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The Connotation, Characteristics and Application of Digital Media Therapy in the Treatment of Autistic Children

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Abstract. The creative medium, healing process and healing experience of digital media art reveal its unique healing mechanism. The healing medium based on digital form has the characteristics of virtual reality. The healing process based on human-computer interaction reflects the characteristics of dynamic balance. The healing experience based on integration and immersion shows the characteristics of natural pleasure. In summary, the digital media therapy focuses on the harmonious symbiosis between man and nature, the harmonious interaction between man and society, and the harmonious unity between man and himself. Based on the analysis of the connotation and characteristics of digital therapy, this paper puts forward specific suggestions on the application of digital therapy in the treatment of autistic children, and provides an effective way to carry out the practice of digital therapy.

Keywords: Digital therapy; children with autism; technology; emotions.

1. Introduction

Characteristics of autism spectrum disorder (ASD) include alexithymia, social skills deficit, cognitive deficits, and restricted repetitive behaviors[1]. Effective emotional regulation is an important factor influencing the symptoms of children with autism[2]. In the field of non-pharmacological interventions, cognitive-behavioral therapy have demonstrated significant feasibility in improving emotional regulation in children with autism. Training programs focused on understanding mental states, including beliefs and emotions, can effectively enhance emotional and cognitive abilities, positively impacting subsequent emotional regulation capabilities in patients[3]. As a relatively new form of art therapy, digital media therapy offers intersectional, intelligent, and systematic characteristics, opening up vast development potential in the field of special education. Rather than being a product of the digital age, it is more accurate to say that the digital age has created an urgent need for digital media therapy in special education. Research indicates that the cognitive skills of most children with autism can be improved to a certain extent through digital interventions[4]. This paper analyzes the essence and therapeutic characteristics of digital media therapy, reveals its unique therapeutic mechanisms, and proposes recommendations for its application in children with autism.

2. The Essence of Digital Media Therapy

With the rapid development of technology, the increasing comfort of using digital technology and social media for creative expression and communication has brought digital media art into the public view, making it an important means of communication and social interaction in people's daily lives. Digital media art refers to the use of computer-based digital information processing equipment, through various software and hardware creation platforms, to describe and realize artistic concepts, ultimately creating and disseminating artistic works based on digital technology[5]. The digital media therapy studied in this paper is a form of therapeutic activity based on digital media art. As a type of art therapy, digital media therapy adheres to the fundamental principles of art therapy, which involve using artistic creation and expression to help individuals release emotions, alleviate psychological stress, and explore their inner worlds, thereby promoting self-awareness, emotional regulation, and psychological growth. However, unlike traditional art

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therapy, digital media therapy is a therapeutic activity conducted on a computer-based software and hardware creation platform, using digital collage, illustration, video, and film media technologies to create therapeutic works, or employing the creation process itself as a therapeutic method. McLuhan argued that media are extensions of human sensory organs, and the history of media development is also the evolutionary history of human sensory capabilities, progressing from "unification" to 'differentiation' to "reunification"[6]. The interdisciplinary nature of science and humanities in digital media art, along with the interactivity between subject and object, further highlights the "reunification" characteristics of media. Therefore, children with autism, due to their social disorder, particularly require the integrative media of digital media therapy to compensate for their cognitive deficits. Digital media therapy involves the following theories: (1) Mirror Neuron Theory: Art therapy promotes the development of social imitation abilities by activating the mirror neuron system, while digital media technology can reinforce this process through dynamic visual feedback. (2) Embodied Cognition Theory: VR technology enhances children's embodied experience of social behavior through the interaction of physical movements with the virtual environment, thereby promoting cognitive internalization. (3) Flow Theory: Gamified digital media tools stimulate children's attention through task difficulty progression, enhancing intervention compliance[7]. For children with autism, digital media therapy combines the characteristics and advantages of art therapy: (1) It does not rely on verbal expression: Due to physiological or psychological reasons, it is challenging for children with autism to express their inner feelings through language. Art therapy offers a non-verbal means of expression, enabling individuals to express emotions and ideas more freely and diversely. (2) Creative Expression: Art therapy emphasizes the creative process. First, through artistic creation, children with autism can develop creative thinking and expressive abilities, enhancing self-awareness and problem-solving skills. Second, through creative artistic appreciation, children with autism can use empathy and transference to enhance aesthetic experiences, achieving psychological regulation by releasing emotions. (3) Psychological Regulation and Self-Exploration: Art therapy can help children with autism better understand and process internal emotions and conflicts during the creative process. Additionally, through the appreciation and creation of various art forms, it can assist them in exploring their inner needs and desires, thereby reducing psychological stress and promoting self-growth. However, compared to traditional art therapy, digital media therapy has more prominent technical therapeutic characteristics, which is determined by the current digital age. No field can avoid the impact of the digital technology development trend, and the digital divide that once existed in the field of art therapy is being rapidly bridged by historical development.

3. The Therapeutic Characteristics of Digital Media Therapy

3.1 The Therapeutic Medium of Digital Media Therapy — Mutual Promotion Between Virtualization and Reality

" Mutual Promotion Between Virtualization and Reality" is a transcendent way of thinking in traditional Chinese philosophy that emphasizes the interconnectedness and mutual influence between humans and nature, as well as between humans and objects. For children with autism, they may find it more challenging to understand and integrate into the "reality" of the real world, such as social rules, language expression, and other complex forms of human communication. Meanwhile, their inner world may be filled with rich and unique "virtualization", such as obsessions with specific objects or repetitive, rigid behaviors, which can be seen as their way of constructing and expressing a virtual world. Traditional art therapy typically uses some form of tangible material as a medium, such as art therapy, which involves using various painting mediums and materials to express artistic intentions as a therapeutic activity. During the therapeutic process, children with autism can create art using real materials, and their works are typically tangible objects that can be seen and touched, making the therapeutic process more authentic but also more challenging. Digital media therapy is based on digital forms, often manifesting as virtual forms or a combination of

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virtualization and reality. Its materiality primarily lies in its form of existence and mode of transmission. On one hand, the visual graphics of the works break free from traditional painting methods that relied on materials like paint and paper to manifest; on the other hand, the emphasis on the realization of media meaning shifts from "material" to "materiality," which encompasses the comprehensive relationship between people and objects, culture, and technology[8]. Healing based on digital media art forms offers a rich variety of painting tools and effects, capable of simulating the effects of traditional painting media while also creating unprecedented artistic effects. Compared to traditional art, digital media therapy has a more pronounced "virtual" characteristic. As a result, digital media therapy reduces dependence on space, time, and material resources, thereby enhancing the convenience and reducing the difficulty of implementing therapeutic interventions for children with autism.

Mutual promotion between virtualization and reality in digital media therapy refers to the mutual penetration and integration of virtual and real elements during the therapeutic process, forming a closely interconnected state. Creators can use digital media to create virtual worlds and present them in the real world, such as in museums, on the streets, or in natural environments, blending reality and imagination to achieve highly rich and unique creative expressions. On the other hand, the rapidly developing field of artificial intelligence technology is a scientific discipline dedicated to researching and developing computer systems and machines that can simulate human intelligent behavior. Digital media works based on AI technology often feature virtual scenes created by creators, which are generated through AI analyzing real-world data using big data analysis and machine learning techniques, then presenting them in the real environment through specific artistic forms. In these works, real scenes and virtual imagery intertwine, with real materials expressed through virtual techniques, creating a harmonious blend of the real and virtual. Mutual promotion between virtualization and reality in digital media therapy highlights the close connection between digital technology and artistic creation, making the healing process more forward-thinking, interactive, and expressive. This not only enriches the forms of artistic expression and dissemination but also drives the practical development and conceptual framework of art therapy. For children with autism who have significant social disorder, alexithymia creates a barrier between them and the real world, making it difficult for the real world to be fully and directly presented to them. Through the virtual-reality-integrated digital media therapy form, children with autism can gradually and indirectly experience the world, thereby better healing themselves. For example, virtual reality technology can be used to create a virtual therapeutic environment where children with autism can freely explore and experience. This not only helps them connect the content they perceive with the real world but also attracts them to participate in therapy through rich visual stimuli and flexible interactive methods, thereby enhancing their learning interest and therapeutic effects. At the same time, children with autism can also use digital media technology to create the real or imaginary world they see, and through "positive imagination" construct an ideal world, thereby achieving the therapeutic effect of expressing their inner emotions and alleviating negative emotions. For example, the Qianqiu Intelligent System has more than 100 realistic scenes built in, combined with common urban landscape designs, to reduce cognitive transfer barriers for people with autism. In digital media therapy for children with autism, the concept of "mutual promotion between virtualization and reality" is manifested in addressing the "reality" of their difficulty connecting with the external world and the 'virtualization' of their unique inner world. By employing digital media art to find a balance between "virtualization and reality", we enable children with autism to both face reality and integrate into society while maintaining their inner uniqueness and creativity.

3.2 The Therapeutic Relationship in Digital Media Therapy — Dynamic Balance

As we all know, the fundamental law of development is change and unity. According to traditional Chinese philosophy, this means that development always maintains a dynamic balance. This balance is not a rigid, static state, but rather a state of harmony and stability that is maintained

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through constant change and flow. The process of digital media therapy embodies this dynamic balance. An important feature of digital media therapy is the interactivity of the healing process. One of the core symptoms of autism is social disorder. Children with autism often find it difficult and uncomfortable to communicate with others, which is also a common challenge in traditional art therapy, where therapists struggle to communicate effectively and smoothly with autistic children. The interactivity of digital media therapy focuses more on human-technology interaction, or human-computer interaction. This process is essentially one of input and output, where humans input instructions to the computer through the human-computer interface, and the computer processes these inputs and presents the results to the user. This form of interaction not only effectively avoids the social barriers that autistic children face when communicating directly with others but also builds a more natural and vivid bridge for their interactions with peers, family members, and others. Digital media artworks often encourage audience interaction and participation, blurring the boundaries between virtual and reality. Users become part of the artwork and can comfortably and efficiently participate in the creation process, directly generating new and effective artistic outcomes. For example, an AI-powered art creation app called “Star Gallery,” specifically designed for children with autism, uses AI technology to assist them in artistic creation. Children with autism can use it to transform their imagination into visual artworks. This new interactive approach opens a new window to art for children with autism, helping them better express themselves, understand themselves, and connect with the outside world.

Dynamic balance in digital media therapy embodies the opposition and unity between humanity and the objective world. Compared to traditional art therapy, the creative process and healing process in digital media therapy integrate the human subject (the creator and the recipient of healing) with the objective world (including technology) in a more natural and seamless manner, reflecting a higher-dimensional harmony and unity between humanity and nature. In particular, in AI-generated art activities—art forms that use AI technology to generate or assist in the creation of artworks—technology transitions from a static tool to a dynamic “human-like” entity, while the identities of creators and technology also exhibit greater diversity and integration. Creators evolve from the role of therapists in traditional healing to designers of human-machine relationships, architects of AI algorithms, and mutual guides of content with AI[9]. As the primary subjects of digital media therapy, children with autism can particularly benefit from the advantages of diverse and integrated identities and a dynamically balanced relationship with technology. Here, children with autism can not only participate in the appreciation process of digital media artworks and gain aesthetic experiences but also engage in the creation process, thereby enhancing their cognitive abilities and expressive skills. In this process, digital media works are not static, and children with autism are not in a passive receptive state. Instead, interaction and communication arise between the two, forming a harmonious and symbiotic landscape. The construction of a diverse and integrated identity facilitates improvements in emotional regulation levels for children with autism, while the dynamic balance with technology aids in addressing their repetitive behavioral deficits and enhancing self-efficacy. The combined effects of these factors contribute to the self-awareness and psychological development of children with autism. For instance, in the film “Animated Life,” the autistic boy Owen, who refuses to communicate with the outside world, acquires nearly all his social skills from animated films. He often uses dialogue from animated films to express his thoughts and feelings. For children with autism who have significant language barriers, the simple and straightforward dialogue and pure, direct emotional expressions in animated films are not only easy to understand but also easy to remember. Therefore, if virtual characters and stories that autistic children enjoy can be constructed through digital media art, they can provide rich and enjoyable sensory experiences and emotional fulfillment. Virtual characters can mimic human behavior and language to interact with autistic children, gradually guiding them to learn social skills such as eye contact, language expression, and emotion recognition, helping them establish emotional connections, enhance their emotional regulation abilities, and overcome social disorder.

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3.3 The Healing Experience of Digital Media Therapy — Natural Pleasure

Traditional Chinese philosophy believes that life experiences should be conducted in a natural way, without excessive intervention, but rather in a soft and flexible manner, to achieve the natural outcome of things. For autistic children with alexithymia and social disorder, it is necessary to help them build confidence, naturally express their inner emotions, enhance understanding and empathy with others, and thus enjoy the joy brought by social interaction. While the official definition of art therapy is difficult to summarize, some argue that art itself is the central focus of the therapeutic process, while others contend that the relationship between the patient and therapist is the most critical factor. Margaret Nomburg, one of the founding pioneers of art therapy, viewed dynamic-oriented art therapy as a direct, unconscious, and concrete form of symbolic communication that can help analyze transference[10]. From this definition, it is clear that immersive experiences are crucial in art therapy, and the therapist serves as a conduit to help patients achieve such experiences, rather than being the ultimate goal. However, in most traditional art therapy settings, professional and systematic guidance from the therapist is typically required for children with autism to engage effectively in art appreciation and creation. Compared to the importance of therapists in traditional art therapy, the role of therapists in digital media therapy is relatively diminished, and in many cases, good therapeutic effects can be achieved without the therapist. Due to the transformation of the relationship between humans and technology, digital media therapy has developed characteristics such as restructuring, participation, dynamism, and personalization, offering autistic children a new experience of integration, immersion, and narrative[11]. Children with autism often struggle with emotional expression, finding it difficult to recognize and articulate their feelings. In traditional art therapy, this can lead to challenges such as the child being unable to accurately interpret the therapist's facial expressions or vocal cues, or to consistently and accurately express their own emotions, which can hinder effective interaction and collaboration with the therapist, resulting in an inefficient therapeutic process and suboptimal outcomes. In digital media therapy, children with autism can directly communicate with technology and work alongside it. Here, technology is not merely a tool but also a partner and teammate. It provides children with rich sensory experiences, promotes emotional expression and communication, stimulates creativity and imagination, offers opportunities for social interaction, and facilitates self-awareness and growth. For example, Penev et al. designed a mobile application called “Guess What,” which provides game-based intervention therapy for children with ASD aged 3–12 via a smartphone. In the game, the phone is placed on the caregiver's forehead, displaying a series of intervention-related cues (such as a surprised face). The child must fully recognize and imitate these cues so that the caregiver can guess the child's imitation content, then proceed to the next cue. Each game lasts 90 seconds. Seventy-two children with ASD (average age 8 years and 2 months) played the game three times daily, three days a week, for four weeks. The study results showed that the game created a positive interactive environment between children and caregivers, enhancing the willingness of children with ASD to engage in social interaction[12]. Therefore, in the therapeutic process for children with autism, the advantages of digital media art should be fully utilized to create a complete, immersive artistic experience and a naturally enjoyable therapeutic experience for children, free from artificial intervention.

3.4 The Natural Attributes of Digital Media Therapy — The Unity of Humanity and Nature

The unity of humanity and nature is an important concept in traditional Chinese philosophy, emphasizing the close connection between humans and nature, and between humans and the external world. This concept holds that humans, as part of nature, should coexist harmoniously with nature and strive for a state of internal and external consistency. With the rapid advancement of technology, particularly the surge of artificial intelligence, humans can now connect with and communicate information across all things in the world. The boundaries between reality and virtuality are becoming increasingly blurred, and a third natural state is gradually emerging. The concept of the unity of humanity and nature has evolved to encompass the original first nature, the

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derived second nature, and the symbiotic third nature. Its core lies in coordinating the relationships among nature, humanity, and machines to achieve a state of harmonious integration between humanity, technology, and nature[13].

The term “art” originates from Latin and Greek, and its meaning encompasses both technique and craftsmanship. Therefore, the very origins of art are inseparable from technicality, and from the day it was born, it has been closely intertwined with technology. In the digital age, the technical nature of art is particularly evident. The harmonious unity between art and technology increasingly reflects the concept of the unity of humanity and nature. Additionally, research by foreign scholars indicates that the “mindblindness” autism model, based on the psychological characteristics of autism, has been transferred from psychology to the field of computer science, providing significant assistance to the development of emotional artificial intelligence. Developers of facial emotion recognition technology have utilized individuals with autism to innovate at the intersection of machine learning and human emotions[14]. This demonstrates the inherent connection between technology and emotional healing for autism. Given the close ties between art and technology, as well as autism and technology, digital media therapy for children with autism naturally embodies the concept of the unity of humanity and nature.

In digital media therapy for children with autism, the concept of the unity of humanity and nature is manifested through three aspects: the harmonious coexistence of humans and nature, the harmonious interaction between humans and society, and the harmonious unity of humans with themselves. First, in the digital media therapy process, visual and auditory elements from nature are often cleverly integrated, such as using high-resolution natural landscape images and recording real natural environment sounds as background, thereby creating an immersive natural atmosphere. This design not only helps children with autism feel the tranquility and harmony of nature in the digital environment but also promotes their psychological relaxation and emotional stability to a certain extent, achieving unity between humans and nature. Second, digital media therapy projects carefully construct social simulation scenarios, using virtual role-playing and online interactive games to provide autistic children with opportunities for social practice. These projects can simulate real social environments, encouraging children to learn communication skills and understand social rules in the digital space, and gradually transition to real-life social scenarios, achieving harmonious integration into society. Additionally, digital media therapy encourages family members and social volunteers to actively participate in the digital media therapy process through collaborative tasks and interactive games, thereby building a supportive social network. Such therapy enhances children with autism's sense of social belonging, promotes positive connections with others, and achieves harmonious coexistence between individuals and society. Finally, based on the individual differences and needs of children with autism, data analysis technology is used to precisely identify their interests, ability levels, and areas of challenge, thereby customizing personalized digital media therapy plans. This personalized design maximizes the stimulation of children's inner potential, helping them achieve self-exploration and growth in the digital environment, and achieving harmony between the individual and themselves. For example, emotion recognition and regulation training, as well as cognitive ability enhancement activities, are integrated into digital media therapy. Through interactive games and feedback mechanisms, autistic children are guided to learn how to recognize and manage their emotions while improving their attention span, memory, and other cognitive abilities. These programs contribute to the children's mental health development, achieving harmonious regulation of emotions and comprehensive enhancement of cognitive abilities. In summary, digital media therapy achieves harmony between humans, nature, society, and the self through the ingenious integration of technology and art.

In today's information age, the boundaries traditionally defined by an artist's identity, experience, and skills are gradually dissolving. Technology enables us to experience the world and express ourselves in more diverse ways, offering richer means of perception and creation. The era where “everyone is an artist” seems to be upon us. Compared to the importance of professional art therapists in traditional art therapy, the role of art therapists in digital media therapy is gradually

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weakening. The technical characteristics of digital media art allow viewers to receive and create artworks more conveniently and efficiently, making art increasingly accessible to the general public with the support of technology. In traditional notions, artists are typically viewed as a group of people with specific identities, rich experience, and exceptional skills. They create works that touch the heart through their unique perspectives and modes of expression. However, with the continuous advancement of technology, many tasks that once required highly specialized skills and extensive training can now be completed with technological assistance or even independently and quickly. This does not mean that artists will be replaced, but rather that the way artists work, the boundaries of their creativity, and our understanding of the identity of "artists" are undergoing significant changes. Especially with the emergence of digital media artworks based on artificial intelligence technology, the exclusivity of the traditional artist identity has been broken, allowing more people to participate in artistic creation. Under new technological conditions, we should perhaps abandon the fantasy of humans surpassing technology and the fear of technology replacing humans, and instead strive to transcend the oppositional relationship between humans and machines. We no longer view technology as an external tool or an opposing force, but rather as an extension of our bodies and minds, an extension of our creativity and wisdom. For children with autism, digital media technology serves as a compensation and extension for their physical or mental limitations. Every interaction and integration between humans and technology has the potential to spark new inspiration and creative ideas, thereby driving the continuous development of art and aesthetics, as well as the inner transformation of children with autism. Through the creation of imaginative, diverse, and comprehensive generative digital media works, children with autism can freely explore the digital world, fulfilling their deeply hidden or long-suppressed aesthetic expectations and emotional needs, achieving an ideal state of the unity of humanity and nature. This not only significantly enhances their sense of self-efficacy but also has a positive therapeutic effect on their emotional regulation disorders. In the therapeutic application of digital media therapy for children with autism, both human-machine collaboration—where children with autism collaborate with digital media software in artistic creation—and direct use of digital media tools for creation can be employed. Digital media art, with its unique perspective and expression methods, provides children with autism with more diverse ways to experience the world. For example, digital media software based on artificial intelligence technology can process and analyze massive amounts of data, uncover patterns and connections that humans might overlook, and create novel, unique artistic works. These works may present the world in ways that children with autism have never imagined, allowing them to reexamine and understand their surroundings from new perspectives.

4. Experimental Design and Results Analysis

4.1 Experimental Objectives

This experiment aims to quantitatively assess the effectiveness of digital media therapy in improving emotional regulation, social skills, and cognitive-behavioral performance in children with autism through experimental intervention. By establishing standardized intervention procedures and behavioral observation indicators, this study seeks to validate the feasibility and impact of the core characteristics of digital media therapy (mutual promotion between virtualization and reality, dynamic balance, natural pleasure, and the unity of humanity and nature) in practical application scenarios, thereby providing an evidence-based foundation for developing personalized rehabilitation strategies.

4.2 Experimental Subjects

The experimental subjects were 16 children with autism spectrum disorder (ASD) from four classes in the same special education school (aged 6–10 years, male-to-female ratio 1.3:1), all of whom had moderate language comprehension and operational abilities. The experimental teachers were four special education teachers with over three years of ASD intervention experience

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(including practical experience in digital media therapy), all of whom were familiar with the behavioral characteristics of the participating children, participated in the entire intervention process, and conducted observations and evaluations.

4.3 Experimental Tools and Measurement Indicators

4.3.1 Intervention Tools

(1) The digital media therapy group used AI painting software, VR social simulation applications, and interactive game platforms.

(2) The control group uses traditional art therapy tools (such as paints, watercolors, paper materials, etc.).

4.3.2 Observation and Evaluation Dimensions

To systematically assess the actual effects of the two intervention methods, this study sets specific observation indicators from multiple dimensions based on the core symptom characteristics of children with autism and intervention objectives, as detailed in Table 1.

Table 1. Experimental observation indicators and evaluation dimensions

Dimension	Primary Indicator	Secondary Indicator	Measurement Method
Emotional Regulation Skills	Emotional Expression	Emotion-related verbal expressions, emotional body movements (such as crying or jumping for joy)	Teacher observation records, video playback analysis
	Emotional Stability	Frequency and duration of emotional fluctuations	Teacher observation records
Social Behavior	Proactive Interaction	Actively approaching others and initiating simple communication behaviors	Teacher records + video observation
	Interactive Response	Responses to interactions with others or systems	Video observation analysis
Cognitive Engagement	Task Engagement	Level of attention to tasks and participation in operations	Teacher observation records
	Task Persistence	Persistence in the face of task difficulties	Video observation records
Self-identity	Self-association	Verbal references to self-related matters and attention to self-related virtual elements	Teacher observation records

4.4 Experimental Process

4.4.1 Experimental Design and Grouping

During the intervention, teachers alternated between digital media therapy and traditional art therapy in the classroom, with each intervention lasting 40 minutes. The two therapies were alternated, with each therapy administered 10 times per cycle, separated by a 7-day interval to avoid practice effects. Digital media therapy utilized AI painting software, virtual reality social scenarios, and interactive game applications as tools to observe children's interactions with virtual environments. Traditional art therapy employed painting pigments, craft materials, and other tools to document children's interactions with materials and peers. Additionally, the two therapies were compared and analyzed across three dimensions: engagement, emotional state, and social interaction. Specific intervention measures are detailed in Table 2.

Table 2 Comparison of traditional art therapy and digital media therapy in autism intervention

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Comparison Dimensions	Traditional Art Therapy	Digital Media Therapy
Media Format	Physical tools (paintbrushes, clay, paints, etc.)	Digital tools (AI software, VR, interactive apps, etc.)
Participation Method	Therapist-led	Children interact spontaneously with the system
Expression Path	Reliance on physical materials, fixed modes of expression	Multimodal expression (integration of visual, auditory, tactile, etc.)
Interaction Object	Children ↔ Therapist	Children ↔ Technology systems/virtual characters
Degree of Personalization	Fixed process, difficult to adjust dynamically	Can adapt in real time to points of interest and ability levels
Data Recording Capability	Based on observation, lack of systematic recording and evaluation	Can collect multimodal data such as eye movements, clicks, and reactions
Participation Interest	Low participation among those who are not sensitive to materials	Instant feedback motivates children and creates a strong sense of immersion
Applicability Restrictions	Requires specific time and place, high operational requirements	Can be implemented on the go with low technical barriers
Efficacy Evaluation	Reliance on subjective observation	Can be combined with objective behavioral indicators and emotional physiological data for assessment

4.4.2 Interview Recordings

The interviews were conducted in a semi-structured format, centered around the four core therapeutic characteristics of digital media therapy: “mutual promotion between virtualization and reality,” “dynamic balance,” “natural pleasure,” and “the unity of humanity and nature.” Four targeted questions were designed to interview four teachers (see appendix). Prior to the interviews, the research objectives were explained to the four eligible special education teachers, guiding them to objectively describe the behavioral differences between children with autism in digital media therapy and traditional art therapy based on actual teaching scenarios, and to record specific cases. Each interview was conducted for approximately 30 minutes, with the entire process recorded and transcribed into text.

Each teacher provided independent responses to four questions. The researchers conducted a narrative structure analysis (based on the Labov model) of the interview content, extracting key behavioral changes, emotional response vocabulary, and typical comparative cases, and then coded and categorized them across six dimensions (introduction, direction, progress, evaluation, conclusion, and response).

4.5 Analysis of Experimental Results

Based on the results of behavioral observations and interviews, digital media therapy demonstrated significant advantages in the intervention of children with autism: in terms of emotional regulation, children experienced fewer emotional fluctuations in the virtual environment, increased positive emotional expressions, and longer periods of relaxation; in terms of social behavior, the frequency of proactive interactions was significantly higher than that of traditional therapy, and the accuracy rate of responses to virtual characters improved; in terms of cognitive engagement, the duration of task focus and persistence rate in difficult tasks were both superior to those of traditional intervention models.

Semi-structured interviews (based on Labov's narrative model) further validated the practical efficacy of the core characteristics of digital media therapy: “mutual promotion between virtualization and reality” promoted the transfer of children's social behavior, the “dynamic balance” mechanism effectively maintained participation motivation, the “natural pleasure” characteristic significantly enhanced positive emotional experiences, and the “the unity of humanity

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and nature" trait facilitated the emergence of social-like behavior. Compared to traditional art therapy, digital media therapy achieves synergistic intervention effects in emotional regulation, social development, and self-identity growth through multimodal interaction, personalized adaptation, and objective data collection, offering a new technologically empowered pathway for the rehabilitation of children with autism.

5. Recommendations for the Application of Digital Media Therapy

5.1 Creating a Healing Space that Blends Reality and Virtuality

Based on the above research findings, digital media therapy demonstrates significant application potential in special education. For children with different subtypes of autism, it can offer highly personalized and diversified therapeutic recommendations. Therefore, corresponding suggestions for the application of digital media therapy are proposed in light of the common characteristics of autistic children.

5.1.1 Using Virtual Natural Spaces to Heal Negative Emotions

With digital media technologies—such as virtual reality (VR) and augmented reality (AR)—a healing space that is both realistic and illusory can be constructed for children with autism. This helps them move freely between the virtual and real worlds, gaining richer emotional experiences and therapeutic effects. According to the "biophilia hypothesis", a beautiful and soothing natural environment can evoke positive emotional responses in autistic children, thereby alleviating negative physical and psychological emotions. While new media technologies cannot fully replace the experience of real nature, they can provide a pathway to connect with nature itself. Through virtual nature technologies, children with autism can develop a deeper understanding of nature's complexity and diversity, fostering a sense of awe and care for nature, as well as savoring the pleasure it brings[15]. Therefore, using digital media technologies to simulate pure natural environments and construct immersive, multi-sensory, and interactive virtual natural healing spaces not only offers visual enjoyment to autistic children but, more importantly, establishes an emotional bond between humans and nature—this will positively impact their emotional regulation.

For instance, in therapeutic programs, 3D modeling software is used to create realistic natural environment models (e.g., forests, oceans, grasslands), and physics engines are employed to simulate dynamic natural phenomena, such as wind rustling through grass or waves lapping at the shore. These elements are integrated with multi-sensory experiences, including visual, auditory, and tactile inputs: natural sounds are delivered via headphones, vibration devices simulate tactile sensations, and even olfactory experiences can be incorporated (e.g., mimicking the fresh air of a forest or the salty aroma of the ocean). Additionally, engaging interactive tasks can be designed, such as searching for specific flora and fauna or participating in virtual natural disaster response drills. Virtual characters favored by autistic children can be introduced to interact with them, providing guidance and support to alleviate negative physical and psychological states and enhance emotional regulation abilities.

5.1.2 Utilizing Virtual Social Spaces to Alleviate Social Barriers

Alexithymia and social deficits are key characteristics of children with autism. Virtual space scenarios enable children with autism to gradually engage with complex situations. For example, in therapeutic settings such as virtual supermarkets, hospitals, and streets, digital media art can be used to add personalized virtual characters to the scenes, allowing these children to assume their preferred roles in the virtual space and enhancing their sense of immersion and participation. Based on the interests and traits of children with autism, unique appearances, movements, and sound effects can be added to the characters to make them more vivid and engaging. Children with autism can learn to cope with various situations in their favorite scenarios alongside familiar peers, while avoiding potential safety risks that may occur in real-world training. Additionally, digital media art

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can be used to tell engaging stories, guiding children with autism through virtual adventures; or to design warm, touching scenes and storylines that evoke emotional resonance and empathy in them. Through the visual and auditory effects of digital media art, a warm and comfortable atmosphere is created, making children with autism feel cared for and warm. Incorporating social skills and cooperation training elements into the storylines of therapeutic programs allows children with autism to subtly improve their social abilities while enjoying the stories. Furthermore, by utilizing sensors and data analysis technologies in digital media art, real-time data on the performance of children with autism in virtual spaces can be collected, analyzed, and processed. This helps identify improvements in their social skills, communication abilities, and cooperation capacities, thereby providing personalized guidance and suggestions to support their better adaptation to virtual scenarios and therapeutic activities. By constructing social therapeutic spaces that integrate social elements (such as daily life and social skills) and conducting purposeful, planned training for children with autism—with subsequent generalization to real-life situations—their social skills, communication abilities, and cooperation capacities can be effectively improved, thus alleviating their social barriers[16].

5.2 Creating Multi-sensory and Multi-dimensional Non-linear Interactive Experiences

5.2.1 Developing Multi-Sensory Healing Projects

Unlike traditional art, which primarily relies on single-sensory experiences such as vision or hearing, digital media art integrates multiple sensory experiences—including hearing, touch, vision, and even smell and taste—through technological innovation. This multi-sensory engagement not only enriches the presentation of artistic works but also significantly enhances viewers' immersion and sense of participation. For example, color therapy is a medical intervention that uses color to provide psychological treatment to patients[17]. Meanwhile, the rhythm and cadence inherent in graphic composition, as well as the patterns derived from the movement speed and direction of dynamic graphics, can all exert distinct effects on human emotions. Additionally, research has demonstrated that artworks can positively influence public emotions through material experiences, crafting processes, and spatial interactions, possessing subtle yet profound spiritual healing effects. Therefore, developing digital media therapeutic works from a tactile perspective also holds significant healing potential[18]. Thus, creatively integrating comprehensive sensory elements—such as color, rhythm, cadence, materials, space, and movement—in digital media therapy for children with autism will more effectively enhance their sensory experiences, thereby alleviating potential psychological stress and releasing negative emotions. For instance, in constructing a therapeutic environment, bright and warm colors (e.g., orange and yellow) can be selected, as these hues can stimulate children's interest and provide a more comfortable sensory experience. During therapy, various materials with distinct tactile qualities—such as silk, velvet, and sand—can be provided for children to touch and perceive, thereby enhancing their tactile awareness. A space filled with creativity and variation can be designed, featuring ever-changing lighting effects and wall decorations, allowing children to explore freely and experience the wonder of the space. Simple movement games can also be designed, such as chasing light and shadow or jumping over obstacles, enabling children to release energy through physical activity, improve bodily coordination, and simultaneously enjoy a pleasant emotional experience.

5.2.2 Designing Multi-dimensional Interactive Healing Projects

Unlike the singularity of traditional art therapy forms, digital media therapy not only enables diverse interactions between people and between humans and technology but also features a variety of interactive modes. Digital media therapy can utilize natural interaction, motion-sensing interaction, gesture interaction, eye-tracking interaction, and other methods to provide audiences with unprecedented engagement and interactivity. These interaction methods not only make the presentation of artworks more vivid and personalized but also guide children with autism to delve into their inner worlds, achieving self-healing through self-awareness and self-exploration.

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Furthermore, they can alleviate physical tension and fatigue, as well as potential motor disorders such as hand-eye incoordination, thereby achieving a state of mind-body balance. For example, for children with autism who love small animals, an augmented reality-based animal world exploration game can be designed. Suitable motion-sensing gaming devices (e.g., Kinect) can be used to enable interaction with digital content through body movements; gesture recognition technology (e.g., Leap Motion) can allow children to control the presentation of digital media works via gestures; and eye-tracking technology can be employed to analyze children's gaze points and adjust the artwork presentation based on their interests. It is essential to ensure that the artworks are guiding in nature, capable of stimulating children's imagination and creativity, and enabling them to interact with virtual animals through gestures. Additionally, soft lighting, comfortable seating, and soothing background music can be used to create a relaxed and pleasant therapeutic atmosphere. Finally, technological means can be utilized to collect data on children's interactions, such as eye movement trajectories and gesture movements. This data can be analyzed to understand children's interests, attention distribution, and emotional changes, providing a basis for optimizing and adjusting subsequent therapeutic programs.

5.2.3 Emphasizing Non-linear Narrative in Therapeutic Projects

In digital media therapy for children with autism, non-linear narrative is particularly crucial. When interactive technologies are introduced into the field of art therapy, the narrative mode of works undergoes a revolutionary transformation: shifting from one-way output to two-way or even multi-directional communication. Children are no longer passive recipients but can actively choose approaches suitable for themselves to understand and explore art, thereby achieving spiritual resonance and emotional release. In digital media therapy for children with autism, it is essential to enable them to immerse themselves in interactions across multiple scenarios. The experiential process of the works has no fixed pattern; instead, it is determined by the children's behavioral pathways, allowing them to select the number and order of scenarios based on their preferences. This multi-stage, non-linear narrative structure not only arouses children's curiosity but also guides them from one scenario to another, letting them savor the joy of exploration. It enables children to express their inner feelings and emotions in a more free and flexible way, using artistic creation to seek meaning and purpose. Therefore, non-linear narrative technology provides an entirely new and creative method for art therapy. It not only helps children with autism better understand and process their emotions and experiences but also allows them to find channels for self-expression and release in the world of art.For example, a non-linear digital media art therapy project entitled Journey Through Stars can be designed for children with autism. Children transform into brave interstellar explorers, traveling through different planets and scenarios. Through free exploration and interaction, they discover themselves, release emotions, and achieve spiritual healing. On the interstellar map, children will see multiple planets and scenarios, each representing a distinct therapeutic theme—such as "Emotion Planet," "Creation Planet," and "Courage Planet." They can choose to visit a specific planet based on their interests and preferences. Each planet contains multiple interactive scenes, with transitions between scenes determined by the child's behavioral path. Within each scene, children can interact with virtual elements via touch, voice, or gestures: on "Emotion Planet," they can engage in emotional communication with virtual characters, learning to recognize and express their own emotions; on "Creation Planet," they can use virtual brushes and musical instruments to create their own artistic works. Such creative and caring digital media art therapy projects, leveraging non-linear narrative and interactive technologies, open up a brand-new world for children with autism, allowing them to grow through exploration and heal through creation.

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5.3 Creating Multimodal Data-driven Personalized Interventions

5.3.1 Constructing Dynamic User Profiles

First, effective multimodal data need to be extracted. Record children's click frequency, task completion time, and error rate in digital tasks to quantify their cognitive abilities and behavioral patterns. For example, a study analyzed children's reaction times in VR social tasks and found that their social motivation was negatively correlated with task difficulty. It is important to note that integrating multimodal data requires addressing technical challenges such as data synchronization, noise filtering, and feature extraction. For instance, timestamp alignment technology can be used to ensure temporal consistency across different data sources; machine learning algorithms can be employed to eliminate noise interference; and feature engineering can be applied to extract key indicators (e.g., attention concentration, frequency of emotional fluctuations). Second, based on multimodal data, deep learning models (e.g., LSTM, Transformer) can be used to construct behavioral-emotional-cognitive feature maps for children. Individual feature models can be built using eye-tracking data, physiological signals (electrodermal activity, heart rate), and behavioral data. For example, an LSTM-based music generation engine can dynamically adjust rhythm in real time to adapt to emotional fluctuations.

5.3.2 Designing Intelligent Adaptation Algorithms

Cognitive rehabilitation products dynamically adjust intervention plans by analyzing training data. For example, a study showed that children acquired 34.5 cognitive skills within three months, with a completion rate of 41.62%. Using a hierarchical intervention model, children are categorized into mild, moderate, and severe groups based on results from the Childhood Autism Rating Scale (CARS)[1]. Differentiated VR scene difficulty levels and reward mechanisms are then designed accordingly. Physiological signals and behavioral data are used to identify children's emotional states and provide personalized regulation strategies. For instance, an AI painting system analyzes brushstroke pressure and color choices to generate real-time emotional feedback (e.g., "You seem relaxed while drawing"), helping children express and manage their emotions.

6. Summary

The close connection between art and technology, and between autism and technology, gives digital media therapy for children with autism a natural attribute of the unity of humanity and nature. Digital media art can help children with autism express their creativity in a more diverse and relaxed manner, and also assist them in participating in appreciation in a more authentic and efficient way. In the process of artistic creation and appreciation, technology bridges the gap between creators and appreciators, between the human spiritual world and the external material world, and between the original first nature and the derived second nature. This facilitates humanity's co-creation of the third nature—the most ideal state of the unity of humanity and nature—through technology. This ultimate beautiful world may offer children with autism unparalleled aesthetic experiences and spiritual healing.

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Appendix

1. Are children more relaxed in virtual natural settings than in real environments? Can this relaxed state be transferred to real life?

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2. Are children more proactive when interacting with digital media tools (such as AI painting software) than when interacting directly with others?

3. In digital media therapy, which designs (such as sound effects or color changes) are most effective in stimulating children's sustained participation?

4. Do personalized digital media solutions (such as virtual characters customized based on children's interests) enhance self-awareness more than standardized solutions?

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