Hindawi
Mathematical Problems in Engineering
Volume 2022, Article ID 9428876, 11 pages
https://doi.org/10.1155/2022/9428876

Research Article

New Idea of College Music Teaching Mode Based on Numerical Deconstruction and Scientific Calculation

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Received 16 May 2022; Accepted 24 June 2022; Published 18 July 2022

Academic Editor: Sagheer Abbas

In the context of rapid social development, education has also faced many challenges in the market. As an important part of higher education, music courses have important value and effect on the cultivation of students' healthy psychological quality. Correct and effective music teaching can effectively guide students' music theory knowledge and aesthetic awareness and promote students' personal future development. However, the learning of theoretical knowledge in music courses is often abstract and boring. In the actual teaching process, problems such as unsatisfactory teaching effect of teachers and low learning interest and enthusiasm of students are often caused by the single teaching mode. Based on numerical analysis and scientific computing, this paper studies the new ideas of college music teaching mode. Under the guidance of scientific educational theory, numerical analysis and scientific calculation are integrated into the teaching of music curriculum theory, and abstract music theory knowledge is concretized to guide students to learn knowledge in a more intuitive way. In the practice of college music teaching mode based on numerical analysis and scientific computing, the method proposed in this paper can effectively improve students' learning effect and learning enthusiasm. And through the questionnaire survey, it is found that more than 80% of the students are satisfied with this teaching mode, and 62.5% of the students hope to continue to use this teaching mode in the learning process. It is feasible to apply it in practical teaching.

1. Introduction

With the continuous progress of the times, the level of social and economic development has also been continuously improved. While the material living conditions of the masses have been improved, the pursuit of spiritual values has also gradually improved. As a mainstream art, music has a pivotal position and value in the field of education development. More and more young people are starting to major or minor in music courses. Effective music teaching can not only bring students a beautiful artistic experience, but also help students form correct values and aesthetics. Especially for the development of college students majoring in music, correct music teaching is very important. The music teaching mode is one of the elements to maintain the orderly progress of the entire music teaching activities, and it has a certain guiding effect on the music teaching practice and music teaching behavior. However, with the continuous change of teaching purposes and requirements, music teaching at this stage still follows the traditional single teaching mode, which cannot make students resonate with creators or musical works through music learning. Therefore, it is very urgent for the development of higher music education to innovate the university music teaching mode and realize the integration of curriculum and teaching.

Numerical analysis and scientific computing are a major branch of theory arising from the continuous development and maturity of applied mathematics. It refers to the methods and disciplines of solving numerical calculation problems with the assistance of computer and other science and technology items. Because of its ability to accurately analyze and calculate data, it has been integrated with many value fields and achieved certain results in the market. For example, numerical analysis and scientific computing are used in the fields of weather forecasting, insurance, finance, and aviation. It has important practical significance for the sustainable development of the industry. This paper integrates it into the research on the new ideas of college music teaching mode, which has a certain role in promoting the innovative teaching mode.

In recent years, many scholars have provided new thinking and methods for the university music teaching model. Georgios L proposed to combine music and dance in music teaching to increase students' intrinsic motivation and enthusiasm for classroom knowledge learning [1]. Reme D explained the pedagogy of one of the major European composition theorists in the eighteenth century to help colleges and universities conduct historical analysis and practical teaching of Baroque music [2]. Fu L believed that colleges and universities need to carry out drastic reforms and innovations in vocal music teaching and continuously improve the quality and level of vocal music teaching by reconstructing the teaching model [3]. Biasutti M believed that a good music teacher can have a positive impact on the development of skills in students' music learning process. The effectiveness of music teachers is a multidimensional structure, including professional and personal characteristics [4]. Bonneville-Roussy A found through correlation analysis of measured responses and qualitative analysis of open-ended questions that teachers' enthusiasm for music in the teaching process and the behavior of supporting autonomy are related to the well-being of students [5]. M. Nevra Küpana investigated university music teaching mode and professional students' employment hope level through one-way analysis of variance and descriptive survey model [6]. The university music teaching model has been deeply studied by many scholars. Although it has certain guiding significance for teaching innovation, the effect of these teaching modes in the practical application of teaching is still not ideal. With the in-depth development of modern higher music education, higher requirements have been put forward for the teaching effect of university music teaching mode. In order to improve the level and quality of university music teaching, it has become a more intelligent choice to integrate numerical analysis and scientific computing into the research of new ideas of teaching mode.

In order to gain an in-depth understanding of numerical analysis and scientific computing, the related applications of numerical analysis and scientific computing are understood in this paper. Chen W proposed and analyzed a ternary Cahn-Hilliard system with polynomial mode nonlinear free energy expansion. Then, the only solvable and unconditionally energy stable numerical analysis scheme in this system is analyzed [7]. The content of Howard Elman's research uses numerical analysis and scientific computing to solve the multigrid of stochastic steady-state diffusion problems. This method uses a polynomial chaos method to discretize the random part of the problem [8]. Li J analyzed the discontinuous Galerkin method for the numerical flux of upwind deflection for a one-dimensional linear hyperbolic formula with degenerate variable coefficients. And the only proof that there is an optimal approximation property is presented [9]. Wang C introduced the special problems of applied modeling, numerical simulation, and optimization included in Applied Mathematical Modeling. These problems can be used in mechatronics and robotics research in manufacturing and industry [10]. Vahid K proposed a systematic computational framework for generating orthogonal rules in multiple dimensions of general geometries. Several examples of numerical analysis investigating optimal low-degree quadrature rules are also presented [11]. Dlz J considered efficient solutions of partial differential formulas with strong elliptic operators with constant coefficients and stochastic Dirichlet data by numerical analysis and scientific calculation of boundary integral formula methods [12]. These studies provide a good analysis of numerical analysis and scientific computing. In the field of education, there are very few studies that combine numerical analysis and scientific computing with the university music teaching model. In order to improve the quality of college music teaching, it is urgent to study new ideas of college music teaching mode based on numerical analysis and scientific computing.

This paper combines numerical analysis and scientific computing methods to study the new ideas of college music teaching mode. According to the teaching practice data, it can be found that the teaching mode of this paper can improve students' learning effect and learning interest to a certain extent. After 8 weeks of course study, the average score of students' knowledge mastery ability test under the teaching mode of this article reached 81.7 points, and the unit learning efficiency score can reach more than 82 points. And in the independent analysis ability and music theory practical ability test, the average scores are 85.8 points and 79 points, respectively, and the learning effect is relatively ideal. In the questionnaire survey of the teaching mode, 78.13% of the students believed that this teaching mode could make the music class more interesting, and 81.25% of the students believed that this teaching mode could change the way students think about problems. These data show that the new teaching model based on numerical analysis and scientific computing proposed in this paper can provide a reference for college music teaching.

2. University Music Teaching Mode Based on Numerical Deconstruction and Scientific Computing

2.1. University Music Teaching Mode. Before studying the university music teaching model, it is necessary to first understand the development and current situation of the traditional music teaching model. The traditional music teaching mode refers to a relatively stable music teaching procedure and strategy system that already exists in the teaching activities of higher music education and can reflect the music teaching ideas, concepts, and composition theories of the era. From the perspective of time, the traditional music teaching mode referred to in this article refers to the teaching mode that existed before the reform of music curriculum.

As a course theory, university music has a history of nearly a hundred years of development, and its teaching mode has been changing. Before the middle of the last century, most music courses existed in the form of singing lessons; that is, teachers sang a sentence and students learned a sentence. In the middle and late stages, music courses begin to develop gradually and systematically. The model is mainly for teachers to organize teaching, review students, and check the learning effect, teach new lessons, and finally consolidate and assign homework. Finally, with the improvement of the level of economic development, the music teaching model has reached a new level, changing the previous singing and replacing it with professional knowledge such as instrumental music and music theory. Overall, the current university music teaching model is still centered on teachers, students are often in a passive position, unable to appreciate music independently, and their innovative consciousness and enthusiasm for learning are inhibited.

For education and teaching practice, the correct music teaching model should cover five characteristics, as shown in Table 1.

Table 1: Features of music teaching mode.

Score	Sequence	Features
Music teaching mode	1	Operability
	2	Targeted
	3	Wholeness
	4	Superiority
	5	Openness

2.2. Operability. The operability of the music teaching mode is reflected in the teaching methods and teaching languages used in the teaching process, which need to be concise and clear. The overall teaching procedure cannot be cumbersome and complicated, and the teaching knowledge content can be internalized by students to imitate and operate after being passed on by teachers. It is not an abstract form but can be actually grasped. Maneuverability is the most basic feature of the music teaching model, especially for the subject of music, which has a high demand for interactivity; the lack of intuition will inevitably lead to a disconnection with practice.

2.3. Targeted. The music teaching mode must be constructed to solve the problems and contradictions existing in practical teaching. It has its own specific teaching objectives and scope of use but cannot be all-encompassing. In this sense, there is no universally effective and omnipotent model in the world, and of course there is no best teaching model. However, the existence of the music teaching mode is not only to achieve a certain teaching purpose. In practical applications, there should be a variety of teaching objectives in the teaching mode, and these objectives will be divided in an orderly manner according to the degree of importance. For example, a behavioral model is a model that aims at musical skills such as instrumental music or singing performance, and although it also has goals such as being affective and cognitive, it mainly focuses on skill goals.

2.4. Integrity. The music teaching model can fully express a certain part of the theory or the key factors and information contained in the knowledge of a certain topic. This wholeness can be generalized to all the content in the whole music teaching theory system. For example, it provides a relatively complete process of music teaching activities for teaching objectives, the ratio of teacher-student activities, and teaching and learning strategies. Therefore, compared with the teaching modes and methods of other disciplines, the music teaching mode often has a relatively sound and complete framework system.

2.5. Superiority. The music teaching model needs to be established based on scientific teaching theories and countless teaching practical experiences. Therefore, superiority is also one of the characteristics that the music teaching model needs to have. If a teaching mode does not have this feature, it proves that the teaching mode will be gradually eliminated by the market in specific teaching, such as the "indoctrination" music appreciation mode, because it makes students lose their interest in music when they master the knowledge; it will inevitably lose the market in music teaching.

2.6. Openness. A music teaching model is relatively stable when its applicable conditions do not change. This is also one of the factors that the teaching mode has the function of demonstration and imitation. But the music teaching model is an open system. With the gradual strengthening of people's understanding of music teaching theory and practice, and the updating of music teaching ideas and concepts, they are constantly revised to make it more complete. It is always perfected by continuous development, change, enrichment, and innovation. There is no optimal music teaching mode, only the optimization of the teaching mode. For example, the formulation of the latest "Music Curriculum Standards" has put forward higher requirements for the reform, construction, and creation of new music teaching models and has given newer connotations.

3. Numerical Deconstruction and Scientific Computing

Numerical analysis and scientific computing is the science of studying algorithms for continuous problems [13]. Among them, the most important concepts are algorithms and continuous problems. First, continuous problems are complex model problems abstracted from physics or other disciplines, generally infinite-dimensional problems and almost impossible to find analytical solutions. These intractable continuous problems naturally become the target objects of numerical analysis. Secondly, the design and analysis of algorithms for solving continuous problems is the core content of numerical analysis. Their purpose is to discretize a continuous infinite-dimensional problem, obtain a discrete finite-dimensional solvable problem, and then obtain an approximate solution, as shown in Figure 1.

The research fields of numerical analysis and scientific computing are very broad. And due to the development of modern interdisciplinary disciplines, the boundaries of numerical analysis are becoming more and more blurred. This paper mainly introduces the two major contents of numerical linear algebra and nonlinear formulas.

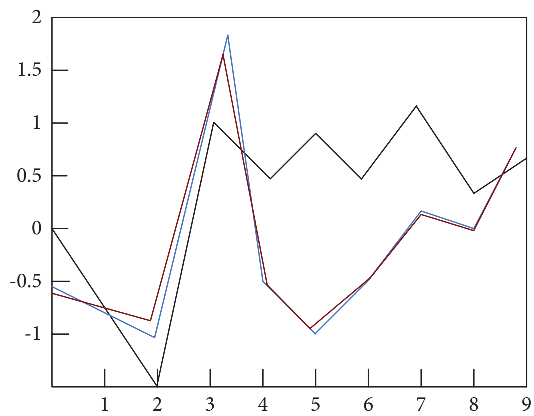

Figure 1: Numerical analysis and scientific computing legend.

3.1. Numerical Linear Algebra. Numerical linear algebra mainly involves the study of algorithms for systems of linear formulas, eigenvalues, and related numerical algorithms. The system of linear formulas comes from the discrete of linear problems or the linearized discrete of nonlinear problems, and its solution becomes the basic content of numerical analysis. Its structure is shown in Figure 2.

The eigenvalue problem is one of the most important topics in numerical analysis, and its main goal is to seek an efficient and stable numerical algorithm, as shown by point C in Figure 3 [14].

Nonlinear system of formulas: The solution of nonlinear formulas is generally based on a series of approximate linear problems, which have many classical methods, as shown in Table 2.

The characteristics and algorithm flow of each type of algorithm are different. Taking fixed point iteration as an example, the algorithm flow is shown in Figure 4.

4. Music Teaching Mode Based on Numerical Deconstruction and Scientific Computing

This paper integrates numerical analysis and scientific computing methods into the teaching of university music theory, objectively describes music works, and strengthens students' understanding of music theory knowledge through similarity quantification. In this way, it breaks the traditional lecture-style teaching and stimulates students to explore and study music knowledge.

Take the teaching content in music theory as an example, as shown in Table 3.

Taking chords, melody, pitch, and rhythm as examples, numerical analysis and scientific calculation methods are integrated into music classification and evaluation teaching.

First of all, when analyzing the music theory knowledge of a piece of music in the teaching process, it is usually a priority to understand the overall harmony relationship of the music at the same time. Therefore, the chord is the implicit state, and the chord output melody pitch is used to represent the dependence of the chord and the melody, which can be represented by a mathematical model, as shown in Figure 5.

In Figure 5, $H_1, H_2, \cdots, H_n$ represents the kind of chord in each state: $M_1, M_2, \cdots, M_n$ represents the pitch state of the melody under the corresponding (same moment) chord state. $HC_1, HC_2, \cdots, HC_n$ represents the chord state transition probability between the two chords from the front to the back. $HO_1, HO_2, \cdots, HO_n$ represents the output probability of the hidden state chord to the melody pitch.

Suppose that all chords appearing in the musical works of this paper constitute the chord state set C, and the event that converts to the chord state y (x and y may be the same and $x, y \in C$) when the previous chord state is x is represented as a vector [15]:

$$\overrightarrow{c} = (x, y). \tag{1}$$

Then, in a certain piece of music sample M, the event probability can be expressed as $p(\overrightarrow{c}|M)$, $p(\overrightarrow{c}|M) > 0$; counting the probability p_{mx} of the chord x appearing in the music sample set of the work, the weighted probability $p_c(\overrightarrow{c}|M)$ of the event $\overrightarrow{c} = (x, y)$ in the work sample is

$$p_c(\overrightarrow{c}|M) = p(\overrightarrow{C}|M) \times p_{mx}. \tag{2}$$

Similarly, the probability of $\overrightarrow{c} = (x, y)$ in the training set music R is represented as $p(\overrightarrow{c}|R)$. Counting the probability p_{rx} of the chord x appearing in the music sample set of the work, the weighted probability $p_c(\overrightarrow{c}|R)$ of converting to the chord state y in the case of the chord state x in the training set is

$$p_c(\overrightarrow{c}|R) = p(\overrightarrow{c}|R) \times p_{rx}. \tag{3}$$

Let r_c be the total number of kinds of chord transitions $\overrightarrow{c}$ that appear in the training set R and m_c be the total number of kinds of chord transitions $\overrightarrow{c}$ that appear in the music sample M of this piece:

$$\sum_{\overrightarrow{c}}^{r_c} p_c(\overrightarrow{c}|R) = \sum_{\overrightarrow{c}}^{m_c} p_c(\overrightarrow{c}|M) = 1. \tag{4}$$

After calculating the weighted probability that the music sample M of the work and the chord state x in the training set R are converted to the chord state y, the weighted probability distance $D_{\overrightarrow{c}}$ between the two is

$$D_{\overrightarrow{c}} = \begin{cases} p_c(\overrightarrow{c}|M) * \left[1 - \min\left(\dfrac{p_c(\overrightarrow{c}|M)}{p_c(\overrightarrow{c}|R)}, \dfrac{p_c(\overrightarrow{c}|R)}{p_c(\overrightarrow{c}|M)}\right)\right], & p_c(\overrightarrow{c}|R) > 0, \\ p_c(\overrightarrow{c}|M). & p_c(\overrightarrow{c}|R) = 0, \end{cases} \tag{5}$$

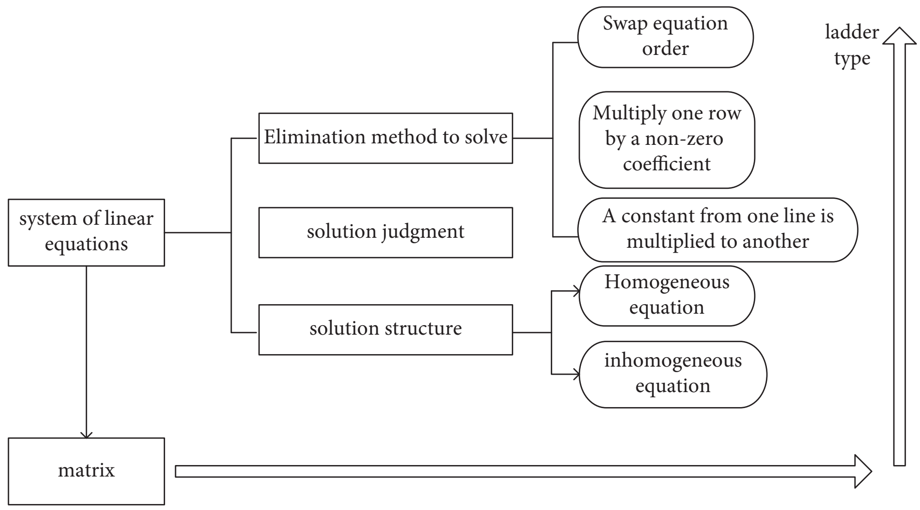

Figure 2: Basic structure of linear formulas.

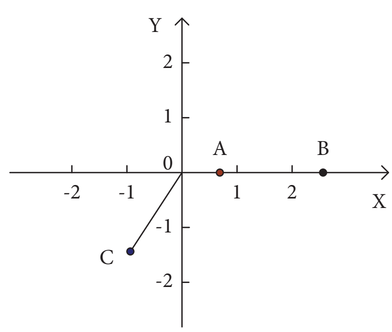

Figure 3: Eigenvalue problem solving legend.

Among them, $min(j, k)$ indicates that the minimum value of k and j is selected. The total weighted probability distribution distance D_c of the work sample and the chord transformation of the training set is

$$D_c = \sum_{\vec{c}}^{mc} D_{\vec{c}}, \tag{6}$$

mc represents the total number of kinds of chord transitions $\vec{c}$ that appear in the musical sample of the composition. The calculation of D_c comprehensively considers the transition probability of the chord and the proportion of the chord itself in the music.

All the melody pitches appearing in the data set constitute the melody pitch state set F. In the case where the chord state is x, the event whose output melody pitch state is y $(x \in C, y \in F)$ is represented as a vector:

$$\vec{s} = (x, y). \tag{7}$$

Then, in a certain piece of music sample M, the event probability can be expressed as $p(\vec{s}|M)$, $p(\vec{s}|M) > 0$; counting the probability p_{mx} of the chord x appearing in the music sample set of the work, the weighted probability $p_s(\vec{s}|M)$ of the event $\vec{s} = (x, y)$ in the work sample is

$$p_s(\vec{s}|M) = p(\vec{s}|M) \times p_{mx}. \tag{8}$$

Similarly, the probability of $\vec{s} = (x, y)$ in the training set music R is represented as $p(\vec{s}|R)$. Counting the probability p_{rx} of the chord x appearing in the music sample set of the work, the weighted probability $p_s(\vec{s}|R)$ of the output melody pitch state y in the case of the chord state x in the training set is

$$p_s(\vec{s}|R) = p(\vec{s}|R) \times p_{rx}. \tag{9}$$

Let r_s be the total number of kinds of chord output melody pitch events $\vec{s}$ that appear in the training set R and m_s be the total number of kinds of chord output melody pitch events $\vec{s}$ that appear in the music sample M of this piece:

$$\sum_{\vec{s}}^{r_s} p_s(\vec{s}|R) = \sum_{\vec{s}}^{m_s} p_s(\vec{s}|M) = 1. \tag{10}$$

After calculating the weighted probability of the music sample M of the work and the output melody pitch state y of the chord state x in the training set R, the weighted probability distance $D_{\vec{s}}$ between the two is

$$D_{\vec{s}} = \begin{cases} p_s(\vec{s}|M) * \left[1 - min\left(\dfrac{p_s(\vec{s}|M)}{p_s(\vec{s}|R)}, \dfrac{p_s(\vec{s}|R)}{p_s(\vec{s}|M)}\right)\right], \\ \\ p_s(\vec{s}|M),\ p_s(\vec{s}|R) = 0. p_s(\vec{s}|R) > 0, \end{cases} \tag{11}$$

Table 2: Classification of nonlinear system of formulas methods.

Sequence	Method classification	Features
1	Dichotomy	The calculation is simple and the method is reliable
2	Fixed point iteration	Algorithms are easy to implement on a computer
3	Steepest descent	Intuitive and easy to understand
4	Newton's method	Convergence is fast

Among them, $\min(j,k)$ indicates that the minimum value of k and j is selected. The total value of the weighted probability distribution distance D_s between the work sample and the chord output melody pitch of the training set is

$$D_s = \sum_{\overrightarrow{s}}^{ms} D_{\overrightarrow{s}}, \tag{12}$$

mc represents the total number of kinds of chord transitions $\overrightarrow{c}$ that appear in the musical sample of the composition. The calculation of D_c comprehensively considers the transition probability of the chord and the proportion of the chord itself in the music.

The chord output melody pitch mode of the sample style music can be known by counting the mean and standard deviation of the sample style D_s of the work.

People then assume that all the harmonies that appear in the work constitute the overall harmony state set H . Then the event that outputs the overall harmony state β when the previous overall harmony state is α is represented as a vector:

$$\overrightarrow{h} = (\alpha, \beta). \tag{13}$$

Next, $p(\overrightarrow{h}|M)$ represents the probability $(p(\overrightarrow{h}|M) > 0)$ of transitioning to the overall harmony state β (α and β may be the same and $\alpha, \beta \in H$) when the previous overall harmony state in the test set music sample is α.

Then the weighted probability $p_h(\overrightarrow{h}|M)$ of the overall harmony state α being converted to the overall harmony state β in the test set sample is

$$p_h(\overrightarrow{h}|M) = p_h(\overrightarrow{h}|M) \times p_s(\overrightarrow{s}|M). \tag{14}$$

In the same way, a numerical analysis and scientific calculation model is established, as shown in Figure 6.

The probability of outputting an overall harmony state β (α and β may be the same and $\alpha, \beta \in H$) given the previous overall harmony state of α in the training set R is denoted as $p(\overrightarrow{h}|R)$. Then the weighted probability $p_h(\overrightarrow{h}|R)$ that the overall harmony state α is converted into the overall harmony state β in the training set is

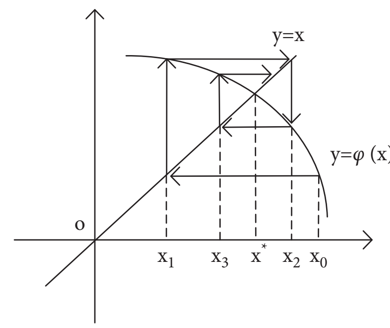

Figure 4: Fixed point iterative algorithm flow.

Table 3: Teaching content in music theory.

Score	Sequence	Knowledge content
Basic knowledge of music theory	1	Chords
	2	Melody
	3	Pitch
	4	Rhythm

$$p_h(\overrightarrow{h}|R) = p(\overrightarrow{h}|R) \times p_s(\overrightarrow{s}|R), \tag{15}$$

r_h represents the total number of kinds of pretransition overall harmony state transitions $\overrightarrow{h}$ appearing in the training set music samples, and m_h indicates the total number of kinds of overall harmony state transitions $\overrightarrow{h}$ appearing in the test set music samples:

$$\sum_{\overrightarrow{h}}^{r_h} p_h(\overrightarrow{h}|R) = \sum_{\overrightarrow{h}}^{m_h} p_h(\overrightarrow{h}|M) = 1. \tag{16}$$

After calculating the weighted probability of converting the overall harmony state α to the overall harmony state β between the music samples of the test set and the music data of the training set, the weighted probability distance $D_{\overrightarrow{h}}$ between the two is

$$D_{\overrightarrow{h}} = \begin{cases} p_h(\overrightarrow{h}|M) * \left[1 - min\left(\dfrac{p_h(\overrightarrow{h}|M)}{p_h(\overrightarrow{h}|R)}, \dfrac{p_h(\overrightarrow{h}|R)}{p_h(\overrightarrow{h}|M)}\right)\right], & p_h(\overrightarrow{h}|R) > 0 \\ p_h(\overrightarrow{h}|M). & p_h(\overrightarrow{h}|R) = 0 \end{cases} \tag{17}$$

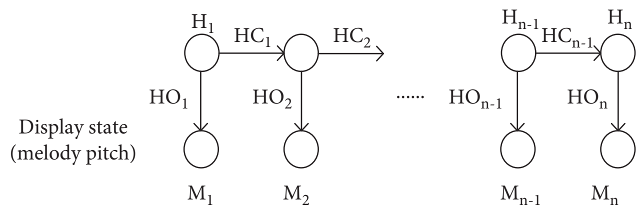

Figure 5: Music theory knowledge algorithm model.

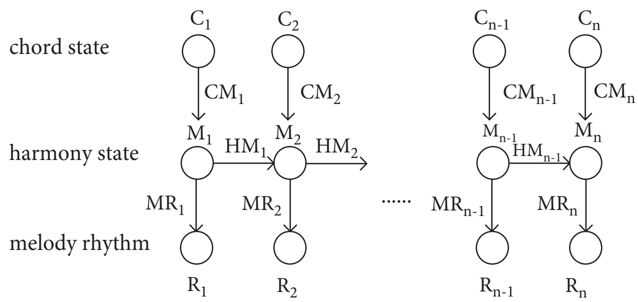

Figure 6: Numerical analysis and scientific computation models.

The total weighted probability distance D_p of the single-step time series overall harmony state transition between the test set samples and the training set is

$$D_p = \sum_{\overrightarrow{p}}^{mp} D_{\overrightarrow{p}}. \tag{18}$$

The mean and standard deviation of D_p are then counted to learn how the overall harmony state transitions of the musical style are presented.

The same method applies to quantifying the probability distribution of the weighted harmonic output rhythm of a musical composition; combining all rhythms that appear in the composition to form a rhythmic state E, the event that outputs rhythm state $\beta (\alpha \in H, \beta \in E)$ given the overall harmony state of α is represented as a vector:

$$\overrightarrow{b} = (\alpha, \beta). \tag{19}$$

Then the weighted probability $p_b(\overrightarrow{b}|R)$ of event $\overrightarrow{b} = (\alpha, \beta)$ in training set R is

$$p_b(\overrightarrow{b}|R) = p(\overrightarrow{b}|R) \times p_{ra}. \tag{20}$$

r_b represents the total number of types of overall harmonic output rhythm events $\overrightarrow{b}$ that appear in the training set R, and m_b represents the total number of types of harmonic output rhythm events $\overrightarrow{b}$ that appear in the test set music samples M:

$$\sum_{\overrightarrow{b}}^{r_b} p_b(\overrightarrow{b}|R) = \sum_{\overrightarrow{b}}^{m_b} p_b(\overrightarrow{b}|M) = 1. \tag{21}$$

Then, the weighted probability distribution distance total value D_b of the output rhythm of the overall harmony state is obtained, and the average and standard deviation of the final statistics D_p can be used to know the overall harmony output rhythm of the musical style.

Integrate numerical analysis and scientific calculation into the appreciation of works in music teaching, and replace a single theoretical explanation with a more intuitive teaching mode. By quantifying the music theory and structure of the works, it can deepen students' cognition of the works and improve the quality and effect of music teaching.

5. Simulation Experiment

This paper integrates the proposed numerical analysis and scientific computing methods into the existing teaching mode and carries out teaching practice. In this experiment, 64 freshmen of a university majoring in music were selected and divided into two groups, A and B, with 32 students in each group. Group A adopted the teaching mode proposed in this paper, and group B adopted the traditional teaching mode. The two groups of students study the course "Basic Music Theory" together. The course leader is held by the same teacher. The teacher has been teaching for 8 years and has rich teaching experience and high professional quality. The course lasts for 8 weeks, with a total of 4 knowledge units. After the study of each knowledge unit, a learning effect test was conducted on the two groups of students. A questionnaire survey was conducted after the end of the course, the content of the survey includes students' learning experience and evaluation of teaching mode, and its purpose is to examine the effectiveness of the teaching model. Before the formal start of the experiment, the basic information of students in groups A and B was learned, as shown in Table 4.

Table 4: Basic information of students in groups *A* and *B*.

Classification	Experimental group	Control group
Total people	32	32
Number of boys	13	16
Number of girls	19	16
Comprehensive ability P value	0.103	0.241

From the data in Table 4, we can know that the gender ratios of students in groups A and B are relatively uniform. In the comprehensive ability information, the significance level of the two groups of students, that is, the P value, is greater than 0.05. It shows that the differences in the comprehensive ability of the two groups of students have not reached a significant level, and the validity of the experiment is guaranteed.

5.1. Learning Effect Test. The learning effect test in this paper is divided into 4 parts; each part corresponds to a knowledge unit. To examine the learning effect of students by means of learning content test to verify whether the teaching mode is effective, the test items are divided into two parts, theory and practice, respectively. The theoretical test is subdivided into knowledge mastery and learning efficiency, and the practical

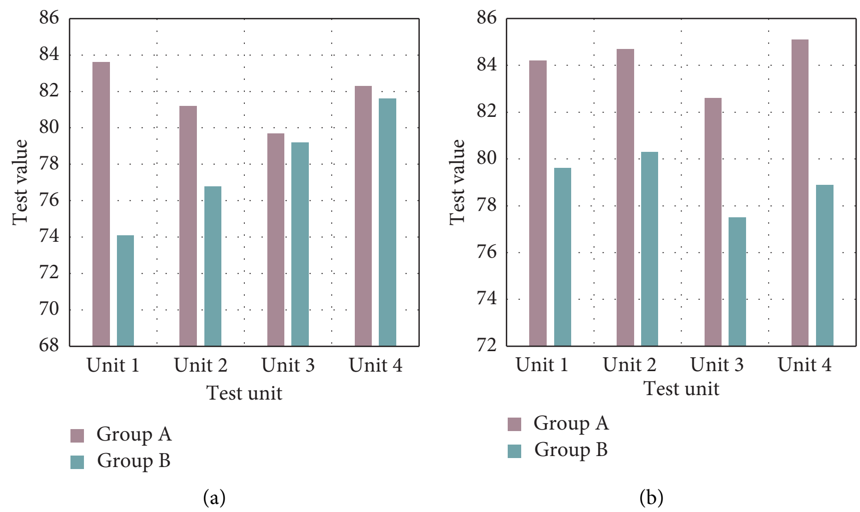

Figure 7: Theory learning test results: (a) shows the results of the knowledge mastery test of the two groups of students; (b) shows the results of the two groups of students' learning efficiency test.

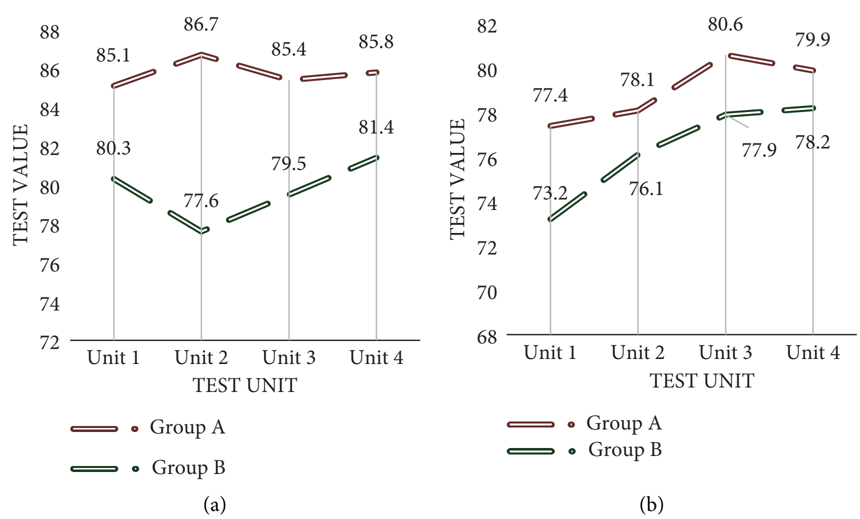

Figure 8: Practical learning test results: (a) shows the results of two groups of students' music theory self-analysis ability; (b) shows the results of the music theory practical ability test for the two groups of students.

test is subdivided into independent analysis ability and practical ability of music theory. The test adopts a scoring system with a full score of 100 points. Each student is scored by the teacher in charge of the course, and the final result is judged based on the students' test scores and the usual performance in class. The test score accounts for 70% and the class performance accounts for 30%. The test results of each group of students are shown in Figure 7.

From Figure 7, it can be seen that there is a certain difference in the theoretical test scores of the two groups of students after using different teaching modes to organize learning. In terms of knowledge mastery, the average test score of the four units of the teaching model integrating numerical analysis and scientific computing reached 81.7 points, while the average test score of students under the traditional teaching model was only 77.9 points. This data shows that quantified music theory knowledge can be more easily grasped by students, as in Figure 8. From the results of the learning efficiency test, we can still draw the conclusion that the learning efficiency of students in group A can reach 82 points or more in each unit, while the learning efficiency of students under the traditional teaching mode is not ideal, and the average test score is about 79.1 points. In university music teaching, the study of theoretical knowledge such as music theory accounts for 60% of the main learning content. This kind of theoretical and difficult knowledge content cannot be effectively internalized by students if it is only taught by teachers in writing or orally. The more intuitive teaching mode of numerical analysis and scientific calculation is used to organize teaching, and the effect is more obvious.

In the process of music teaching, if students can transform book knowledge and classroom knowledge into practice and can apply it proficiently, it proves that the

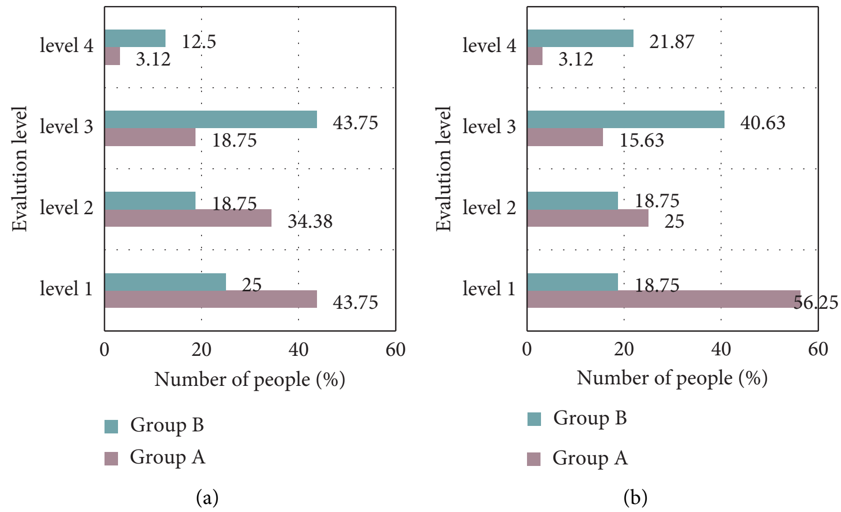

Figure 9: The survey results of the experience of teaching mode: (a) shows two groups of students' evaluations of whether the teaching mode makes the classroom more interesting; (b) shows the evaluations of the two groups of students on whether the teaching mode changed the way of thinking about problems.

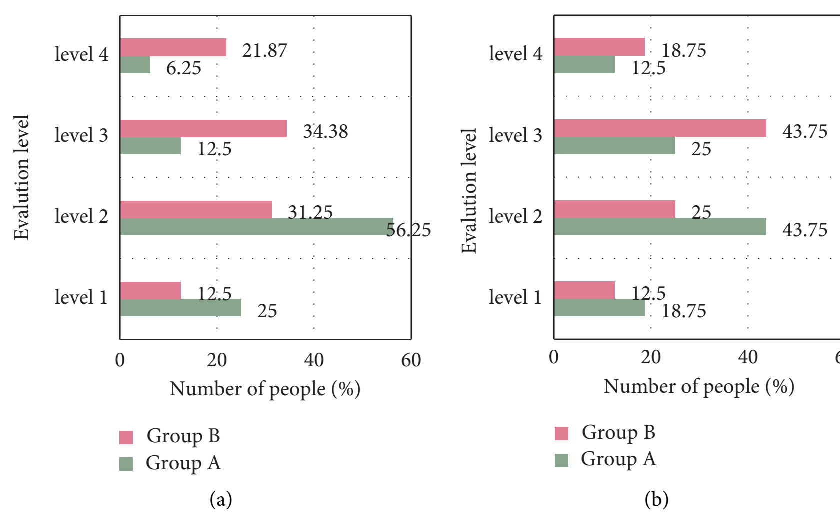

Figure 10: Satisfaction survey results of teaching mode: (a) shows the evaluation of whether the two groups of students like the teaching mode. (b) shows the evaluation of whether the two groups of students wish to continue to use the teaching mode.

teaching mode is effective. From Figure 8, it can be seen from the students' music theory self-analysis ability test and music theory practical ability test that the practical ability of group A students is relatively ideal. Students can self-appreciate and self-analyze musical works through numerical analysis and scientific calculation and deepen their understanding of music knowledge. The average scores of students in group A's self-analysis ability and practical ability test were 85.8 points and 79 points, respectively, and the average test points of group B were 79.7 points and 76.4 points, respectively. Overall, although the students in group A have superior self-analysis ability, there is a small gap between the practical ability of music theory and the students in group B. This may be due to insufficient review by students and the lack of timely consolidation of course knowledge.

5.2. Questionnaire Survey. This questionnaire survey is aimed at all students in groups A and B. At the end of the 8-week course, a survey was conducted to each student participating in the experiment. The questionnaire mainly judges the feasibility of the teaching mode by counting students' experience and satisfaction with the teaching mode. The content of the experience survey includes "This teaching model makes the classroom more interesting, this teaching model has changed the way I think about problems," and the satisfaction survey content is "I like this teaching model, I hope to continue to use this teaching model." The evaluation level is divided into 4 levels, including level 1, level 2, level 3, and level 4, which represent strongly agree, agree, general, and disagree, respectively. The survey results are shown in Figure 9.

In the teaching mode experience survey in Figure 9, it can be seen that more than 78% of the students believe that the teaching mode proposed in this paper can make the music classroom more interesting. And 81.25% of the students believed that the university music teaching model based on numerical analysis and scientific computing could change the way students think about problems. In contrast to the traditional teaching mode in group B, 40.63% of the students thought that the traditional teaching mode was generally interesting, and more than 20% of the students believed that the traditional teaching mode did not change the way students think about problems. This survey data shows that numerical analysis and scientific computing methods have certain innovations in teaching practice, which can increase students' interest in learning and broaden their thinking to a certain extent (see Figure 10).

It can be seen from Figure 10 that 56.25% of the students are not satisfied with the traditional teaching mode, and 62.5% of the students do not want to continue to use the traditional teaching mode, indicating that the innovation of the teaching mode is very necessary. 81.25% of students like the teaching mode proposed in this paper, and 62.5% of students want to continue to use this teaching mode. Only 6.25% of the students are dissatisfied with this teaching mode, which may be related to the individual differences in the adaptability of each student. Students who are not adaptable will experience a certain sense of exclusion when they receive new methods, but this feeling of exclusion will gradually disappear with the increase of teaching time. Overall, most students can adapt to and like the university music teaching model based on numerical analysis and scientific computing.

6. Conclusions

The university music teaching model needs to guide the educational and teaching activities based on the scientific educational theory. In the specific implementation process, it is necessary to fully integrate the actual situation, integrate multiple modes, and teach students in accordance with their aptitude. This paper proposes a new teaching mode, which integrates numerical analysis and scientific calculation into the teaching of music theory. It expounds and appreciates music theory knowledge and works in an intuitive way, deepening students' understanding of professional theory. It can not only improve the quality and efficiency of music teaching, but also cultivate students' learning enthusiasm and independence. It has certain reference significance for improving and enriching the traditional single oral teaching or text teaching mode in the current music teaching.

This paper conducts a profound study on the new ideas of music teaching mode through numerical analysis and scientific calculation methods. However, there are still many areas for improvement in this paper. In the process of teaching practice, all variables that may affect the experimental results are not considered, which may cause certain errors in the experiment. Whether numerical analysis and scientific computing have universal applicability in practical applications remains to be considered. In the future research, we will think more carefully about this issue and combine the existing scientific and technological level to improve the conditions and level of experimental research.

Data Availability

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

Conflicts of Interest

The authors declare no conflicts of interest.

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