

## Research Article

# Exploring Key Competencies and Professional Development of Music Teachers in Primary Schools in the Era of Artificial Intelligence

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Artificial intelligence (AI) has introduced new era elements to the connotation of key competencies and professional development of music teachers in primary schools. The education management department in the AI era has flawed systems for the professional development of music teachers in primary schools. To assist music teachers in primary schools fulfill the development needs of the development of the times and enhance the quality of music education in primary schools, the status and income of music teachers in primary schools warrant improvement, and the system should be upgraded to promote the implementation of key competencies. Moreover, the related system construction of music teachers in primary schools should be reinforced by rationally arranging teachers, workload and creating a teacher learning community, in order to guide schools to provide a suitable environment for teachers, key competencies and professional development. Furthermore, methods like strengthening teachers, awareness of independent development and augmenting professional identity should be adopted to prompt teachers to comprehensively enhance their key competencies and professional development.

## 1. Background

Under the current background of artificial intelligence (AI) and “Internet +” and the deep integration of education and teaching [1, 2], key competencies [3, 4] and professional development [5–7] of music teachers in primary schools have garnered significant attention. AI is integrated through robust technology, resources and ideology into teachers, key competencies and professional development challenging teaching practice and professional development [8, 9]. Huang believed that AI education played a very important role in the basic stage of students, analyzed the components of key competencies content, designed relevant questionnaires, and finally drew the conclusion that AI courses can significantly improve students’ key competencies ability [3]. Pomsta proposed that AI as a methodology for supporting teacher training and continuous professional development was of great help to enhance teachers’ professional skills and professional practice [10]. Gunawan et al. described the competency enhancement program for science teacher that

assisted by AI in designing higher-order thinking skills (HOTS)-based integrated science learning, which help to improve teachers’ professional development [11]. Wu et al. proposed that video teaching reflection was the main method for teacher education and teachers’ professional development. With the development of AI, information fusion between RGB video and bone information can improve the recognition accuracy and enhance teaching efficiency of teachers [12]. This study, conducts extensive research and practice by designing questionnaires (Sojump). Relevant data are plotted into graphs by combining Origin software, focusing on the understanding of key competencies of music education by music teachers in primary schools in the AI era and the methods of teachers, professional development of teachers in the AI era [13–15]. In addition, this study systematically explores the ways and methods of key competencies and professional development from the three aspects of education management departments, schools, and teachers in the AI era [16, 17]. Furthermore, smart learning resources for music teachers in primary

schools are provided through the smart learning environment, which cultivate teachers, key competencies of teachers, and guides and promotes them to develop in a high-quality, professional and innovative direction [18–20].

## 2. Methodology

**2.1. Research Objects.** Xinxiang City is located in the northern part of Henan Province, which is one of the 18 prefecture-level cities in Henan Province. Xinxiang is a crucial industrial city in the north of Henan and is one of the significant cities that comprises the central Henan urban agglomeration. After years of urban development and growth, Xinxiang City has now become a key education, economy, culture and transportation city in Henan Province. Xinxiang City (District) has 186 primary schools and 274 music teachers which provided a large number of analysis samples for this study.

**2.2. Experimental.** This study primarily started from the basic condition of teachers, key competencies and professional development in the AI era, as well as considered the background of key competencies to examine the professional growth of some music teachers in primary schools in Xinxiang from multiple aspects. A total of 120 questionnaires were issued, among which 120 were returned and 112 were valid (effective rate = 93.3%). These data provided real data support for this study.

## 3. Results and Discussion

**3.1. Basic Information.** As shown in Figure 1(a), we surveyed 6 male and 106 female music teachers in primary schools, respectively, accounting for 5.36% and 94.64% of the total number of teachers surveyed, suggesting severe gender imbalance. This could be attributed to the fact that most college students majoring in musicology are females, making the main workforce of music teachers in schools. As shown in Figure 1(b), 63 teachers were in the age group of 20–30 years, 41 in the age group of 31–40 years, 8 in the age group of 41–50 years and none in the age group of 51–60 years respectively, accounting for 56.25%, 36.61%, 7.14% and 0% of the total number of teachers surveyed, suggesting that young and middle-aged teachers dominated the community of music teachers in primary schools in Xinxiang.

**3.2. Understanding of Key Competencies of Music Education.** To cultivate students, key competencies, it is essential to fortify the leadership of teachers, key competencies [21–23]. As shown in Figure 2(a), 15.18% and 80.36% music teachers in primary schools displayed good and a little understanding of key competencies respectively. When answering, “What do you think is included in key competencies of music education” (Figure 2(b)), most teachers believed that it should include aesthetic perception, artistic expression, and cultural understanding. Figure 2(c) shows that the ways for music teachers in primary schools to acquire key competencies of music education are training lectures (90.18%),

peer exchanges (84.82%), online media (77.68%), and newspapers or books (59.82%), suggesting that key competencies have been documented in music teachers in primary schools to a certain extent. Nevertheless, some teachers did not fully comprehend the content of key competencies. By designing the question “What do you think of the relationship between three-dimensional goals and key competencies”, 106 teachers (94.64% of the surveyed population) believed that the two were closely related and could promote each other, indicating that most teachers had a certain degree of awareness of the concepts and internal connections of these two things. However, a small number of teachers could not recognize the correlation between the two, which would compromise the implementation of key competencies in the process of primary school music teaching compromised.

Table 1 shows that 103 participants (91.96%) believe that key competencies are essential for music teachers’ professional development. The data revealed that most teachers could recognize the significance of key competencies for their professional development. While answering “the understanding of connotation of key competencies of music education”, 30.36% of teachers did not understand the concept of key competencies of music education very well. In addition, while answering, “Do you consciously improve your key competencies of music education”, 33 teachers and 1 teacher, respectively occasionally and never intended to enhance their key competencies. We observed that, some music teachers in primary schools in Xinxiang City had an incomplete understanding of the connotation of key competencies of music education and lacked the awareness to actively advance their own music key competencies. Thus, the width of key competencies of music education in music education in primary schools warrants an extension. Furthermore, there remains much room for improving teachers’ awareness of actively mastering key competencies of music education.

**3.3. Conditions of Teachers, Professional Development in the AI Era.** As shown in Figure 3(a), 63, 38, 11, and 0 teachers display strong, some, average and indifferent affection to their profession respectively, accounting for 56.25%, 33.93%, 9.82%, and 0% of the total number of surveyed teachers; this demonstrates that most teachers like their professions of being music teachers in primary schools, although some teachers that think that the profession is average that cannot stimulate more interest and enthusiasm in them, and who only consider this profession as one’s own means of earning a living. Figure 3(b) shows that only 50% of teachers like their students to a great extent. In addition some teachers do not realize the precious creativity of their work, do not fully love their profession, and do not care for their students, which are not conducive to teachers’ professional development under the background of key competencies.

While answering, “What is your teacher professional pursuit”, 42.86% of teachers wanted to be national or provincial excellent teachers, 38.39% wanted to be municipal (district-level) excellent teachers, and 11.61% wanted to be

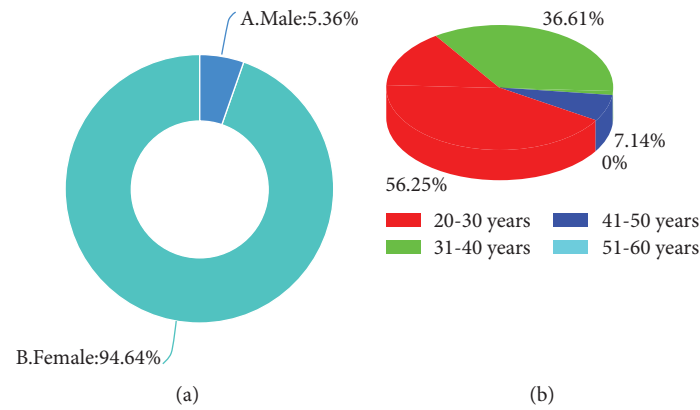


FIGURE 1: (a) Gender and (b) age of music teachers in primary schools.

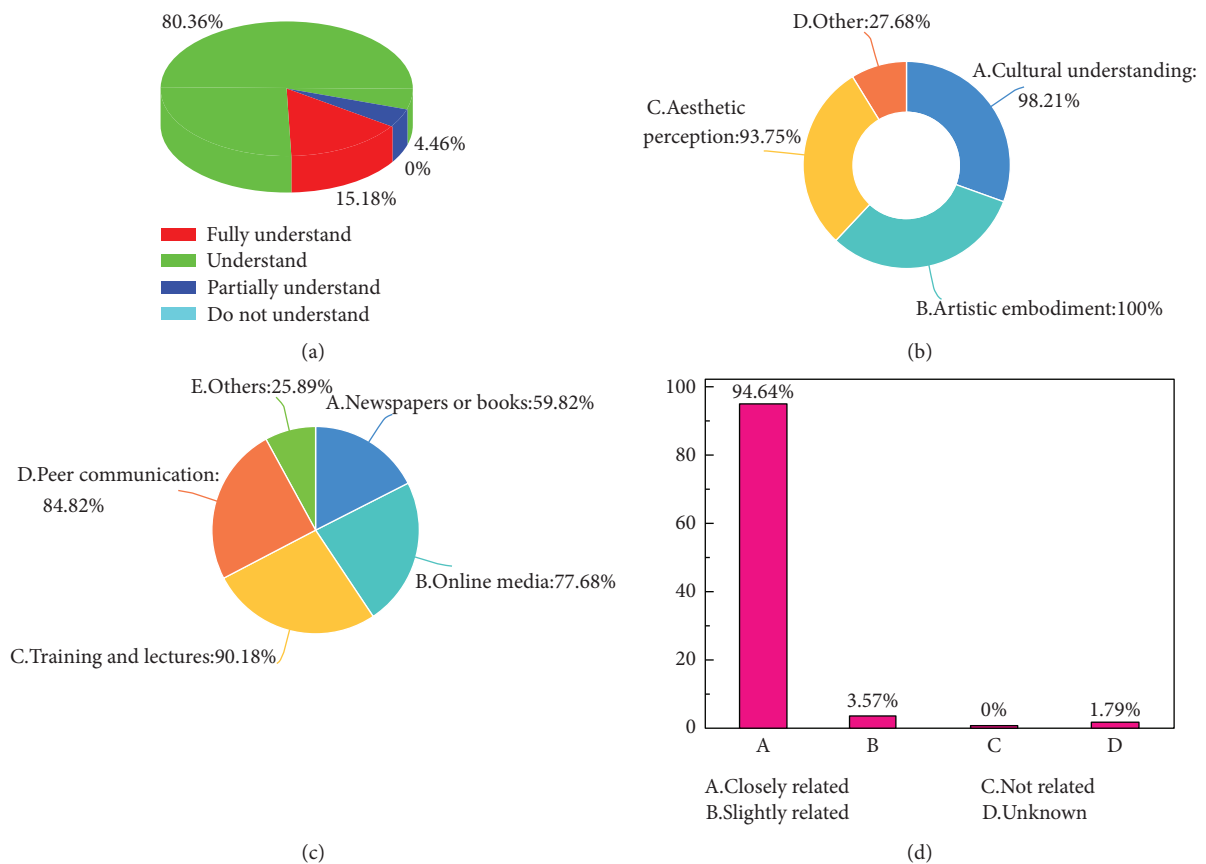


FIGURE 2: (a) Mastery of key competencies of music teachers in primary schools in the AI era; (b) reckoned contents included in key competencies of music education; (c) the understanding of the methods of key competencies of music education; (d) reckoned relationship between three-dimensional goals and key competencies.

school-level outstanding teachers. Only 7.14% of teachers wanted to be ordinary teachers (Figure 4(a)), showing that most teachers had lofty ideals and pursuits, but only a few of them had low professional pursuits and needed to be self-awakened or guided by others. Figure 4(b) shows that 36, 65, 11, and 0 music teachers have “seriously studied”, “have some understanding”, “heard of” and “no understanding” of professional standards, accounting for 32.14%, 58.04%, 9.82% and 0% of the total number of surveyed teachers,

respectively. This demonstrated that there remain few teachers who have a deep understanding of professional standards, and the popularization of professional standards warrants further enhancement and extension.

**3.4. Approaches and Methods of Teachers, Professional Development in the AI Era.** When examining the motivation of music teachers in primary schools to promote their

TABLE 1: Connotation of influences of key competencies on professional development/key competencies of music education by music teachers in primary schools in the AI era, and whether they can consciously enhance their understanding of key competencies of music education.

	Option	Counts	Percentage
Influence of key competencies on professional music teachers,	Highly important	103	91.96
	Important	8	7.14
	Not important	0	0
	Not sure	1	0.89
Understanding of connotation of key competencies of music education	Fully understand	19	16.96
	Understand	65	58.04
	Partially understand	34	30.36
	Do not understand	0	0
Consciously mention improving key competencies of music education	Always	21	18.75
	Often	57	50.89
	Occasionally	33	29.46
	Never	1	0.89

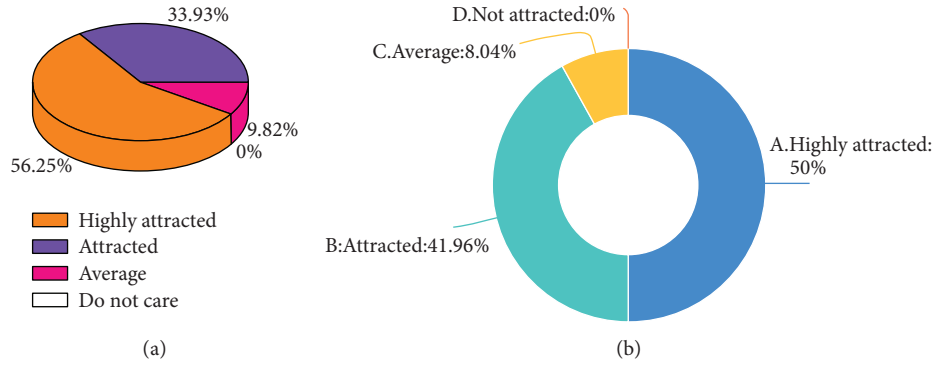


FIGURE 3: (a) Satisfaction with their profession of music teachers in primary schools in the AI era and (b) degree of preference for students of music teachers in primary schools in the AI era.

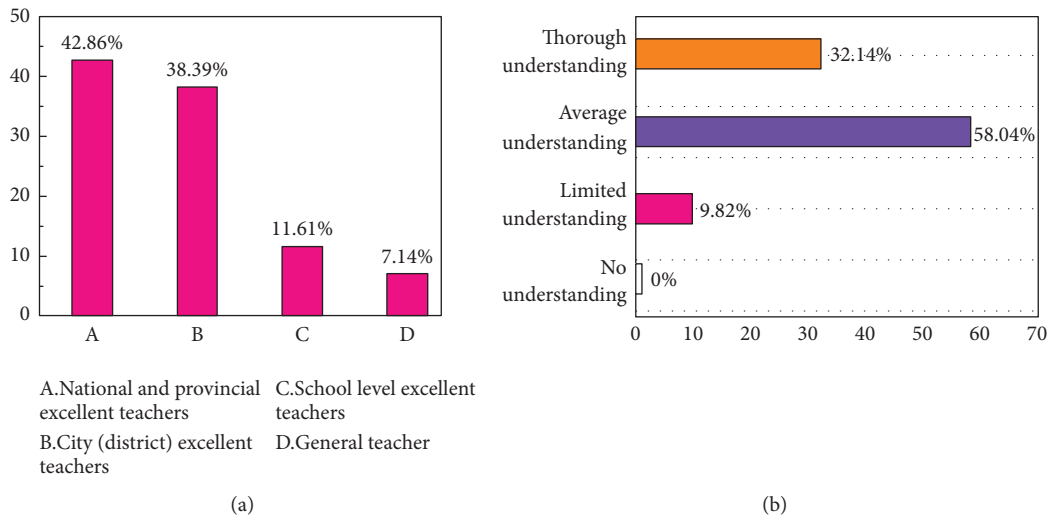


FIGURE 4: (a) Degree of pursuit for their professions of music teachers in primary schools in the AI era; (b) degree of mastery for professional standards of music teachers in primary schools in the AI era.

professional development (Figure 5(a)), 57 teachers considered it necessary for professional promotion, 99 thought that they could continuously enhance their quality and become better teachers, 65 thought it is the need of students, 81

claimed it is to adapt to the requirements of the times, and 43 thought it is for the schools' development. Although teachers' professional development has an internal and active professional improvement those with external and passive

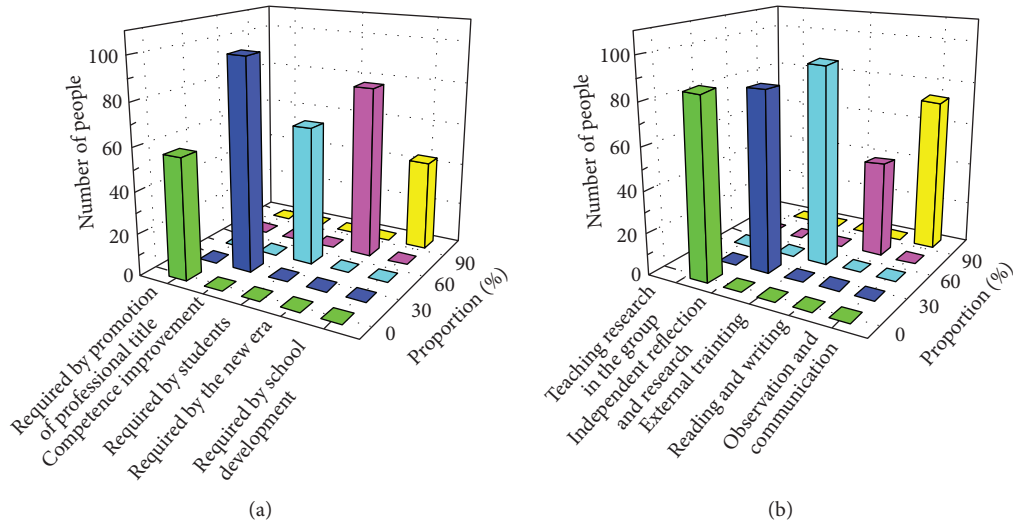


FIGURE 5: (a) Motivation diagram for promoting their professional development; (b) diagram for motivating the professional growth of music teachers in primary schools in the AI era.

TABLE 2: Training frequency and methods of music teachers in primary schools organized by schools.

	Option	Population	Proportion (%)
Whether the school organizes training for music teachers	Frequently	28	25
	Once or twice a semester	24	21.43
	Once or twice a school year	17	15.18
	Rarely	43	38.39
The methods of schools, organizing training for music teachers	In-school lectures, seminars	87	77.68
	Sending teachers out to study	78	69.64
	Expert lecture	51	45.54
	Remote teaching	49	43.75
	Other	22	19.64

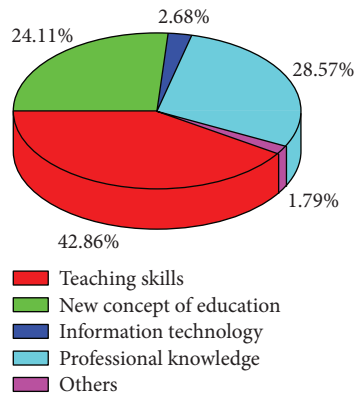
professional improvement are also very common. While answering the question “What do you think are the professional growth paths of music teachers” (Figure 5(b)), 86, 85, 94, 45, and 73 teachers claimed that the improvement of their professional level could be attained by self-reflection and research, teaching and research within groups, outside training, reading and writing, and school teaching observation and communication methods respectively. Furthermore, most teachers claimed that the ways to promote their professional growth included outside training, independent reflection and research, and teaching and research within groups.

Teacher training is not only a crucial part of a teacher’s role but also an essential way for teachers’ professional development [24–26]. Table 2 shows that 25%, in terms of the frequency of training organized by schools, 21.43%, 15.18% and 38.39% of teachers think respectively that the school organizes training frequently, once or twice times a semester, once or twice a school year, and rarely organizes. In addition, 87, 78, 51, 49 and 22 teachers received training through in-school lectures and seminars, sending teachers to study abroad, expert lectures, remote lectures and other methods. The survey revealed that music teachers in primary schools had fewer opportunities to participate in training owing to the policy and funding reasons, and their

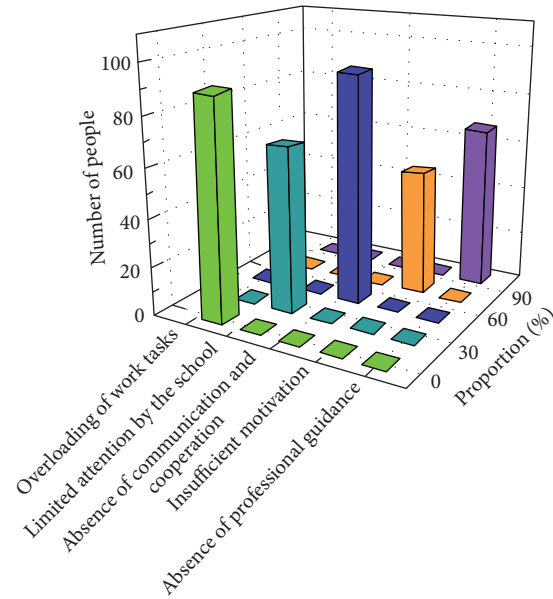
participation methods were single, resulting in poor training effects and low enthusiasm of trainers, which is not conducive to teachers’ professional development.

For training content desired by music teachers in primary schools (Figure 6(a)), 48, 27, 3, 32, and 2 teachers selected teaching skills, new ideas of education, information technology, professional knowledge and other methods to attain valuable training, accounting for 42.86%, 24.11%, 2.68%, 28.57% and 1.79% of the sample, respectively. In addition, the survey showed that music teachers in primary schools were more lacking in teaching skills and professional knowledge, and hoped to attain learning opportunities in these areas. When answering “What do you think are the factors restricting the professional development of music teachers” (Figure 6(b)), 91, 68, 52, 52, and 67 believed that these included reasons such as too many tasks, absence of attention from schools, absence of communication and collaboration among teachers, and absence of internal motivation and expert guidance. These findings revealed that most music teachers believe that the factor restricting their professional development is extensive workload. Hence, schools should arrange teaching tasks reasonably and provide room for the professional development of music teachers [27, 28].

Regarding the support provided by schools (Figure 7(a)), 72, 85, 70, 65, and 91 teachers believed that it included

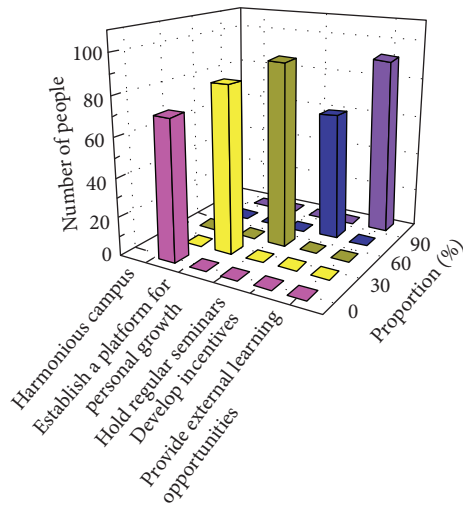


(a)

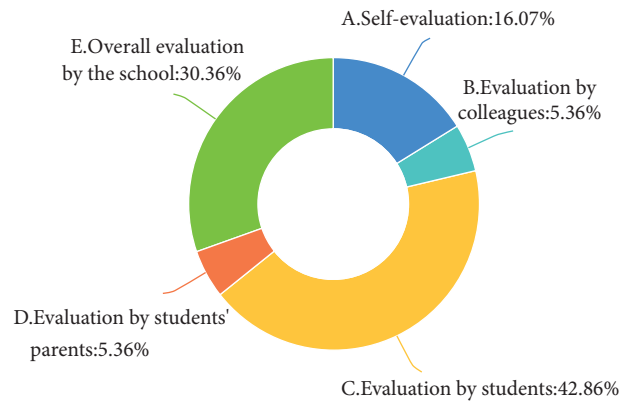


(b)

FIGURE 6: (a) Diagram of the training content hoped to obtain; (b) Diagram of the factors that restrict professional development of music teachers in primary schools in the AI era.



(a)



(b)

FIGURE 7: (a) Diagram of desired support from schools; (b) diagram of reckoned sense of value achievement of professional development of music teachers in primary schools in the AI era.

construction of a supportive and harmonious campus environment, the establishment of a growth platform, regular teacher exchanges and discussions, the establishment of corresponding incentive policies, and the assistance of teachers' outside training respectively, this demonstrates that more teachers expected schools to provide opportunities to go out to learn, so as to promote their own professional development. While answering the question "What kind of evaluation do you think is the most valuable for teachers' professional development" (Figure 7(b)), it is considered self-evaluation, colleague evaluation, student evaluation, parent evaluation and school

comprehensive evaluation by 18, 6, 48, 6 and 34 teachers, respectively. Overall, the findings revealed that teachers focus more on the evaluation of students, making it easier to disregard other effective evaluation methods.

Through the above investigation, it is found that the gender ratio of primary school music teachers is seriously unbalanced, and teachers' understanding of the core literacy of music subject is not deep. In the era of artificial intelligence, teachers should have higher career pursuit, and teachers' professional development approaches should be further diversified.



## 4. Methods and Countermeasures

### 4.1. *The Education Management Department in the AI Era Should Strengthen the Construction of Relative Systems for the Professional Development of Music Teachers in Primary Schools*

**4.1.1. Improve the Status and Income of Music Teachers in Primary Schools.** Evidently, the identity of music teachers in primary schools needs to be strengthened. Compared with teachers in major subjects of Chinese, mathematics and foreign languages, music teachers are at a disadvantage in the promotion of professional titles, and most are dissatisfied with their salaries. To handle the opportunities and challenges fronted by music teachers in primary schools in the context of key competencies, the education management department should enhance the protection mechanism of music teachers' professional development in primary schools and take real and practical action in terms of teacher identity, professional promotion, and salary so that music teachers can transfer more energy to music teaching and refining their qualifications.

**4.1.2. Improve the Evaluation System to Promote the Implementation of Key Competencies.** A scientific and effective management mechanism guarantee improvement of teachers' professional development. The education management department should establish a robust evaluation system for teachers to provide a basis for enhancing teachers' professional quality and promoting their professional development [29–31]. Thus, this study claims that the education management department should establish a special supervision group, which can regularly monitor the music class in primary schools and formulate corresponding evaluation standards. Schools that can effectively implement key competencies into the classroom should be commended, excellent music teachers should be rewarded, and notable lesson examples can be used as demonstration for publicity and learning. This not only improves the enthusiasm of teachers, but also promotes the development of students' key competencies.

### 4.2. *A Good Environment Shall be Provided by Schools for the Professional Development of Music Teachers in Primary Schools in the AI Era*

**4.2.1. Reasonably Arrange the Workload of Teachers.** School leaders should focus on the significance of the professional development of music teachers to the cultivation of key competencies of primary school students and the overall development of the school. It is essential to rationally arrange the workload of music teachers, allocate teaching tasks judiciously, and minimize other administrative tasks other than teaching tasks. Thus, music teachers can have adequate time and energy for professional learning and improve their professional development.

**4.2.2. Form a Teacher Learning Community.** In the AI era, key competencies need teachers to fortify professional exchanges and collaboration and enhance their

professional development. Thus, schools must promote the establishment of teacher learning communities and create a win-win situation where teachers help each other and complement each other's advantages. The so-called "teacher learning community" is a learning group organized by teachers based on a shared goal and a sense of belonging to the subordinate team. In this group, teachers share their professional opinions and various learning resources, and complete specific tasks in the spirit of inquiry through equal communication, exchange and discussion, finally realizing the organizational form of their professional development.

**4.2.3. Classify Training According to Needs.** *The Guiding Opinions on Deepening the Reform of the Training Model for Primary and Secondary School Teachers and Comprehensively Improving the Quality of Training* states: training should be carried out per the needs of teachers at different stages of development, such as: pre-job training for new teachers, professional ability improvement training for in-service teachers, and advanced training for key teachers. Consistent with the requirements of the document, schools should understand the development needs of teachers from multiple viewpoints and arrange corresponding professional training based on different development stages. For example, for teachers new to the job and having a short teaching experience, some training on teaching design, class management, and after-school reflection, can be arranged; for teachers employed for 5–10 years, some training in aspects of innovative teaching methods and cutting-edge education theories can be arranged; for key teachers, some training on enhancing scientific research ability and educational research ability can be arranged. In the choice of training mode, schools should diversify training modes per the teachers' needs.

### 4.3. *Music Teachers in Primary Schools in the AI Era Should Comprehensively Improve Their Professional Development*

**4.3.1. Enhance Professional Identity.** Professional identity promotes teachers' self-confidence and is also a driving force for professional development. Music teachers in primary schools must identify with their profession, devote themselves to the career of music education in primary schools, and be responsible for educating students. Particularly in the development of key competencies under AI, teachers should continuously further their professional knowledge from various aspects, augment professional skills, and promote the all-round development of students. Currently, many music teachers in primary schools do not have precise professional positioning and feel that the subject they are teaching is a sub-subject. Thus, when exams approach, they tend to give up their class to Chinese, Math, and English teachers such deviation in understanding is not conducive to their professional development. Hence, music teachers in primary schools should enhance their professional identity, affirm the subject's professional value

for themselves, love music from their heart, care for students, and continue to strive for music education as their own career.

**4.3.2. Enrich Professional Knowledge.** First, music teachers in primary schools must master knowledge of music subject, also known as ontological knowledge, it is an integral part of key knowledge of music teachers and a prerequisite for the development of music teaching activities. Music subject knowledge comprises music theory, sight-singing, ear training, harmony, song composition, vocal music, keyboards, dance, and folk music. Then, music teachers in primary schools must master professional theoretical knowledge of education, also known as conditional knowledge, including pedagogy and psychology. Teachers, as guides of students' learning, must master the theoretical knowledge of education. Only when teachers understand students' psychological characteristics and development rules can they start teaching according to the different stages of students from the actual situation. Moreover, music teachers in primary schools should reinforce the study of basic knowledge, also known as general knowledge, which typically implies that teachers should possess all the general cultural knowledge that is conducive to effective teaching.

**4.3.3. Improve Professional Skills.** Music teachers' professional skills in primary schools are primarily reflected in the control of classroom teaching, and students learn and understand key competencies of music education in music teaching activities. Thus, teachers should enhance their classroom teaching ability to better promote the cultivation of students' key competencies of music education.

Regarding lesson preparation, teachers can refer to the teacher's reference books, however, this does not imply that teachers can copy all of them. Lessons should be redesigned per the teaching content and students' characteristics. Then, in the course of teaching, teachers should focus on harnessing the corresponding skills of students based on different types of courses. Music classes in primary schools are primarily set up for two types of classes: (i) listening and appreciation classes, and (ii) singing and chorus classes. Together with a basic connotation of key competencies of music education, corresponding listening and appreciation classes primarily enhance students' aesthetic perception, while singing and chorus classes primarily improve students' artistic expression. Moreover, in terms of teaching evaluation and after-class reflection, teachers should focus on multiple evaluations and self-reflection consciousness. Regarding the evaluation of students, teachers should combine the training requirements of key competencies, as well as the evaluation of teachers, parents, and students themselves, to promote the overall development and improvement of students' overall quality.

## 5. Conclusions

With the advent of the AI era, education and teaching have undergone profound changes, presenting the topic of the times for the key competencies and professional

development of music teachers in primary schools. Through a professional investigation platform combined with the AI analysis, this study methodically explored the problems of key competencies and professional development of music teachers in primary schools, demonstrating that the times require us to reorganize the system construction and development environment of music teachers in primary schools. It is crucial to summarize the experience in practice and accrue first-hand information to conduct more expensive research on key competencies and professional development of music teachers. Accordingly, teacher training programs that fulfill actual local conditions can be organized to guide teachers to consciously enhance their professional development, for improving the professional competencies of music teachers in primary schools and achieving the goal of nurturing key competencies in music for primary school students. Besides, it serves as a crucial reference for the comprehensive development of promoting the overall development of personality and capability of primary school students, thereby providing strong data support and an effective model for key competencies and professional development of music teachers in primary schools in China. This study will also provide better experimental methods and research models for key competencies and professional development of teachers in other disciplines.

## Data Availability

The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

## Conflicts of Interest

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

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