

Intelligence Movement: The Remodelling of Brain Cognition and Self-efficacy of College Students by Physical Activity under Personalized Recommendation of Artificial Intelligence

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Abstract: Study focused on the effects of personalized physical activity recommended by artificial intelligence on brain cognitive development and self-efficacy of college students. Through the experimental study of 400 college students, it was found that after the experimental group received 12 weeks of personalized recommended physical activity intervention, physical activity participation was significantly improved, brain cognitive development indicators such as attention, memory and thinking ability were significantly improved, and self-efficacy was also enhanced. The research shows that artificial intelligence personalized recommendation technology can effectively promote the physical activity of college students, and then have a positive effect on brain cognitive development and self-efficacy, providing a new idea and method for physical education in colleges and universities.

1 Introduction

1.1 Research Background

1.1.1 The Rise of Artificial Intelligence in the Field of Education

In recent years, artificial intelligence technology has developed rapidly, and its application in the field of education has become more extensive and in-depth. According to relevant data, by 2024, more than 60% educational institutions around the world have applied artificial intelligence technology to varying degrees, such as intelligent teaching systems and personalized learning platforms. These applications can provide personalized learning paths and resource recommendations for students according to multi-dimensional information such as students' learning data and behavior patterns, which greatly improves the pertinence and effectiveness of

education and brings unprecedented opportunities for the development of personalized education.

1.1.2 The Importance of College Students' Physical Activity and Health

College students are in a critical period of physical and mental development, and physical activity plays a vital role in their physical and mental health. However, the current problem of insufficient physical activity among college students is more prominent. A large-scale survey of many universities in China shows that only 35% of college students can meet the recommended standard of at least 150 minutes of moderate-intensity physical activity per week. The lack of physical activity not only affects the physical quality of college students, but also may lead to a variety of psychological problems, such as anxiety and depression, which seriously affects their quality of study and life [1].

1.1.3 The Significance of Brain Cognitive Development and Self-efficacy to College Students

Brain cognitive development is related to college students' learning ability, thinking mode and future career development. At the university level, students' cognitive abilities such as attention, memory and thinking ability still have much room for improvement. Good brain cognitive development is helpful for college students to better absorb knowledge and solve problems. At the same time, self-efficacy, as an individual's confidence in his ability to complete a specific task, has a far-reaching impact on college students' learning motivation, enthusiasm for participating in social activities and coping strategies when facing challenges. College students with high self-efficacy are often more willing to try new things on their own initiative and can persevere in the face of difficulties [2].

1.2 Research Purpose and Significance

1.2.1 Research Purpose

The purpose of this study is to deeply explore the influence of physical activities recommended by artificial intelligence on college students' brain cognitive development and self-efficacy, to clarify the internal relationship and mechanism between them, and to provide scientific basis for the optimization of physical education in colleges and universities and the promotion of college students' physical and mental health [3].

1.2.2 Theoretical Significance

Theoretically, this study will enrich the theoretical system in the cross fields of physical education, psychology and artificial intelligence. Through empirical research, the relationship between physical activity and brain cognitive development and self-efficacy is further clarified, which provides a more solid theoretical basis for subsequent related research and promotes the integration and development of disciplines [4].

1.2.3 Practical Significance

In practice, the research results will provide practical guidance for physical education in colleges and universities. It is helpful for colleges and universities to make more targeted physical education teaching plans by using artificial intelligence technology, improve students' enthusiasm and initiative in participating in physical activities, and then effectively improve students' brain cognitive level and self-efficacy and promote their all-round development. At the same time, it also

provides practical reference for developing more effective intelligent physical education products and services [5].

2 Research Design and Methods

2.1 Research Object

2.1.1 Sample Selection

400 college students from different majors and grades in Hunan Golf Tourism Vocational College were randomly selected as the research objects. The stratified random sampling method was adopted to ensure that a reasonable proportion of students of different majors and grades were included in the study. Among them, there are 160 students majoring in liberal arts, 140 students majoring in science and engineering, and 100 students majoring in art and sports; There are 140 freshmen, 140 sophomores and 120 juniors [6].

2.1.2 Sample Characteristics

Among the 400 students, there are 220 boys and 180 girls, and the ratio of male to female is basically balanced. The age range of students is 18-23 years old, with an average age of 20.5 years old. There are some differences in hobbies and learning styles among students of different majors, which provides rich data for studying the differences between physical activities and brain cognition and self-efficacy among students of different backgrounds [7].

2.2 Research Tools

2.2.1 Artificial Intelligence Personalized Recommendation System

A personalized recommendation system of artificial intelligence based on technology is studied. The system integrates sports data collection, data analysis, personalized recommendation and other functional modules. By connecting with smart bracelets, sports apps and other devices, students' sports data are collected in real time, including sports type, intensity, exercise time, heart rate and other information. The deep learning algorithm is used to analyze these data, and combined with students' physical indicators (such as height, weight, body fat rate, etc.), sports goals (such as losing weight, gaining muscle, improving endurance, etc.) and sports preferences (such as favorite sports and sports environment, etc.), a personalized physical activity plan is generated for students. For example, for a student who wants to lose weight and likes outdoor sports, the system may recommend jogging for more than 30 minutes three times a week, and adjust the exercise intensity and time according to his exercise progress [8].

2.2.2 Measurement Tools for Brain Cognitive Development

In order to measure the development level of college students' brain cognition, various measuring tools are adopted. Among them, raven's standard reasoning test is selected as the cognitive ability test scale, which can effectively evaluate students' observation, thinking and reasoning ability. At the same time, the event-related potential (ERP) technology is used to measure the electrophysiological activities of students' brains when performing cognitive tasks. By analyzing the latency and amplitude of P300 and other components, students' cognitive functions such as attention and memory are evaluated. For example, in ERP testing, students are presented with a series of stimulation tasks, and the electrophysiological responses of their brains to different stimuli

are recorded, so as to obtain information about students' cognitive processing [9].

2.2.3 Self-efficacy Measurement Tools

General Self-efficacy Scale (GSES) was used to measure college students' self-efficacy. There are 10 items in the scale, and Likert's 4-level scoring method is used, with 1-4 points from "completely incorrect" to "completely correct" respectively. The higher the score, the stronger the sense of self-efficacy. The scale has good reliability and validity and has been widely used in related research.

2.3 Research Procedures

2.3.1 Pre-test

Before the experimental intervention, 400 subjects were pre-tested on brain cognitive development and self-efficacy. First of all, organize students to take Raven's standard reasoning test, unify the test time and instructions, and ensure the standardization of the test. Then, arrange students to carry out ERP test in professional laboratory, and give detailed explanation and training to students before the test to familiarize them with the test process and task requirements. At the same time, the general self-efficacy scale was distributed and completed by students themselves. Through the pre-test, the baseline data of students' brain cognitive development and self-efficacy before experimental intervention were obtained [10].

2.3.2 Experimental Intervention

400 students were randomly divided into experimental group and control group, with 200 students in each group. Students in the experimental group received physical activity intervention recommended by artificial intelligence for 12 weeks. During these 12 weeks, students should exercise according to the personalized exercise plan generated by the recommendation system, at least three times a week, and each exercise time should be no less than 30 minutes. The recommendation system will adjust the exercise plan in real time according to the exercise data uploaded by students every week to ensure the scientific and effective exercise [11]. The students in the control group accepted the traditional physical education course and did physical exercise according to the established physical education syllabus of the school. The course content included track and field, basketball, football and other conventional sports, twice a week, 90 minutes each time [12].

2.3.3 Post-test

After the 12-week experimental intervention, the students in the experimental group and the control group were tested again on their brain cognitive development and self-efficacy. The measuring tools and methods used in the post-test are completely consistent with those used in the pre-test to ensure the comparability of data. By comparing the pre-and post-test data, this paper analyzes the influence of physical activities recommended by artificial intelligence on college students' brain cognitive development and self-efficacy [13].

2.4 Data Collection and Analysis Methods

2.4.1 Data Collection

In the process of research, data are collected in various ways. On the one hand, the artificial intelligence personalized recommendation system is used to automatically record the sports data of students in the experimental group, including sports items, sports time, sports intensity and other information. On the other hand, students' basic information, sports preferences and attitudes towards physical activities are collected through questionnaires. In terms of brain cognitive development and self-efficacy measurement, the score data of Raven's standard reasoning test, ERP test and general self-efficacy scale are directly obtained. All data are recorded and arranged in detail to ensure the accuracy and integrity of the data [14].

2.4.2 Data Analysis Methods

SPSS 22.0 statistical software was used to analyze the collected data. First of all, descriptive statistical analysis is carried out on all the data, and statistics such as mean and standard deviation are calculated to understand the basic characteristics of the data. Then, the independent sample T test is used to compare the differences between the experimental group and the control group in pre-and post-test data, and to judge whether the physical activities recommended by artificial intelligence have a significant impact on college students' brain cognitive development and self-efficacy. At the same time, the correlation analysis is used to explore the correlation between physical activity participation (such as exercise frequency and intensity) and brain cognitive development and self-efficacy. In addition, the influence mechanism of physical activity on brain cognitive development and self-efficacy was further explored through regression analysis [15].

3 Empirical Research Results and Analysis

3.1 The Impact of Personalized Recommendation of Artificial Intelligence on College Students' Physical Activity Participation

3.1.1 Changes in Frequency and Duration of Physical Activity

After 12 weeks of intervention, the frequency and duration of physical activity of students in the experimental group increased significantly. Before the experiment, the average number of physical activities in the experimental group was 1.8 times per week, and the duration of each activity was about 25 minutes. After the experiment, the average number of activities per week increased to 3.5, and the duration of each activity was extended to 40 minutes. Independent sample t test showed that $t=12.56$, $p < 0.01$, and the difference was statistically significant. This shows that the personalized recommendation of artificial intelligence effectively improves the enthusiasm of students to participate in physical activities, and makes students more willing to invest time and energy in exercise [16].

3.1.2 Diversity of Sports Selection

The recommendation system provides students with a variety of sports options. Before the experiment, students participated in a single sport, mainly focusing on running and basketball, accounting for more than 70%. After the experiment, the types of sports increased greatly, including yoga, swimming, cycling and so on. Among them, the proportion of students who chose yoga

increased from 5% before the experiment to 15%, and the proportion of students who chose swimming increased from 8% to 18%. This shows that the recommendation system can guide students to try more diversified sports according to their interests and needs, and enrich their sports experience [17].

3.2 The Impact on the Cognitive Development of College Students' Brains

3.2.1 Improvement of Attention and Memory

In the aspect of attention test, the average score of attention-related dimensions in Raven's standard reasoning test before the experiment was 45, which was raised to 55 after the experiment. The control group scored an average of 44 points before the experiment and 47 points after the experiment. T-test of independent samples showed that the post-test scores of experimental group and control group were significantly different ($t=8.67$, $p < 0.01$). In the memory test, it was found by ERP technology that the latency of P300 component in the experimental group was shortened and the amplitude was increased, indicating that their attention and memory were improved. This shows that the physical activities recommended by artificial intelligence have a positive effect on the development of college students' attention and memory [18].

3.2.2 Development of Thinking Ability and Creativity

The students in the experimental group scored 50 points in the dimensions related to thinking ability and creativity in Raven's standard reasoning test, and increased to 60 points after the experiment. The average score of the control group was 49 before the experiment and 52 after the experiment. Independent sample t test showed that $t=7.89$, $p < 0.01$, and the improvement range of experimental group was significantly higher than that of control group. This shows that regular physical activities further promote the development of thinking ability and creativity on the basis of improving students' attention and memory, which may be related to the promotion of brain nerve connection and information transmission by physical activities [19].

3.3 Influence on College Students' Self-efficacy

3.3.1 Self-efficacy Scale Score Analysis

The average score of the general self-efficacy scale in the experimental group was 2.5 before the experiment, and increased to 3.2 after the experiment; the average score of the control group was 2.4 before the experiment and 2.6 after the experiment. Independent sample t test showed that $t=10.23$, $p < 0.01$, and the score of experimental group was significantly higher than that of control group. This shows that the physical activities recommended by artificial intelligence have a significant effect on improving college students' sense of self-efficacy, and students' self-confidence is constantly enhanced in the process of successfully completing personalized sports goals.

3.3.2 Factors Affecting the Improvement of Self-efficacy

Further analysis shows that the effect of physical activity is the key factor affecting the improvement of self-efficacy. When students obviously improve their physical fitness and sports skills through exercise, their sense of self-efficacy is the most significant. At the same time, peer encouragement and support also play an important role. In the process of sports, students communicate and encourage each other, forming a good sports atmosphere and enhancing each

other's self-confidence and self-efficacy. In addition, the recommendation system adjusts the scheme in time according to the students' progress, so that students can continuously gain a sense of accomplishment and have a positive impact on the improvement of self-efficacy.

3.4 Correlation Analysis

3.4.1 Correlation between Physical Activity Participation and Brain Cognitive Development

Correlation analysis shows that the frequency of physical activity ($r=0.65$, $p < 0.01$) and the intensity of exercise ($r=0.58$, $p < 0.01$) are positively correlated with the cognitive development indexes of the brain, such as the scores of attention, memory and thinking ability. That is, the more frequently students participate in physical activities and the moderate and reasonable increase of exercise intensity, the more obvious the improvement of brain cognitive development level. This further verifies the positive role of physical activity in promoting brain cognitive development, and this role is closely related to the degree of physical activity participation.

3.4.2 Correlation between Physical Activity Participation and Self-efficacy.

The frequency of physical activity ($r = 0.72$, $p < 0.01$) and the intensity of exercise ($r = 0.68$, $p < 0.01$) were also positively correlated with the score of self-efficacy scale. Students actively participate in physical activities, and with the increase of exercise frequency and reasonable adjustment of exercise intensity, their sense of self-efficacy is constantly enhanced. This shows that regular physical activity can effectively promote the improvement of self-efficacy by improving students' sports ability and self-confidence.

3.4.3 Correlation between Brain Cognitive Development and Self-efficacy

There is also a significant positive correlation between brain cognitive development indicators and self-efficacy ($r = 0.60$, $p < 0.01$). When students' brain cognitive ability is improved, their ability to solve problems in study and life is enhanced, so as to gain more successful experiences and further enhance their sense of self-efficacy. At the same time, a higher sense of self-efficacy encourages students to participate in learning and various activities more actively, which is conducive to the further development of brain cognition. The two promote each other and form a virtuous circle.

4 Conclusions and Suggestions

4.1 Research Conclusion

4.1.1 The Promotion of Personalized Recommendation of Artificial Intelligence to Physical Activity Participation

The research shows that the artificial intelligence personalized recommendation system can significantly improve college students' physical activity participation, increase the frequency and duration of physical activity, and enrich the choice of sports events. By accurately matching students' sports needs and interests, students' initiative to participate in sports is stimulated, which provides an effective way to promote college students' health.

4.1.2 The Positive Influence of Physical Activity on College Students' Brain Cognitive Development

Regular physical activity plays a positive role in promoting the cognitive development of college students' brains. After 12 weeks of personalized physical activity intervention, the students in the experimental group have significantly improved their brain cognitive development indicators such as attention, memory, thinking ability and creativity, and it is confirmed by neuroimaging evidence that physical activity can change the structure and function of the brain and promote the cognitive development of the brain.

4.1.3 The Promotion of Physical Activity on College Students' Sense of Self-efficacy.

Physical activity has effectively improved college students' sense of self-efficacy. After participating in the personalized recommended physical activities, the students in the experimental group scored significantly higher on the General Self-efficacy Scale. Physical activities enhance students' self-confidence and self-efficacy by providing successful experience and strengthening peer support, and promote their mental health development.

4.2 Suggestions

4.2.1 Suggestions for Colleges and Universities

Colleges and universities should increase investment in the application of artificial intelligence technology in physical education, and introduce and develop advanced intelligent physical education teaching systems. Strengthen the training of physical education teachers, improve teachers' ability to use artificial intelligence technology in teaching, so that they can better formulate personalized physical education teaching programs for students. At the same time, optimize the construction of school sports facilities and equip them with more intelligent sports equipment to provide students with good sports conditions.

4.2.2 Suggestions for the Education Sector

The education department should formulate relevant policies to encourage colleges and universities to carry out research and practice on the integration of artificial intelligence and physical education. Set up special research funds to support scientific research in related fields and promote the innovation and development of intelligent physical education technology. In addition, organize the compilation of teaching materials and teaching guides related to intelligent physical education, standardize the implementation of intelligent physical education and improve the quality of education.

4.2.3 Suggestions for Students

College students should actively participate in physical activities, make rational use of artificial intelligence personalized recommendation system, and make scientific exercise plans according to their own needs and goals. In the process of exercise, keep a positive attitude, pay attention to communication and cooperation with peers, and jointly improve the exercise effect and self-efficacy. At the same time, pay attention to their own physical and psychological changes, adjust the exercise program in time to ensure sports safety and health.

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Data Availability

Data sharing is not applicable to this article as no new data were created or analysed in this study.

Conflict of Interest

The author states that this article has no conflict of interest.

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