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Research on AI in Psychological Intervention in Adolescent Learning

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Abstract: In recent years, China's artificial intelligence has developed rapidly, with many policies introduced to encourage the growth of the AI industry. Moreover, it actively promotes the sustainable development of artificial intelligence. At the same time, the artificial intelligence industry has become the driving force of a new round of education revolution, actively promoting the transformation and upgrading of traditional education and giving birth to many new education industries, which is crucial to the development of educational psychology. This paper aims to show how adolescents can use artificial intelligence technology to build a personalized learning psychological intervention model to improve their learning motivation. To this end, self-determination and self-efficacy theories will be applied to answer these questions. By integrating the existing research and prospects of multiple researchers, this paper examines how adolescents can use artificial intelligence to boost their learning motivation. The findings demonstrate how teenagers can use artificial intelligence tools, like natural language processing and machine learning algorithms, to construct personalized learning psychological intervention models to improve their learning motivation, self-efficacy, and academic performance.

Keywords: adolescents, machine learning algorithms, natural language processing technology, self-efficacy theory, self-determination theory

1. Introduction

With the increasing and in-depth application of artificial intelligence (AI) technology, the field of education is undergoing an unprecedented and profound change from the traditional one-size-fits-all limitations to the personalized learning services created by AI according to the specific situation of students, from the traditional way of teaching knowledge to the fact that students can ask AI for help to find answers when they encounter difficulties at home. AI is reshaping many aspects of the education system with its powerful data processing and intelligent decision-making capabilities.

In this era, student education is facing unprecedented challenges and opportunities. Catching with the changing technological environment, students' learning must actively adjust their educational philosophy, innovate teaching methods, and ensure that the educational content can incorporate the latest AI technology and application examples to meet the country's demand for innovative and comprehensive talents. In particular, in the face of the trend of AI technology replacing traditional jobs, colleges and universities must re-examine and reshape the ability training system of students, strengthen their skills in data analysis, algorithm application, innovative thinking, and interdisciplinary cooperation, so as to improve students' comprehensive learning

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ability and enable them to stand out in an educational environment where AI technology is deeply penetrated.

At present, the proportion of students with psychological confusion and psychological problems among adolescents is increasing, which dramatically affects the learning state of adolescents, since only in a healthy psychological state can there be sufficient motivation for learning. However, the resources of psychological counseling services are still relatively scarce in many areas, and the level of psychological counseling services is uneven, with differentiation between urban and rural areas and between regions. Based on the relatively low public awareness of mental illness, public's trust and acceptance of psychological counseling are low, and some people are still skeptical. Therefore, in order to better popularize psychological counseling and other psychological interventions, Radovic and Badawy concluded that AI psychological counseling uses AI technologies and methods to provide psychological assistance and support for individuals or groups, which can be applied to adolescent mental health education to meet the psychological needs [1]. It combines AI, machine learning (ML), natural language processing, sentiment analysis, and other technologies to simulate human emotional, cognitive, and communication processes, to connect and communicate with users, as well as to provide personalized psychological counseling and psychological support. Klarin also reported that it is helpful to improve the mental health of adolescents when the psychological needs of adolescents are significant and the practical resources are not abundant [2].

AI can be used to improve the health and well-being of adolescents, but this vision is still facing many challenges, such as the complexity of multimodal data fusion, the limitations of model generalization capabilities, and the need for real-time prediction and dynamic adjustment. Therefore, the realization of this vision needs to be realized through continuous technological innovation, algorithm optimization, and interdisciplinary cooperation [3]. Current AI technology shows specific promises in intelligent learning environments, interactive narrative generation, user modeling, and adaptive coaching. Through efficient image analysis, multimodal data fusion, and deep learning algorithms, AI can provide more accurate disease identification and treatment plans as well as regular monitoring and dynamic adjustment of patients' conditions to improve treatment results. In addition, Rowe and Lester emphasized the importance of future AI in providing preventive healthcare interventions for adolescents by combining AI with emerging technologies to optimize clinical decision support systems [3].

However, their application in improving adolescent learning motivation has been relatively limited. In order to fill this gap, this paper presents a review of adolescents' use of AI technologies, such as ML algorithms, natural language processing, to build personalized models of psychological intervention for learning to improve motivation, self-efficacy, and academic performance. This research can enrich the solution of students' psychological problems in the learning process, and also provide better prospects for the development and application of artificial intelligence.

2. Theoretical framework

2.1. Self-determination theory

Accounting to Ryan and Depane, self-determination theory aims to explain why people are naturally motivated to engage in self-regulating behavior. Based on the self-determination theory, individuals' behavioral motivation and self-regulation are influenced by the satisfaction of three basic psychological needs: the need for autonomy, the need for competence, and the need for relatedness. Autonomy needs is the individuals' desire to independently decide their behaviors and actions and pursue the development and expression of their true selves. The need for competence is the desire of an individual to feel capable and capable of applying their skills to a variety of tasks

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and challenges. The need for relatedness is the drive to interact with people and form intimate bonds.

AI's Natural Language Processing (NLP) technology can analyze students' interests and preferences to help build learning plans that personalized to the student. On the learning platform, students can choose the areas of interest instead of passively accepting the task arranged by the school or teachers.

Secondly, ML algorithms can analyze students' mastery of a specific knowledge field and assign exercises that match students' abilities through the analysis results. By ensuring that the difficulty of the exercises is controlled within the "recent development zone", students can acquire more learning information and abilities. In addition, AI can recommend appropriate study groups and discussion topics for students. It also enhances students' sense of relatedness by recognizing their social needs and interactions in the learning community.

2.2. Self-Efficacy Theory

The Self-Efficacy Theory refers to a person's belief that they can complete a specific task (Albert Bandura). Individuals with high self-efficacy tend to set challenging goals and are more motivated to accomplish set task. In educational settings, students with high self-efficacy tend to be characterized by performing better, being more engaged in learning, and being more likely to achieve academic goals. At the same time, people with high self-efficacy tend to be more optimistic and lower levels of stress and anxiety when it comes to their mental health. As ML algorithms analyze students' knowledge mastery and provide them with detailed learning plans. Learning Management System (LMS) system collect behavioral and psychological data from student and regular feedback on the completion of their plans. This approach intuitively allows students to recognize their own progress, which in turn enhances their self-confidence and self-efficacy. In addition, by imitating the role of a teacher or classmate and interacting with the adolescent, NLP can analyze students' emotional and psychological status, and give emotional value to the adolescent by using encouraging or humorous language, thereby improving their learning motivation and academic performance.

3. Applications

3.1. Application of ML algorithms

ML is the scientific study of computer systems' algorithms and statistical models to perform specific tasks without explicit programming [4]. The main advantage of ML is that once the algorithm has learned how to process the data, it can do its job automatically [5]. With the advent of the era of big data in education, practical knowledge and rules can be obtained from data information through data mining. And the use of data mining-related technologies as guidance tools for education and teaching work is conducive to improving students' performance and subjective initiative. Learn algorithms have been added to many applications used in daily life, such as the web search engine, exemplified by Google, which has learned how to sort web pages through algorithms and that is one of the reasons why people use them to search for information. Besides ML algorithms, numerous algorithms, including data mining, image processing, predictive analysis, etc. are used in software for different purposes of use to improve the convenience of life.

Therefore, integrating data mining technology into education and teaching practice will become an inevitable trend in future education [6]. Using the algorithm in data mining technology, establishing a personalized learning psychological intervention model, and mining students' usual learning behavior data is the key to helping teenagers improve their academic performance. The key factors affecting students' teacher achievement are obtained through data analysis and prediction

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analysis, which provides theoretical guidance for preparing teenagers and has important significance for guiding students to review more effectively.

Furthermore, Achuta Rao et al. collected 140 datasets and compared the performance predictions of each algorithm in terms of training time, prediction time and accuracy [7]. The aim is to design more efficient (in terms of time and space) and practical generalized learning methods for better performance in a wide range of domains. Constantly optimized algorithms can make more efficient use of known data resources and provide higher prediction accuracy. This can continuously optimize the application of algorithms in different scenarios, bringing efficiency and enhancement to the industry in which they are applied.

3.2. The application of natural language processing technology

In recent years, with the rise of the student-oriented advanced education concept, results-oriented education has been paid more and more attention by educators. When the center of education changes to the student, it becomes imperative to correctly understand the student's feelings in the teaching process. There are many ways for students to express their teaching feelings, among which analyzing students' emotional factors guarantees improved teaching quality [8].

Natural Language Processing (NLP), as an important branch of AI, plays an irreplaceable role in promoting the progress of modern science and technology and is an important part of the entire AI industry. Treviso et al. claim that Natural Language Processing can help identify areas for improvement in educational infrastructure, learning management systems, teaching practices, and learning environments [9]. NLP techniques play a crucial role in analyzing student feedback in text format. Researchers apply existing feature extraction, feature selection and topic modeling methods to feed student feedback data into traditional ML algorithms or ML techniques [10]. These methods and applications can be adapted to applications in education, such as emotion annotation, entity annotation, text summarization, and topic modeling.

Pham et al. analyzed social media posts from a gated community of more than 300 students in a single course cohort by processing datasets for sentiment analysis using Google cloud-based natural language processing APIs [11]. Emotion scores and magnitudes were then visualized to help explore the research question, "How natural language processing tools can help analyze student online emotions in graduate programs." The Google Cloud Natural Language API suggests that when emotions are high, students should cope well with their learning. In contrast, low emotions indicate that students may not be coping well with their learning and may need to be provided with more support.

4. Conclusion

This paper examines how adolescents can use AI to boost their learning motivation, focusing on ML algorithms and natural language processing technology, and applies self-determination and self-efficacy theories to construct personalized learning psychological intervention models. The research shows that AI can help teenagers improve their academic performance and self-confidence.

However, the study has several limitations. Firstly, it mainly focuses on the theoretical aspects, lacking specific case studies and practical data to support the arguments. Secondly, it doesn't consider the potential negative effects of AI on adolescents' learning and mental health. Finally, the research is relatively single - sided, mainly from the perspective of psychological intervention, and doesn't involve other aspects such as educational content and teaching methods.

In future research, we should pay more attention to the application and effect of AI in actual learning situations, carry out in - depth research on the learning psychology and behavior of adolescents, and explore the potential of AI technology in more fields. At the same time, we should

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also pay attention to the balance between the advantages and disadvantages of AI, and strive to provide more comprehensive and objective research results.

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