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Research on the Teaching Quality Evaluation of China's Network Music Education APP

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***Abstract*—**With the advent of the Internet era in recent years, social music education has gradually shifted from the original entity education mode to the mode of entity plus network teaching. No matter for school music education, professional music education or social music education, the teaching quality is the most important evaluation index. Regarding the research on teaching quality evaluation, scholars at home and abroad have contributed a lot of research results on the basis of multiple methods and evaluation subjects. However, to our best knowledge the complete evaluation model for the virtual teaching interaction mode of the emerging network music education Application (APP) has not been established. This research firstly found out the basic dimensions that accord with the teaching quality required by the three parties, constructing the quality evaluation index system; and then, on the basis of expounding the connotation of each index, it determined the weight of each index by using method of fuzzy analytic hierarchy process, providing ideas and methods for scientific, objective and comprehensive evaluation of the teaching quality of network education APP.

***Keywords*—**Network music education APP, teaching quality evaluation, index, connotation.

I. Introduction

IT is known to all that the internet is borderless, so is internet-based online education system. Scholars are witnessing a sort of multicultural extension on the basis of online education which tends to blend international students and teachers into a borderless academic life [1]. Therefore, whilst promoting public interest in globalization-based online education, internet has further strengthened globalization. Network and computing technologies have completely changed global business and many aspects of modern life, and they are becoming a goal for education, too. A combination of internet with modern curriculum management system will make it possible to provide online courses in a worldwide scope. A key task in the future is to create and spread some high-quality courses that are acceptable to students so that the education can develop on a sustainable basis [2]. Jung et al. [3] found that all sorts of national, regional and international measures had been taken to guarantee the quality of e-study. It was pointed out by [4] that those attaching importance to online learning had developed and published their ideas about how to manage learning experience and quality of internet learners in the past decade. Online education offers chances for the general public to have access to high-quality education [5], [6]. It is beyond question that online education is quickly developing into an established pattern. The future of online education lies in utilizing integrated and high-quality multimedia teaching applications to support the network for online education process [7]-[9].

Teaching quality in classroom lies at the core of improving education quality [10], which is also an important indicator in assessing school-running level of different music teaching organizations [11]. No matter for school music education or specialized and social music education, teaching quality always stays as a critical evaluation indicator. Scholars at home and abroad have made great academic contribution on the basis of diversified methods and evaluation subjects, but no consensus has been reached in how to evaluate the emerging network music education APPs, a kind of virtual teaching interaction. Teaching quality evaluation is a process evaluation that highlights course delivery process and covers overall evaluation, technical support, website utilization, interactive learning, resources utilization, learner support, evaluation and flexibility. In process evaluation, there are three mainstream methods, namely student's learning experience survey and feedback, supervisor opinion survey, and project director's monitoring on e-study process [12]. On the basis of explaining connotations of all indicators, the present study employs fuzzy analytic hierarchy process (FAHP) to determine the weights of indicators on different levels and offers directions and methods for evaluating teaching quality of network education APPs in a scientific, objective and comprehensive way.

II. Literature Review

After collating related references, the present study summarizes and describes key criteria for evaluating teaching quality of network music teaching APPs as shown in Table I. There are five fundamental evaluating dimensions, including teaching attitude, teaching communication, software technology, teaching methodology, and basic teaching skills, and 15 criteria. They are used to discuss key factors therein.

III. Research methods

The present study conducts an AHP questionnaire survey on and analysis of network music education, applies FAHP to corresponding computation, and discusses relative weights of indicators and criteria applicable to network music education evaluation.

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TABLE I
EVALUATION OF DIMENSIONS AND CRITERIA

Evaluation dimension	Criterion	Criterion description	References
Teaching attitude	Lecturing environment and network status	Lecturing environment is tranquil; and network remains unblocked.	[13]-[18]
	Lecturing state	Disciplined, punctual, seldom changing schedule; mild and gentle, actively responding to questions raised by students; decent clothing, upright attitude; interactive with students	[17], [18]
Teaching communication	Pre-class communication	Successful communication with students before class; offer product introduction as required by the companies	[15], [16], [19]
	Exercises review	Verify exercises of students and point out and correct the problems concerning students' homework	[14], [17], [18]
	Classroom summarization	Sort out key and tough points in the music, and offer accurate prompts to students	[18], [16], [19]
	After-class communication	Give prompt feedback about learners to their parents; actively respond to the questions raised by parents; assign proper homework about ways of practicing	[17], [18]
	Q&A	Answer questions as instructed by company's regulations; inform contents of the course and offer ending remark	[15], [17], [19]
Software operation	Function presentation	Accurately install and use software; proficiently use the presentation functions of both audio and video	[13], [15]-[17]
	Remark and demand	Check and note students' conditions in time; find and change music score according to playing effect of students during the class	[13], [14], [16], [19]
Teaching methods	Fundamentality	Accurately divide composition and sentences; correct problems in intonation (such as clef and time signature); accurately sing rhythms	[15]-[18]
	Pertinency	Give lectures as per key problems concerning intonation and rhythm; master well lecturing pace; prescribe reviewing and pertinent training	[13], [14], [19]
	Systematization	Ask the students to practice sentence by sentence; offer professional instructions before each practice	[17], [18], [20]
Basic teaching skills	Perception ability	Accurately perceive intonation at a rate of over 70%	[17]-[19]
	Ways of practice	Reasonably use HS and both-hand ensemble; strengthen guidance on tough parts such as left-hand practicing	[14], [17], [18]
	Course effect	Course does yield positive effect, as students make significant progress in the study	[17], [18]

Fuzzy Analytic Hierarchy Process

The steps of FAHP in this paper are summarized as follows.

(1) Establish a hierarchical structure: The guidelines are based on the framework in Table I. The 0th level represents the measurement target of key factors of outsourcing information system of banking, the first level indicates the main assessment aspects, and the second level indicates the assessment factors covered by each assessment aspects.

(2) Establish a clear comparison of the assessment facets: A pairwise comparison questionnaire is used to obtain an expert's view of the relative importance of the two assessment facets.

(3) Establishing triangular fuzzy numbers: According to the extension principle of the fuzzy numbers [20]. Let M1 = (l1,m1,u1) and M2 = (l2,m2,u2) be fuzzy numbers, the fuzzy operation can be expressed as:

$$M_1 \oplus M_2 = (l_1 + l_2, m_1 + m_2, u_1 + u_2)$$
$$M_1 \ominus M_2 = (l_1 - l_2, m_1 - m_2, u_1 - u_2)$$
$$M_1 \otimes M_2 = (l_1 l_2, m_1 m_2, u_1 u_2)$$
$$M_1 \oslash M_2 = (l_1 / l_2, m_1 / m_2, u_1 / u_2)$$

(4) Establish a fuzzy positive reciprocal matrix: The normalized calculation of the geometric mean of the column vector can be used before the matrix is established [21]. After multiplying the elements of each column, the algorithm takes the geometric mean and normalizes it. Each assessment aspect expresses its assessment of the relative importance of the two-to-measure facets, and establishes a fuzzy positive reciprocal matrix.

(5) Calculation of the Fuzzy weights of the fuzzy positive reciprocal matrix: Buckley uses the concept of geometric mean to evaluate the fuzzy weights of each assessment aspects [22]. The formula is expressed as:

$$\tilde{Z}_i = (\tilde{a}_{i1} \otimes \tilde{a}_{i2} \otimes \ldots \otimes \tilde{a}_{in})^{1/n}, \quad \forall i = 1,2,\ldots,n$$
$$\tilde{W}_i = \tilde{Z}_i \oslash (\tilde{Z}_1 \oplus \tilde{Z}_2 \oplus \ldots \oplus \tilde{Z}_n)$$

$\tilde{a}_{ij}$: The normal fuzzy number of the i^{th} column and the j^{th} column in the fuzzy positive reciprocal matrix. $\tilde{Z}_i$: Geometric mean of column vectors of normal fuzzy numbers. $\tilde{W}_i$: Fuzzy weight of the i^{th} factor.

(6) Defuzzication: In this paper, the GMIR defuzzication proposed by Chen & Hsieh is used to defuzzify [23]. The reason is that Chen & Hsieh's method is currently effective in the process of defuzzification and it is convenient and simple to use.

(7) Normalization: In order to facilitate the comparison of the relative importance of the evaluation levels at each level, the above-mentioned defuzzifying weights are normalized.

(8) Hierarchical tandem and importance ranking: The integrated weight value of each layer is obtained by hierarchical tandem, and the calculated weight is sorted to the final assessment factor.

IV. RESEARCH RESULTS

This study sets to discuss and select some key factors affecting the quality of network music teaching APPs. An AHP questionnaire survey is conducted among experts evaluating the quality of network music education APPs. Altogether 11

questionnaires were distributed in the present study, in which 7 (63.6%) were effectively recovered. Since the AHP questionnaire survey in this study is of expert questionnaire type, it is suggested by Robbin that 5-7 experts are ideal for group decision-making issues [24]. This explains the representativeness of those effectively recovered questionnaires in the present study.

After encoding effectively recovered questionnaires and integrating opinions of all experts, this study figures out relative weights of evaluation criteria at serial levels by following FAHP operation in the hope to understand importance-oriented ranking of all evaluating dimensions and criteria. The post-collation results are listed in Table II.

TABLE II
WEIGHTS OF EVALUATING DIMENSIONS AND CRITERIA AND INTEGRATED WEIGHTS

Dimension	Weight (A)	Criterium	Weight (B)	Integrated weight (C) = (A)*(B)
Teaching attitude	0.239(3)	Lecturing environment and network status	0.771(1)	0.184(2)
		Lecturing state	0.228(2)	0.054(7)
Teaching communication	0.143(4)	Pre-class communication	0.237(2)	0.034(10)
		Exercise review	0.206(3)	0.029(11)
		Classroom summarization	0.260(1)	0.037(9)
		After-class communication	0.199(4)	0.028(12)
		Q&A	0.096(5)	0.013(15)
Software operation	0.243(2)	Function presentation	0.763(1)	0.186(1)
		Remark and demand	0.236(2)	0.057(6)
Teaching methods	0.282(1)	Fundamentality	0.510(1)	0.144(3)
		Pertinency	0.253(2)	0.071(4)
		Systematization	0.235(3)	0.066(5)
Basic teaching skills	0.090(5)	Perception ability	0.254(2)	0.023(13)
		Methods of practice	0.218(3)	0.019(14)
		Course effect	0.526(1)	0.047(8)

Note: numbers in brackets indicate ranking.

As revealed by data in Table II, key factors affecting teaching quality of network music education APPs are as follows:

(I) Evaluating Dimensions

Teaching methods (0.282) are considered as the most important link in evaluating teaching quality of network music education APPs, followed by software operation (0.243), teaching attitude (0.239), teaching communication (0.143) and basic teaching skills (0.090). Results indicate it is agreed among experts that teaching methods constitute a fundamental dimension.

(II) Evaluation Criteria under Five Evaluating Dimensions

(1) In teaching attitude, lecturing environment and network status are deemed as the most important evaluation criteria.
(2) In teaching communication, classroom summarization is deemed as the most important criteria.
(3) In software operation, function presentation is deemed as the most important one.
(4) In teaching methods, fundamentality is deemed as the most important one.
(5) In basic teaching skills, course effect is deemed as the most important one.

A review of overall weights of all 15 evaluating criteria indicates the top five factors in network music teaching APP quality evaluation are function presentation (0.186), lecturing environment (0.184), teaching fundamentality (0.144), teaching pertinency (0.071), and teaching systematization (0.066). The sum of those factors' weights accounts for 65.1% of total weights. Daniel [25] declared that for most businesses, 2-6 key factors determined whether the businesses could end with a success. And in order to succeed, those factors must be well controlled so as to move toward the right direction. As the number of key factors cannot be too high, in the present study only top five factors are selected as the key factors in evaluating teaching quality of network music education APPs.

V. CONCLUSIONS

Although as a newly sprouted pattern, network music teaching is quality-oriented in both key teaching factors and evaluation model. Therefore, with network music teaching as an example, the present study summarizes factors affecting online teaching from related literature, distributes AHP expert questionnaires, computes relative weights of all evaluating factors using FAHP on the basis of effectively recovered questionnaires, and offers key factors to be considered in evaluating network music teaching quality. Finally, major findings made in the present study are as follows:

(1) Teaching methods are found to be the most important dimension in network music teaching evaluation.
(2) Network music teaching evaluation is affected by following key factors, function presentation, teaching environment, teaching fundamentality, teaching pertinency, and teaching systematization.

As revealed by the findings above, in spite of great changes in teaching techniques in recent years, teaching methods keep evolving. The focus of teaching has transited from so-called "saint on stage" to "guide around you". The former mode reflects orthodox and mature lecturing pattern in traditional schools, whereas the latter represents a novel pattern of education in which teachers act to coordinate with students in their learning trip [26], [27]. Thus, the discovery about teaching methods as the most important dimension in network music teaching evaluation is in line with the research by other scholars [28], [29]. However, when it comes to overall weights of 15 evaluating criteria, function presentation comes to top of the list. This also confirms the utmost importance of software operation in network teaching. Anyone who fails to transcend the limit will be deprived possibility of becoming a competent network music teacher. Lecturing environment and network status ranking second in the list also testify the importance attached by experts to status of environment and network which serve as carrier of the teaching. This coincides with feedback from practicing teachers and course-attending students.

Construction of evaluation indicators should take into account their comprehensiveness as well as compatibility and independence at the same time. In determining evaluation indicators, the present study collects different opinions. It is thus consistent with the requirement concerning comprehensiveness. Nevertheless, when satisfying prerequisite about compatibility and independence, 5 evaluating dimensions and 15 important factors are not integral yet. It is suggested to discuss pertinence among evaluation indicators in clarity and ensure their compliance with construction principles in future research. Apart from that, analytic network process (ANP) may be incorporated to explore independence issue and further analyze any dependence among those indicators in the hope to determine the most appropriate weights of abovementioned key factors.

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