



Teaching Effect Evaluation Method of College Music Course Based on Deep Learning

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Abstract. Teaching effect evaluation is the key to deepen the teaching reform and improve the teaching quality of music course. In order to improve the teaching level of music course and realize the rapid popularization of music teaching in colleges and universities, the evaluation method of music teaching effect is studied. According to the application principle of the deep learning algorithm, the artificial neural network is constructed and the relevant learning indexes are combined to solve the Sofhnax regression condition. Based on this, the evaluation system model is perfected and the evaluation network based on deep learning is constructed. Determine the characteristics of music curriculum teaching evaluation and the scope of the teaching object. Through the statistics of the target elements, the evaluation mode is verified and evaluated, and the design of the evaluation method of music teaching effect based on deep learning is completed. The experimental results show that the cognitive load level of music teaching is promoted to 3.5 efficiency values under the effect of deep learning algorithm. In promoting the development of music teaching in colleges and universities can play an obvious role in promoting the impact.

Keywords: Deep Learning · Music Course · Teaching Effect · Artificial Neural Network · Sofhnax Regression · Target Element

1 Introduction

College education refers to professional education and vocational education on the basis of completing secondary education, and is the main social activity for cultivating senior professional talents and professional personnel. Higher education is one of the important parts of the education system that are interconnected. It usually includes various educational institutions with high-level learning and training, teaching, research and social services as their main tasks and activities [1]. Colleges and universities are the cradle of cultivating talents with all-round development in morality, intelligence, physique and labor. Under the requirements of the new era of educational reform, the implementation of public music education has been strengthened so as to balance the aesthetic education with other moral, intellectual and physical education courses. Compared with other

developed countries, the development level of domestic public music education is still in the primary stage, and the public music education in colleges and universities is in a slow state of development, which does not match the development of other professional disciplines [2]. However, with the popularization of quality education in the new era, public music education, which aims at improving the overall quality of college students, is bound to mushroom. The reform of public music education in domestic colleges and universities will also be accelerated. Therefore, it is necessary for the administrative department of education to formulate a scientific and systematic evaluation method of teaching effect of public music course in colleges and universities. Therefore, it is of great significance to study the status quo of college public music education. At present, there are many methods for evaluating the effectiveness of courses in English, physical education and other subjects. Due to the particularity of music course evaluation factors, the teaching effect evaluation of music subject is less. In order to further improve the teaching level of music courses, this paper proposes a method for evaluating the teaching effect of music courses in colleges and universities based on deep learning. Firstly, the artificial neural network is constructed using deep learning algorithm. On this basis, a deep learning music course evaluation network is constructed. The target elements of music course teaching are counted, and the evaluation of music teaching effect is completed.

2 Teaching Effect Evaluation Network Based on Deep Learning

To evaluate the effect of music teaching in colleges and universities, we can improve the evaluation network with the support of deep learning algorithm. This chapter will focus on the above contents.

2.1 Artificial Neural Networks

In the field of deep learning algorithms, artificial neural networks are computational models that mimic the animal's central nervous system, especially the brain, enabling machines to learn and recognize information like the human brain. Neural networks are calculated by a large number of interconnected neurons. Often used to model complex relationships between inputs and outputs, or to explore intrinsic patterns of data.

First of all, take the supervision goal of music course teaching in colleges and universities as an example, for a labeled data sample set $(q(\alpha), w(\alpha))$. Deep learning algorithms use this hypothetical model to fit sample data by building a complex nonlinear hypothetical model $R_{E,\chi}(q, w)$ with parameters E, χ .

You can start with the simplest single neuron to describe the neural network model architecture of the deep learning algorithm. Figure 1 is the simplest network model that contains only one neuron.

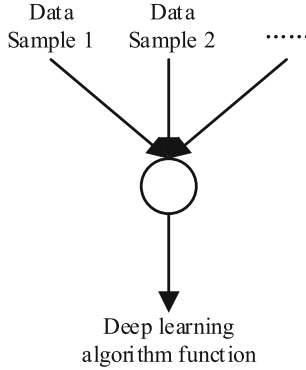


Fig. 1. Single neuron architecture for deep learning algorithms

This single neuron is a unit of computation. Its input condition is the data sample of music teaching effect of to be evaluated. Its activation function condition is:

$$\delta(\alpha) = \frac{R_{E,\chi}(q, w)}{1 + \exp(\beta\alpha)} \tag{1}$$

In formula (1), α represents a randomly selected data sample of the teaching effect of music courses in colleges and universities. β represents the data sample activation condition.

Because the level of music teaching effect data samples in colleges and universities can not be “1”, the neural network of deep learning algorithm can not contain only one neuron structure. A complex neural network is one that connects multiple single neurons, using the output of one neuron as the input to the next, as shown in Fig. 2.

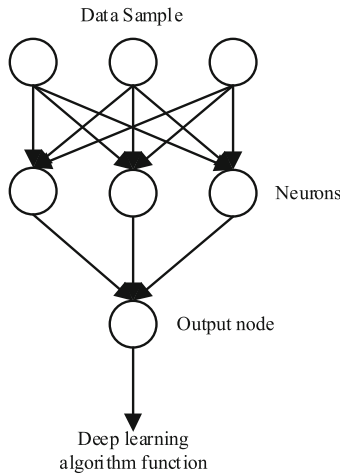


Fig. 2. Complex neural networks for deep learning algorithms

In the cognition of deep learning algorithm, each layer of neuron nodes is a linear one-dimensional arrangement structure, and all neuron nodes in each layer are fully connected. In complex neural networks, the neuron nodes between layers are not fully connected. Using the local spatial correlation between layers, the adjacent neuron nodes in each layer are only connected with the upper neuron nodes, that is, the local connections. Thus, the neural network structure needed to evaluate the effect of music teaching in colleges and universities is obtained. Because of the different audiences targeted by professional music education and public music education, the content and method of teaching chosen by teachers in the course of teaching will be different [3]. Music education courses for non-music majors in universities are generally general elective courses. Most of the lectures are in the form of music appreciation, and teachers will choose composers or representative works of art to appreciate and study. Elective courses for professional content generally will not involve too much, the classroom to teach the main, practical little.

2.2 Softmax Regression Conditions

Softmax regression is based on the complex neural network structure. Its aim is to solve multi-classification problems. In such problems, the types of training samples are usually more than two. Softmax regression can be used to classify handwritten digits in similar deep learning algorithms. The problem is to distinguish between the 10 handwritten numbers 0–9. Softmax regression is a supervised learning algorithm that can also be used in combination with either deep or unsupervised learning methods.

In logistic regression, the data evaluation sample set for the teaching effect of music courses in colleges and universities is composed of labeled samples. Its definition is:

$$\mathfrak{N} = \left\{ r | r = - \left| \frac{\phi(u_1 + u_2 + \dots + u_\varepsilon)^2}{|\gamma^2 - 1| \sqrt{\delta(\alpha)}} \right| \right\} \quad (2)$$

In the expression, r represents a random sample parameter in a set of samples. $u_1, u_2, \dots, u_\varepsilon$ represent ε randomly selected sample indices. And the condition of inequality of $u_1 \neq u_2 \neq \dots \neq u_\varepsilon$ is constant. ϕ represents the sample identification coefficient based on the deep learning algorithm. γ represents the iterative transfer coefficient of the data samples to be evaluated in a complex neural network. And the value condition of $\gamma \neq 0$ is constant.

The complex neural network based on deep learning is a multi-layer supervised learning neural network, and the implicit convolution layer and pool sampling layer are the core modules [5]. Courses are divided into theoretical courses and professional courses. Through the systematic music education curriculum to improve students' professional literacy.

Set $r_1, r_2, \dots, r_\varepsilon$ as the sample parameters of ε unequal to or equal to 1 in the sample set \mathfrak{N} of music teaching effect data evaluation. \bar{Y}_ε represents the data sample learning vector when the value condition is ε . \bar{Y} means the average value of the learning vectors. t means the discriminant coefficient. u means the marked features of the data of music teaching effect evaluation. In conjunction with the above physical quantities,

the SoRmax regression condition expression based on the deep learning algorithm can be defined as:

$$\varphi = (u - 1) \left| \frac{\sum_{t=1}^{+\infty} r_1 \times r_2 \times \cdots \times r_\varepsilon}{\sum_{t=1}^{+\infty} \sqrt{|\bar{Y}_\varepsilon^2 - \bar{Y}^2|}} \right| \quad (3)$$

After the deep learning algorithm processing, we get the classification process of the teaching effect data of college music course. The domain multilayer perceptual feedforward neural network is similar. Data indices to be identified are used as input samples, and the final classification results are propagated forward layer by layer to output layer. Music can broaden the vision of college students and cultivate noble moral character. Music education is that teachers guide and inspire students with infectious music language, play the role of moral and aesthetic education, and integrate art and ideology together. Through music education to stimulate students' interest and fighting spirit, cultivate students' noble moral sentiment, and establish correct values.

2.3 Perfect Evaluation System

The music education system in colleges and universities is mainly divided into two parts. They are professional music education for students majoring in music and public music education for non-music students. Professional music education, as the name suggests, refers to the education of music majors in major music schools and normal colleges. Public music education in colleges and universities is generally divided into a broad sense and a narrow sense [6].

It includes not only public music education courses offered in colleges and universities, but also various forms of public music education such as art clubs, online music education, and extracurricular literary and art organizations. Both are music education, and both have the same positive role in educating people. However, due to the difference in the absorptive capacity of the teaching objects for the course, there are also great differences between the two in terms of teaching content, methods, and curriculum settings. The layout of the complete teaching effect evaluation system of music courses in colleges and universities is shown in Fig. 3.

The development of music education and teaching in ordinary colleges and universities is generally classroom teaching, and there are also a few general courses that choose online teaching, but follow the basic principles of teaching. In order to achieve the balance of theory and skills, the unity of culture and art, and the perfect combination of moral education and aesthetic education, the main subjects of music education are teachers and students. Through teachers' explanations and demonstrations, relevant professional knowledge is imparted to students to enrich students' cultural knowledge and professional quality. The teaching process always takes music education as the theme, and completes teaching tasks through different teaching methods and teaching practices.

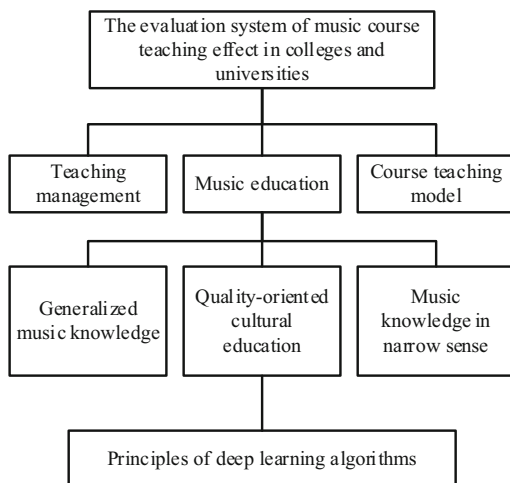


Fig. 3. Evaluation system layout form

3 Teaching Effect Evaluation Mode and Audit Evaluation

With the support of the deep learning algorithm model, the realization of the teaching effect evaluation method of music courses in colleges and universities also needs to define the evaluation characteristic performance behavior. And while determining the scope of the evaluation object, analyze the manifestations of its target elements.

3.1 Evaluation Characteristics

According to the connotation of accreditation assessment, the biggest feature of accreditation assessment is the purpose of assessment, that is, whether the school has the qualification to run a school. According to the evaluation purpose, the accreditation evaluation mode requires the education department or professional evaluation agency to directly evaluate the teaching quality of the school according to the unified minimum evaluation standard. Focus on investigating the school's school positioning, teaching resources and other investment. If the school input meets the evaluation criteria, it will be passed, otherwise it will be rejected [7]. Grading evaluation is to evaluate the "level" of colleges and universities. It is developed on the basis of certification, and is divided into different levels on the basis of meeting minimum standards. Through observation and analysis of a series of relevant indicators, colleges and universities are divided into four grades: excellent, good, qualified and unqualified according to the evaluation results.

Let I' denote the pass rate of the assessment of the teaching effect data of college music courses. \bar{U} represents the unit cumulative amount of data to be evaluated. λ represents the coefficient of qualification for running a university. f represents the audit standard judgment parameter. With the support of the above physical quantities, formula (3) is simultaneously established. The characteristic solution expression of deep learning-based music course teaching effect evaluation in colleges and universities can be defined as:

$$P = f \times \frac{I'\varphi - \bar{U}^2}{\lambda + 1} \quad (4)$$

According to the connotation of grading evaluation, the purpose of grading evaluation is to evaluate the educational level of colleges and universities. The graded evaluation model requires education departments or professional evaluation agencies to classify colleges and universities according to the purpose of evaluation. Formulate corresponding evaluation standards according to different categories, directly evaluate the teaching effect of music courses in colleges and universities, and focus on the output of college students' learning outcomes. Compared with the certification evaluation model, the subject of graded evaluation is also the education department or professional institution. But it can also be implemented by a consortium of universities or by individual universities themselves. The grading evaluation must also refer to the evaluation indicators, but it is not only to judge whether the college meets the minimum standards, but to give an accurate grade judgment. The graded assessment is also broad, but it focuses on process and output, and measures the quality of teaching through educational output. The graded assessment will publish most of the specific data in the assessment results, which is convenient for comparison between universities.

3.2 Evaluation Object and Scope

By reviewing whether the talent training goals of colleges and universities meet the needs of social and personal development, whether the teaching resources such as teachers are sufficient, whether the undergraduate teaching quality assurance system is perfect, whether students and employers are satisfied, etc., it covers all links and elements that affect the quality of talent training. In a nutshell, the audit evaluation focuses on the quality of personnel training and focuses on the construction of the quality assurance system.

It can be seen from this that the concept of outcome-oriented education has many similarities with the basic concept of review and evaluation. But the most prominent feature should be that both emphasize the degree of conformity and achievement of talent training goals, which can also be expressed as the degree of conformity and achievement of students' learning outcomes. To this end, with student learning outcomes as a link, the combination of outcome-oriented education concepts and audit evaluation is shown in Fig. 4.

Let κ denote the selection coefficient of the teaching effect evaluation object of college music courses, and the inequality condition of $\kappa \neq 0$ is always established. s represents the evaluation range metric. ι represents a randomly selected teaching effect evaluation authority parameter. d_i represents a standard value for dividing the evaluation range based on the coefficient ι . \hat{h} represents the characteristics of teaching effect evaluation of college music courses based on deep learning. g_1 and g_2 represent two randomly selected evaluation benchmark values, Combined with the above physical quantities, the definition formula of the evaluation object and scope of the teaching effect of music courses in colleges and universities is deduced as:

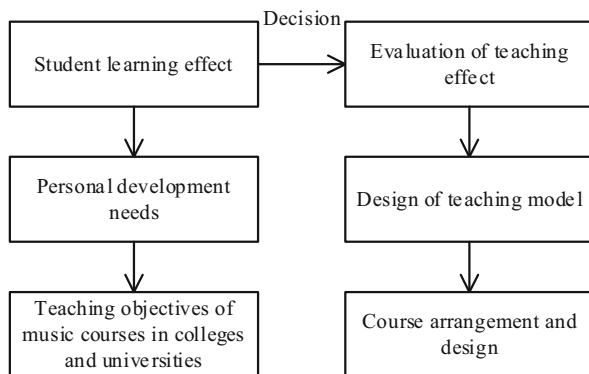


Fig. 4. Criteria for dividing the scope of teaching effect evaluation

$$A = \frac{\kappa}{2} \sum_{s=1}^{+\infty} (d_s \cdot P) / \hat{h} \cdot \sqrt{g_1^2 + g_2^2} \quad (5)$$

The scope of review and assessment is not a uniform standard, and each school can understand the scope of assessment according to its own actual situation. This again shows that the audit assessment emphasizes “measure yourself with your own ruler”. In the teaching process of existing music courses in colleges and universities, the focus of review and evaluation is on three aspects: how well the quality assurance system is built, how well it operates, and how well it works. Specifically, it is the degree of conformity between quality standards and quality objectives, and the degree of conformity between quality assurance systems and quality standards. The degree of compliance of the operation effect of the quality assurance system with the quality expectations. In a nutshell, it is the degree of conformity and achievement of personnel training objectives.

3.3 Target Element

The general goal of music teaching training in colleges and universities is the basis for formulating professional training goals, and the professional training goal is the general outline specific to the training of a certain professional. It determines how colleges and universities build professional knowledge structure, how to set up curriculum system and how to carry out teaching activities. The formulation of professional training goals should not only reflect all aspects of talent training, but also clearly express the goals that students can achieve in terms of knowledge, ability, and quality (graduation requirements). It should also reflect the expected development that students will achieve in the future after entering the society. Generally speaking, professional training objectives should be clearly stated in the professional training plan.

Let j represent the value vector of the teaching goals of college music courses based on deep learning. j' represents a supplementary explanation condition for the coefficient j . \bar{l} represents the feasibility evaluation index of the teaching effect data. \hat{l} represents

the feasibility audit feature of the teaching effect data. μ represents the audit evaluation coefficient.

The solution expression of the target elements of the teaching effect evaluation of college music courses based on deep learning is:

$$K = \frac{A}{j^2 - j^2} \left\| \tilde{l}^2 - \mu l \right\| \quad (6)$$

If the quality standard of professional training builds a structural framework for professional training in terms of knowledge, ability, quality, etc., the teaching link is the basic structural unit to realize this framework. The quality standard of the teaching link is essentially the decomposition of the quality standard of professional training. In other words, the collection (merging and strengthening) of the quality standards of each teaching link is the quality standard of professional training [10].

Therefore, the quality standard of professional training is the basis for the formulation of the quality standard of each teaching link. The school should formulate quality standards (or basic requirements) for the courses and main practical links (experiments, practical training, graduation design, etc.) in the training plan according to the quality standards for professional training. The quality standards of each teaching link are the support for the formulation of quality standards for professional training. The specific requirements for the training of students in terms of knowledge, ability and quality in the professional training quality standards. These should be fully reflected in the quality standards of teaching links.

4 Case Analysis

In order to verify the ability of the teaching effect evaluation method based on deep learning to promote the popularization of music course teaching in colleges and universities, the following experiments are designed. First, record students' cognitive level of music course teaching without evaluation method. Then, the teaching effect evaluation method based on deep learning is applied to intervene students' learning behavior, and the students' cognitive level of music course teaching is recorded again. Finally, compare the experimental results of the two groups and summarize the experimental rules.

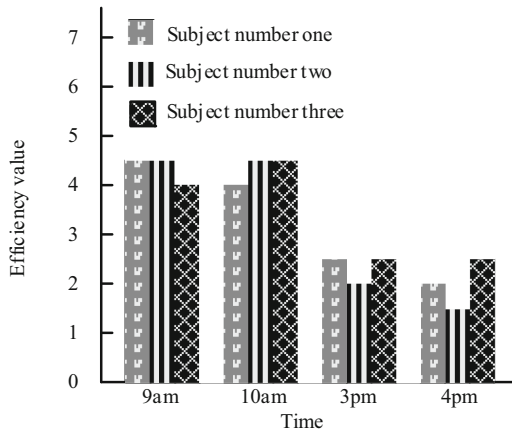
The equipment used in this experiment is shown in Table 1.

In the experiment of this chapter, the subjects can choose two time periods of the day to complete the additional efficiency test. The purpose is to allow the subjects to more accurately and intuitively understand the cognitive load input and efficiency at different times of the day through EEG signals. Here are three subjects as an example (see Fig. 5 for the initial cognitive load-efficiency mapping relationship for the teaching of music courses in colleges and universities. The three subjects chose 9 am–10 am and 3 pm–4 pm). Participate in the test in a period of time. In this section, scatter plots are used to count the experimental results.

Analysis of Fig. 5 shows that the three students have a relatively high distribution level of cognitive load scatter when they complete the efficiency test in the morning. The distribution of cognitive load scatter points was lower when the efficiency test was completed in the afternoon session.

Table. 1 Experimental equipment selection

Serial number	Device name	Model
1	Harmonic wave analyzer	FR300R mass spectrometer
2	Brain wave analysis equipment	PLC controller
3	Monitoring the host	Tp-ipc 4U rack mounted industrial computer
4	Control equipment	610E-E
5	Network control system	Windows 10
6	The processor	Intel i7

**Fig. 5.** Initial cognitive load-efficiency mapping relationship

Using the deep learning-based teaching effect evaluation method of music courses in colleges and universities, the learning ability of the three subjects was assessed, and the test time was kept unchanged. The changes of the cognitive load-efficiency mapping curves of the three subjects were recorded, as shown in Fig. 6.

Analysis of Fig. 6 shows that compared with the initial cognitive load level of students in music course teaching. With the application of the teaching effect evaluation method based on deep learning, the learning ability of the three subjects has been significantly improved, and the unit increase is 3.5 efficiency values. This means that this method has a certain promoting effect in improving the teaching level of music courses.

To sum up, the conclusion of this experiment is that the teaching effect evaluation method of college music courses based on deep learning can significantly improve the teaching level of music courses, and meet the practical application needs of rapid popularization of college music teaching. The features extracted from EEG data are used to establish the corresponding relationship between cognitive load and efficiency value distribution, and finally determine the students' music learning ability. In the design of

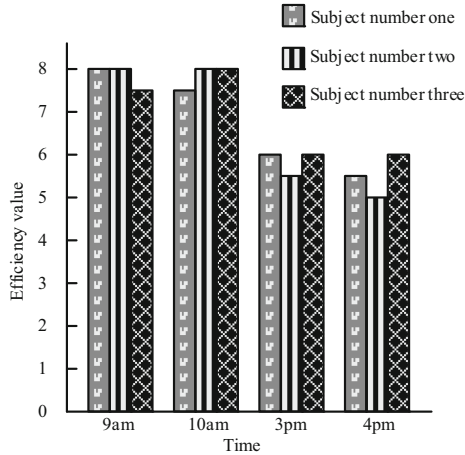


Fig. 6. Experimental results of cognitive load-efficiency mapping relationship

the scheme, the general process of the whole scheme is first introduced, and then the experimental paradigm is designed in detail, including the delineation method of the moving time window and how to calculate the efficiency value within the time window. Finally, the cognitive load-efficiency distribution mapping relationship of the three subjects was analyzed. Finding the individual optimal cognitive load level for each subject from the perspectives of the mean and stability of the distribution of efficiency values lays the foundation for the subsequent application of the model to teaching evaluation.

5 Conclusion

In view of the problems exposed in the evaluation of music teaching in colleges and universities, it is urgent to explore how to construct a quality assurance system with colleges and universities as the main body. Based on the deep learning algorithm and the audit and evaluation model, the paper studies the construction of college music teaching security system and draws the following conclusions.

- (1) The idea of deep learning is a brand-new educational idea with the result as the core. Its biggest thinking revolution lies in the shift from the emphasis on resources to the students' learning achievements. It emphasizes the student-centered, continuous improvement, learning output of students and the conformity and attainment of talent training goals.
- (2) Audit and evaluation is a new evaluation model, which emphasizes the quality of personnel training as the core, attaches importance to continuous improvement, emphasizes their own ruler, not horizontal comparison. The key inspection university music curriculum teaching quality safeguard system's validity and the continuity. The review and evaluation emphasizes that schools are the main body responsible for the quality of talent training, and the aim of evaluation is to promote teaching reform and improve the quality of talent training. The key point of the evaluation

is the process of personnel training, and the teaching quality is evaluated indirectly through the evaluation of the internal quality assurance system.

- (3) The quality guarantee system of music teaching in colleges and universities is a complex system, which mainly consists of target guarantee, resource guarantee, process guarantee and management guarantee. These four elements include several sub-elements, which together constitute the elements of undergraduate teaching quality assurance system. In addition, the outline of quality assurance standards, the framework of quality assurance structure and the basic process of quality assurance are the core and pillar of this complex system.
- (4) Based on the deep learning algorithm and audit and evaluation model, this paper constructs the quality assurance system model of music teaching in universities from three aspects. That is, according to the needs of social and personal development and the orientation of running a school, colleges and universities should establish quality objectives and quality standards, and carry out the construction of music teaching resources and teaching process management. And through the effective internal quality assurance system to continuously improve the quality of talent training in all aspects and all factors, and constantly improve the quality of college talent training.

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2. School-level projects of NanChang JiaoTong Institute: Research on the innovative path of VR technology into college music classroom teaching (Project No.: XJJG2022-23).

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