The Educational Impact of Human-Computer Interaction-based Animation on the Psychological Development of Adolescents

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Abstract: *In order to enhance the lifestyle of adolescents, this study analyses the educational impact of animation on their psychological development, with particular attention to animation based on human-computer interaction technology and artificial intelligence. In order to improve the lifestyle of teenagers, the educational influence of animated films on their psychological development is analysed. First, the research background is introduced, and the influence of animation on the psychological development of teenagers is introduced; second, the theoretical knowledge of artificial intelligence, human-computer interaction and virtual reality involved in the research are discussed; finally, the deficiencies and improvement measures of animation in teenager psychological development education are studied. The results show that the use of human-computer interaction technology can increase the sense of immersion, interactivity and imagination when watching films, help teenagers develop their lifestyle, and significantly improve their deductive, inductive and analogical reasoning abilities. It is hoped that this study can provide some reference for animation to help teenagers develop lifestyle.*

Keywords: artificial intelligence, human-computer interaction, virtual reality technology, animation, teenagers develop
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1. Introduction

With the rapid development of animation, the output of animation is increasing. Research shows that animation has an important impact on the development of teenagers. From the perspective of animation development situation, China's animation has maintained a large production, and has been maintaining a larger growth trend year by year. In the development process of animation, the existing problems are gradually exposed, and the quality and content of animation begin to be widely concerned. It is particularly important for the development of animation to strengthen the standardization of animation market. animation is a hot spot for teenagers to watch, and teenagers show their love for cartoons in subjective consciousness. However, with the introduction of foreign animation, animation has been impacted, and its output cannot meet the actual demand. In addition, in terms of content, there is a big gap between animation and foreign animation, making animation gradually in a disadvantage position in the development process. In view of this problem, China's animation begins to be improved, and the quality and output have been greatly improved. However, due to the late start of China's animation industry, compared with the western developed countries, there is still a large gap, and the unbalanced development of animation industry has become

increasingly prominent. Meanwhile, the lack of understanding of relevant theories and some other problems in the process of animation creation have seriously affected the quality of animation and have a relatively negative impact on the psychology of teenagers (Huang & Wen-Hui,). Considering the development background of animation, it is necessary to strengthen the research on this issue. Teenagers are the backbone of social development. American scholars have combed the research on children and teenager psychological development from ten aspects. Chinese scholars have also summarized the teenager development psychology from eight aspects. Animation provides a sample of entertainment for teenagers. While watching cartoons, teenagers will unconsciously learn language, knowledge, aesthetics and so on (Wang et al., 2017).

The influence of animation on the psychological development of teenagers is mainly studied. The theoretical knowledge of artificial intelligence (AI), human-computer interaction (HCI) and virtual reality (VR) is analyzed. The application of VR technology in animation is analyzed. At the same time, the educational impact of animation based on HCI on psychological development of teenagers is analyzed, and the deficiencies of animation development and improvement measures are studied.

2. Research theory

2.1 AI

AI is a technical science that researches and develops theories, methods, technologies and application systems for simulating, extending and expanding human intelligence. It is a branch of computer science, hoping to produce a new kind of intelligent machine which is similar to human intelligence so as to respond. AI research fields include robot, language recognition, image recognition, natural language processing, imprecise and uncertain management, artificial life, neural network, complex system, genetic algorithm and expert system (Lu et al., 2017). AI is a science that contains knowledge of many disciplines, involving computer science, psychology, language and other disciplines. It covers almost all disciplines in natural science and social sciences and humanities, and belongs to the interdisciplinary of natural science and social sciences and humanities (Ghahramani, 2015). One of the main purposes of AI research is to enable machines to replace humans to complete some repetitive, simple, or complex tasks that require human intelligence (Moravčík et al., 2017). Among them, Figure 1 shows the application and characteristics of AI technology.
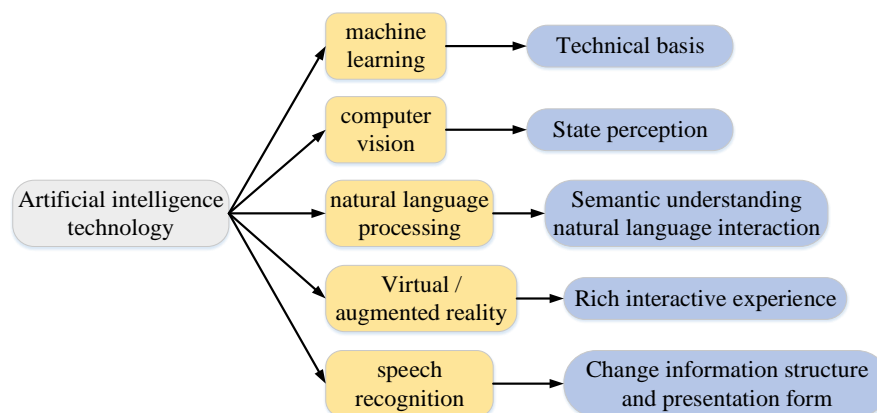

Figure 1: Application and characteristics of AI technology

At present, there are two ways to realize AI by computer. One is to use the traditional programming technology to make the computer system have intelligent performance. In this

technology, more attention is paid to the final effect, regardless of whether the method used is the same as that used by human or biological organism. This method is called engineering approach. This method has been used to realize machine intelligence in some fields, such as word recognition with devices, and computer playing chess (Raza & Khosravi, 2015). Another method is modelling approach (Davis & Marcus, 2015). In this method, it not only pays attention to the final implementation effect, but also require that the method to realize intelligence is the same or similar to that used by human or biological organism. The current popular genetic algorithm (GA) and artificial neural network (ANN) belong to the latter type. GA simulates the genetic evolution mechanism of human or biological (Zang et al., 2015), and ANN simulates the activity mode of neural cells in human or animal brain (Jeavons, 2017). Relatively speaking, the manual programming method is more cumbersome and prone to errors. Once a programming error occurs, people need to modify the original program, then recompile, debug, and finally provide users with a new version or a new patch, which is very troublesome. When using the modelling approach, the programmer should design corresponding intelligent system for different roles to control. The intelligent system will not understand anything from the beginning, and gradually learn to adapt to the environment, and will cope with various complex situations. There will be also errors in this system, but the system can learn a lesson, and errors may be corrected in the next calculation run. The same error will not occur all the time, and there is no need to release new versions or patches for it. Similarly, this method has higher requirements for relevant personnel (Parkes & Wellman, 2015).

With the continuous development of AI technology, it has gone from machine intelligence to perceptual intelligence, and is moving towards the stage of cognitive intelligence (Bundy, 2017). Human language system is more complex, and the current "one question and one answer" HCI format can no longer meet the real needs of users. Therefore, machines are required to learn to deal with the complex human language. With the maturity of speech recognition, NLP and other technologies, multi round dialogue interaction system will become an important link and bridge of HCI (Rigas et al., 2015).

2.2 HCI technology research

HCI is a technology mainly to study human, computer and their mutual connection (Yeo et al., 2015). Conversational AI (CoAI) refers to the intelligent behaviour embodied by dialogue and interaction. Usually, intelligent systems interact with users or environments, and learn and model in the interaction (Churchill et al., 2016). HCI is the most challenging and comprehensive technology in AI, covering the knowledge of semantic understanding, knowledge representation, language generation, logic and reasoning (Rempel et al., 2014). Figure 2 shows the application of HCI technology.

Figure 2: Application chart of HCI technology

CoAI mainly includes, but is not limited to, the following aspects of research: universal question answering system, including automatic question answering, reading comprehension; task or goal-oriented dialogue system; and open field chat system (Schwenker et al., 2015). As a broader concept of HCI, interactive system not only takes natural language as the carrier, but also comprehensively uses multimedia information such as images and voice, so that machines can understand their own environment and show intelligent behaviour in accordance with the situation (Siau, 2016).

VR is a new "HCI" technology, which combines computer graphics, AI, computer network and distributed processing and other disciplines (Hibbeln et al., 2017). VR technology is a technology which includes computer technology, HCI technology, detection technology and control technology. It has the characteristics of immersion, interactivity and imagination. It is the most promising human-computer interface to realize "people-centered". Human-computer interface is the medium and dialogue interface for information transmission and exchange between human and computer, which is an important part of computer. There is a close relationship between HCI and human-computer interface (Pimenta et al., 2016).

2.3 Teenager development psychology

The research of teenager development psychology is a branch of life development psychology (Freeman, 2014). The psychological characteristics of teenagers mainly include the following three aspects. First, psychological development is not synchronized with physiological development. Adolescence is a transitional period from ignorant childhood to mature youth. In adolescence, the physiological characteristics of individuals are mature, and the external characteristics tend to be stable. Comparatively speaking, the speed of psychological development is slower than that of physiology. In the face of the rapid change of physiological form, the individual is easy to have psychological discomfort, the initiation of sexual consciousness and taboo feeling are intertwined. Therefore, it is necessary to provides timely and effective psychological guidance for teenagers to help them safely through this important period of development, avoid unnecessary harm caused by psychological problems, and lay the foundation for the healthy development of teenagers in the future. Second, it is the dual development of intelligence and thinking, as well as the enhancement of independent consciousness. In adolescence, the intelligence and thinking of individuals develop rapidly, and the thinking in images changes to abstract logical thinking. The stronger the self-awareness, the stronger the desire for independence. At this stage, teenagers are prone to make false self-evaluation. Third, the demand of teenagers for interpersonal communication is enhanced. With the gradual enhancement of the sense of independence, teenagers' desire for interpersonal communication is becoming stronger and stronger. In the group they are familiar with, teenagers have a strong sense of belonging and dependence.

2.4 Common psychological problems of teenagers

In adolescence, individuals are prone to many psychological problems, mainly including adolescent adaptation, social adaptation and learning adaptation (Durkin & Barber, 2003). Adolescent adaptation: when teenagers face with a series of physiological and psychological changes in adolescence, due to the relatively shallow life experience and lack of psychological maturity, it is difficult for them to correctly deal with many sudden problems, which makes them prone to obsessive-compulsive, partial depression and self-consciousness disorder and other symptoms. Social adaptation: the growing sense of independence of teenagers contradicts with the fact that they do not have the ability to be truly independent at this stage. At this stage, teenagers still need to rely on their parents to live. Then, teenagers can't treat the sexual consciousness germinated in adolescence correctly, and correctly deal with the desire to

interact with the opposite sex and shyness for physical development. Therefore, teenagers are prone to have poor interpersonal relationship, love problems and Internet addiction. Learning adaptation: with the expansion of the enrolment of colleges and universities across the country, the pressure of the college entrance examination in the past is gradually transferred to the high school entrance examination and even the junior high school entrance examination. At the same time, the society's call for all-round development of talents and the family's ardent expectations for their children will bring heavy pressure to the majority of teenagers. School performance is directly related to the future of teenagers' education, employment and even the whole life direction. In the face of the change of learning style and the enhancement of learning pressure in the middle school stage, as well as the attack of various other kinds of pressure, teenagers are easy to have psychological problems such as decadence, weariness of learning, anxiety of examination, and avoidance. If the psychological problems of teenagers cannot be solved in time, it is easy to develop into various psychological crises, and then increase the incidence of psychological disorders and diseases. Individuals will have a variety of emotional problems, behavioural problems, cognitive problems and physiological problems. If there is no intervention, it will have immeasurable serious consequences (Gutman & Eccles, 2007). Therefore, in adolescence, it is necessary to carry out psychological intervention and related psychological education to help teenagers develop healthily. The traditional adolescent intervention methods include four stages: problem inquiry, analysis and cognition, treatment and consolidation.

2.5 Theoretical analysis of animation

Animation, also known as cartoon, is one of the four kinds of films. It is the general name of animation, papercut, puppet, origami and other types of films. In animation, painting or other forms of plastic arts are taken as the main means of expression of character modelling and environmental space modelling. It does not require the lifelike characteristics of feature films. It reflects people's life, ideals and wishes by means of exaggeration, likeness and deformation, with the aid of fantasy, imagination and symbol. It is a highly hypothetical film art (Sitkiewicz, 2008). Animation art is inextricably linked with film art and plastic arts, so it can be thought that animation has two artistic attributes: modelling and narrative.

Animation has the advantages of popularizing knowledge and promoting the development of teenagers' thinking (Jullien-Ramasso et al., 2012). Science popularization: in the development process of animation in China, more attention is paid to strengthening the educational function of animation to publicize some positive and upward educational ideas through animation production. In the creation of animation, the education of objective knowledge is emphasized in many cartoons. Therefore, it is of great significance to promote the development of teenagers' thinking. In the process of watching cartoons, teenagers can better understand and memorize knowledge and learn relevant knowledge imperceptibly, which can promote the future growth of teenagers. In the process of creation, some cartoons also include the introduction of some scientific knowledge, biological and chemical laws, which is of great significance to open up teenagers' thinking and help them understand the world. Promote the development of teenagers' thinking animation itself has certain educational significance. It carries out knowledge education through indoctrination, which enables teenagers to master and understand knowledge imperceptibly in the process of watching cartoons, so as to promote their intellectual development and future growth and development. The character expression form of animation is mainly language expression, and the educational function is realized through language expression; in the character design of animation, the design of "polarization" is adopted. This kind of polarized character design can make teenagers better understand the good people and the bad guys. The psychological age maturity of teenagers is not very high,

their own understanding ability is poor, and the social understanding is shallow, if the concept is vague, it is not conducive to the physical and psychological development of teenagers.

2.6 VR technology features

VR technology, with the characteristics of immersion, interactivity and imagination, is very suitable for the requirements of teenager psychological education (Coburn et al., 2017). Immersion: VR technology uses computer imaging technology and panoramic display equipment to provide users with real-time and all-round scene experience, and establishes a new HCI paradigm. The user is no longer the audience in front of the computer screen, but the audience who immerses in the virtual three-dimensional world in the form of real-time data source. In addition to visual signals, VR technology also provides users with a variety of input signals such as hearing, touch and smell. Users can get a variety of sensory experience, wholeheartedly into the virtual world; interactivity: VR technology also provides realistic interactive effects. Through the handle, tactile feedback shoes, data gloves and other sensing devices, the interaction between the user and VR environment can be realized; the user can control the limbs through the idea, and interact with the virtual environment in a nearly natural way; imagination: VR is a multi-view, real-time and dynamic three-dimensional environment based on computer graphics, which can be a real simulation of the real world, or a fictional world beyond reality.

2.7 Application of VR technology in animation

Using VR technology to produce animation can make animation have the characteristics of immersion, interactivity and imagination. Teenagers are the main crowd to watch animated films. Through the use of VR technology, HCI animation can provide adolescents with an immersive experience. Audiences can be fully immersed in a virtual world, receiving comprehensive stimulation through visual, auditory, tactile, olfactory, and other sensory signals. This sense of immersion can stimulate adolescents' desire to explore, excitement, and curiosity, offering them a new psychological experience. Rahmawati et al. (2023) explored the application of VR media in alleviating childhood anxiety, finding that the intervention of VR media significantly reduced anxiety levels in paediatric patients (Rahmawati et al., 2023). Stein (2021) studied the psychological and ethical impacts brought about by HCI crossing technological boundaries (Stein, 2021). HCI animation has controllability, allowing the design and control of virtual scenes through VR technology. During the animation production process, VR technology can be used to design animation scenes carefully, incorporating elements and knowledge that resonate with adolescents. The realistic impact created by VR technology enables adolescents to learn relevant knowledge and, simultaneously, addresses psychological issues in their developmental process. This opens up new possibilities for the application of animation in psychological education. Halldorsson et al. (2021) focused on the mental health issues of children and adolescents, particularly using digital interventions such as gaming and virtual reality to enhance access, engagement, and potential effectiveness of psychological therapy. The conclusion emphasizes that despite enthusiasm for the application of gaming and VR, the existing interventions are limited in number, and their efficacy evidence requires further collaborative design, development, and evaluation to ensure they become routine therapeutic tools for children and adolescents' mental health issues (Halldorsson et al., 2021). Adolescents typically watch animations from an observer's perspective. Therefore, they can judge the quality of things by observing the behaviours of cartoon characters in animations, and form correct behaviours. Virtual scenes created through VR technology can vividly present various situations, allowing adolescents to more deeply understand and comprehend the moral and values embedded in the behaviours of cartoon characters while imitating them. In HCI animation, using VR technology to create educational animations can promote the

comprehensive development of adolescents in subjects and moral ethics. Wei et al. (2023) explored the relationship between virtual character endorsers and real celebrity endorsers and the impact of different advertising scenarios on consumer purchase intentions. The findings revealed that virtual character endorsers had a more positive impact on consumer purchase intentions, achieved through the mediation of psychological need satisfaction (Wei et al., 2023). By using virtual scenes and characters, HCI animation can stimulate the expression and understanding of emotions in adolescents, helping them better recognize their own and others' emotions. Utilizing VR technology to create highly interactive adventure plots enables adolescents to participate in virtual world adventures, and enhance their problem-solving and collaboration abilities. Through these types of HCI animations, combined with VR technology, a more comprehensive understanding of their positive impact on adolescents' psychological development and education can be achieved, providing more insights and possibilities for future animation production and educational research. Rizzo et al. (2021) introduced innovative research findings and perspectives on the application of VR in psychology, covering the broad applicability of various challenges psychologists face in clinical research and practice. They regarded psychologists' professional knowledge and skills as crucial components in interdisciplinary methods that could optimize VR's creation, relevance, and value across all application domains (Rizzo et al., 2021).

3. Method

3.1 Experimental design

In the animation applying HCI technology, this study designs an experiment to assess its educational impact on the psychological development of adolescents. The participants are middle school students, totalling 60 students, divided into experimental and control groups. Both groups receive the same teaching content in the same educational environment, but the experimental group uses ally produced animation based on HCI technology, while the control group uses traditional animation. In the research and evaluation of the application of VR technology in animation, the control group and experimental group are set up to investigate and analyse the deductive reasoning ability, inductive reasoning ability and analogical reasoning ability of the two groups of teenagers. Table 1 shows the specific experimental design.

Table 1: Teaching experiment design

	Experimental group	**Control group**
Teaching experiment object	60 students in the fourth grade of middle school	60 students in the fourth grade of middle school
Teaching implementation environment	Classroom equipped with computers, projectors and other multimedia equipment, and with animation film education equipment for teenagers based on VR technology	Classroom equipped with computers, projectors and other multimedia equipment
Arrangement of teaching experiment	Consistent teaching content as well as teaching progress	

In the process of application effect evaluation, its educational impact on teenagers is analysed and compared in the form of questionnaire, including the pre-test and post-test. The score obtained is the post-test score and pre-test score. Among them, the whole process of questionnaire design, distribution and data collection does not involve personal privacy; the whole process of questionnaire survey is carried out with the consent of participants; the

questionnaire is not open to the public, only used for research purposes. Among them, P<0.05 means there is statistical difference.

3.2 Experimental content

The experiment primarily assesses students' deductive reasoning ability, inductive reasoning ability, and analogical reasoning ability. Data on students' reasoning abilities are collected before and after the experiment by presenting relevant animation content in the classroom.

4. Results and analysis

4.1 Application effect evaluation and analysis

In order to ensure the accuracy of the experiment, independent sample t-test is conducted on the pre-test results of the experimental group and the control group, as shown in Figure 3. It is found that there is no significant difference in the deductive reasoning ability between the experimental group and the control group ($t=-0.931$, $P=0.357$); in the inductive reasoning ability, there is no significant difference between the experimental group and the control group ($t=1.77$, $P=0.076$); in the ability of analogical reasoning, there is no significant difference between the experimental group and the control group ($t=0.78$, $P=0.447$).

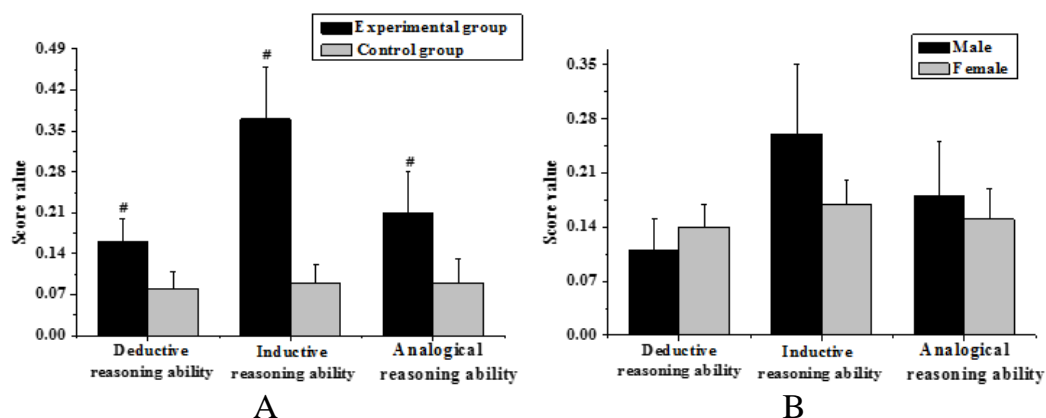**Figure 3: The score chart of two groups of subjects in pre-test**

Figure 4: Comparison chart of scores obtained by teenagers (A. comparative analysis of scores obtained by experimental group and control group; B. comparison and analysis of scores obtained by students of different genders (# means that compared with experimental group, P < 0.05))

Figure 4A is a comparison of the scores obtained by the experimental group and the control group on three reasoning tasks. The results show that the scores of deductive reasoning ability, inductive reasoning ability and analogical reasoning ability are significantly different between the experimental group and the control group ($P < 0.05$), especially in the inductive reasoning ability ($P<0.01$). This indicates that, compared to traditional teaching methods, using VR technology in three-dimensional courses can significantly enhance adolescents' deductive reasoning, inductive reasoning, and analogical reasoning abilities. This may be attributed to the fact that VR technology creates a more immersive, interactive, and imaginatively rich learning environment, which helps stimulate adolescents' thinking and reasoning abilities. Figure 4B shows the results of comparative analysis on the scores of three reasoning abilities of teenagers of different genders. The results show that there is no significant difference between boys and girls in deductive reasoning, inductive reasoning and analogical reasoning ($P > 0.05$). This indicates that gender does not significantly impact the scores, suggesting that VR technology has similar effects on enhancing reasoning abilities for both male and female students. This shows that compared with the conventional teaching methods, the three-dimensional curriculum with VR technology can significantly improve the deductive logical reasoning ability, inductive reasoning ability and analogical reasoning ability of teenagers, while gender discrimination has no significant impact on the scores.

4.2 Analysis of the deficiencies of animation production

Lack of core values: core values are the guiding ideology in the development of animation industry. In the process of animation creation, where the intention and what is the purpose of the expression of the theme, is a problem that must be considered in the current creation process. The lack of core values mainly refers to the fact that in the process of creation, animation has failed to grasp the hearts of the audience and has failed to play a better educational significance. Moreover, in the actual creation process, due to the social and historical conditions, the educational function of animation is lack, and technical means and creative ideas are not mature enough, which affects the educational significance and substantive role of animation creation, leading to the empty content and rigid mode. From the current situation of animation development, the positioning of animation is not clear enough. In the development process of animation industry, how to effectively establish the core values is related to the future development and progress of animation, and also related to the psychological education of teenagers.

Shortage of innovative animation talents: the development of animation industry is inseparable from the support of innovative new talents. At the present stage, in the development of China's animation industry, there is a serious shortage of innovative animation talents. The animation story plot is the same, and the story has deficiencies of pattern and rigidity. In this way, it will directly lead to the low competitiveness of China's animation industry, which is not conducive to the rapid development and progress of the animation industry. Creative talents are the source of animation development and the fundamental support of the animation industry. However, at this stage, China's animation industry talent training mode is relatively backward, and lack of strong professional animation talent training institutions, leading to animation creation lack of stamina.

Wang and He (2022) primarily analyzed the use of Pop Art in "Spider-Man: Into the Spider-Verse," focusing on color elements and composition. They explored the impact of the Pop Art movement on Chinese animation production, providing insights and reflections for the development of Chinese animation (Wang & He, 2022). Cao (2023) investigated how the Chinese animation industry maintains high quality and sustainable development in the context

of high output (Cao, 2023). Liu et al. (2023) discussed the integration and innovative development of animated films with traditional culture from the perspectives of thematic stories, scene construction, and visual details (Liu et al., 2023). In the digital media landscape, animated films based on digital technology are continuously exploring innovative ways to integrate with traditional cultural elements. Fan and Feng (2021) utilized Porter's Diamond Model to analyze the current status of the Chinese animation industry from six aspects: factors of production, demand conditions, industry chain, firm strategy, cultural factors, and government policies (Fan & Feng, 2021). The findings indicated that the sustainable development of the animation industry required efforts in integrating internal industry resources, improving the industry chain, enhancing enterprise capabilities, technological innovation, cultural integration, talent development, government support, and legal protection. Jin (2023) integrated the curriculum with products to establish an innovative teaching system for animation majors. They actively explored new models for cultivating applied animation talents, and constructed a scientifically reasonable teaching system for animation majors to lay a solid foundation for the cultivation of applied animation talents (Jin, 2023). Li (2021) conducted a study on characters in Japanese schoolgirl anime. The results suggested that characters in Japanese schoolgirl anime tended to focus excessively on the emotional development of the protagonist while overlooking pressures related to academic advancement or employment. Further analysis and summarization of patterns are necessary for drawing inspiration and innovation in the creation of Chinese schoolgirl anime works (Li, 2021). Bai (2023) analyzed the Chinese animated short film "Wings of the Dawn," showcasing the charm of Chinese animation on the international stage and highlighting the fusion of artistic nationality with the world (Bai, 2023). These literature studies offer rich perspectives and insights for addressing the core value deficiency and shortage of innovative talents in the Chinese animation industry. The Chinese animation industry can better clarify its core values, emphasize innovative talent cultivation, and promote sustainable development by combining various research aspects.

4.3 Analysis of animation production measures based on teenager psychological education

Building a good core values of animation: in the process of constructing the benign core values of animation, attention should be paid to the audience's needs and the needs of animation at different ages. For the production of animation, what kind of animation the audience like must be considered, which is an important issue in the process of animation production. Audience demand will directly affect the ratings of animation. In order to give full play to the educational significance of animation, the premise is to have a broader audience. In this process, audience demand analysis is a problem that the animation industry needs to seriously consider. To meet the needs of the audience, the initiative needs of the audience should be considered. Jin et al. (2021) investigated the impact of self-produced audiovisual animations on preoperative anxiety and postoperative excitement in paediatric patients undergoing strabismus surgery. They found that watching self-produced audiovisual animations could effectively alleviate preoperative anxiety in paediatric strabismus surgery patients, benefiting parents as well. It was also found to be effective in reducing postoperative excitement (Jin et al., 2021). Curran et al. (2023) explored the impact of sports on adolescents' awareness of mental health. The results indicated that after watching the animation, participants showed improvements in mental health knowledge, attitudes, confidence, and willingness to seek support. Additionally, there was a significant reduction in social bias towards depression after watching the animation (Curran et al., 2023).

Animation is a kind of cultural commodity. Since it is a commodity, it will be affected by the relationship between supply and demand. In the process of animation industry development, capital determines the development of animation industry. Kaplan et al. (2021) argued that health assessment questionnaires were reliable in the field of psychometrics (Kaplan et al., 2021). Price and Price-Mohr (2023) suggested that there was no gender difference in primary school students' computer coding ability and the quality of story creation (Price & Price-Mohr, 2023). Cardona et al. (2021) addressed the issue of nurses lacking formal training in evidence-based therapies, such as cognitive-behavioural therapy, in the field of child mental health. They proposed an improvement method, including video interactions between expert clinicians and simulated patients in highly acute situations (Cardona et al., 2021). Lively et al. (2023) used different combinations of three multimedia elements (animation, audio, and subtitles) to present the effectiveness of adolescents' interrogation rights in increasing comprehension. The multimedia presentation with animation and subtitles resulted in the highest level of understanding. These findings were significant for issues related to protecting adolescents and using technology in interrogations (Lively et al., 2023). Kellems et al. (2023) studied the interaction between adults and virtual animated characters, emphasizing the positive role of virtual animated characters in improving social engagement in children with autism spectrum disorders. This provides valuable information for designing future interventions and educational programs (Kellems et al., 2023). Brubaker et al. (2023) analysed the body images of main characters in Disney animated films and explored their relationship with physical, psychological, and social characteristics (Brubaker et al., 2023). Yang et al. (2022) investigated the impact of narrative-based environmental education on children's environmental awareness. The study found that narrative environmental education effectively enhanced children's environmental awareness, particularly in terms of their environmental knowledge and attitudes, although the impact on their willingness for environmental conservation behaviour is not significant. These findings supported the future implementation of environmental education for lower-grade students (Yang et al., 2022). The research in these studies provides rich perspectives and insights for addressing animation's lack of core values and shortage of innovative talents. Only when the animation industry has obtained greater economic benefits in the process of development, can the better development and progress of this industry be promoted. Funds can be used to improve technology, which can realize the better development of animation industry. In the process of animation creation, attention should be paid to the core idea of animation creation. From the development of animation in China, the entertainment of animation creation is the first important meaning of animation development. It is a mainstream direction of animation to add educational elements in entertainment to better meet the needs of education and play a better educational significance for teenagers.

Age level consideration: for the establishment of benign core values, it is necessary to consider the age level of teenagers. If animation is to play a better educational significance, the audience's age level must be grasped, which is a grasp of the audience's consciousness. Each age group of children's psychological characteristics are different, which must be considered in the process of animation creation. Only in this way can favourable conditions be created for the establishment of core values and the educational significance of animation be better realized.

The exploration and development of the benign strategy of innovating national traditional animation: As for the innovation of national traditional animation benign strategy, attention should be paid to achieving the effective balance of entertainment and education of animation creation. Only by finding the balance between the two can the goal of benign development be realized.

5. Conclusion

The analysis of the experimental results reveals that ally produced animation based on HCI technology has a significant educational impact on the psychological development of adolescents, particularly demonstrating excellent performance in reasoning abilities. This provides an innovative direction for the animation industry, emphasizing the potential role of technological innovation in psychological education. In the development process of animation, attention should be paid to the cultivation of innovative talents and strengthen of the development mode of industrial chain. The development of animation is inseparable from the support of talents and technology. Talent is the key to the development of animation industry. The main idea of the balance between entertainment and education in animation industry is to make animation have educational significance while ensuring its entertainment. In the process of developing animation industry, it is necessary to insist on education through entertainment and seek the balance between entertainment and education. In the development of animation industry, animation creation and education is a coexistence relationship. In the animation production, the educational significance must be integrated with it effectively. At the same time, in China's animation production, designers should not blindly avoid love, but should appropriately add love to the creation and development of animation, and pay attention to take effective ways to guide love, so that teenagers can correctly treat love. The application of VR technology to animation can significantly improve teenagers' deductive logical reasoning ability, inductive reasoning ability and analogical reasoning ability. In summary, animation has a significant educational impact on adolescents, particularly in the context of HCI technology. Animation serves as a means of entertainment and a crucial avenue for edutainment. In the future of animation development, it is essential to focus more on integrating educational elements to ensure that animation provides beneficial educational content for adolescents while offering entertainment. This balanced developmental direction not only contributes to the improvement of the quality of animation but also meets the comprehensive developmental needs of adolescents. Through the application of VR technology, animation has achieved notable success in enhancing the reasoning abilities of adolescents, indicating a promising direction for the future of the animation industry and presenting new possibilities for adolescent education.

Due to the limitation of knowledge level, time and space, there is no empirical study on the educational impact of animation based on HCI technology on teenagers' psychological development, and there is no specific discussion on the process of making animation with HCI and AI. It is hoped that in the follow-up study, these deficiencies can be improved, so as to improve the comprehensiveness and depth of writing.

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