial intelligence.

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3.1.4 students agreed with the fields affected by artificial intelligence.

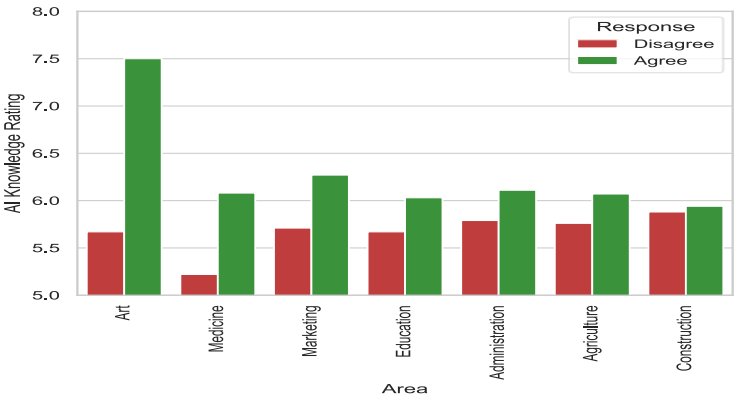

Figure 5. Fields affected by Artificial technology (original).

By contrasting the results of the bar chart (figure 5), it is evident that the majority of students are aware of artificial intelligence's impact on the field of art. It suggests that students are optimistic about the potential and influence of AI in the field of art. This result demonstrates the vast potential of AI technology in fostering artistic innovation, creation, and expression, as well as the concern and interest of students in AI technology. This high recognition rate demonstrates that students understand the significance and value of AI in the field of art, and provides a positive social foundation and support for further exploration and application of AI technology's potential for artistic creation and aesthetic expression.

The findings contribute to the comprehension of the perspectives and attitudes of students regarding the function of AI in the art domain. It highlights the importance of AI as a catalyst for artistic innovation and reinforces the need for AI education and incorporation in art curricula. Recognizing students' positive reception of AI's artistic potential can help educators and policymakers devise programs and initiatives that foster the development of AI-driven artistic practices, fostering a symbiotic relationship between technology and innovation [14]. The high rate of student recognition of AI's impact on the field of art demonstrates their cognitive awareness, enthusiasm, and support for AI's impact on artistic domains [8]. This award provides a solid foundation for further exploration, experimentation, and application of AI technology in artistic creation and aesthetic expression, influencing the future landscape of art and technology integration.

3.2. Results of the random forest model in predicting students' performance in AI-related tasks

The Random Forest algorithm is highly resilient and insensitive to discrete data points. Due to the diversity of movie information, noise data are unavoidable, but the random forest algorithm can effectively mitigate their influence on the final model. The Random Forest algorithm can assess the significance of all input features, establishing the groundwork for future research on how to enhance students' understanding of artificial intelligence. To conduct the investigation, this paper employs the random forest classification algorithm.

Engineering features is a crucial stage in machine learning, and the quality of feature selection has a direct impact on algorithm performance. Informative input characteristics and the transformation of existing characteristics into suitable vectors can significantly enhance experimental outcomes. This experiment's characteristics are as follows: level of AI knowledge comprehension, major, age, method of AI knowledge acquisition, gender, response to AI, number of years of study, and exam passing rate.

$$\propto_1+\propto_{major}+\propto_{age}+\propto_{sources}+\propto_{gender}+\propto_{feelings}+\propto_{studyyear}\xrightarrow{Classifier}\propto_{passed}$$

(Where, in order, the degree of understanding, the major, the age, the way to obtain artificial intelligence, the gender, the response to artificial intelligence, the year of learning, whether the student passed the exam.)

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3.2.1. Random forest model modeling. In this experiment, sklearn's randomforestrclassfier package was used to implement the randomforest classification algorithm, sklearn's train_test_split method was used to divide the data set into 80% training set and 20% test set, and predict () was used to predict the corresponding values of the test machine.

3.2.2. Model performance evaluation. The dataset was trained and evaluated using a random forest classification model. To assess the efficacy of the model, the accuracy rate is calculated. The figure 6 illustrates how the accuracy rate varies as the model's complexity increases.

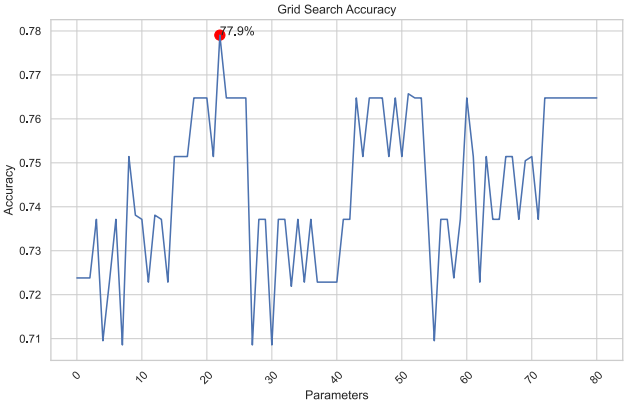

Figure 6. Changes in accuracy rate as the complexity of the model increases (original).

Meanwhile, SVC and Gradient Boosting are also used to classify the model, and the accuracy rate is as follows:

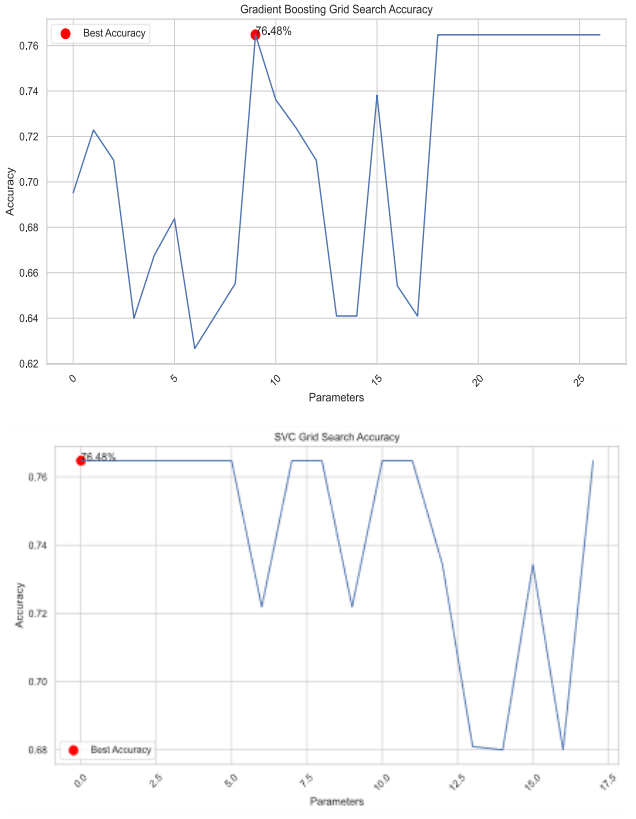

Figure 7. SVC and Gradient Boosting accuracy rate (original).

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From figure 7, it can be observed that the highest accuracy of random forest is 77.9%, indicating that the model is suitable for this data set.

3.2.3. The highest parameter of visual relational type. This paper plots the most relevant parameters by using sklearn's feature_importances_ method.α_{passed}

As can be seen from the figure 8, factors such as knowledge level of AI knowledge, gender and major have the most influence on students' passing the AI exam.

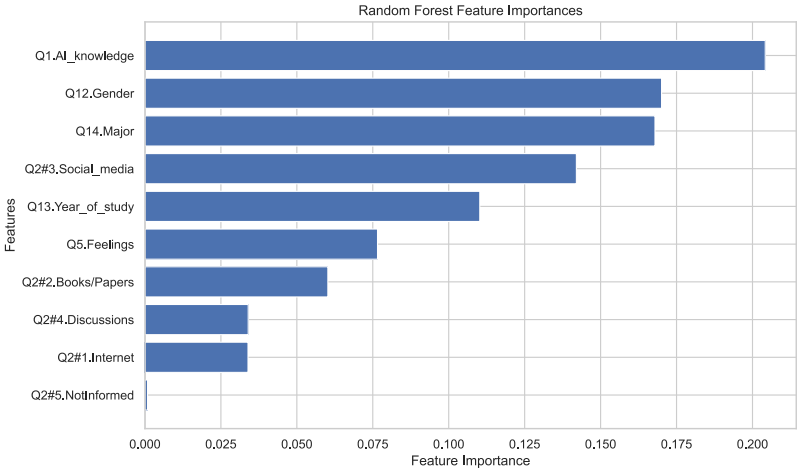

Figure 8. Influence that AI has on the student's exam performance.

4. Discussion

Schools can organize a variety of AI-related lectures, practical activities, competitions, etc., in order to increase students' access to AI knowledge and their mastery of its fundamental concepts, technologies, and applications. Similarly, schools can encourage students to actively partake in the open-source community in the field of artificial intelligence and to improve their AI skills by communicating and learning from industry professionals.

To help students learn AI in a more systematic manner, institutions can extend the number of years spent on related majors. In order to establish an AI concentration in computer science and technology majors, for instance, students must complete three to four AI-related courses at the undergraduate level and delve into AI technology and applications in a particular field at the graduate level. By extending the number of years students study AI, their professional understanding and technical mastery can be enhanced.

In addition, schools should focus on cultivating students' daily interest in AI learning. The field of artificial intelligence is expanding at a rapid rate, and institutions can increase their investments in equipment and laboratory construction to provide students with sufficient research tools and a conducive environment. In addition, special short-term training programs can be implemented to help students gain a deeper understanding of AI knowledge and increase their learning motivation.

Lastly, schools can increase the exam's difficulty in order to assess students' AI expertise in a more comprehensive manner. For instance, the exam for the artificial intelligence course is scheduled at the end of the semester, uses a semi-open writing format, and increases the difficulty of questions and exam time in order to assess the students' understanding of artificial intelligence more thoroughly. In addition, schools can implement measures to encourage exceptional students to participate in a variety of artificial intelligence competitions, which can not only enhance students' practical experience but also their general aptitude.

Overall, schools need to start from multiple angles to improve students' understanding and cognition of artificial intelligence, including the establishment of artificial intelligence courses and the

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improvement of teaching methods, the provision of more extensive and in-depth learning channels and activities, the elevation of the difficulty of investigation, and the encouragement of participation in AI-related learning and practical activities. Students should be given the opportunity to acquire artificial intelligence knowledge and skills that are more substantial and professional.

5. Conclusion

This study examined students' perceptions of AI in education to improve their comprehension. Several major discoveries emerged. First, most students understood AI. Second, pupils learned AI from the Internet and discussions. Students displayed curiosity, anxiety, conviction, and skepticism concerning AI. Finally, students noticed how AI affects art.

These findings suggest improving student AI cognition. To teach students about AI, schools can hold lectures, workshops, and competitions. Students' professional knowledge and technical skills can improve by studying AI in appropriate majors for more years. Investing in technology, labs, and short-term training sessions daily promotes AI. Increasing test difficulty and fostering AI competitions can also completely assess students' AI expertise.

This study offers insights into student AI cognition yet has limits. To gain a complete picture, future research should use larger and more diverse student samples and qualitative approaches like interviews and observations. Investigating socio-cultural influences on student AI cognition would enhance comprehension.

This study helps us comprehend students' AI education cognition. This research identifies elements that affect student cognition and makes recommendations to improve AI education and prepare students for the future. AI cognition traits assist teachers identify students who need more help. This data can help tailor AI education to students' needs. Second, it recommends AI education upgrades.

The findings can assist educators and policymakers establish evidence-based AI education programs. This may involve introducing AI-related topics to the curriculum, supporting multidisciplinary AI education, and providing instructors with AI teaching training. The results help governments allocate resources and create AI education programs. AI education will be adequately integrated into the educational system to fulfill students' and the future workforce's needs.

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