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Impact of Piano Teaching Mode Based on Human Computer Interaction on Students' Psychological Changes

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Abstract: With the development and progress of modern technology, the application of intelligent interaction technology in social production and life has gradually become widespread and in-depth. Especially in recent years, the country has vigorously promoted reforms and innovations in the field of education and teaching, and the introduction of intelligent interaction technology has brought revolutionary changes to the traditional piano teaching mode. Piano teaching, as an important part of music education, is particularly critical to the innovation of its teaching mode. Through experimental research, this paper analyzes the specific effects of piano teaching on students' psychological changes under the human-computer interaction environment. A physiological data comparison experiment was conducted to compare the psychological changes of students under human-computer interaction teaching mode and traditional teaching mode. During the experiment, the students' skin conductivity data were counted every 10 seconds to reflect their emotional changes and psychological stress state, and 60 sets of data were collected and analyzed within 10 minutes. This result can prove that the new teaching mode can make students more receptive to piano teaching and improve their learning efficiency.

1. Introduction

In today's era of rapid development of digitalization and intelligence, human-computer interaction technology is gradually penetrating into various fields, among which the education field is particularly benefited. With the updating of educational concepts and technological advances, the traditional teaching mode has been difficult to meet the growing personalized learning needs of students. Especially in the field of piano teaching, which is highly dependent on teacher-student interaction and emotional communication, the innovation of teaching mode is particularly important. As an important part of music education, piano teaching not only requires students to master solid playing skills, but also needs to cultivate their good musical perception, expression and creativity. However, traditional piano teaching often focuses on the teaching and practicing of skills, ignoring

the psychological changes and emotional experience of students in the learning process. This single mode of teaching easily makes students feel boring and even resistant, thus affecting the learning effect and the cultivation of interest. In order to change this situation, a piano teaching model based on human-computer interaction has emerged.

Human-computer interaction is an important emerging field of modern computers, and the latest software engineering and computer science knowledge systems have listed human-computer interaction as an independent knowledge domain. In the human-computer interaction course for software engineering majors, the course objectives are mainly to understand the concept of human-computer interaction, master the basic principles and methods of human-computer interaction interface design, and then design human-computer interfaces with good interactive performance and user experience. Universities and colleges have opened this course, but this course is faced with many cross-disciplines, aging teaching mode, teachers' inexperience and other problems. The traditional teaching method can not make students master the knowledge of this course well, and can not achieve the cultivation of highly innovative and practical computer talents.

Therefore, this paper aims to systematically analyse the specific effects of interactive piano teaching on students' psychological changes through empirical research. Through a comparative experiment on the mental changes of students in the traditional learning mode and the new learning mode of human-computer interaction, this paper reveals the potential advantages and shortcomings of the new technological means in piano teaching, and provides a scientific basis for the innovation of piano education mode. At the same time, this paper explores the effects of this teaching mode on students' interest in learning, self-confidence, self-efficacy and other psychological factors. Finally, based on the results of the study, this paper proposes strategies and suggestions to optimize the human-computer interaction piano teaching mode. This paper is divided into five parts: in the introduction part, the article introduces the research background, challenges, motivations, and objectives. In the related work section, the study reviews and summarizes the current status of domestic and international research on the application of human-computer interaction technology in piano teaching. After that, the research design, experimental process and data analysis method of this article are described in detail. Then the experimental results are presented to analyze the specific effects of the piano teaching mode based on human-computer interaction on students' psychological changes. Finally, a conclusion is drawn to summarize the research results, put forward optimization suggestions, and look forward to the future research direction.

2. Related Works

Nowadays, the society pays more and more attention to the quality of education. With the development of artificial intelligence technology, applying artificial intelligence to piano teaching is the key to improve the efficiency of piano teaching and increase the interest in music. Yu X et al. studied the piano teaching mode based on human-computer interaction. The results showed that interactive teaching not only improved students' learning efficiency, but also improved teachers' ability to teach innovatively based on their original work, which made the classroom atmosphere more dull [1]. Bobby T collected the opinions of adult piano teachers and students through an online survey and digital interviews. The results indicated that potential end-users considered posture and movement, communication between teacher and student, and independent practice as important aspects of piano teaching [2]. Bai J explored a teacher-student learning model different from others, developed a K-Means algorithm download function, created a multimedia network for shared classrooms, created a musical background for the piano, and stimulated students' interest in learning [3]. Sang T et al. investigated the importance of human-computer interaction model in music teaching, provided new applications for human-computer interaction music, and evaluated the

current online music learning software [4]. Meanwhile, Wei C et al. proposed the combination of intelligent piano and piano teaching. Based on the multiplicative harmonic model of the mono signal and the variability of speech characteristics, they proposed a speech synthesis model capable of processing speech [5]. Deja J A et al. conducted professional interviews with several piano experts, systematically reviewed the enhanced piano prototype with a focus on instrument learning, and explored the key focus items in piano teaching process [6]. Sun J Q used the Suzuki method to analyze and search for interactive piano learning systems. Through a one-year study tracking of the survey subjects, he found that students could learn to understand melodies of different levels of complexity with their ears and play complex melodies using sheet music through the system [7]. Moreover, Novosiadla I summarized the scenarios of psychological stress that students may encounter during the teaching process by analyzing the process of piano music teaching in terms of abnormal movement problems caused by the psychological effects of students, which provided a reference for teachers to adjust their piano music teaching mode [8].

After summarizing the above research on piano teaching models based on human-computer interaction, it can be found that these studies have achieved significant results in multiple aspects. However, there are still some shortcomings in these studies. Although most studies have mentioned the impact of teaching atmosphere, teacher-student interaction, and other factors on students' learning experience, there are few studies that deeply explore the specific changes in students' psychological levels under human-computer interaction models. Therefore, the study focuses on the core issue of students' psychological changes. By designing a systematic psychological assessment tool or scale, this article can quantitatively analyze students' psychological changes and deeply explore the specific impact and mechanism of human-computer interaction piano teaching mode on students' psychological level. This paper closely links teaching modes with students' psychological changes, explores the differences and reasons for students' psychological changes under different teaching modes, and provides scientific basis for optimizing teaching modes.

3. Methods

3.1. Current Development of Human-Computer Interaction Courses

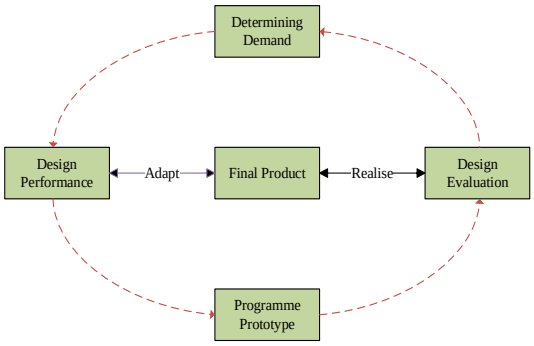

Figure 1: HCI design and development process

From the development of traditional Internet to mobile Internet, the information industry is constantly upgrading and iterating. Through the actual teaching process of the course, it is found that the theoretical teaching content of the human-computer interaction course is abstract and complex, and the knowledge of cross-disciplinary fields is widely involved. In response to these characteristics, although a relatively complete curriculum framework system has been established, it is still difficult for students to learn the curriculum [9]. How to teach the classroom content to students in the form of human-computer interaction is also a part of the human-computer interaction

classroom. The traditional teaching method of reading from the book is no longer suitable for the new teaching requirements. In the practical teaching part, the HCI design and development process is shown in Figure 1.

3.2. Practical Application of Human-Computer Interaction in the Classroom

(1) Artificial Intelligence Piano Application

Intelligent piano is not an electric piano. The artificial intelligence piano still has the traditional characteristics of the piano in the process of playing. There are differences between it and the electric piano, so it emphasizes that the player should have the traditional piano playing skills from the previous piano learning process [10]. At the same time, unlike traditional pianos, smart pianos contain a lot of modern technology and many more technological features. Some manufacturers and music colleges in China have started to cooperate to promote the application of AI piano practice forms comprehensively, and really use AI pianos in teaching in online classroom teaching, which provides students with an interactive learning experience with teachers and students, and thus helps students' piano practice become more interesting [11].

However, there are also drawbacks to just using smart piano teaching. After some students have reached the intermediate or advanced level, one-on-one mode should be adopted in the teaching, after the students have finished the basic performance, the piano teacher must guide the students for the emotion of the music works, help the students to understand the works, and turn the meaning of the works into the resonance of the students' heart and soul. At this stage, the teacher must make situation-specific guidance work according to the different situations of the students, instead of teaching in a collective common mode, the teacher must guide each student's understanding instead of simply copying the work, which cannot be accomplished by an AI piano. But for introductory and beginner piano learners, a group lesson format may be more appropriate. Musical works are relatively simple, the meaning of the expression is easy to understand, more in the form of children's songs, in the face of the same rhythm, the same melody, the same fingering, the teacher is completely unnecessary to teach one-to-one teaching mode, this time the usefulness of the artificial intelligence piano classroom becomes apparent, the piano teacher can be 1 to 10 or 1 to 8 large class to teach, the students to follow the teaching of the intelligent piano to operation, while the teacher patrols each student to see the student's hand shape, sitting posture, playing, etc., which not only saves time, but also stimulates the interest of the learners, so that the threshold of learning the piano becomes low.

(2) Implementation of music education in HCI software

The implementation of music education in HCI software aims to create an efficient and fun learning environment for students through the integration of innovative technologies and traditional educational concepts. This process requires not only a friendly and easy-to-use software interface to reduce students' learning burden, but also the ability to stimulate students' creativity and imagination to promote all-round development. The following is a detailed expansion of these two core objectives:

1) Reducing the cognitive burden of music theory learning

(a) Intuitive presentation of complex concepts: Using multimedia elements such as graphics, animations, and videos to visualize and concretize abstract music theory knowledge. Human computer interaction software can dynamically display the movement of notes on the sheet music to keep up with the teacher's rhythm and beat, or use 3D models to simulate the internal structure of musical instruments to help students understand the principles of sound production, thereby effectively reducing students' cognitive barriers.

(b) Interactive learning path: Teachers should design personalized learning paths that

automatically adjust difficulty and teaching content based on students' learning progress and abilities. Through quizzes and instant feedback mechanisms, students can gradually master knowledge points in a relaxed and enjoyable atmosphere, avoiding cognitive overload caused by receiving too much information at once.

(c) Gamified learning experience: The teaching model should incorporate gamification elements, transforming the learning process into a series of fun tasks and games, allowing students to naturally absorb knowledge while having fun, and reducing resistance to theoretical learning.

2) Cultivate rich imagination

(a) Creative composition tools: Schools should provide easy-to-use composition tools that allow students to freely combine notes, rhythms, timbres, and other elements to create their own musical works. Through practical creation, stimulating students' creativity and imagination, and encourage them to express their personalities and emotions.

(b) Scenario simulation and role-playing: The teaching department should be set up diverse music scenarios for students to play different roles, and cultivate their music perception and imagination by simulating interactions in real scenes.

(c) Cross cultural music exploration: The publicity department should introduce music styles and traditions from around the world, allowing students to experience the charm of music from different cultures through video introductions, audio appreciation, interactive Q&A, and other forms. This cross-cultural experience can broaden students' horizons, stimulate their curiosity and imagination, and promote the development of innovative thinking.

3.3. The Psychological Impact of Human-Computer Interaction on Students

(1) Social Cognitive Theory - A Social Tool for Human-Computer Interaction

The basic starting point of social cognitive theory is that human activity is determined by the interaction of three factors: individual behaviour, individual cognition and other personal characteristics, and the external environment in which the individual lives. These three factors are influencing each other, varying in time and intensity, and the effect of the two-way influence is gradually manifested over time. Based on this theory, it can be concluded that human beings are both shapers and products of environmental effects. As we all know, in the era of big data, cell phones, computers, tablets and so on have become a necessity for daily work and study, and the Internet has set up a bridge for people and the environment to come into contact with each other, and human-computer interaction has become a future development trend. The computer-as-social-actor paradigm asserts that the relationship between humans and computers is not one of tool use but of social interaction. This concept suggests that computers are similar to human social actors in their ability to influence and modify human behaviour and social interactions. In contrast to the traditional idea of computers as passive tools, this approach views computers as active participants in interpersonal relationships.

(2) Relationship Motivation Theory - Emotional Expert of Constant Companionship

According to relational-motivational theory, autonomy and motivation are important aspects of human development and progress. In particular, individuals seek self-sovereignty to satisfy their physical, safety, emotional, dignity and self-actualisation needs. Artificial intelligence systems have the potential to satisfy emotional, dignity and self-actualisation needs. The AI is able to independently answer users' requests and promote social friendship and care. In addition, the interactive content remains private, so users can feel valued and appreciated without fear that the dialogue will be criticised or exposed. Customised content from AI allows users to find answers to their questions quickly, increasing productivity and efficiency and maintaining dignity. Self-actualisation is the highest level of human need, and AI can provide a wealth of intelligent

support to allow individuals to feel more productive and focused in their work, thus recognising their self-worth.

(3) Truly achieving student-centered emotional care

When users use AI, their adaptability, autonomy, communication, and coordination are reflected and expressed in a question and answer. The solution was implemented with the user in mind, and the solution-oriented interaction actually promotes learning autonomy, improves adaptability to collaborative learning, and encourages students to seek the best answers to their questions and immerse themselves in knowledge. The AI embodies the dual attributes of friend and helper, fulfilling the students' need for peer interaction. It is not only a tool for natural language communication and generative services, but also a full-time partner, ready to answer questions. The ability of users to feel the emotional care of the AI also helps to reduce the risk of developing psychological disorders, such as depression, anxiety, and irritability, thus promoting the development of users' mental health. In addition, the communication between users and AI will also reduce the fear and uneasiness of loneliness.

4. Results and Discussion

4.1. Classroom Evaluation of Human-Computer Interaction

The study randomly selected a university piano students as the experimental subjects, according to the survey of the institution has 237 piano students, and the basic level of the same. In this study, 118 students were taken as the experimental group to carry out one semester of piano teaching under the human-computer interaction teaching mode, and the remaining 119 students were taken as the control group to keep the original teaching mode unchanged. At last, the study counted the final examination scores of the two groups of students as well as the evaluation of the experimental group of students on the teaching mode of the semester. Table 1 shows the specific mode of piano examination. Table 2 shows the comparison of the final examination scores of the two groups of students.

Table 1: Composition of Final Exam Scores for Piano Majors in Universities

Assessment section	Proportion	Explain
Performance of repertoire	60%	Performance of the repertoire prepared by students themselves, including techniques, expressiveness, difficulty of the repertoire, etc
Sight reading	10%	Students score based on the music score provided during the exam
Musical knowledge	15%	Assessing students' mastery of music theory through written exams
Regular grades	15%	Including classroom performance, completion of assignments, practice progress, etc

Table 2: Comparison of Average Final Exam Scores between Experimental and Control Groups

Assessment section	Experimental group	Control subjects
Performance of repertoire	52.17	53.34
Sight reading	8.97	6.34
Musical knowledge	14	12
Regular grades	14.12	14.67
Total (per cent)	89.26	86.35

In this study, we further collected the evaluation of the teaching mode of this semester from the students in the experimental group, 118 questionnaires were distributed and 115 were returned, all of which were valid. The questionnaires were divided into five aspects: learning interest and motivation, learning efficiency, classroom interactivity, teaching personalization, and professionalism. The results of the survey are shown in Figure 2.

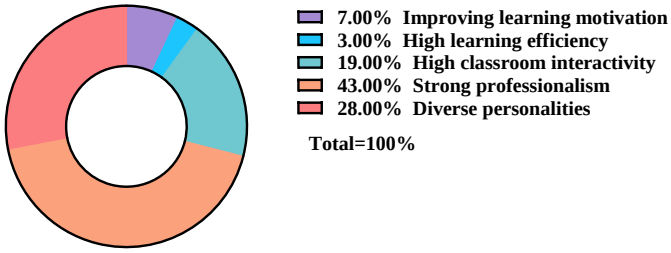

Figure 2: Survey results

According to Figure 2, it can be seen that the most obvious pedagogical outcomes of HCI instruction in students' psyche are in the areas of both professional skills and personalized instruction, with 43% of students believing that the HCI model has more professional instruction, and 28% believing that the HCI model is more diversified and personalized.

4.2. Investigation of Psychological Changes

In order to investigate the psychological changes of the students in the learning process under the human-computer teaching mode, the study randomly selected 1 group among the students in the above experimental and control groups, in which 1 group of students wore professional heart rate monitors and skin conductance sensors. While classroom instruction was being conducted, the data logging software was launched to ensure that heart rate and skin conductance data could be synchronized and collected and matched to the students' practice sessions. The study recorded heart rate changes for 10 minutes at 60-second intervals. The study used video recording as an aid so that subsequent analyses could more accurately correspond physiological indicators to exercise content. And, the baseline data were recorded for a period of time before the formal practice in order to understand the normal physiological state of the students. Figure 3 shows the comparison of the experimental group and the control group. For the convenience of statistics, A represents the experimental group and B represents the control group.

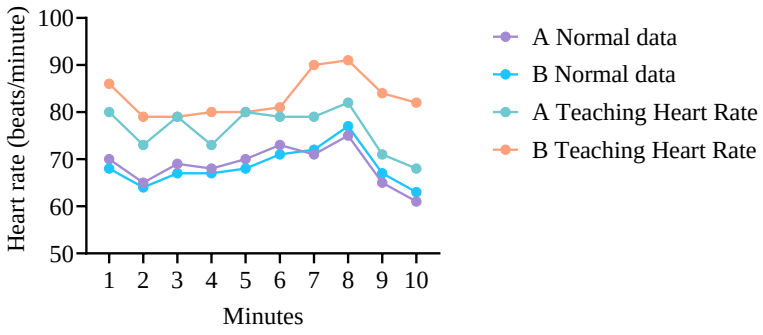

Figure 3: Changes in heart rate between the experimental group and the control group

Figure 3 shows that the average heart rates of the experimental and control groups ranged from 65-75 beats per minute, with no significant difference, indicating that the physiological state of the two groups of students was similar before the experiment. The heart rate of the test group remained

relatively stable in the classroom (71-82 beats per minute) despite the increase of the heart rate of the test group (A) in the classroom. This suggests that students in the experimental group felt more comfortable and relaxed in the human-computer learning mode and did not experience significant mood swings or stress. Heart rate variability in the control group was more pronounced in the control group, but stronger in the control group (B), which increased from an initial 68 beats per minute to a peak of 91 beats per minute. This large heart rate fluctuation may reflect the feelings of nervousness, anxiety or stress that the control group of students experienced when faced with learning tasks in the traditional teaching mode.

The study further counted the difference in skin conductance data of this group of students, the study counted the data every 10 seconds and collected 60 sets of data in 10 minutes, the experimental data is shown in Figure 4.

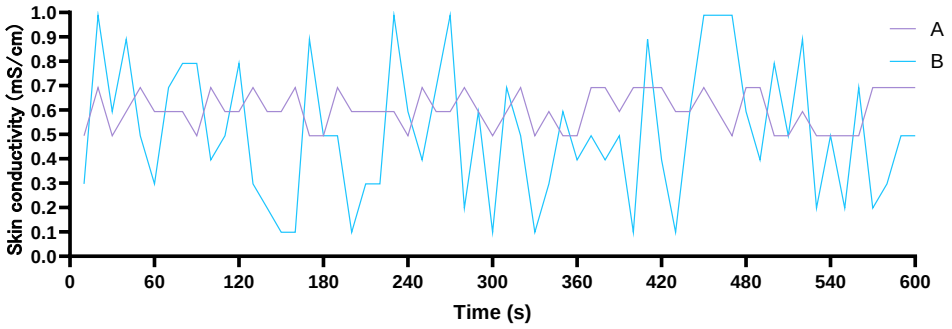

Figure 4: Skin conductivity data of experimental and control groups

As can be seen in Figure 4, the skin conductivity of the experimental group was more stable compared to the control group throughout the experiment. The stability of the skin conductivity of the students in the experimental group may imply that they are able to maintain a more calm and focused state when facing the learning task, and are less susceptible to the interference of external factors or internal emotional fluctuations. This stability may be the result of a combination of factors such as personalized learning, instant feedback and high interactivity in the human-computer teaching model. By providing customized learning resources and timely guidance, the HCI model may help students take better control of their learning process, thereby reducing unnecessary stress and anxiety.

5. Conclusion

Utilizing artificial intelligence technology to carry out piano class teaching in colleges and universities can improve students' learning efficiency and learning quality, and make piano learning more interesting. The emergence and promotion of this teaching method will certainly bring broader development space and more opportunities for piano teaching, but it will also face many challenges in the application process. The study designed experiments to test the effectiveness of teaching human-computer interaction. The experimental results show that the piano teaching mode of human-computer interaction not only contributes to students' emotional stability, learning motivation and self-efficacy, but also provides them with a richer, more vivid and personalized learning experience. Therefore, the study recommends that this human-computer interaction teaching mode be widely promoted and applied in future piano teaching in order to optimize the teaching effect, enhance the teaching quality, and promote the overall development of students.

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