



Research on the Positive Empowerment of AI Virtual Humans on the Mental Health of Primary and Secondary School Students Under the Double Reduction Policy

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Abstract. Since the implementation of the Double Reduction Policy, students' academic burden has been reduced, but mental health problems have become younger, more complex and concealed. Mental health education faces insufficient resources, weak personalized supply and poor school-family-society co-operation. Based on psychological theories and TAM, this paper analyzes students' mental health needs, explores virtual humans' positive effects on emotion, self-identity, communication and stress management, and assesses their application. Results show that virtual humans, with standardized, precise and inclusive advantages, can make up for traditional education shortages and provide a new digital path for mental health education.

Keywords: Double Reduction Policy; virtual humans; primary and secondary school students; mental health; AI

1 Introduction

China's "Double Reduction" policy, issued in 2021, has significantly alleviated academic burdens by reducing homework and strictly regulating off-campus tutoring, creating more room for students' physical and mental growth. However, new challenges have emerged in the post-policy period: insufficient peer interaction, increased electronic dependence, weak self-management abilities, heightened academic anxiety^[1], and more complex and concealed psychological problems. Traditional school mental health education faces resource shortages, insufficient personalized services, and poor coordination among schools, families, and communities.

Against the backdrop of rapid advances in artificial intelligence, affective computing, and computer graphics, virtual digital humans offer an innovative solution. With anthropomorphic appearance, natural language interaction, and 24/7 availability, they overcome the limitations of time and space, lower students' psychological resistance to seeking help, and provide private, immediate, and non-judgmental emotional support. This paper aims to analyze the current situation and core demands of student mental health under the Double Reduction policy,

explore the positive empowerment mechanisms of AI virtual humans in emotional regulation, self-identity, interpersonal communication, and stress management^[2], and propose practical application strategies based on case analysis and theoretical foundations.

2 Core Concepts, Theoretical Foundations, and Current Mental Health Situation

2.1 Core Concepts

Double Reduction Policy: A policy issued by the Chinese government to effectively reduce the excessive homework and off-campus tutoring burdens on students in compulsory education. Its measures include controlling homework volume, improving after-school services, strictly regulating tutoring institutions, and enhancing school teaching quality.

Virtual Humans (AI Digital Humans): Digital figures created using artificial intelligence, computer graphics, speech synthesis, and multi-modal interaction technologies. They feature human-like appearance, movements, and intelligent dialogue capabilities, enabling natural and empathetic communication with users in virtual spaces^[3].

Mental health of primary and secondary students: A stable psychological state during growth, characterized by consistency in internal psychological processes and good adaptation to the external environment. It includes emotional stability, positive self-identity, effective interpersonal skills, and adequate stress coping abilities^[4].

2.2 Theoretical Foundations

This study is grounded in four theoretical frameworks. Developmental psychology (Skinner) distinguishes respondent behavior triggered by observable stimuli and operant behavior occurring without external stimuli, leading to the concept of teaching machines that compensate for educational deficiencies. Positive psychology focuses on human potential, virtues, and positive emotions, helping students achieve a happy life and psychological well-being. Constructivist learning theory (Piaget, Vygotsky) emphasizes learner-centered, active knowledge construction through collaboration and interaction in specific social and cultural contexts. Technology Acceptance Model (TAM) includes perceived usefulness, perceived ease of use, user attitude, behavioral intention, and actual usage behavior, providing a framework for understanding students' acceptance of AI virtual humans.

2.3 Current Situation of Student Mental Health

Despite the reduced academic burden after the Double Reduction policy, students' mental health problems have shown a trend of becoming younger, more complex, and more concealed. Joint monitoring data indicate that 24.6% of Chinese primary and

secondary students have depression, with 7.4% suffering from severe depression. Approximately 60% of early psychological symptoms are not identified or intervened in a timely manner. Rural and remote areas face even higher detection rates due to shortages of professional mental health resources. Nationwide, mental health course coverage exceeds 85%, and the ratio of mental health teachers to students is over 70%, but the urban-rural gap remains striking: 1:800 in cities compared to 1:1500 in remote regions.

2.4 Core Demands and Existing Problems

Students under the Double Reduction policy have more free time but also prominent emotional fluctuations. They urgently need a stress-free, private, and easily accessible channel for instant emotional relief. Due to individual differences, customized one-on-one counseling tailored to different developmental stages is required. Schools and families need regular, precise monitoring tools for early risk detection, and students need to improve their emotional regulation and psychological resilience. An integrated, data-connected home-school-community support system is also essential.

However, existing mental health education has multiple problems. Traditional group courses lack personalized counseling for issues such as exam anxiety, parent-child conflicts, and peer relationships. There is a lack of effective monitoring tools for early psychological intervention, and students' abilities to regulate emotions, manage time, and cope with stress remain insufficient. Moreover, low parental mental health literacy, poor home-school communication, and inadequate social coordination hinder the construction of a comprehensive mental health protection network^[5].

3 Positive Empowerment Mechanisms of Virtual Humans

3.1 Educational Empowerment Characteristics

AI virtual humans possess three key characteristics for empowering mental health education. First, standardized and stable output with a professional psychological corpus ensures consistent and reliable information. Second, personalized one-to-one counseling based on student psychological portraits enables precise support tailored to individual needs. Third, inclusive and low-threshold services available 24/7 significantly expand the coverage of mental health services, especially for students who are reluctant to seek face-to-face help.

3.2 Emotional Regulation

Virtual humans provide stable emotional support through multi-modal emotional perception and immediate response mechanisms. They accurately identify emotional states such as anxiety, depression, and anger by analyzing voice, facial expressions, text, and even physiological signals. Upon recognition, they trigger programmed responses including comfort, active listening, and encouragement. With a gentle,

empathetic interaction style, they create an atmosphere of unconditional positive attention, helping students safely release negative emotions and reduce psychological defense. Additionally, virtual humans offer lightweight self-regulation tools such as breathing exercises, mindfulness guidance, and emotional journaling, decomposing emotion regulation methods into manageable steps and helping students master independent coping strategies.

3.3 Self-Identity

With a non-judgmental, unconditionally accepting interactive attitude, virtual humans affirm students' emotional expressions and self-feelings, thereby strengthening their sense of self-worth. Through personalized dialogue and growth records, they guide students to objectively understand their own strengths and weaknesses and establish positive self-evaluation. Combined with growth trajectory tracking, they visually present psychological progress and behavioral changes over time, enhancing students' sense of self-efficacy. By avoiding moral judgments or labeling, virtual humans effectively alleviate self-negation caused by inferiority and sensitivity, promoting the formation of a stable and positive self-identity^[6].

3.4 Interpersonal Communication

Virtual humans build safe, low-pressure simulated communication scenes, providing a practice platform for students with social avoidance or weak communication skills. Through situational simulation and role-playing, they train students' expression skills, listening ability, and conflict resolution strategies. Repeated practice in virtual interactions reduces social anxiety, gradually establishes communication confidence, and facilitates transfer to real interpersonal settings. Furthermore, virtual humans can feed back students' communication tendencies and difficulties to teachers, assisting in the design of targeted group activities to compensate for the lack of real communication opportunities.

3.5 Stress Management

Targeting core problems such as academic pressure, further education anxiety, and general growth pressure after the Double Reduction policy, virtual humans form a whole-chain stress management system of "monitoring-evaluation-counseling-training." They monitor stress-related language, behavioral, and physiological signals in real time to identify stress levels and sources. They provide personalized stress assessment reports and counseling programs, conducting specialized interventions for exam anxiety and peer pressure. Through relaxation training, cognitive restructuring, and positive psychological suggestion, they help students establish scientific stress coping models. Interactive and incentive mechanisms improve the participation and sustainability of stress management training, ultimately enhancing students' psychological resilience.

4 Case Analysis and Application Strategies

4.1 Case Analysis

Under the Double Reduction policy, two representative AI digital human applications demonstrate the potential of this technology. “Sunny Duoduo” at Hangzhou Nanxiaobu Primary School integrates AI with campus counseling for psychological screening, counseling, intervention, and follow-up, providing graded guidance based on risk levels. “Hua Xiaoyi,” a joint university-middle school product at the High School Affiliated to Central China Normal University, offers emotion recognition and customized guidance to help secondary students relieve pressure and adapt to academic challenges.

Both projects significantly enhance service coverage and accessibility. Sunny Duoduo raises screening coverage from less than 60% to over 90%; Hua Xiaoyi provides 24/7 online support, filling after-school service gaps. Practical application shows reduced anxiety and depression tendencies, relieved academic and interpersonal stress, and improved psychological resilience and self-acceptance among students. However, limitations remain: algorithm-based responses lack deep empathy and cannot handle complex psychological crises; emotion recognition errors may lead to misjudgment; data privacy and ethical concerns require stricter governance; and weak home-school coordination results in incomplete intervention loops. Future directions include positioning virtual humans as auxiliary tools, establishing a collaborative model of digital screening plus teacher intervention, upholding strict data security and ethics, and promoting a fully integrated home-school-community mental health ecosystem^[7].

4.2 Application Strategies

Virtual digital humans for campus mental health should target four key scenarios: after-school services, psychological screening, emotional relief, and crisis early warning. Their roles are defined as auxiliary assistants, supportive companions, and warning sentinels—not replacements for professional counselors, focusing on inclusive, preventive, and basic support, seen as Fig.1.

Design strategies must balance professionalism and age-appropriateness. Expert collaboration enables CBT-based scales and guidance. Enhanced multi-modal emotion recognition forms an “assessment–counseling–tracking” loop, supported by brief mental health micro-lessons and relaxation audio for after-school use. Collaborative support mechanisms involve schools establishing a teacher-led, homeroom-assisted mechanism with clear referral rules. A parent portal shares updates for home-school coordination. Technical measures include data encryption and system stability; education authorities should issue guidelines to supervise quality and privacy. Monitoring and risk control use quantitative and qualitative feedback to optimize interaction and early warning accuracy. Data anonymization and time limits prevent over-reliance. Pilot experiences should yield replicable manuals to expand coverage, making digital humans an effective and safe mental health support tool.

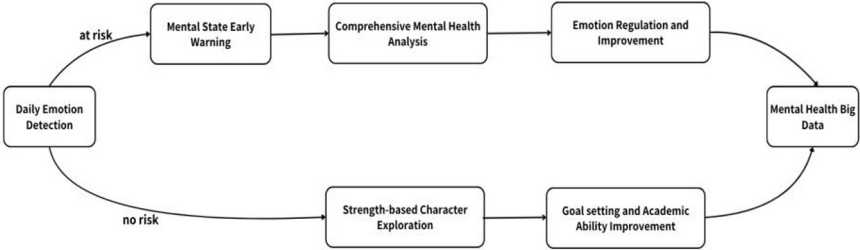


Fig. 1. AI Virtual Human Solution of Sunny Duoduo

5 Conclusion and Prospect

The digital transformation of primary and secondary school mental health education under the Double Reduction policy is an inevitable future trend. AI virtual humans, with their advantages of stability, personalization, accessibility, and low thresholds, effectively support students in emotional regulation, self-identity construction, interpersonal communication improvement, and stress management. Cases such as “Sunny Duoduo” and “Hua Xiaoyi” prove their effectiveness in expanding service coverage, enabling early screening, and reducing negative emotions, although technological and ethical limitations remain, seen as Fig.2.

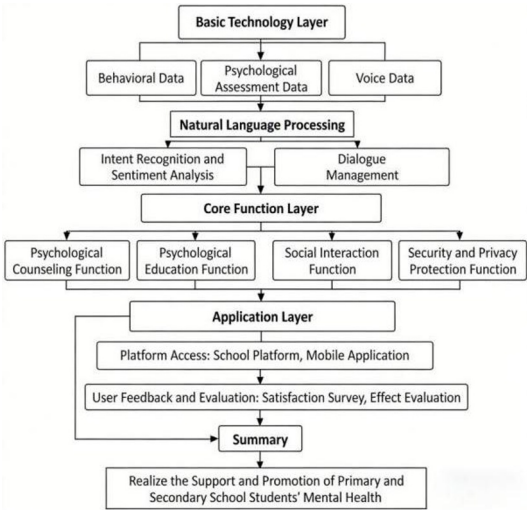


Fig. 2. Research Framework of the Technical Route for AI Virtual Humans

Virtual humans should supplement rather than replace traditional mental health education. Future efforts should focus on upgrading multi-modal emotional

understanding and situational awareness technologies, breaking information barriers to promote equal urban-rural services, building a closed-loop home-school-community collaborative system, preventing over-reliance on AI through clear usage guidelines, and integrating virtual humans into regular mental health courses. With continuous technological progress and ethical governance, AI virtual humans can truly become a “warm” auxiliary force in safeguarding the mental health of primary and secondary school students.

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