Research on the Application of ChatGPT in the Interdisciplinars of Higher Education

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Abstract: This paper focuses on analyzing and assessing the role and potential impacts of ChatGPT within the realm of higher education, with a specific emphasis on its utility in interdisciplinary academic and research contexts. As an advanced tool in the ever-evolving landscape of artificial intelligence, ChatGPT's deployment in educational and research frameworks introduces both novel opportunities and challenges. The study employs an array of methodological approaches including comprehensive literature reviews, in-depth case studies, empirical data analysis, and comparative research to gauge the effectiveness of ChatGPT in higher educational settings. Findings from the study suggest that ChatGPT serves as a pivotal medium for the integration and dissemination of knowledge across various disciplines, promoting cross-disciplinary dialogue and understanding. It also plays a significant role in enhancing students' ability to think across different academic domains and nurture their innovative skills. The multifaceted research approach not only sheds light on the diverse functionalities of ChatGPT in interdisciplinary higher education but also underscores its potential as a forward-looking tool in shaping future educational and research paradigms.

1. Introduction

With the development of technologies such as artificial intelligence, big data, cloud computing, and the Internet of Things, the field of engineering technology is rapidly evolving. The advancement of these technologies has brought new research directions and application areas to engineering disciplines. New engineering disciplines, especially interdisciplinary ones such as intelligent manufacturing, bioinformatics, and computational social science, are becoming key areas for future development [1]-[3]. Interdisciplinary studies involve combining theories buildings, methods, and technologies from different academic fields in research and teaching to foster the creation of new knowledge and solve complex problems. This intersection not only breaks the boundaries of traditional disciplines but also promotes innovative thinking and diverse solutions. The current and future job market has a high demand for engineers skilled in new technologies. Government educational policies and industrial development strategies are also driving the growth of new engineering disciplines [4]-[6]. For example, China's 14th Five-Year Plan emphasizes

innovation-driven and high-quality development, necessitating the educational system to produce more innovative engineering and technological talents. The introduction of new engineering disciplines can promote academic research and technological innovation, contributing to the scientific and economic development of Shandong Province and the nation as a whole.

Shandong Province, with its significant industrial base in fields such as new energy, intelligent manufacturing, and information technology, is a focal point for the transformation of new engineering disciplines. As a province advanced in economy and education in China, Shandong has numerous higher education institutions, many of which are in the process of transitioning to new engineering disciplines. This is an inevitable choice to adapt to technological trends, meet job market demands, respond to national educational policies, enhance international competitiveness, and promote scientific and technological innovation. The rise of interdisciplinary studies not only helps improve students' employability and innovation skills but is also significant for regional and national economic and technological development [7]-[8]. The integration of ChatGPT into the higher education system of Shandong Province, particularly in interdisciplinary teaching and research, signifies a major transformation in educational models and research methods [9]-[13]. As an advanced artificial intelligence technology, ChatGPT is not just a tool for information transmission but also a bridge for communication and collaboration between different disciplines. It facilitates mutual understanding and cooperation between various disciplines by providing a wealth of interdisciplinary knowledge and practical cases, thereby promoting the integration and innovation of knowledge [14]-[16].

In the field of education, the application of ChatGPT can greatly enrich teaching content and methods [17]. For instance, in disciplines such as engineering, computer science, environmental science, and others, teachers can design more practical, interdisciplinary courses and projects for students using the latest research findings and technology trends provided by ChatGPT [18]-[19]. This teaching approach not only enhances students' understanding of theoretical knowledge but also stimulates their innovative thinking and problem-solving abilities. Additionally, ChatGPT can serve as a virtual assistant, providing personalized learning support for students, such as problem-solving, learning advice, etc., thereby improving the efficiency and effectiveness of learning.

In summary, integrating ChatGPT into the interdisciplinary higher education system of Shandong Province will greatly enhance the quality of education and research capabilities. This is not only an improvement to the existing educational model but also a significant contribution to the future development of education and research.

2. Research Content

2.1. The Application of ChatGPT in Interdisciplinary Teaching

Enrichment and innovation of teaching content. ChatGPT can assist teachers in developing teaching materials that incorporate knowledge from multiple disciplines, such as case analyses combining principles of engineering with fields like artificial intelligence and data science; by providing examples and problems under an interdisciplinary background, it encourages students to establish connections between different disciplines.

Enhancing students' interdisciplinary thinking abilities. Through questions and discussions, ChatGPT can guide students to think about how to apply knowledge from different disciplines to solve complex problems; it offers interdisciplinary problem-solving exercises based on real-life situations, promoting the cultivation of students' critical thinking and innovative abilities.

Supporting course design and development. ChatGPT assists teachers in designing interdisciplinary courses and projects, such as integrated courses combining engineering, computer science, and design thinking; it provides personalized suggestions to help adjust course content to

meet the cross-disciplinary needs of different subjects.

2.2. The Application of ChatGPT in Interdisciplinary Research

Literature search and integration. ChatGPT can assist researchers in quickly accessing and integrating research literature and information from different disciplines, especially when venturing into unfamiliar areas. It can provide comprehensive literature overviews related to specific topics or questions, helping researchers quickly grasp basic concepts and recent developments in new fields.

Research design and methodology. When designing research projects, ChatGPT can provide information on research methods and techniques from different disciplines, helping researchers evaluate and choose the most suitable methods; for complex interdisciplinary research issues, ChatGPT can propose preliminary research plans, including possible research methods, data analysis techniques, and theoretical frameworks.

Data analysis and interpretation. When dealing with large or complex data sets, ChatGPT can offer advice on data processing and analysis, especially in situations requiring the application of interdisciplinary knowledge. ChatGPT can assist in interpreting research findings, providing possible perspectives for explanation, and suggesting further research directions or experiments.

3. Research Methods

3.1. Literature Review

This stage aims to systematically review the existing literature in the field of interdisciplinary teaching and research, with a special focus on the application research of ChatGPT. The method involves not only traditional academic papers but also conference papers, monographs, and industry reports. We need to analyze the discussions and conclusions in the existing literature about the role of ChatGPT in interdisciplinary fields, focusing particularly on its application in facilitating academic communication, innovative teaching methods, and solving complex problems. The output of this stage includes a literature review report, which will provide a theoretical basis and identify research gaps for subsequent studies.

3.2. Case Study

We need to select several universities that have already adopted ChatGPT for interdisciplinary teaching and research as case studies, collect feedback on the use and effectiveness of ChatGPT from teachers and students through methods such as semi-structured interviews, observations, and questionnaires. We need to pay special attention to its role in facilitating the understanding of complex control theory concepts, improving teaching methods, and enhancing research efficiency. We need to analyze the collected data and evaluate the actual application effects of ChatGPT in these universities. Focus on its impact on student learning outcomes, teacher teaching quality, and research activities.

3.3. Data Analysis

We need to conduct an in-depth analysis of the collected data, including using statistical methods to analyze questionnaire data and content analysis to analyze interview and observation records. We need to use appropriate statistical software (such as SPSS or R) for data processing and analysis to ensure the accuracy and reliability of the results, obtaining the actual effects and influence of ChatGPT in interdisciplinary teaching and research through data analysis.

3.4. Comparative Study

We need to select similar courses or research projects that do not use ChatGPT as a control group for comparative studies. We need to focus on the differences between the two groups in terms of learning outcomes, teaching quality, and research results. Through comparative analysis, determine whether the use of ChatGPT has a significant positive impact on teaching and research. The analysis results will help understand the actual value and potential limitations of ChatGPT in the current educational and research environment.

4. Feasibility Analysis

4.1. Resource Acquisition

Considering the research needs, including literature, datasets, software tools, and professional human resources, the higher education system and research environment in Shandong Province offer accessibility to these resources. Firstly, numerous universities and research institutions in the province have rich library resources and online databases, providing a wide range of academic literature crucial for comprehensive literature reviews. Secondly, universities and research institutions in Shandong Province have a strong research foundation in artificial intelligence and control engineering, meaning that it is relatively easy to obtain relevant datasets and case study resources in these fields. Moreover, with the rapid development of information technology, efficient data analysis software and tools are becoming more accessible. Finally, the academic and research environment in the province gathers a large number of professionals, including scholars, researchers, and industry experts, who can serve as valuable human resources, offering the necessary expertise and technical support for the research. Therefore, from the perspective of resource acquisition, conducting this research in Shandong Province is highly feasible.

4.2. Methodology Implementation

The success of the research depends not only on the availability of resources but also on the effective implementation of the chosen methodology. In this study, the methodologies adopted include literature review, case study, data analysis, and comparative study. These methods have been widely used and proven effective in educational and social science research. Literature review, as the foundation of the research, can systematically integrate and analyze existing knowledge, providing theoretical support for the study. Data analysis, including quantitative and qualitative analysis, will be used to extract meaningful information from the collected data and validate research hypotheses. Finally, comparative study can reveal the differences between courses or research projects with and without the use of ChatGPT, thereby evaluating the actual effects of ChatGPT. Considering the research capabilities and technical support of the higher education system in Shandong Province, the implementation of these methodologies is feasible. Moreover, with the continuous advancement of educational technology and the innovation of research methods, the implementation of these methodologies will be more efficient and precise.

5. Innovative Point

5.1. The Innovation of Academic Thought

The combination of ChatGPT's applications in both education and research to explore its comprehensive role in interdisciplinary studies offers a new academic perspective. Most existing

research usually focuses on a single field, but this study enhances the depth and breadth of academic thought through cross-disciplinary comprehensive analysis. It emphasizes practicality and foresight. This research highlights the application of ChatGPT in practical teaching and research scenarios, and how to effectively integrate and utilize this tool in interdisciplinary studies, which not only meets the current practical needs of education and research but also reflects forward-thinking in anticipating future educational and research trends.

5.2. Innovation in Academic Views

ChatGPT as a medium for knowledge integration and dissemination.The research proposes viewing ChatGPT as an important medium for integrating and disseminating interdisciplinary knowledge, a relatively new perspective in academia. While most studies focus on the functionality of technology, this research emphasizes knowledge integration and dissemination, exploring how ChatGPT facilitates dialogue and understanding between different disciplines. Educational institutions and teachers are valued in the role of ChatGPT in enhancing students' innovative thinking. This research emphasizes the potential of ChatGPT in fostering students' interdisciplinary thinking and innovation skills, introducing a new educational viewpoint that artificial intelligence tools can stimulate and promote students' innovative thinking.

5.3. Innovation in Research Methods

Comprehensive research methods. The study combines various research methods such as literature review, case study, and data analysis. This comprehensive approach allows for a more thorough evaluation of ChatGPT's effects and explores its role in interdisciplinary fields from multiple dimensions. The study delves into the actual effects of ChatGPT through case studies and empirical data analysis, relatively rare in existing related research. The application of empirical research can provide more conclusive evidence to support or refute theoretical hypotheses. Interdisciplinary perspective. The research method itself reflects an interdisciplinary nature, combining methodologies from fields such as education, information science, and sociology, offering a multi-dimensional and multi-angle research perspective.

6. Conclusions

This paper review reveals the potential of ChatGPT in enriching teaching content, fostering students' innovative thinking, and innovating teaching methods. Subsequently, through case studies of several universities that have actually employed ChatGPT, the research analyzes its specific effects in enhancing understanding of complex concepts, improving teaching quality, and boosting research efficiency. Moreover, through empirical data analysis, this study provides a deeper and more concrete understanding of the effects of ChatGPT in actual educational settings. The results indicate that ChatGPT can act as an important medium for knowledge integration and dissemination, facilitating dialogue and understanding between different disciplines, while also enhancing students' interdisciplinary thinking and innovative capabilities. Furthermore, the application of a comprehensive research methodology not only demonstrates the multidimensional role of ChatGPT in interdisciplinary higher education but also highlights its forward-looking role in future educational and research trends. In conclusion, this study provides a comprehensive perspective for understanding and evaluating the application of ChatGPT in interdisciplinary higher education, offering a theoretical and empirical foundation for future research and practice in related fields.

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