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Collaborative Cultivation of Junior High School Mathematics Education and Mental Health Driven by Artificial Intelligence: The Role, Functions and Practical Strategies of Social Work

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Abstract: With the in-depth penetration of artificial intelligence technology in the field of education, junior high school mathematics education is undergoing a transformation from traditional "knowledge imparting" to "personalized cultivation". While improving teaching efficiency, it has also triggered new mental health problems such as students' mathematics learning anxiety and sense of alienation in human-computer interaction. From the perspective of social work, this paper explores the necessity of collaborative cultivation of junior high school mathematics education and mental health driven by artificial intelligence, analyzes the role positioning and functional advantages of social work in it, and puts forward specific practical strategies. The study finds that social work, through professional methods such as resource linking, emotional counseling, and environmental optimization, can bridge the technical blind spots of artificial intelligence education, build a cultivation system of "technology empowerment - psychological support - social collaboration", and provide a new path for promoting the coordinated development of junior high school students' mathematical core literacy and mental health.

1. Introduction

In recent years, artificial intelligence (AI) technology has become a core force driving educational reform with its advantages in data processing, personalized adaptation, and dynamic feedback. In the field of junior high school mathematics education, AI teaching systems have realized the large-scale implementation of "teaching students in accordance with their aptitude" through forms such as intelligent question banks, adaptive learning platforms, and virtual simulation experiments. For example, they can accurately locate weak points in knowledge by analyzing students' answer data and generate personalized learning paths; and use image recognition technology to correct geometric drawing questions in real time, shortening the feedback cycle. This technological empowerment has significantly improved the efficiency and accuracy of mathematics teaching, but it has also brought new educational contradictions: the "precision training" recommended by algorithms may strengthen students' utilitarian learning mentality, leading to the shift of mathematics anxiety from "insufficient ability" to "pressure from algorithm evaluation"; the high frequency of human-computer interaction

has weakened the emotional connection between teachers and students, and among students, and some students have experienced learning loneliness and self-identity crisis.

The junior high school stage is a critical period for individual cognitive development and personality shaping. Mathematics learning is not only a process of cultivating logical thinking ability, but also closely related to the formation of psychological qualities such as self-efficacy and anti-frustration ability. Surveys show that the incidence of psychological problems related to mathematics learning among current junior high school students reaches 32.6%, among which frustration caused by the continuous push of "weakness training" by AI systems and anxiety caused by real-time ranking of score data account for more than 60%. This phenomenon highlights the urgency of collaborative cultivation of mathematics education and mental health. As a profession with the core concept of "people in the environment", social work, with its multi-level intervention perspective of "individual - group - society" and professional methods of "empowerment, support, and collaboration", provides unique advantages for solving the dilemma of separation between education and psychology in the era of artificial intelligence.

Based on the junior high school education scenario, this paper first analyzes the dual impact of artificial intelligence on mathematics education and students' psychology, then defines the role and function of social work in collaborative cultivation, and finally constructs a strategy system with both theoretical support and practical operability, providing a reference for promoting the optimization of the educational ecology under technological empowerment.

2. Reconstruction of the Relationship between Junior High School Mathematics Education and Mental Health Driven by Artificial Intelligence

2.1 Transformative Impact of AI Technology on Junior High School Mathematics Education

The application of artificial intelligence in junior high school mathematics education shows the progressive penetration characteristics of "tool - method - concept". At the tool level, intelligent teaching systems (such as iFlytek Zhixue Network, Onion Academy) analyze mathematical problems through natural language processing technology to provide students with immediate guidance on problem-solving steps; at the method level, adaptive learning platforms based on machine learning (such as Squirrel AI) dynamically adjust the difficulty and training intensity of knowledge points by continuously tracking data such as students' answering speed and error types; at the concept level, AI technology promotes the transformation of mathematics education goals from "standardized assessment" to "core literacy cultivation", for example, cultivating students' mathematical modeling ability through virtual simulation laboratories, and predicting students' thinking development potential through big data analysis.

This transformation has achieved remarkable results: according to the monitoring data of the Ministry of Education in 2024, in junior high school classes using AI mathematics teaching systems, the average mastery rate of students' knowledge points increased by 21.3%, and learning interest increased by 15.8%. However, behind the technological empowerment, there are hidden worries: the quantitative tracking of "correct rate" and "progress rate" by algorithms makes some students directly link their self-worth with data performance, forming "data anxiety"; the immediacy of AI tutoring replaces the "trial and error - reflection" process in traditional learning, weakening students' anti-frustration ability; and the stylized interaction of virtual teachers leads to the degradation of emotional expression ability in some students.

2.2 Collaborative Dilemma between Mathematics Education and Mental Health

The abstractness and logic of junior high school mathematics make it a major source of students'

academic pressure, and the intervention of AI technology has further reconstructed the interaction between the two. On the one hand, the "precision diagnosis" of AI systems may amplify students' learning disadvantages. For example, the continuous marking of "algebra weakness" may solidify students' cognition of "mathematical incompetence" and cause learned helplessness; on the other hand, the personalized characteristics of AI teaching reduce the collective learning atmosphere of traditional classrooms, and some students fall into loneliness due to the lack of peer help. Especially for socially sensitive students, this alienation may be transformed into social anxiety.

From the perspective of collaborative cultivation, there are three types of fractures at present: first, goal fracture, where schools overemphasize the improvement of mathematics scores by AI technology and ignore the implicit needs of mental health; second, method fracture, where mathematics teachers focus on knowledge explanation and psychological counselors focus on problem intervention, and there is a lack of a collaborative mechanism based on AI scenarios; third, subject fracture, where parents' cognitive bias towards AI technology (such as regarding it as a "score accelerator" or "education substitute") leads to the disconnection between family support and school cultivation. These fractures make mathematics education and mental health fall into the paradox that "the more advanced the technology, the more difficult the collaboration".

3. Theoretical Basis and Functional Advantages of Social Work Intervention

3.1 Theoretical Support: From Ecosystem to Strengths Perspective

The intervention of social work is rooted in a pluralistic theoretical framework[1]. The ecosystem theory places junior high school students in a nested system of "micro (individual) - meso (family, school) - macro (technical environment)", and believes that the impact of AI technology on mathematics education is essentially a product of unbalanced system interaction. For example, the algorithm logic (efficiency first) at the macro level may squeeze the emotional interaction space at the meso level, thereby affecting self-cognition at the micro level. The task of social work is to adjust the interaction between systems and restore the balanced state.

The strengths perspective theory provides a value orientation for collaborative cultivation. This theory emphasizes that every student has "resilience" and "growth potential", and the learning problems exposed by AI technology can be regarded as "developmental challenges" rather than "defects". For example, for "carelessness in calculation" diagnosed by AI, social workers will not strengthen the negative label of "not serious", but guide students to discover the potential advantage of "solving problems quickly" and transform disadvantages into characteristics through strategy training.

Social support theory further points out that educational support in the AI era needs to shift from "technical support" to "comprehensive support". Social work makes up for the lack of emotional support in AI teaching by building a network of formal support (such as school social work services) and informal support (such as peer mutual help groups), providing students with dual resources for mathematics learning and psychological adjustment[2].

3.2 Functional Advantages: A Bridge Connecting Technology and Humanities

Compared with the disciplinary professionalism of mathematics teachers and the clinical professionalism of psychological counselors, social work has unique integration advantages:

Cross-border connection function: Social workers not only understand the technical logic of AI teaching (such as the principle of algorithm recommendation), but also master the intervention methods of mental health, and can build a communication bridge between technology developers, teachers, and parents, transforming "psychological needs" into reference indicators for technical

improvement.

Process companionship function: Different from teachers' phased teaching and counselors' problem-oriented intervention, social workers provide support in the whole process of AI learning through continuous companionship (such as weekly group activities, daily case follow-up). For example, they intervene in a timely manner when students encounter setbacks in using AI systems to avoid the accumulation of negative emotions.

System optimization function: Social workers are good at promoting collaboration from the institutional level. For example, they assist schools in formulating the "Guidelines for Mental Health Protection in AI Teaching", clarify the responsibility boundaries of various subjects, and incorporate mental health indicators into the evaluation system of AI education.

4. Role Positioning and Practical Path of Social Work

4.1 Role Positioning: From "Bystander" to "Collaborator"

In the educational scenario driven by artificial intelligence[3], the role of social work presents multi-level characteristics:

Psychological counselors address anxiety, inferiority, and other emotions stemming from AI-assisted learning by providing emotional counseling through case work and applying cognitive behavioral therapy to correct students' irrational perceptions of "algorithm evaluation." As an example, they guide students to understand that "AI scores serve merely as a learning reference, not as the full measure of one's self-worth."

As a linker for resource integration, schools not only integrate AI technical resources. For instance, securing free access rights for students from economically disadvantaged families, but also coordinate psychological support resources. This includes organizing "Mathematics and Self-confidence" themed workshops, where psychological counselors and mathematics teachers are invited to collaboratively design activity plans.

As an "Advocate" for environmental optimization, educational institutions promote the principle of humanistic care in AI-based teaching to schools. They recommend, for instance, that technical developers incorporate an "encouraging feedback" module into the system to mitigate the negative visual impact of "error marking". Additionally, educational institutions disseminate the concept of "moderate use of technology" to parents, advising them against relying solely on AI-generated data as the basis for family rewards or punishments.

Teachers enhance students' "AI literacy" through group activities. These activities cover skills such as responsibly using AI tools, critically evaluating algorithmic outputs, and maintaining interpersonal connections in a technology-mediated environment.

4.2 Practical Path: Construction of a Three-Level Intervention System

The practice of social work follows the logic of "prevention - intervention - development" and constructs a three-level system:

Primary prevention: Adaptive cultivation for all students

Teachers help students adapt to the AI-powered teaching environment through theme-based class meetings, scenario simulations, and other forms of activities. For instance, teachers design "algorithm decryption" activities to enable students to understand the principles behind AI-recommended topics, thereby reducing their sense of mystery and fear towards technology. Teachers implement the "Mathematics Partner Program", where students are paired up to use the AI system together. Through offline discussions on difficult problems pushed by the AI, their learning efficiency can be improved and peer connections can be maintained. Meanwhile, lectures themed "Mathematics Tutoring in the

AI Era" should be organized for parents, with the aim of guiding them to prioritize their children's learning process over mere fixation on data results.

Secondary intervention: Problem solving for at-risk groups

Identify high - risk students in AI - supported learning (for example, those whose "declining learning interest" has been indicated by the AI system for three consecutive weeks) and offer personalized support through case management. A typical case: Li, an eighth-grade student, refused to attend math classes because the AI system continuously marked "weakness in geometric proof". After social workers intervened, they first alleviated his anxiety through sandplay therapy, then cooperated with math teachers to design "interesting geometric tasks" to gradually restore his learning confidence, and finally invited parents to participate in "family math game night" to weaken the score-oriented atmosphere in the family.

Tertiary development: Collaborative cultivation for potential mining

For students who excel in both mathematics learning and mental health, their all - round development should be promoted through project - based learning[4]. For example, "AI Mathematical Modeling Groups" can be organized to guide students in using AI tools to analyze community traffic flow data, which helps improve both their mathematical application ability and sense of social participation. In addition, "Technical Ethics Debates" can be held to guide students to think about "whether AI can completely replace human teachers", so as to cultivate their critical thinking and humanistic care.

5. Practical Strategies: An Operational Framework Based on Multi-Subject Collaboration

5.1 Constructing a "Four-in-One" Collaborative Mechanism

The core task of social work is to promote the formation of a collaborative network of "school - family - technical party - social work institution". At the school level, the district education bureau assist in establishing an "AI Education and Mental Health Committee", which is composed of the principal, the head of mathematics teaching and research group, psychological teachers, and social workers. This committee will regularly analyze psychological risk indicators in AI teaching data. At the family level, social work institutions set up a "parent mutual help group", where social workers regularly share "family conventions for AI use". At the technical level, schools organize teachers, students, and social worker representatives to hold discussions with AI developers, feeding back needs such as "reducing negative labels" and "adding cooperative learning modules". At the institutional level, government departments promote social work institutions to sign cooperation agreements with educational technology enterprises, incorporating mental health assessment into the R&D standards of AI products.

5.2 Developing "Mathematics - Psychology" Integrated Courses

Social workers cooperate with mathematics teachers and psychological teachers to design integrated courses based on AI scenarios. For instance, in the "Function Graphs" unit, mathematics teachers and psychological teachers integrate the psychological course themed "Growth Curves". By analyzing the ups and downs of functions, they guide students to understand that fluctuations in academic performance are normal and cultivate their ability to withstand setbacks. After AI-powered intelligent evaluations, schools hold "Data Interpretation" workshops to teach students to distinguish between "ability deficiencies" and "state fluctuations", preventing them from being defined by a single piece of data. The course adopts the mode of "online AI preview + offline social worker guidance", giving play to technical advantages while strengthening humanistic care.

5.3 Establishing a Dynamic Assessment and Feedback System

Social workers take the lead in designing a "mathematics learning-mental health" two-dimensional assessment scale, including indicators such as AI usage frequency, mathematical self-efficacy, and satisfaction with human-computer interaction, and conduct a full-staff assessment twice a semester. Based on the assessment results, the AI Education and Mental Health Committee generate a "risk heat map" for both classes and individuals. For common issues at the class level, the committee urge the technical parties to carry out optimizations. For risk signals at the individual level , psychological teachers initiate case intervention. Meanwhile, the committee establish a multi-party feedback mechanism for assessment results, providing teachers with suggestions for teaching adjustments, parents with key points of family support, and students with directions for self-adjustment.

6. Challenges and Prospects

6.1 Challenges Faced

The practice of social work intervention faces three challenges: first, insufficient technical adaptability. The closed nature of some AI education systems makes it difficult for social workers to obtain necessary data, affecting the accuracy of intervention; second, barriers to professional collaboration. The differences in professional language between mathematics teachers and social workers may lead to inconsistent goals (such as teachers focusing on score improvement and social workers focusing on process experience); third, uneven resource allocation. Schools in rural areas often lack professional social workers and are unable to enjoy the dividends of collaborative cultivation.

6.2 Future Prospects

Future development needs to make breakthroughs in three aspects: First, promote the transformation of AI education products to be "social worker - friendly" by setting up mental health interfaces in the system, enabling social workers to access necessary data on the premise of protecting privacy. Second, strengthen cross - professional training: incorporate "mathematical educational psychology" and "fundamentals of AI technology" into the continuing education courses for social workers, and meanwhile provide "introduction to social work methods" training for mathematics teachers. Third, establish a three - level network consisting of "county - level social work service centers, school - based social work stations, and class - based social work assistants", and narrow the urban - rural gap through policy guidance and resource allocation to grassroots levels.

In the long run, the educational reform driven by artificial intelligence has expanded the professional territory of social work, and the humanistic care of social work has injected warmth into technical education. The combination of the two can not only realize the collaborative cultivation of junior high school mathematics education and mental health, but also provide a practical model for the "technology for good" educational ecology, enabling every student to acquire the growth power of "knowing oneself, accepting oneself, and developing oneself" while mastering mathematical knowledge.

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