Research Article

Innovation of Digital Piano Collective Class Teaching Mode under the Theory of Constructivism

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1. Introduction

With its sophisticated electronic monitoring system and one main piano driving dozens of auxiliary pianos for group instruction, the digital piano teaching system is a cutting-edge teaching method. It can fully utilize its auxiliary teaching software, multimedia projectors, advanced monitoring and monitoring systems, and other contemporary tools. It can also gather information and materials on advanced music Frontier education online, use computers and multimedia systems, and choose top-notch national and even international candidates’ course materials and integrate them into the classroom’s instruction [1]. The collective class teaching system for digital pianos is actually a cutting-edge computer music multimedia system. It has a high-end digital piano for teachers, a computer music system, a music teaching tool, an audio control system, a video projection system, and an audio-visual system in addition to the digital piano for students. The teacher’s piano’s sequencing system A number of digital pianos for students and, typically, a more sophisticated digital piano for teachers are included in the system for teaching group classes on the digital piano. The teacher’s piano has a number of ensemble functions, and can automatically accompany a number of instruments, and some models also have a potent music production sequence function that can provide a concerto for piano lessons and orchestra background music [2]. Collective classes using a digital piano as the teaching tool fully illustrate contemporary teaching methods, tools, and concepts while simultaneously enhancing students’ understanding of keyboard music theory, harmony, musical form, polyphony, orchestration, ensemble, and other music theory concepts through the use of the digital piano as the playing tool flawlessly matched. A new teaching methodology that incorporates skills, theory, and practice has been developed, and the many courses of the music education major are
organically, scientifically, and rationally integrated. With the playing form of a digital piano, the collective class teaching method for the digital piano fully demonstrates contemporary teaching tools, formats, and ideas while also enhancing students’ knowledge of keyboard music theory, harmony, musical form, polyphony, orchestration, ensemble, and other music theory topics perfectly matched. A new teaching method that integrates knowledge, skills, and practice has been developed, and the many courses of the music education major are integrated organically, scientifically, and logically [3].

Students’ understanding of pitch, timbre, rhythm, melody, and other musical elements in a group class on a digital piano should not solely depend on the teacher’s instruction of music theory knowledge, but rather should be facilitated through engaging and engaging classroom activities, such as music games and physical rhythm that allow students to participate in the performance of music and develop their perceptual cognition and ultimately master various musical elements. This paper focuses on addressing the underappreciated piano teaching in the piano teaching reform of teacher education majors through an extensive comparative study of training objectives, curriculum settings, teaching content, teaching methods, and evaluation methods in the digital piano collective class teaching mode. Its own laws and teaching characteristics, as well as a propensity to outright reject the professional teaching approach used by music colleges, are all characteristics of the system [4]. Promote and standardize the systematic and scientific nature of piano instruction, make necessary adjustments to the way it is done, and thoroughly investigate the issues of professionalism, standardization, thoroughness, and systematicity in the field. It is imperative to create a comprehensive and scientific piano teaching system for teacher education in the new era, one, that is, genuinely distinct from professional piano education, complies with the modernization and popularization development trend of college education, satisfies the criteria for quality-oriented teacher preparation, and exhibits the qualities of teachers. Important theoretical implications can be drawn from it [5].

Digital piano collective class instruction will develop talents in piano teachers, piano performance, piano accompaniment, and other areas, all of which require a scientific piano teaching system as the foundation. This is based on the idea of developing qualified teachers for basic music education.

Constructivist learning theory believes that learning should not be just passive acceptance of knowledge granted by teachers, but an active construction activity by learners based on their own knowledge and experience [6]. The learning process of students is a process in which a new cognitive structure is established through active exploration and active communication with the help of existing knowledge and experience under the situation created by the teacher. The process of enriching, enriching, and transforming one’s existing knowledge and experience through the interaction of existing knowledge and experience [7]. As a novel teaching and cognitive theory, it is fundamentally student-centered, emphasizing the initiative, social, and situational aspects of learning as well as students’ active pursuit of knowledge acquisition and comprehension of its significance construction in motion. As a result, the modern constructivism theory offers a philosophical methodology and a scientific theoretical foundation for the instruction of basic music in the classroom, while also adapting to the changing needs of the new educational environment [8]. This paper conducts a thorough analysis of constructivism theory from two theoretical and practical perspectives, identifies a collective teaching mode for digital pianos that follows constructivism theory, and attempts to apply it to music education. Comparing the teaching experiments of the experimental class and the control class allows for an analysis of the viability of building the theoretical teaching mode.

This paper’s originality is focused: in order to teach students according to their aptitude, this paper incorporates constructivism theory into the digital piano collective class and develops the piano level evaluation index. The digital piano has its own distinct features and benefits and has created a new platform for public music education and teaching in regular colleges and universities. It is based on audio sampling, digital editing, and digital processing. Digital piano collective class instruction can succeed with the help of this platform. Due to the limitations of conventional piano instruction, its multi-level duplex teaching offers the opportunity to realize a more thorough and thorough musical education.

2. Related Work

The modern constructivism theory adapts to the development of the times and the needs of the new educational environment and provides a scientific theoretical basis and a philosophical methodology for the digital piano collective class. The traditional music teaching model overemphasizes the role of teachers and imparting knowledge, neglects students’ enthusiasm and initiative in learning, and neglects the cultivation of individual students’ emotions, subjectivity, and creativity. Therefore, the development of the music teaching mode and the whole music teaching reform should change and update this old educational concept, focusing on cultivating students’ subject spirit, innovation spirit, practical spirit, autonomous learning ability, and self-development ability. Under the constructivist view of mathematical concept learning, scholars have developed many new theories and viewpoints [9].

Liang and Music believe that in the music classroom under the guidance of constructivism theory, teachers should not only clearly show a set of well-organized teaching procedures to students, but more importantly, stimulate students’ motivation to learn music and provide scaffolding to facilitate students’ connection and reflection on current music content and previous experience, and promote the meaning-building of knowledge [10]. Shixia Zhang and Shimin Zhang believed that learning is a process in which learners actively respond to new information on the basis of their original knowledge and experience, under a certain situation, that is, social and cultural background, with the help of teachers and learning partners, that is, through interpersonal collaborative activities. The process of
processing and constructing one's own meaning [11]. Zhang believes that the learning process is not a simple process of information input, storage, and extraction. It also includes conceptual transformation and structural reorganization caused by the conflict between new and old experiences. It is a two-way action process between new and old experiences. Learning is a process in which learners use their senses to absorb and construct meaning. This process is not passively accepting external knowledge, but the result of interaction with the external world that the learner contacts. Constructivism not only pays attention to the spirit that knowledge is actively constructed by learners, but also pays attention to the social level of knowledge, and the communication and negotiation between peers, teachers, and students [12]. Ding and Wang believed that constructivism pays special attention to the design of the learning environment, and provides sufficient resources for learners to actively construct the meaning of knowledge [13]. Yang believes that students do not enter the classroom empty-headed. He has knowledge related to the learning content, as well as more general daily experience, including knowledge that conflicts with new knowledge, and knowledge that integrates with new knowledge. Background knowledge beliefs and own values, personality. It is precise because students have these background knowledge and emotional factors that it is possible for them to take the initiative to make a reasonable explanation of the new knowledge [14]. Lu and University believe that constructivism emphasizes that the role of teachers is to change from imparting knowledge to students to prompting students to construct knowledge actively, and teachers change from an authoritative role to a helper, a facilitator, a tutor for students' learning, and a teacher, who actively constructs meaning of senior partner [15]. Zheng et al. believe that textbook knowledge is only a more reliable and more probable hypothesis about various phenomena, rather than a template for explaining reality, and it is not an absolutely correct final answer; textbook knowledge is in different situations and has its specificity mentioned below. To master textbook knowledge, it is necessary to grasp the complex changes in different environments [16]. Zhong believes that teaching is a cumulative process that relies on prior knowledge and past experience. Students’ learning is influenced by the experiences they activate in characteristic situations. The more an individual knows about a field, the more he/she can master it through learning. And because new knowledge is constructed on the basis of old knowledge, students must learn to use the experience, knowledge and skills that have been processed. Teachers should initially adapt teaching to students’ existing levels and then help them construct and connect new information [17]. Kun regards constructivism as a creative activity that cultivates students’ subjectivity. Students are active participants in teaching activities and active constructors of knowledge. Constructivism requires respecting students’ subject position in teaching activities, giving full play to students’ consciousness, initiative and creativity, and continuously improving students’ subject consciousness and creativity. Make students become social subjects who can educate themselves [18].

It is challenging for students to understand the extent of decentralization of autonomous learning because there are not many theories in the fundamental teaching of music under the theory of autonomous learning. That is to say, through extensive teaching experience, it will be possible to determine the appropriate level at which students should be able to take charge of their own learning. The collective class for teaching digital piano is taught using this new educational theory in order to achieve a common standard, which is also the aim of this study.

3. Constructivist Theory

Swiss psychologist Piaget first put forth the constructivism theory. According to Piaget, wisdom is essentially an adaptation to the environment, and it is an active adaptation. Only after a stimulus has been ingrained into the subject’s cognitive structure can the subject respond. From a functional standpoint, constructivism examines intelligence as a highly dynamic adaptation. According to the structural analysis, developing and creating a variety of cognitive structures at various levels is the essence of wisdom. The constructivist theory of cognitive development is based on two theoretical pillars: the functional variability of cognitive structures and the structural variability of cognitive structures [19, 20].

The source of cognitive structure is the interactive activities of subject and object. In the interactive activities, there is a two-way construction, that is, the internalization of environmental information to form a cognitive structure (internalized construction), and at the same time, it has formed or is forming. Cognitive structures are applied to the environment to transform the environment (externalizing constructs). In other words, the internalized construction itself reflects the individual’s adaptation to the environmental information, while the externalized construction means that the individual applies the cognitive structure to the external object at this time and incorporates the object into the subject’s cognitive structure. The previously internalized cognitive structure transforms the object or environment, and this process naturally reflects assimilation [21]. The theoretical schematic is shown in Figure 1.

Learners are required to actively engage in and actively contribute to the teaching process in the constructivism theory-based classroom. Teachers should no longer rely on their personal opinions and preexisting textbooks when instructing group lessons on the digital piano. Students are directly taught knowledge, but this instruction is based on the students’ prior knowledge and actual circumstances. The construction of knowledge occurs not only for students but also for teachers concurrently during the group class teaching activities involving the digital piano. In order to adapt to students’ learning with changing teaching tasks and objectives, teachers must constantly change the teaching environment, their own knowledge, and their teaching methods. Promote and standardize the systematic and scientific nature of piano instruction, make necessary adjustments to the way it is done, and thoroughly investigate the issues of professionalism, standardization, thoroughness,
and systematicity in the field. It is imperative to create a comprehensive and scientific piano teaching system for teacher education in the new era, one, that is, genuinely distinct from professional piano education, complies with the modernization and popularization development trend of college education, satisfies the criteria for quality-oriented teacher preparation, and exhibits the qualities of teachers.

The constructivist view of learning points out that, first of all, the essence of learning is the process of learners actively constructing meaning, and the construction of meaning is bidirectional. On the one hand, the understanding of new information is constructed by using existing experience, and at the same time, the information extracted from the memory system itself must be reconstructed according to the variation of the specific situation, rather than extracted intact; Doctrine also vigorously publicizes the subjectivity of learners, arguing that there is no constructivity without subjectivity, and this subjectivity is endowed by the nature of learning, so it is naturally possessed by learners [22].

Constructivism promotes placing the learner at the center under the direction of the teacher, emphasizing the role of the learner’s cognitive subject but not minimizing the leading role of the teacher. Instead of dispensing knowledge and imparting it, teachers aid and facilitate the construction of meaning. Teachers should stop acting as the traditional gatekeepers of knowledge and start acting as mentors or senior partners in the learning of their students. Instead of being passive recipients and indoctrinated knowledge objects, students are the primary actors in the construction of meaning and the processing of information. In contrast to traditional teaching, constructivist methods encourage students to take charge of their own learning by requiring them to complete tasks in challenging real-world scenarios. Furthermore, they value collaboration and conversation between teachers and students very highly. According to them, students can clearly see all sides of a situation through cooperation and routines. When participating in a discussion, students frequently examine their own thought processes and arrange and rearrange different ideas, which is more beneficial to enhancing their construction skills.

4. Design of Constructivism Teaching Mode

4.1 Design Principles of Digital Piano Collective Class Teaching Mode. According to the suggested teaching tasks and teaching objectives, teachers must create their own research plans and lesson plans. Teachers can only determine which activities should be intervened in, to what extent, and which activities they should make every effort to give students opportunities for independent learning by doing so. The teaching objectives should be examined first in the constructivist digital piano class teaching mode. The purpose of the analysis of teaching objectives is to identify the subject matter that will be covered by students as they learn the current music education material, which is knowledge content pertaining to fundamental concepts, principles, methods, and processes.

The constructivist learning philosophy places a strong emphasis on the fact that learners must fully express their passion and autonomy in order to achieve meaning construction. A good learning environment will benefit students, who use various learning strategies to acquire a variety of knowledge, according to constructivism, who also contends that students can express their creativity in an interactive setting regardless of time. It is best displayed in a subdued, open, and natural setting. Teachers can evaluate teaching tasks and learning objectives in the context of teaching design and decide that some content should be explored by students independently. In this case, teachers can determine that the subject of students’ independent study should be an understanding of the life and creative background of musician Hua Yanjun. And to achieve
4.2. Teaching Level Design of Digital Piano Collective Class. The roles of teachers and students must be reoriented in accordance with constructivist theory. Students are active participants in their learning and the construction of meaning rather than being passive recipients of the information. Students construct the meaning of knowledge through exploration and discovery during the learning process. Students must gather and evaluate a substantial amount of pertinent data and materials during the meaning-construction process very carefully. Teachers are now helping and guiding students as they create meaning, rather than acting as protagonists onstage or behind-the-scenes directors. By creating situations that satisfy the requirements of the teaching content and cues that encourage the connection between old and new knowledge, this will help students develop long-lasting learning motivation and help students construct the meaning of what they are currently learning. In order to make sense construction more effective, teachers should organize collaborative learning under possible conditions and guide the collaborative learning process. This paper divides the theory of the digital piano collective class teaching system into three levels, as shown in Figure 2.

Teaching materials are the main basis for teaching content and the main medium for teachers to carry out teaching work. High-quality teaching materials are the basis for realizing their piano teaching goals. The piano teaching materials for teacher education majors should have the following characteristics: normative, systematic, professional, and complete. Teaching system design belongs to the macroscopic design level, and it involves a relatively large teaching system, such as the establishment of a school, a new major, a training system or a learning system, and so on. When designing, the first step is to formulate training objectives according to the needs of the society for talents. The second step is to determine the curriculum system and teaching arrangements according to the training objectives and to make curriculum plans. The third step is to determine the knowledge structure of each course and its role in the entire curriculum system. Role and status, determine the curriculum standards for each course.

Normative means that the content of the textbook has an exemplary role and conforms to the basic laws of piano teaching in teacher education; systematic means that the organization of the content of the textbook conforms to the basic laws of digital piano group teaching in teacher education, showing a clear and orderly state; professionalism means that the content of the teaching material has a high degree of directionality and completeness to the piano art, and it means that the content of the teaching material includes works of various styles, forms, and contents suitable for the teaching of digital piano collective classes in teacher education. Teaching process design is the teaching design for the teaching process of a course or a unit or even a class. In this paper, the instructional design of a course or unit is called curriculum instructional design, and the instructional design of a class or a knowledge point is called classroom instructional design.

The course teaching design is based on the overall teaching objectives stipulated in the curriculum standards, and carefully analyzes the teaching content and teaching objects to complete target system. According to the above target system, classroom teaching design selects teaching strategies and teaching media, formulates teaching process structure plans, conducts teaching practice tests, and then makes evaluations and revisions.

4.3. Evaluation Indicators of Digital Piano Collective Class Teaching. The focus of digital piano teaching should be to train the fingers to organize and seek the balance, integrity, and stability of the palm. The teaching of digital piano collective courses in normal colleges must grasp the integrity
of the teaching system and structure, pay attention to the teaching of basic theories, basic contents, and basic methods, and cannot have too much subjective arbitrariness and improvisation. Teachers should follow the pre-drawn teaching plan, step by step and focus on teaching theories of performance, and use a spiral method to repeatedly strengthen basic concepts and essentials to teaching of basic theories, basic contents, and basic methods, which have existed since the introduction of the class teaching system. Individual differences are undoubtedly present, but overall, the level of students in the digital piano group class is fairly consistent across all grades. Although all educators uphold the idea that students should be taught in accordance with their aptitude, the level of students varies in digital piano group lessons, and the gap between them is even too wide. Even when teaching the same piano pieces, each student’s level of difficulty will vary. Teachers will find the setup even more challenging. The time of vibration affects the piano sound’s length and shortness. If an object vibrates for a longer period of time, a longer sound will be produced in response. On the other hand, a longer sound will result from a shorter vibration time. Similarly shorter Speaking of sound strength and weakness, let us get to it. By the object’s amplitude, it is established. When a person asks what an object’s amplitude is, they are referring to the object’s vibration’s range and amplitude. The corresponding sound will be louder if the hair’s amplitude is greater, and the opposite will be true if the amplitude is smaller. A person with good hearing should first conduct an extensive analysis of the various music heard and then express it when the audience participates in the music appreciation process and displays the various sounds heard. A linear combination of a number of previous audio sampling points can be used to approximate the audio signal, according to linear prediction. By minimizing the sum of the squares of the differences between the actual audio samples and the linear prediction samples, a unique predictor coefficient can be obtained, which is expressed as

$$s(n) = \sum_{i=1}^{t} a_i s(n-i).$$  \hspace{1cm} (1)$$

The prediction error is shown as

$$e(n) = s_n - \sum_{i=1}^{t} a_i s(n-i).$$  \hspace{1cm} (2)$$

The sum of squares of all prediction errors for audio frames is shown as

$$E = \sum_{n=1}^{\infty} \left[ \sum_{i=1}^{t} a_i s_{n-i} - s(n) \right].$$  \hspace{1cm} (3)$$

When the error is the smallest, the predictor coefficients are the same as the parameters in the digital model generated by the audio signal, and the linear prediction model is obtained by derivation, and the recurrence relation is shown in the following equations:

$$c_m = a_m + \sum_{i=1}^{m} \left( \frac{s}{m} \right) a_{m-i} (1 \leq m \leq p),$$  \hspace{1cm} (4)$$

$$c_0 = \sin \ln s^2.$$  \hspace{1cm} (5)$$

Through the spectral mapping of audio data, each frame of signal is only composed of 12 feature vectors, thus greatly simplifying the data of each frame. One of the most useful properties of this feature vector: it can encode the chords contained in a given song. Therefore, two audio data with similar chord content have the same feature vector. Of course, musical instrument information and the like of the audio signal are similarly encoded. Orthogonalize and independent of the feature parameters of audio signals. It can also be regarded as dimensionality reduction of feature parameters in order to reduce the computational complexity of the algorithm. In this paper, the note recognition algorithm is applied to a certain piano piece, and the results are shown in Table 1.

| Feature extraction algorithm | Multi-note recognition rate (%) |
|-----------------------------|--------------------------------|
| No feature extraction       | 69.84                          |
| Add feature extraction      | 73.67                          |

Table 1: Comparison of recognition rates before and after feature extraction optimization.

By observing the influence of each component of the eigenvector on the recognition rate, the feature weighting selectively weights each component in the eigenvector according to the difference in the ability of different components to represent audio. For large and high-dimensional feature components with small values, the component weighting coefficients generally use a raised half-sine function as

$$r_i = \frac{1}{2} \sin\left( \frac{i}{\pi} \right) - 1.$$  \hspace{1cm} (6)$$

The dimension of the feature vector is expanded according to a certain rule, so as to obtain a high-dimensional feature vector. Different types of eigenvectors represent different audio characteristics, and the combination of features is beneficial to reflect the individual’s personality from different angles to a certain extent, so as to realize the evaluation of different students’ piano levels.

5. Evaluation of Constructivist Teaching Models

Understanding students’ self-evaluations and experiences is a crucial part of determining the impact of an experiment. Statistical testing is a crucial part of this process as well. Enhancing students’ subject status and subject consciousness as well as fostering their capacity for autonomous learning and knowledge construction are the two main goals of using constructivism theory as a teaching tool for students engaged in autonomous learning. As a result, the enhancement of students’ subject status, subject consciousness, and self-directed learning serves as an index to assess the experiment’s
The link between teaching and evaluation is crucial. The teaching examination should adopt a method that combines both theoretical testing and practical evaluation, with the evaluation course’s content being flexibly set. In this study, two classes were used for teaching experiments, with one class being taught using constructivist theory and the other using a more conventional approach. Before the teaching starts, the weights of the indicators at all levels of the teaching content are determined, as shown in Table 2.

Before teaching, students in the experimental class and the control class were given a thorough examination. The comparison of the examination results is shown in Figure 3. From Figure 3, it can be seen that the piano level of the experimental class and the control class is similar before teaching, which belong to the same level. In order to ensure the validity of the experiment, some irrelevant variables that may affect the authenticity of the experiment are controlled as follows: First, in terms of the tested variables, the computer is randomly divided into classes to ensure the mathematics of the experimental class and the control class in the initial test results of the experiment. There is no significant difference in performance; second, in terms of teacher variables, the experimental class and the control class are taught by the same teacher, and in terms of teaching investment, the experimental class and the control class are basically the same in terms of curriculum setting, teaching
material range, and classroom interior settings. After 10 weeks of teaching, the piano proficiency of the experimental class and the control class was assessed. The results are shown in Figures 4 and 5.

During the teaching experiment, it was found that the students in the experimental class had a strong interest in digital piano learning and were active in class. Therefore, in the mid-term comparison of teaching results, it was obvious that the average score and piano level of the experimental class were higher than those of the control class. Finally, at the end of the term, the final assessment of the piano level of the experimental class and the control class is made. The comparison of the test scores is shown in Figures 6 and 7.

According to Figure 7, the experimental class received a final grade of 69.87 and a piano level index of 0.0824, while the control class received a final grade of 64.69 and its piano level index was 0.0741. Both the piano level and the piano test results favor the experimental class over the control class. Learning to play the piano is a form of individualized study that emphasizes the development of a student’s unique musical temperament. In order for students with high talent in the field of piano study to obtain continuous individualized development, self-directed learning can overcome the drawbacks of group classes that cannot take into account the individual development of students. The teaching process must include both teaching and learning. Of course, teachers are crucial to the teaching process, but there is no denying that students are even more crucial. Teaching experience demonstrates that paying attention to the learning process is just as important as changing teaching methods when trying to enhance teaching effectiveness. Along with imparting knowledge and skills, music education also aims to enhance students’ learning strategies, spur their interest in the subject, and enhance their capacity for both independent and group learning.

6. Conclusions

A major innovation in piano teaching reform, the digital piano collective class is a new approach to teaching the piano that follows the development and trend of contemporary educational reform. Establishing classroom facilities, improving the learning environment, and raising its viability. Constructivist teaching practices place a strong emphasis on active, critical, situational, and constructive learning methods as well as on developing learners with a keen interest in and aptitude for learning on their own. Teachers now organize, lead, assist, and facilitate the teaching process rather than dispensing knowledge. The role of the teacher is to engage students in learning, design an appropriate learning environment, and support their understanding of how meaning is constructed in a collaborative and interactive learning setting. Through the comparison experiment, it was determined that the experimental class’s final grade was 69.87 and its piano level index was 0.0824, while the control class’s grade was 64.69 and its piano level index was 0.0741. In terms of piano proficiency and test results, the experimental class outperforms the control class. It supports the viability of group instruction on digital pianos in the construction mode, which is a potent and advantageous addition to the conventional piano teaching approach. Open a fresh framework for piano instruction. There are no surveys of teachers or educational administrators in this study, which only uses students as its research subjects. Teachers, students, teaching resources, and teaching media are just a few of the various components that go into teaching. From various angles and to varying degrees, these factors can influence students’ test results, learning interests, and ability development. Future studies should take a more comprehensive look at the constructivist teaching mode’s instructional impact.

Data Availability

The data used to support the findings of this study are available from the corresponding author upon request.

Conflicts of Interest

The author does not have any possible conflicts of interest.
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