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AI-Enhanced Cognitive Behavioral Therapy in Social Work Group Activities for Adolescent Anxiety: Program Design and Effectiveness Research

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Abstract: Adolescent anxiety is becoming increasingly severe, with traditional interventions suffering from limitations such as a single perspective, insufficient technological integration, and weak program operability. This study employs Ecological Systems Theory as an analytical framework, integrating Cognitive Behavioral Therapy (CBT), the ADDIE instructional design model, and AI-enhanced technology. A six-session, progressive social work group intervention program was designed and implemented for 32 ninth-grade students experiencing anxiety at DF Middle School in City C. Using semi-structured interviews, participatory observation, and pre- and post-intervention assessments with the GAD-7 scale, the results show that adolescent anxiety arises from the interaction of multiple systems—micro, meso, exo, and macro—with individual cognitive biases and weak emotional abilities serving as core triggers. Following the intervention, the mean anxiety score of participants decreased from 8.50 to 2.75, with all participants transitioning from mild anxiety to normal levels, of which 87.5% returned to the normal range. Significant improvements were also observed in emotion management, communication expression, and social adaptation skills. The study demonstrates that a social work intervention program deeply integrating AI empowerment with CBT and the ADDIE model is systematic and operable, effectively alleviating adolescent anxiety. AI technology enhances service precision and engagement. Future efforts should focus on building multi-stakeholder collaborative support networks to achieve long-term intervention effects.

Keywords: AI Empowerment; Adolescent Anxiety; Cognitive Behavioral Therapy; ADDIE Model; Social Work Group Intervention

1. Introduction

Against the backdrop of accelerated social transformation, educational involution, and social comparison, adolescent anxiety is becoming increasingly prevalent. The <Report on National Mental Health Development in China (2023–2024)>, released in 2025, indicates that approximately 14.7% of adolescents in China experience varying degrees of anxiety [1]. A survey by Yu and Huang showed that the detected rate of anxiety symptoms among Chinese adolescents has reached 26.9%, exhibiting an overall upward trend [2]. Anxiety not only affects adolescents' academic adjustment and interpersonal relationships, but may also lead to smartphone addiction, non-suicidal self-injury, and even suicidal ideation [3]. The <Implementation Plan for Improving the Social Psychological Service System and Crisis Intervention Mechanism>, issued by 25 departments including the National Health Commission, explicitly proposes to essentially establish a social psychological support service system covering the entire population and the whole life cycle by 2030 [4]. Against this backdrop, research on adolescent anxiety intervention has both practical urgency and feasibility.

Existing research predominantly conducts individualized interventions on adolescents from psychological and medical perspectives, rarely systematically integrating Ecological systems theory, CBT, ADDIE instructional design model, and AI technology. Furthermore, there is a lack of structurally complete, implementable, and replicable social work service programs. Ecological systems theory emphasizes that individual development is nested within the interaction of multiple systems, providing a comprehensive "individual-family-school-community-society"

perspective for analyzing adolescent anxiety [5]. CBT focuses on the interplay of cognition, emotion, and behavior, serving as a core evidence-based method for alleviating anxiety [6]. The ADDIE model offers a standardized curriculum design process of "Analysis-Design-Development-Implementation -Evaluation" [7]. AI technology facilitates emotion recognition and personalized feedback in classroom setting [8].

Therefore, this study addresses three core questions: 1.Based on ecological systems theory, what are the needs underlying adolescent anxiety? 2. How can CBT, AI empowerment, and the ADDIE model be integrated to design a tailored social work intervention program? 3. What is the implementation effect of this program? Through empirical research, this study aims to provide a practical paradigm for school social work intervention in adolescent anxiety that is systematic, precise, and operable.

2. Literature Review

2.1 Application of Cognitive Behavioral Therapy in Adolescent Anxiety Intervention

The core logic of CBT—that cognition influences emotion and behavior—has been widely applied in social work and psychological intervention practices. Xu noted that CBT is not only effective in alleviating anxiety but also enhances individual cognitive levels [9]. Wang has conducted psychological interventions for migrant children to help them develop a positive mindset, using CBT as a guide [10]. Chen combined CBT with group work and casework, successfully helping students alleviate academic anxiety and enhance learning motivation [11]. Internationally, Turner pointed out that CBT is highly compatible with adolescents' cognitive development and emotion regulation characteristics, necessitating age-optimized intervention designs [12]. Lai et al., from a school social work perspective grounded in CBT, proposed strategies such as cognitive restructuring and behavioral training [13]. Gregory confirmed the stable effect of CBT on psychological distress through meta-analysis, aligning closely with social work practice logic [14].

2.2 AI Empowerment in Social Work and Adolescent Anxiety Intervention

Ma and Luo utilized AI and big data technology for intelligent psychological assessment, compensating for the limitations of traditional assessments, such as high subjectivity and low efficiency [15]. Li and Hu noted that AI can accurately assess needs and improve service efficiency but cannot replace social workers' deep empathy and ethical judgment; a human-machine collaborative approach should be adopted [16]. He achieved positive results using "AI+Social Work" for online intervention design [17]. Tong and Wu emphasized that AI empowerment must still adhere to client self-determination and a humanistic orientation [18]. Internationally, Boduroğlu et al. pointed out that while AI offers advantages in optimizing service processes and strengthening support for vulnerable groups, it also carries ethical risks [19]. Zhou et al., through empirical testing, found that teaching intervention models integrating AI and immersive technologies effectively alleviate student learning anxiety [20].

2.3 Application of the ADDIE Model in Instructional Design

The ADDIE model, a classic framework in instructional design encompassing analysis, design, development, implementation, and evaluation, is highly systematic and operable [7]. Han applied the model to online learning resource design, validating its effectiveness and practicality [21]. Bu utilized the model in micro-course design, expanding its application scenarios [22]. Internationally, Reinbold employed the ADDIE model as a core framework integrated with new technologies to design learning modules, demonstrating that this model better caters to student needs [23]. However, the specific application of the ADDIE model in adolescent mental health interventions, particularly in emotion regulation curriculum design, still requires further development.

2.4 Research Review

In summary, the effectiveness of CBT is well-established, the value of AI empowerment is increasingly evident, and the ADDIE model provides a normative reference for service design. However, significant limitations persist: social work interventions often follow traditional models with insufficient integration of AI and CBT; Ecological systems theory is primarily used for etiological analysis without linkage to intervention programs; empirical research on AI

empowerment in social work is scarce; and the ADDIE model is rarely applied to anxiety intervention or social work contexts. Addressing these limitations, this study employs ecological systems theory for needs analysis, utilizes CBT as the core intervention, builds the framework using the ADDIE model, and enhances intervention effects through AI empowerment.

3. Theoretical Foundations

3.1 Ecological Systems Theory

Proposed by Bronfenbrenner, ecological systems theory emphasizes that individual development is nested within interacting environmental systems, describing a dynamic model of interaction between the person and the environment [5]. This study adopts its four-layer analytical framework to dissect the causes of adolescent anxiety: Microsystem refers to the environment with which the adolescent interacts most directly, including individual cognitive, emotional, and behavioral characteristics, as well as direct interaction partners like family and school peers; Mesosystem refers to the interconnections among various microsystems, such as the interaction between home-school communication, parent-child relationships, and peer support; Exosystem refers to environments the adolescent does not directly participate in but which impact them, such as community mental health resources, parents' work environments, and social support networks; Macrosystem refers to the culture, subculture, and social environment embedded within the previous three systems, such as highly value academic grades. This theory provides a comprehensive framework for analyzing the causes of adolescent anxiety from an "individual-family-school-community-society" perspective and guides intervention programs to address service user needs from a multi-system viewpoint.

3.2 Cognitive Behavioral Therapy

Cognitive Behavioral Therapy primarily explores the intrinsic connections and interactions between individual cognitive processes and behavioral patterns [6]. Its core logic is that cognition plays a mediating and coordinating role between emotion and behavior, with cognition, emotion, and behavior continuously interacting to form a dynamic circular influence system. In practice, individual difficulties often result from a combination of cognitive biases and behavioral skill deficits. Without effective cognitive restructuring, individuals may continue to employ irrational coping strategies, hindering their development. This study introduces CBT as the core intervention because its focus on the "cognition-emotion-behavior" nexus provides a precise logic for cognitive restructuring, emotion recognition, and behavioral optimization. Specifically, it helps students identify cognitive biases such as "tying self-worth to academic performance", learn emotion recognition and regulation techniques, thereby systematically alleviating anxiety symptoms.

3.3 ADDIE Instructional Design Model

The ADDIE model is a classic instructional design framework consisting of five interrelated phases: Analysis, Design, Development, Implementation, and Evaluation [7]. This model features a closed-loop, complete process and is student-centered, aligning with the social work principle of client-centeredness. This study employs the model to design the service program, utilizing the complete process of needs analysis, framework design, content development, standardized implementation, and evaluation optimization to ensure the systematic nature and operability of the intervention program.

4. Research Methods

4.1 Research Design

This study adopts a mixed-methods approach, integrating literature review, semi-structured interviews, participatory observation, and quantitative assessment to evaluate the effectiveness of the AI-enhanced CBT group intervention for adolescent anxiety from multiple perspectives. The research design follows a basic "pretest-intervention-post-test" logic, using qualitative data to gain in-depth understanding of anxiety causes and change processes and quantitative data to test intervention effects.

4.2 Research Subjects and Sampling

This study was conducted at DF middle school in C city. This township public school serves a diverse student population, including local students and children of migrant workers. This diversity realistically reflects the psychological

states of adolescents in an urban-rural interface context. The study focused on ninth-grade students due to their concentrated exposure to academic pressure and anxiety about entering high school, making their anxiety manifestations more representative and valuable for research.

Participants were identified in two steps: First, a questionnaire survey using the Generalized Anxiety Disorder scale (GAD-7) was administered to all ninth-grade students. The scale has a Cronbach's α coefficient of 0.89-0.92 and a test-retest reliability of 0.83, indicating excellent reliability and validity. Second, based on the screening results, 32 students with anxiety symptoms (GAD-7 score 5-9) were selected proportionally by class to form the anxiety intervention group (14 males, 18 females, mean age 14.8 years). For deeper exploration of anxiety manifestations and influencing factors, 8 students were selected from the 32 intervention group members using stratified sampling based on gender, personality traits, and academic level for semi-structured interviews.

4.3 Research Tools and Materials

(1) Generalized Anxiety Disorder Scale (GAD-7): Contains 7 items rated on a 0-3 point scale (total score 0-21). Scores 0-4 = normal, 5-9 = mild anxiety, 10-14 = moderate anxiety, 15-21 = severe anxiety. Used for quantitative pre- and post-intervention assessment.

(2) Semi-structured Interview Guide: Designed around adolescents' emotional experiences, anxiety causes, practical difficulties, and service needs, covering the microsystem (individual emotions, cognition, behavior), mesosystem (family interaction, peer relationships, school support), exosystem (accessibility of community resources, parents' work pressure, social support networks), and macrosystem (social and cultural atmosphere, social media environment).

(3) Group Session Evaluation Form: Completed by the assistant social worker after each session, containing three dimensions (teaching objectives, teaching process, teaching effectiveness) with 9 indicators rated on a 1-5 point scale.

(4) Worksheets: Including <My Anxiety Cognitive Exploration (CBT Version)>, <My Emotion Recognition Handbook>, <My Emotion Regulation Practice Cards>, <Communication Expression Practice Cards> and so on.

4.4 Data Collection Procedure

The study strictly adhered to ethical norms. Prior to implementation, the school, parents, and students were fully informed of the research purpose, implementation process, and confidentiality principles. All participants signed informed consent forms, and data were anonymized. In the pretest phase, the GAD-7 scale was administered to the 32 group members, and one-on-one in-depth interviews (30-45 minutes each) were conducted with the 8 interview participants, audio-recorded and transcribed verbatim. During the intervention phase, six group sessions were conducted (once weekly, 90 minutes each). Each session was led by a primary social worker, with an assistant social worker conducting participatory observation and completing the "Group Session Evaluation Form". Worksheets and commitment forms were collected after each session. In the post-test phase, the GAD-7 scale was re-administered to the 32 group members within one week after the intervention concluded, and supplementary interviews were conducted with some group members and accompanying teachers to gather subjective feedback and suggestions for improvement.

4.5 Data Analysis Methods

(1) Qualitative Data Analysis: Interview transcriptions were analyzed using thematic analysis, coding and categorizing the data according to the four-layer framework of Ecological Systems Theory to extract core needs and common concerns. Observational records and worksheet content were descriptively organized to present the process of change among participants.

(2) Quantitative Data Analysis: Pre- and post-intervention GAD-7 data were analyzed using descriptive statistics (means, standard deviations, range of change) in SPSS 26.0. Due to the small sample size, inferential statistics were not performed; the focus is on presenting descriptive results and individual changes.

5. Intervention Program Design: AI-Enhanced CBT Group Curriculum Based on ADDIE Model

This study uses ADDIE model as the design framework, integrating ecological systems theory and CBT, and embedding AI empowerment technology to design a six-session, progressive emotional growth group curriculum.

5.1 Analysis Phase: Multi-system Needs Diagnosis

5.1.1 Microsystem

The microsystem focuses on students' own emotional and cognitive development needs, representing the core internal source of anxiety. The study found that some students exhibit self-cognitive biases, tying self-worth to academic performance due to external evaluation, making them prone to self-blame. For example, S3 stated, *"My family has very* high expectations of me, sometimes it feels suffocating". S6 felt "particularly embarrassed" due to classroom streaming. S1 wanted to learn *"skills that truly help us"*, and S4 desired *"professionals to teach us some psychological knowledge"*, Additionally, students struggled with emotion recognition, finding it hard to accurately identify their negative emotions and anxiety levels, often describing their state vaguely. S2 summarized their feelings as *"confused and irritable*", while S4 admitted *"There are so many sources of pressure, I can't really explain it myself"*. Furthermore, most students lacked professional emotion regulation methods, often coping with anxiety negatively. S5 relied on *"playing games, but it makes me more anxious"*, and S4 tended to *"overthink and force myself to sleep"*.

5.1.2 Mesosystem

The mesosystem encompasses needs related to interpersonal interaction in students' daily core living environments, covering family, school, and peer dimensions. Regarding safe disclosure, students desired a confidential, non-judgmental space to talk, fearing gossip and being labeled. S3 hoped for *"a safe place to talk, like an anonymous treehole"*. Most preferred light-touch group formats. Regarding communication expression, students struggled with *"daring not to speak, not knowing how to speak"* in parent-child and teacher-student interactions, where one-way communication often escalated conflicts. S2 admitted *"Things are very strained at home, I don't know how to adjust myself"*. S8 explained *"If I tell them, they might get more anxious or tell me not to overthink, which makes me feel misunderstood"*. Regarding social participation, students generally preferred light-social, immersive activities and disliked public sharing or large-scale socializing. S3 stated *"Doing crafts is much more meaningful than theme sharing"*. S7 preferred *"activities where you don't need to talk to express yourself, like painting or music workshops"*.

5.1.3 Exosystem

Interviewed students reported low coverage and poor accessibility of community psychological service stations, as well as insufficient after-school leisure and emotional release spaces. Some parents, due to high work pressure and limited time with their children, tended to transfer negative emotions onto them. As S2 stated directly *"My mom hopes that I study hard, get into a good university in the future, and live in a big city. My parents went to work in Tibet. They don't really pay much attention to me usually, but whenever we meet, they put a lot of pressure on me. I find it really annoying"*. The absence of regular youth mental health support activities by communities and social organizations further amplifies adolescents' anxiety.

5.1.4 Macrosystem

Regarding service format preferences, all students rejected "lecture-style, didactic" services, favoring experiential and practical activities. S4 stated *"Don't turn popular science into a class; that's completely ineffective"*. Most students endorsed a "one-on-one + group" service model. Regarding service implementation requirements, students generally expected activity leaders to be gentle and patient, preferred flexible scheduling, private and enclosed spaces, and strict privacy protection. Core concerns included fear of gossip, privacy leakage, and ineffective or boring services. S1 mentioned *"My biggest worry is being gossiped about"*. S3 also worried about *"being gossiped about and privacy leakage"*. S5 feared the activities would be *"useless and boring"*.

5.1.5 Summary of analysis

The multi-system needs diagnosis based on ecological systems theory reveals that the causes of adolescent anxiety exhibit multi-level interactive characteristics. At microsystem level, students exhibit self-cognitive biases (e.g., tying self-worth to academic performance), vague emotion recognition, and a lack of professional emotion regulation methods, tending toward negative coping strategies. At mesosystem level, students desire safe, non-judgmental spaces for disclosure, feel "unable or unwilling to speak" in family and school communication, and prefer light-social, immersive activities. At the exosystem level, issues such as poor accessibility of community psychological

services and the transfer of parental work-related stress further amplify anxiety. At macrosystem level, students generally reject didactic, lecture-style services, favoring experiential, hands-on activities. They expect gentle and patient facilitators, flexible scheduling, enclosed and private spaces, and strict privacy protection. Their core concerns center on being gossiped about, privacy leakage, and ineffective services. In summary, adolescent anxiety is the result of multi-system interactions, and intervention programs need to respond systematically from multiple levels, including individual cognition and emotion, interpersonal relationships, community resources, and social culture.

5.2 Design Phase: CBT-Oriented Curriculum System

5.2.1 Ideologically guided program objective design

Aligned with <Ten Measures to Further Strengthen Mental Health Work in Primary and Secondary Schools> in Guangdong, this program uses ideological and political education as a guide, deeply integrating concepts such as life education, responsibility, and mutual support throughout the six-session series of service activities, adhering to the educational requirements of "nurturing the heart with virtue, nurturing the heart with wisdom, nurturing the heart with aesthetics".

5.2.2 Program content design

The program design is supported by Padesky's five-part model (Situation, Cognition, Emotion, Physiology, Behavior), revolving around four intervention dimensions: cognitive restructuring, emotion recognition, skill enhancement, and support building. Six progressive sessions were designed, with content difficulty tailored to adolescents' cognitive development, emphasizing concrete and scenario-based presentation.

5.2.3 Program process design

Based on the closed-loop process of Kolb's experiential learning cycle, the program content is transformed into a four-stage intervention process: Warm-up, Implementation, Consolidation, Extension. Throughout each session, the four intervention dimensions of cognitive behavioral therapy-cognitive restructuring, emotion recognition, skill enhancement, and support building-serve as an underlying thread, guiding the session in a well-sequenced manner.

5.2.4 Program resource design

Program resources encompass four categories: teaching materials, interactive tools, support documents, and auxiliary resources. Teaching materials include illustrated PPT, short educational videos, and case studies from school and home settings. Interactive tools contain simplified emotion self-rating scales, emotion recording templates, and skill cards. Support documents provide implementation guides and emergency support checklists. Auxiliary resources include mindfulness audio and anonymous feedback channels. All resources are designed with accessibility and privacy protection in mind.

5.2.5 AI Empowerment across the design

In this study, AI consistently serves as an assistive tool to enhance session effectiveness, not as a replacement for the social worker's professional guidance and humanistic care. By supplementing CBT strategies, decoding emotions, generating stress-reduction plans, role-playing communication scenarios, providing empathetic responses, and generating social creativity, AI effectively enhances intervention precision and engagement, strengthens the practical application of CBT, and facilitates student growth through more dynamic interactions.

5.3 Development Phase: Six Sessions and AI-Enhanced Design

The topics and core objectives of the six group sessions are shown in Table 1.

Using Session 1 "Understanding Anxiety: A Gentle Encounter", as a detailed example:

(1) Three-Dimensional Teaching Objectives

Cognitive Objective: Students will understand the physiological mechanisms and common types of anxiety and identify cognitive biases such as tying self-worth to academic performance.

Affective Objective: Students will accept anxiety as a normal emotional response, reducing self-blame and shame.

Behavioral Objective: Students will preliminarily record their own irrational cognitions and complete a self-worth exploration exercise.

(2) Teaching Activity Design

(A) Warm-up Activity: Anxiety's Body Signals (5 minutes)

Participants close their eyes and recall a recent anxious moment, drawing "My Anxiety Body

Map" on white paper using simple symbols. The social worker guides an explanation of the physiological process of the "amygdala alarm", emphasizing that anxiety is a normal emotional alert system of the body.

(B) Core Exploration: Cognitive Traps of Anxiety under CBT (28 minutes)

Concretizing CBT (5 minutes): The social worker uses PPT slides to explain the core CBT logic: Event (A) – Cognition (B) – Emotional & Behavioral Consequence (C), emphasizing that it is not the event but your cognition that makes you anxious.

Yellow-Grey-Blue Card Classification Activity (8 minutes): Yellow cards represent triggering events, grey cards represent automatic thoughts/cognitions, and blue cards represent emotional/behavioral consequences. Participants take turns presenting and sharing in small groups, identifying common patterns.

Identifying and Discussing Cognitive Biases (5 minutes): Using PPT slides showing common cognitive biases in adolescents (tying self-worth to academics, excessive self-blame, catastrophizing), participants compare these with the grey cards to identify irrational beliefs.

AI Empowerment · CBT Strategy Expansion (10 minutes): Students independently think and write down 3 personal CBT coping strategies. 5-6 students are randomly selected to present theirs on the board. The teacher uploads photos of the student strategies to an AI tool, inputting instructions to generate 5 additional high-quality strategies. Students compare, select, and integrate them to form a personalized "Cognitive-Behavioral Adjustment Strategy List".

(C) Conclusion: Reflections on Cognitive Restructuring for Anxiety (12 minutes)

Participants complete the <My Anxiety Cognitive Exploration (CBT Version)> worksheet, sorting out their own event-cognition-emotion patterns for anxiety, cognitive biases, and rational alternative thoughts. Participants share in small groups, offering mutual support.

Table 1. AI-Enhanced Adolescent Anxiety Intervention Group Curriculum

No.	Session Name	Core Objectives	AI Empowerment Application
1	Understanding Anxiety: A Gentle Encounter	Understand anxiety's physiological mechanisms and common types; identify cognitive biases; accept anxiety as a normal emotion.	AI generates CBT strategy lists, analyzes cognitive biases, integrates personalized "CBT Strategy List."
2	Exploring My Emotions: An Emotional Journey	Recognize basic and complex emotions; learn to identify and express personal emotional states; master emotion recording methods.	AI Emotion Decoder (describing scenarios, AI analyzing potential emotions), AI assists in practicing emotion expression.
3	My Emotion Regulation Toolkit: The Wisdom of Taming the Mind	Understand the principle of emotion regulation delaying gratification; learn various regulation techniques; create a personalized "Emotion Regulation Toolkit."	AI interacts to generate personalized "Emotion Regulation Toolkit" (breathing, mindfulness, behavioral activation suggestions).
4	Communication Workshop: My Voice, I Express	Identify unhelpful communication patterns; master the "I-message" expression method; improve listening and feedback skills.	AI simulates parent/teacher roles for "I-message" practice; AI assesses sentence styles and provides improvement suggestions.
5	Light Social Challenge: My Circle of Growth	Identify social fears; learn behavioral activation strategies; design and complete a personalized "Light Social Plan."	AI assists in designing the "Light Social Plan," providing immersive scenario ideas and social skill tips.
6	My Anxiety Recharge Manual: Embracing the Future	Review and consolidate learned knowledge and skills; conduct a structured group closing activity; create a personalized "Anxiety Recharge Manual."	AI generates an "Anxiety Recharge Manual" template based on student characteristics; AI provides empathetic feedback and parting messages.

5.4 Implementation Phase

Group sessions were held once a week for 45 minutes each, over a total of 6 weeks. The social worker led the sessions with adolescent participants as the main agents. The activities strictly followed the research design and guidance to ensure orderly and efficient implementation.

5.5 Evaluation Phase

In the evaluation phase, both process and outcome evaluations were employed.

5.1.1 Process evaluation

The assistant social worker completed the "Group Session Evaluation Form" after each

session, dynamically tracking participant growth and changes. Sessions began with a brief check-in reviewing previous content. In-session observations noted discussion engagement and skill practice proficiency. Post-session, worksheet completion was reviewed to assess knowledge and skill acquisition.

5.1.2 Outcome evaluation

Within one week post-intervention, the GAD-7 scale was re-administered, and subjective feedback was collected to verify the achievement of intervention objectives.

6. Research Results

6.1 Qualitative Evaluation: Process Changes and Subjective Feedback

Observational records showed participants transitioning from initial reticence and avoidance to active sharing and enthusiastic practice. In Session 1, most participants kept their heads down and avoided eye contact. By Session 3, they were actively asking questions and trying stress-reduction techniques. By Session 6, they could naturally express emotions and provide peer support.

Interview and worksheet feedback indicated that participants could view anxiety more rationally, reducing self-blame and shame. S3 noted *"Before, watching videos made me worry I was depressed; now I understand these are just normal emotions"*. S5 reported *"Now when I can't sleep, I listen to mindfulness audio; it's quite helpful for falling asleep"*. S8 wrote *"I no longer care too much about others' opinions; those negative comments are actually their projections"*. Teacher feedback highlighted significant improvement in participants' emotional stability and communication initiative, *"During psychology class, I can clearly see the students are much more attentive"*, and *"Many students proactively share their feelings with me after class"*. Suggestions for improvement from participants included *"adding more interactive, hands-on activities"* and *"extending the activity cycle"*, providing a basis for program iteration.

6.2 Quantitative Evaluation: Pre- and Post-Intervention GAD-7 Results

Pre- and post-intervention GAD-7 assessments were conducted on all 32 participants. The results showed that post-intervention, the mean anxiety score decreased from 8.50 to 2.75. All participants transitioned from mild anxiety to normal or very mild levels, with 28 participants (87.5%) returning to the normal range (0-4 points), and the remaining 4 participants (12.5%), while still within the mild anxiety range, showed significantly decreased scores. The quantitative results corroborate the qualitative observations, indicating that the group intervention had a significant effect on alleviating adolescent anxiety.

7. Discussion

7.1 Multi-system Causes and Core Mechanisms of Adolescent Anxiety

This study found that adolescent anxiety results from the interaction of micro-, meso-, exo-, and macro-systems, consistent with conclusions drawn by scholars like Yu and Zhou using ecological systems theory to analyze adolescent mental health[24][25]. Unlike most studies focusing on single-system analysis, this study further reveals that individual cognitive biases and weak emotional capacities within the microsystem are the core triggers of anxiety. Factors such as high family expectations, insufficient school support, and societal "exam-score-only" culture are transmitted and amplified through the individual level. This finding addresses the limitation of existing research that "emphasizes environment while neglecting individual internal mechanisms." Furthermore, adolescents have strong needs for confidentiality, experiential learning, and non-didactic approaches in anxiety services. The prevalent formalized and stigmatized nature of existing school psychological support is a significant realistic factor exacerbating anxiety.

7.2 Effectiveness and Extended Application of CBT Intervention

Through the six-session group curriculum, this study found that cognitive restructuring, emotion recognition, and behavioral training can effectively alleviate adolescent anxiety, consistent with Papageorgiou et al.'s findings that school-based CBT effectively intervenes with students[26]. Unlike previous research primarily focusing on individual symptom improvement, this study found that CBT not only regulates emotions but also improves adolescents' communication expression and peer relationships. Furthermore, within the safe atmosphere of the group, adolescents were more willing to expose their emotions and modify

irrational beliefs. This expands the application scenarios of CBT for adolescents and validates the catalytic role of the group format in CBT intervention.

7.3 Innovative Value and Practical Pathways of AI Empowerment

This study integrates the ADDIE model with CBT while embedding AI empowerment, constructing a standardized and replicable closed-loop intervention model. Existing research rarely applies instructional design tools to social work service development, nor does it often explore the practical integration of AI technology into adolescent anxiety intervention. The innovations of this study are: using AI-assisted analysis of interview data during the Analysis phase to accurately identify multi-system triggers; integrating AI into CBT intervention logic during the design and development phases to aid in generating personalized strategies; utilizing AI during the Implementation phase to lower barriers to expression through functions like anonymous disclosure, emotion recognition, and communication simulation; and employing AI during the Evaluation phase to assist in analyzing quantitative data. AI does not replace the social worker's professional guidance and humanistic care but serves as a tool to enhance the applicability and engagement of CBT, compensating for the limitations of traditional interventions, such as insufficient personalization and limited appeal. This aligns with the "human-machine collaboration, complementary strengths" perspective proposed by scholars like Li and Tong [16-18].

7.4 Research Limitations and Future Directions

This study has certain limitations: the sample is limited to 32 ninth-grade students from a single township middle school, limiting representativeness; the intervention focused on the microsystem without achieving multi-system linkage across family, school, and community; AI application is still in the stage of assisted generation and feedback, with insufficient depth in intelligent interaction. Future research should expand the sample scope, construct a full-chain intervention model of "adolescent group + parent communication workshop + teacher psychological support + community resource linkage", and deepen the intelligent application of AI in emotion recognition, cognitive training, post-session companionship, and other areas.

8. Conclusion

Using Ecological Systems Theory as a framework and integrating CBT, the ADDIE model, and AI empowerment technology, this study designed a six-session social work group intervention curriculum for ninth-grade students experiencing anxiety, leading to the following conclusions: First, adolescent anxiety results from the interaction of multiple systems. Cognitive biases and weak emotional capacities within the microsystem are core triggers; high family expectations, insufficient school support, and peer competition within the mesosystem act as transmission vehicles; resource scarcity and places great emphasis on grades within the exo- and macro-systems further amplify anxiety. Second, the ADDIE model-based intervention program is systematic and operable, precisely addressing the core needs of adolescents and forming a standardized, replicable social work service protocol. Third, the CBT group intervention effectively alleviates anxiety and enhances psychological capacities: the mean post-intervention GAD-7 score decreased from 8.50 to 2.75, with 28 participants (87.5%) returning to normal levels, and significant improvements in emotional stability and communication initiative. Fourth, AI empowerment enhances service efficacy, increasing precision and engagement in strategy generation, emotion decoding, and interaction simulation, embodying a "human-machine collaboration" practical pathway. This study has limitations, including a single sample source, lack of multi-system linkage, and limited depth of AI integration. Future research should expand the sample, construct a full-chain intervention model, and deepen AI applications to provide a more generalizable practical paradigm for adolescent mental health services.

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