

Teaching and Training Method of Piano in Colleges and Universities Based on the Background of Educational Psychology

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Abstract: *With the improvement of people's living standards, people began to gradually pursue their own cultural quality, and the piano, as an ancient Western musical instrument, is deeply loved by college students. Although there are many research achievements on piano training, there is less literature on studying psychological changes in students during training. Piano teaching is an educational activity involving a wide range of theory and practice, which may cause students to encounter many setbacks in the learning process and become discouraged. Such bad psychological factors often lead to students losing interest in piano learning. In order to avoid such problems, this paper established a teaching model of constructivism theory under the background of teaching psychology, and conducts research on piano teaching and training in colleges and universities through deep learning methods. It was found that in the piano training under the background of educational psychology, the classroom was more lively and interesting, which could give full play to the students' initiative, enthusiasm and creativity, and improve the teaching efficiency by 8.63%.*

Keywords: *Educational Psychology, Constructivist Theory, Piano Teaching in Colleges and Universities, Evaluation of Piano Teaching*

1. Introduction

Nowadays, people attach great importance to the development direction and prospect of music education, and piano education also plays an important role in quality education. At present, piano teaching is more inclined to the cultivation of professional skills, and it is still relatively weak in teaching ability and practice. These weak areas often need to be changed in piano training methods to make up. With the increasing popularity of piano teaching, it is of great significance to apply educational psychology to piano training methods and to cultivate students' comprehensive quality.

At present, many scholars have begun to study educational psychology. Zhang X proposed that psychoeducation is a developmental process through which people can gradually adapt in various ways to their physical and mental environment from childhood to adulthood [1]. Vaninsky A applied educational psychology to the classroom to produce effective pedagogy, and to view the educational process as a three-tiered system consisting of the human brain, personality psychology, and classroom pedagogy [2]. Harun-Ur-Rashid M pointed out that psychology has changed the spirit of education, it has given new meaning to classroom learning, and educational psychology is committed to studying how people learn, which can change the old concept of classroom education [3]. Gonzalez-Dehass A R pointed out that it is possible to identify classroom patterns that affect students' mastery of method goals through case studies, thereby predicting educational psychology students' adoption of similar goals [4]. Fee J analyzed the interaction between the two frameworks through the application of educational psychology to human rights [5]. To sum up, although educational psychology is widely used, it is rarely used in piano teaching and training.

With the development of the times, piano has gradually entered the teaching of colleges and universities, and many scholars have made relevant research on the training methods of piano teaching. Huang D proposed that the piano teaching in colleges and universities mainly focuses on the content of Western piano music, and the teaching system also inherits the Western piano music teaching system, from etudes to textbooks, and even the teaching mode. This would make students feel that China does not have its own unique piano teaching method, and even create a feeling of foreign adoration [6]. Li L

proposed that the piano training system should be reformed and the training system should be continuously improved [7]. Rao T thought about the core and method of the ideological and political construction of piano teaching in colleges and universities, hoped to provide some reference and inspiration for the peers in the industry, so as to promote the smooth progress of the ideological and political construction of piano teaching in colleges and universities [8]. Hui W's research on traditional teaching found that this traditional teaching method would lead to students' fixed thinking and lack of autonomy and enthusiasm in learning [9]. Zhang X believed that in college education and teaching, piano education can not only improve students' aesthetic ability, but also help students master the basic piano performance methods and skills, so it is necessary to systematically analyze the piano teaching model [10]. These theories only introduce the importance of piano education, but do not point out the influence of psychological quality on piano training.

In order to change the piano training method, this paper innovated the piano training under the background of educational psychology. By integrating educational psychology into piano teaching and training in colleges and universities, a set of piano teaching and training psychological system based on piano teaching was proposed, and the teaching and training methods were optimized according to the depth method. The experimental results showed that piano training under the background of educational psychology not only optimized the training method, but also improved the whole teaching efficiency by 8.63%.

2. Connotation of Educational Psychology and Application in Teaching

2.1. Connotation of Educational Psychology

Educational psychology mainly studies the psychological changes of middle school students in the process of learning [11]. Education is a universal social phenomenon, and psychology is the study of people's psychological phenomena and the combination of psychology and education. In the educational phenomenon, people's cognition of external things starts through cognition activities, so the research on piano teaching mode needs to start from the perspective of psychology. As shown in Figure 1, students' psychological changes are divided into two categories. The psychological process is divided into cognitive process, emotional process and will process, and personality psychology is divided into two categories: personality tendency and personality characteristics.

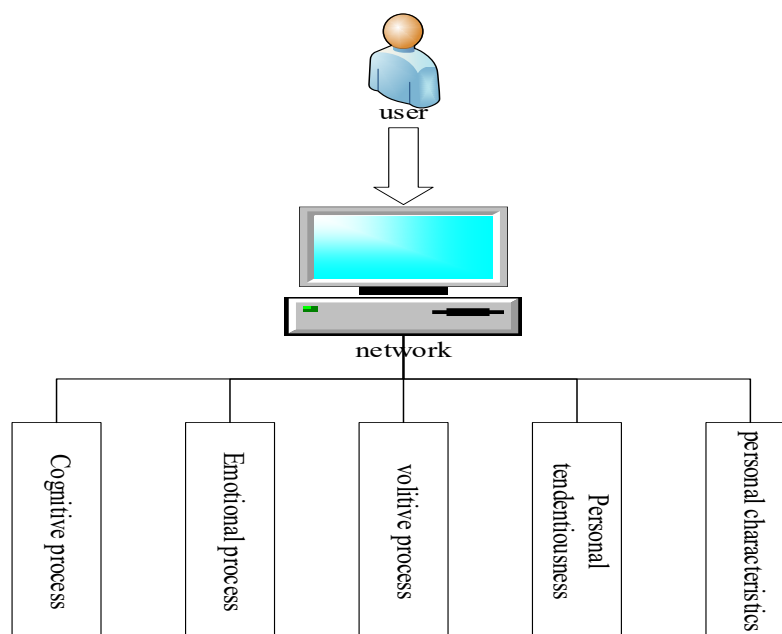


Figure 1: The connotation of educational psychology

2.2. Role of Educational Psychology in Teaching

Educational psychology can improve students' psychological quality during training, and by cultivating students' positive learning attitude, students can better complete piano training. In

educational psychology, teachers can discover the shortcomings of students' training, and then guide students to correct them, so that students can psychologically accept the teaching method of piano training [12]. In the process of learning, it is not only necessary to cultivate students' learning ability, but also to develop students' innovative thinking ability. Educational psychology can find corresponding solutions to students' weaknesses. In the training process, students should be guided to combine training with fun, so that students can accept the piano as an instrument psychologically. By promoting students' enthusiasm for learning, exploring the essence of piano training, and mastering study skills, the training efficiency is improved. At the same time, there are some students with high level of piano but not very proficient in piano scores. This is because in the process of teaching, teachers directly instill a lot of training points to students, and directly give students answers when encountering difficulties. Indirectly, a vicious circle of passive learning of students is formed, and educational psychology can effectively improve this situation.

3. Piano Teaching Training Using Educational Psychology

3.1. Traditional Piano Training Mode

In the traditional teaching process, the teacher is basically the instiller of knowledge, and the knowledge is continuously delivered to the students. As the receiver of information, students directly memorize the knowledge taught by the teacher without any subjective element. That is to say, in the whole teaching process, students only need to copy and paste the knowledge taught by teachers continuously. The teacher's teaching mode is also too simple, without adding any emerging technology, which cannot drive students' interest and enthusiasm in learning, resulting in students being very passive in piano training. At present, teachers are divided into two types. One is older and has rich educational experience, but has a relatively low acceptance of emerging things, and has always retained the previous teaching methods, which cannot be in line with the times. The other is relatively young, easy to accept new things, and easy to get along with students, but the teaching experience is relatively insufficient, and the theory and practice cannot be well combined.

At present, the piano teaching methods are mainly divided into three types: individual class teaching, group class teaching and group class teaching, as shown in Figure 2. Individual course teaching: in this teaching method, the teacher can well grasp the students' learning cognition and psychological state, but the piano training method needs to be repeatedly taught to different people. This invisibly increases the pressure on teachers, and at the same time, students cannot communicate with each other, and a single teaching model cannot broaden students' horizons. Collective class teaching: this teaching method solves the problem of interaction and communication between students, but the teacher cannot fully understand the learning status of each student [13]. Group teaching: this teaching method divides students with similar levels of piano performance into groups for teaching. This method not only integrates teaching resources, but also facilitates exchanges and discussions between students and teachers, and improves teaching efficiency as a whole.

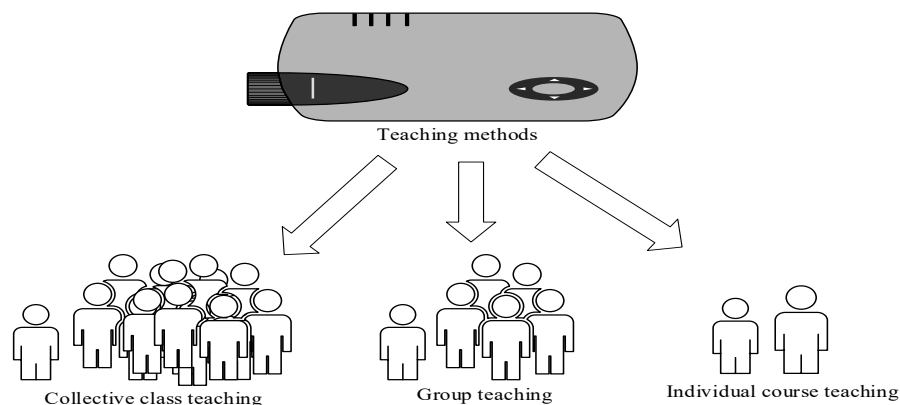


Figure 2: Traditional piano teaching and training mode

3.2. Piano Training Based on Cognitive Learning Theory

The cognitive learning theory proposed by Gagne combined the advantages of the behavioral school and the cognitive school. On the basis of the information processing theory, the training method of

piano memory ability was improved [14]. As shown in Figure 3, under the stimulation of the training environment, it enters the student's nervous system through the learner's brain, resulting in fast memory and long-term memory. This learning mode can enable teachers to focus on cultivating the ability to read music memory information in the teaching process and enhance students' music memory ability.

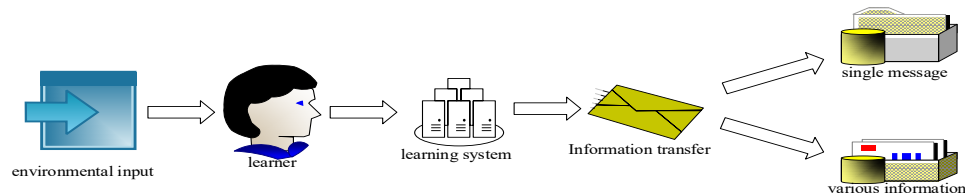


Figure 3: The learning process of cognitive learning theory

When applying Gagne's cognitive learning theory to the training of piano memory skills, attention should be paid to the training time of memory, so as to achieve the effect of strengthening music memory. This piano teaching and training mode has a guiding role for students. During the training, students' ability to read information about piano training should be cultivated, and at the same time, the students' familiarity with piano scores is also enhanced [15]. In piano training, it is necessary not only to pay attention to the existing music cognitive structure of students, but also to pay attention to the knowledge structure of piano knowledge itself. Let students improve their piano training efficiency and enhance their piano level by understanding the connection between the notes in the melody and the connection between these two structures. In piano training, students should strengthen the memorization of piano melody and piano training skills according to cognitive learning theory, so as to effectively improve teaching efficiency.

3.3. Design of Piano Training Based on Constructivism Theory

The constructivist theory of educational psychology advocates that learners build a knowledge system. Compared with traditional teaching, each role has different responsibilities. In the constructivist learning model, the leader of the classroom changes from the teacher to the student. Teachers only organize and guide students' training, and through the constructivist learning theory, on the basis of the original teaching and training, they simplify the complex piano training knowledge, and provide students with a knowledge framework that is easy to understand, which can give full play to students' active creativity and construct students' meaning framework for piano training [16]. Teachers can also create a real situation and discuss examples of questions, and improve students' learning efficiency by a level through the scaffolding effect. As shown in Figure 4, the piano teaching training is divided into five teaching links: creating a scenario, asking questions, self-learning, collaborative learning, and evaluation.



Figure 4: Five teaching links of constructivism theory

In this teaching mode, teachers can use technology to create an interactive training atmosphere for students, so as to guide students to actively explore, create and discover, combine tradition and innovation, and allow students to reorganize and build their own knowledge and cognitive structure [17]. In the teaching process, strengthen the collaborative communication between students and students, teachers and students, and students and the environment, and continuously improve the cognitive structure of learners through collaborative learning to realize the construction of knowledge.

In traditional teaching, education is above all else. However, under the theory of constructivism, the education method has abandoned the backward elements in the traditional teaching concept, and the role has undergone a great change: the student has become the builder of the cognitive system. The way of learning is also gradually diversified, and the way of thinking of students is no longer limited by the inherent thinking. But this does not mean that the role of teachers is weakened. On the contrary, the role of teachers is very important, because the theory of constructivism requires teachers to have good psychological quality. In addition to conventional teaching, they should also tap the potential of students [18]. Although teachers no longer forcefully instill knowledge in teaching, they are still important guides in training. Teachers need to take students as the main body, teach their knowledge to

students in a planned way, and give them space for divergence.

4. Piano Teaching and Training under the Deep Learning Algorithm

In order to demonstrate the practicability of piano teaching and training methods in the context of educational psychology, this paper applied deep learning algorithms to piano teaching and training to provide students with more effective piano training methods, thereby improving the efficiency of piano teaching.

How Deep Learning Algorithms Work

Deep learning algorithms are currently a popular artificial intelligence technology. For solving problems, through the collected training samples, deep learning algorithms can be used to establish a predictive model for problem solving. Then, by effectively fitting the input and output relationship of the problem through the predictive model, the future output can be predicted with high precision [19]. The specific principle is shown in Figure 5.

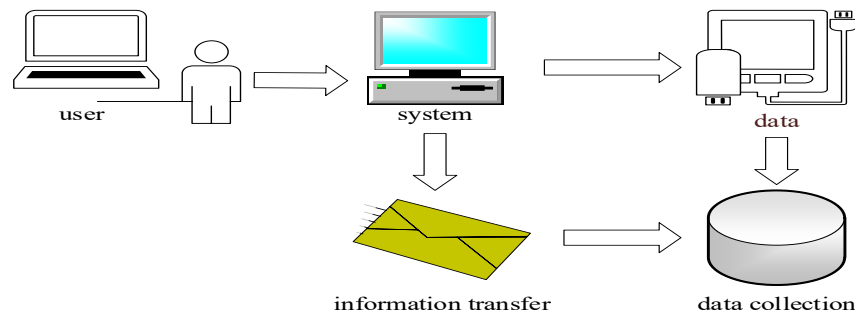


Figure 5: How deep learning algorithms work

(1) Support Vector Machines

(2) Support vector machine is of great significance to this study [20]. For training sample $\{x_n, y_n\}, n = 1, 2, 3, 4, \dots, m$, the support vector machine can analyze the relationship between input and output by establishing a linear regression function:

$$f(x) = \alpha \cdot x + \beta \tag{1}$$

Among them, α represents the weight.

In order to obtain the optimal regression function, the weight α must be minimized, because under the condition of the fitting accuracy of δ , the minimum α solution problem can be described as a convex optimization problem, which is:

$$\begin{aligned} & \min \frac{1}{2} \|\alpha\|^2 \\ & s.t. \quad y_n - \alpha \cdot x_n - \beta \leq \delta \end{aligned} \tag{2}$$

In the modeling process of the support vector machine, relaxation factors η_1 and η_2 need to be introduced, so that:

$$\min \frac{1}{2} \|\alpha\|^2 + C \sum_{n=1}^m (\eta_n + \eta_n^*) \tag{3}$$

$$s.t. \quad \begin{cases} y_n - \alpha \cdot x_n - \beta \leq \delta + \eta_n \\ y_n - \alpha \cdot x_n - \beta \leq \delta + \eta_n^* \end{cases} \tag{4}$$

Among them, C is a constant.

According to the duality theory, Formula (3) is transformed into a quadratic programming problem, and a Lagrangian function is established, specifically:

$$\begin{aligned}
 m(\alpha, \eta_n, \eta_n^*) &= \frac{1}{2} \|\alpha\|^2 + C \sum_{n=1}^m (\eta_n + \eta_n^*) - \\
 &\sum_{n=1}^m \lambda_n (\delta + \eta_n - y_n + \langle \alpha, x_n \rangle + \beta) - \\
 &\sum_{n=1}^m \lambda_n^* (\delta + \eta_n^* - y_n + \langle \alpha, x_n \rangle + \beta)
 \end{aligned} \tag{5}$$

Among them, λ_n and λ_n^* represent Lagrange multipliers. Take the partial derivatives for α , β , η_n and η_n^* and set them to 0, that is:

$$\frac{\partial m}{\partial \alpha} = \alpha - \sum_{n=1}^m (\lambda_n - \lambda_n^*) x_n = 0 \tag{6}$$

$$\frac{\partial m}{\partial \beta} = \sum_{n=1}^m (\lambda_n - \lambda_n^*) = 0 \tag{7}$$

$$\frac{\partial m}{\partial \eta_n} = C - \lambda_n = 0 \tag{8}$$

$$\frac{\partial m}{\partial \eta_n^*} = C - \lambda_n^* = 0 \tag{9}$$

The primal problem is transformed into a dual problem using classical Lagrangian principles:

$$\min \frac{1}{2} \sum_{n,p=1}^m (\lambda_n + \lambda_n^*) (\lambda_p + \lambda_p^*) \langle \varphi(x_n), \varphi(x_p) \rangle + \sum_{n=1}^m \lambda_n (\eta_n + y_n) - \sum_{n=1}^m \lambda_n (\delta + \eta_n^* - y_n) \tag{10}$$

According to Formula (9), an optimal value of Lagrange multipliers λ_n and λ_n^* can be obtained:

$$\alpha = \sum_{n=mp} (\lambda_n - \lambda_n^*) \cdot x_n \tag{11}$$

Among them, mp represents the samples corresponding to $\lambda_n \neq 0$ and $\lambda_n^* \neq 0$.

The above is the solution to the linear programming problem. For nonlinear programming, nonlinear functions should be used to solve the problem in high-dimensional feature space:

$$\alpha = \sum_{n=mp} (\lambda_n - \lambda_n^*) \cdot \varphi(x_n) \tag{12}$$

Using the kernel function instead, the regression form of the support vector machine is finally obtained as:

$$\begin{aligned}
 f(x) &= \sum_{n=1}^m (\lambda_n - \lambda_n^*) \langle \varphi(x_n), \varphi(x) \rangle + \beta \\
 &= \sum_{n=1}^m (\lambda_n - \lambda_n^*) K(x_n, x) + \beta
 \end{aligned} \tag{13}$$

Different kernel functions can be selected to establish different support vector machine regression

forms. The main forms of the current kernel function are as:

$$K(x_i, x) = (\langle x_i, x \rangle + C)^p \tag{14}$$

$$K(x_i, x) = \exp\left(\frac{\|x_i - x\|^2}{(2\delta)^2}\right) \tag{15}$$

$$K(x_i, x) = \tanh(v(x_i, x) + C) \tag{16}$$

(3) Wavelet Kernel Function

For wavelet base function $\varphi(x)$, after shifting it to the left by m and n scales, the wavelet kernel function is obtained as:

$$\varphi_{m,n}(x) = |m|^{\frac{1}{2}} \varphi\left(\frac{x-n}{m}\right) \tag{17}$$

For any function, the continuous wavelet transform can be described as:

$$\begin{aligned} W_f(m, n) &= \langle f, \varphi_{(m,n)} \rangle \\ &= \frac{1}{\sqrt{|m|}} \int_0^\infty f(x) \varphi\left(\frac{x-n}{m}\right) dt \end{aligned} \tag{18}$$

By discretizing the continuous wavelet, the discrete coefficients obtained are:

$$C_{m,n} = \int f(t) \varphi_{m,n}^*(t) dt \tag{19}$$

According to the Mercer condition, the wavelet function of the support vector machine function is obtained as:

$$\varphi(x) = \cos(2.50x) \exp\left(-\frac{x^2}{3}\right) \tag{20}$$

The wavelet vector machine can be expressed as:

$$f(x) = \sum_{n=1}^n (a_n - a_n^*) \varphi(x) + b \tag{21}$$

5. Experimental Results of Piano Teaching and Training under Educational Psychology

Table 1: Statistics of recovered samples

	Indicator options	Number of samples	The proportion	Total sample
Major	piano	85	45.9%	185
	violin	70	37.8%	
	other	30	16.3%	
gender	boy	79	42.7%	
	girl	106	57.3%	
grade	first grade	65	35.1%	
	second grade	63	34.1%	
	third grade	32	17.3%	
	fourth grade	25	13.5%	

Constructivist theory in educational psychology emphasizes that teachers and students should change from traditional indoctrination teaching to interactive teaching. From this level, educational psychology has a strong guiding role in piano teaching in colleges and universities. In order to test the

effect of applying deep learning algorithms to piano teaching, this paper collected relevant experimental information through a sampling survey on the methods of piano training in colleges and universities, the acceptability of students, and the training atmosphere. A total of 200 test papers were distributed, 185 were recovered, and the recovery rate accounted for 92.5%, and the statistics of the recovered samples are shown in Table 1.

5.1. Evaluation of Piano Teaching and Training

The evaluation of piano teaching and training is one of the important indicators to measure the effect of piano teaching and training under educational psychology. Training evaluation of piano teaching is an important prerequisite for the development of piano training. Therefore, this paper analyzed the evaluation of piano teaching and training, as shown in Figure 6.

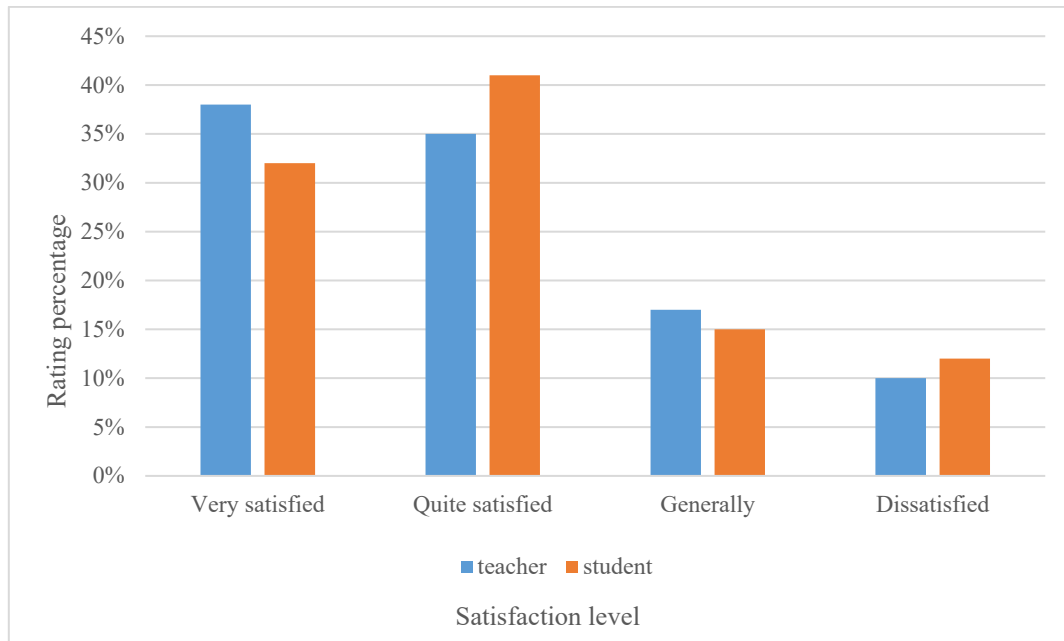


Figure 6: Teachers and students' evaluation of teaching methods

As shown in Figure 6, 38% of teachers in the school were very satisfied with the current teaching method; 35% of the teachers were satisfied with the piano training method; another 17% of teachers said that they were in general, thinking that schools need to further improve the training environment and training equipment; and the remaining 10% of teachers expressed dissatisfaction. Most of the students agree with the school's piano training methods. In terms of teachers' teaching flexibility, 32% of students were very satisfied with their teaching training; 41% of the students thought that the teaching training was satisfactory; 15% of students thought that teaching was average; and the remaining 12% of students were dissatisfied with the teaching method.

5.2. Acceptability of Students under the Constructive Learning Theory

Students have different methods of piano teaching and training under different theories. For this reason, it is necessary to conduct in-depth research on the analysis of students' acceptability under the constructive learning theory, as shown in Figure 7.

From the comparative analysis of the teaching method under the constructivism theory and the traditional teaching method in Figure 7, it can be concluded that the constructivist theory teaching is superior to the traditional teaching in terms of understanding, memory and classroom vividness. According to the feedback of the students surveyed, the theoretical teaching of constructivism can bring a better experience to the students, it is more conducive to mobilizing the learning atmosphere, and it is also conducive to teachers to create a teaching situation, and it can also allow students to apply theoretical knowledge to piano training. Compared with the traditional teaching method, the piano teaching method under the constructivism theory is more popular with the students. It can be seen that the piano training needs to add constructivism and introduce new teaching models.

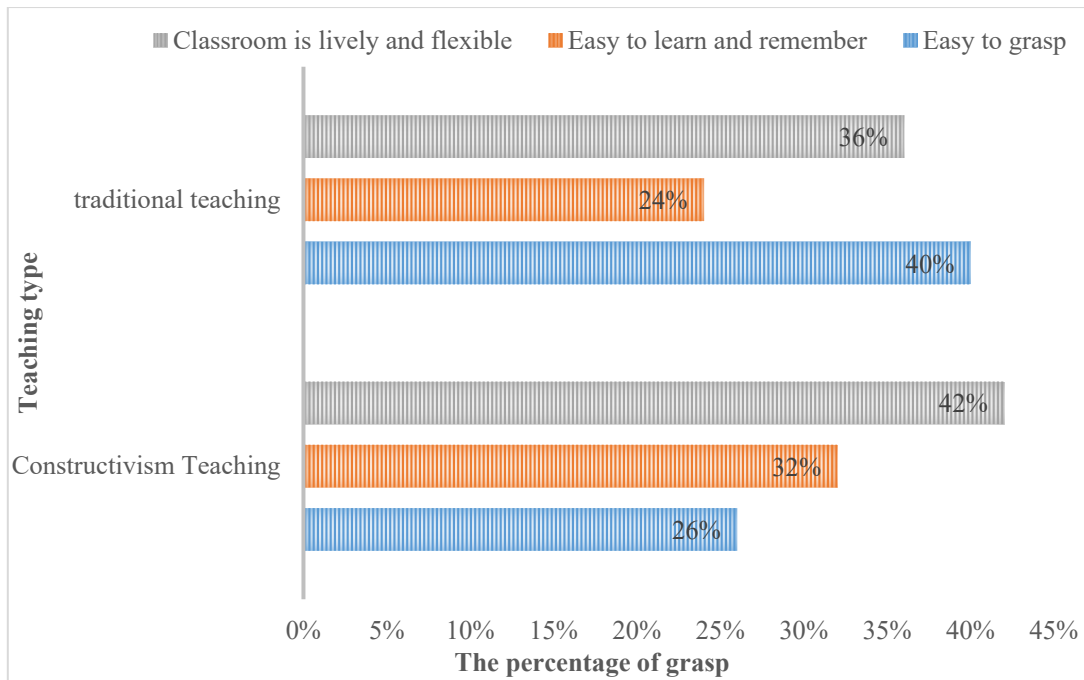


Figure 7: Comparison of constructivism theory and traditional teaching methods

5.3. Students' Learning Efficiency under the Constructive Learning Theory

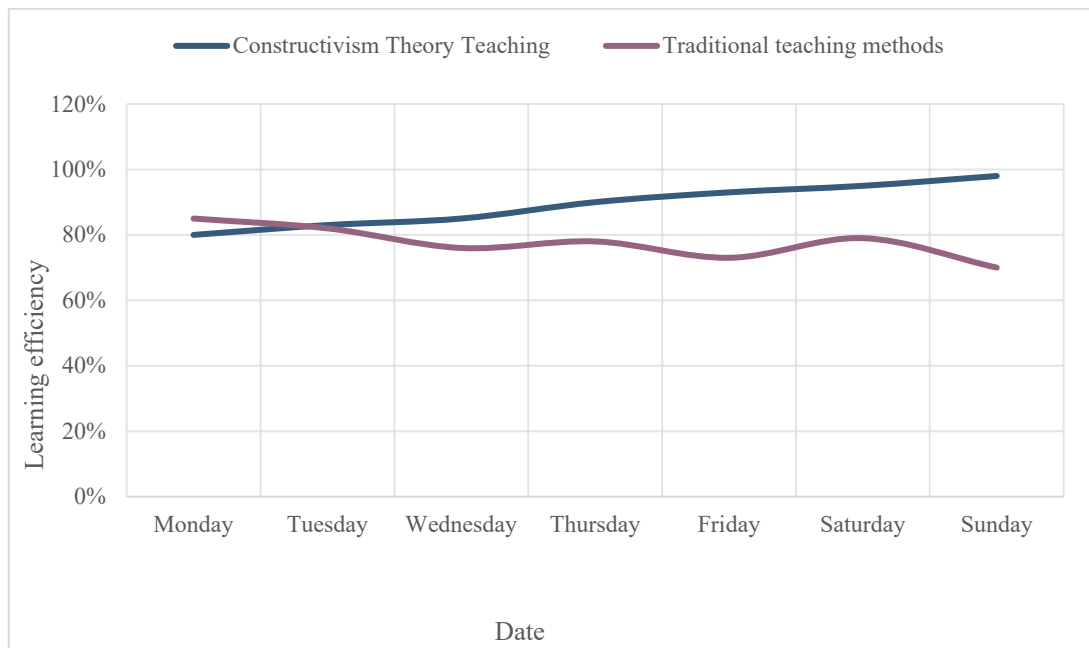


Figure 8: Analysis of learning efficiency

In this paper, two teaching models were used, and one week was used in the two teaching modes. The deep learning algorithm was used to compare the learning efficiency of students in these two teaching modes, so as to select the teaching method suitable for students' learning. As shown in Figure 8, students' learning efficiency is more efficient in the teaching mode under the constructivism theory. The main reason is that under the educational psychology teaching mode, the classroom is more vivid, which is conducive to teachers' creation of situations and makes it easier for students to integrate into piano training. In the traditional teaching mode, teachers' teaching methods are too old-fashioned and boring, which is not conducive to students' learning.

In order to make the results more accurate, this paper applied the deep learning algorithm to two teaching modes, and compared its evaluation accuracy and modeling time, as shown in Figure 9.

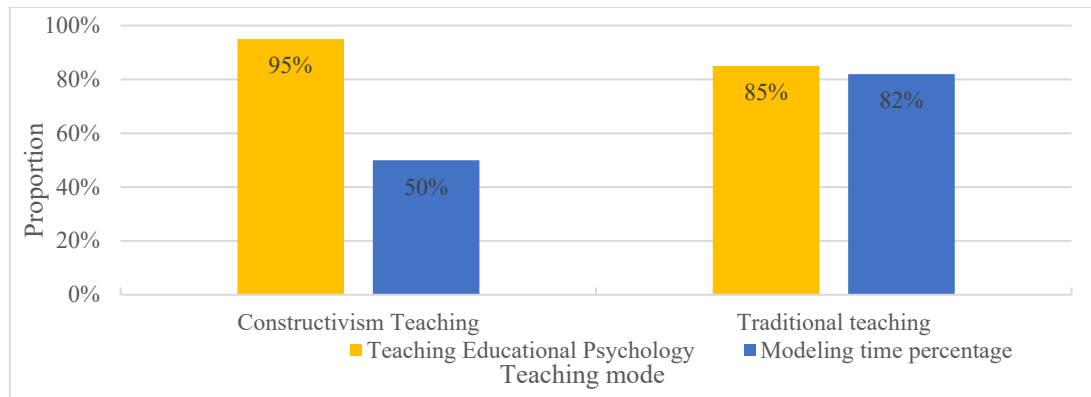


Figure 9: Teaching mode evaluation accuracy and modeling time ratio

It can be seen from Figure 9 that the average evaluation accuracy of the teaching mode under educational psychology was 95%, while the average evaluation accuracy of the traditional teaching mode was 85%, which verified that the teaching mode of educational psychology is more superior. It can be found in the modeling time that the teaching mode under educational psychology was far less than the traditional teaching mode, which improved the evaluation efficiency of the teaching mode. Overall, the teaching mode of educational psychology was easier for students to accept, and the teaching efficiency was 8% higher than that of traditional teaching.

6. Conclusions

In piano training, most students cannot control their psychology well, and are more or less disturbed by external factors. As a teacher in the new era, staying in the past teaching methods and only teaching students traditional knowledge and fixed skills training can no longer meet the development of the times. Piano training should establish a constructivist learning system and apply it to teaching mode. Through the use of educational psychology in teaching, the effectiveness of students is analyzed to help students learn to change bad psychological factors and cultivate psychological literacy, so as to achieve a win-win goal of teaching and training. Students should use their own training skills to continuously improve their knowledge system of piano skills. This student-centered constructivism teaching system focuses on cultivating students' independent thinking ability and creative imagination ability. Compared with the traditional teaching mode, this system can stimulate the enthusiasm of students for piano training, and encourage schools to cultivate more comprehensive and comprehensive piano talents.

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