Application of Digital Music Technology in Music Pedagogy

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Abstract—This paper expounds the concept and current development of digital music technology in modern times by exploration and analysis around the music technology, in order to better develop music pedagogy. In allusion to the contemporary music pedagogy, a new instruction idea is proposed by analyzing the digital music technologies such as MIDI, digital audio and other new music carriers, namely, an instruction model which integrates the digital music technology and the traditional teaching mode and means in the music classroom of middle school. In order to validate the availability of digital music technology, this paper also contemplates the current development of digital music industry and demonstrates the importance of digital music in modern music pedagogy by drilling down the digital music characteristics. In the end, it is concluded that the digital music technology introduced in music classroom instruction of middle schools contributes to cultivating students' music learning capacity.

Keywords—digital music technology, music pedagogy, MIDI, digital audio

1 Introduction

Since China opened to the outside world, our country has witnessed tremendous development in various fields such as economy, science and technology, culture and arts. In the context of great prosperity of China's socialist culture, supported by dramatic development in economy and society, the field of culture & art also flourishes with each passing day. In middle school, a person faces a key period to grow up. The music education in middle school is committed to cultivating their positive and optimistic thoughts and sentiments, in addition to imparting them some musical skills. However, for the most part, parents think their kids can learn nothing when it comes to the music lessons of middle schools, so do many students in middle schools. They believe it a relaxing and recreational time in music lessons. There is no interest but listening to music, and learning obsolete sings. They more tend to learn with their teachers after class or by the Internet and other modern means.

It is a great challenge about how to improve teachers' music quality and instruction skills under the existing conditions and intrigue students' interest in learning music so as to revamp the instruction quality. The digital music technology emerges as a new idea to meet many challenges that the music pedagogy in middle school faces in current time. This paper attempts to investigate the significance and application of digital music technology in music pedagogy in middle school.

2 Literature review

2.1 Domestic research situation

As early as late 1980s, some art institutes and departments in China have explored the instruction model assisted with digital music technology. By the late 1990s and early 2000s, the digital music technology started to be popularized in the universities [1]. Beijing Central Music Co. has made a large stride in this area with the Central Music Technology, the first domestic computer music publication. Since 2001, STN contests has been convened in many consecutive years and received enthusiastic responses from more than 40 major universities in China, whether it is a seminar or a new music contest, great repercussion has been stirred up in education circle [2].

Today, the computer music technology has been an indispensable tool in the music instruction of the most conservatories of music in the universities. The music departments and conservatories in many universities have set up the relevant curriculums and delved into the music instruction to contribute more in the fields of music creation and performance, for example, the composition department, CCOM(Central Conservatory of Music), where each classroom has an extra equipped with advanced computer music systems in addition to the traditional instruments such as piano with great help in the impartation.

2.2 Status quo of overseas research

Digital music technology stemmed from Europe, the United States, Japan and other developed countries, where the people naturally have a bottomless cognition for digital music technology [4]. In Europe and the United States and other developed countries, it is of great importance to introduce the computer music and other information technology in the quality education phase, for example, the U.S. Congress adopted the Goals 2000: American Education Act in 1994, based on which, the National Standard for Arts Education in America was issued. This is the first set of national standards compiled by the national educational institutions with the auspices of the federal government, which incorporates the 4 major disciplines, i.e. dance, music, visual arts and drama for the purpose of "training competitive labor forces in the world economic market in the 21st century"[5]. They think that computers can create unimaginable efficiencies and opportunities in teaching experiments so that these technologies must be thrown into services in no time.

The above materials inform us that the developed countries attach great importance to the access of modern information technology and digital music technology to the classroom, and even recognize them in the form of national standards. They have made explicit requirements at all stages of students' learning, which most deserves our reference [6].

3 Application of Digital Music Technology in Music Pedagogy of Middle School

3.1 Objective of music pedagogy

In the middle school, it is not only a good time for students to grow up, but also a key phase for them to have a fastest accumulation of knowledge. Our country also intensifies the secondary education with all might and develops the curriculum standards in the field of music pedagogy, which have a very strong normative effect on us. Nowadays, under the background of deepening education reform, improving the quality education in an all-round way, and making efforts to launch fair education and accomplishing the healthy and sustainable development of education cause, especially after the aesthetics is chosen as a guiding principle for national education, students' good aesthetic sentiment and humanistic literacy have been improved with a good effect [7]. The music curriculum standards in middle and high schools somewhat differ, but most of them are still similar with contents summed up as follows:

"Students may learn and participate in a wide variety of artistic practical activities by music lessons to explore, discover, appreciate the artistic charm of music, so that it is effortless to cultivate students' lasting interest in music, conservation and beauty, harmonious body and mind, mold characters and sentiments and perfect personality. It is just required that we should take students' hobbies as a driving force in the instruction, and strive to motivate students' aesthetics of music, allow students experience music, understand music, love music in practices, while developing their creative thinking.

3.2 Application of Digital Music Technology in Specific Instruction

Digital music technology may train students to be accurately rhythm as a key part of secondary music pedagogy. Many units have rhythmic training or accompaniment of melodies with percussion. The common ground for secondary school music lessons is to allow students to learn percussion and appropriate accompaniment for percussive melodies. In the past instructions, it is very difficult to round up various percussion instruments of Beijing Opera gong and drum drop. When teaching, students are only allowed to watch the videos, hard to experience it. In this case, MIDI technology can resolve these problems [8].

In addition to imparting the students, music teachers will organize a wide variety of extracurricular activities, all of which must be assisted with digital music. In addition, we also constantly make a novel entertainment programs on demands, for example,

we have ever developed some innovative cultural activities such as film and television dubbing, cell phone music ensembles, and so on.

4 Analysis of developing trend and characteristics of digital music technology

Judgment of noises in music files must be dependent on file parser and feature extractor. In essence, an audio file is the data combination of various waveforms, however, the different compression algorithms make an original waveform generate different data arrangement modes. Pure data comparison will help occurrence of a fallacy. In order to better identification of the voice, the features of the audio file will be extracted, which can facilitate identification and analysis of waveforms.
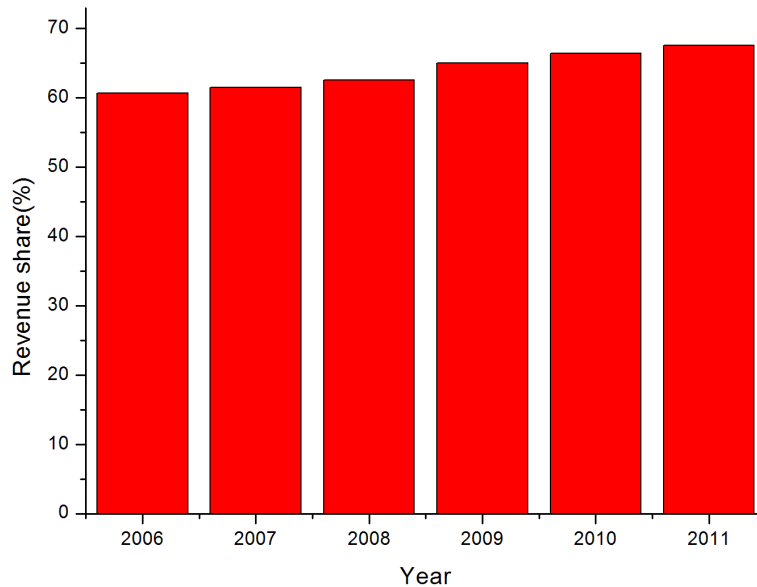

Fig. 1. Global music industry revenue forecast in 2006-2011 years

### 4.1 Developing trend of digital music industry

The global music industry maintains a slow growth: As shown in Fig. 1, e Marketer estimated that the global music market reached 67.6 billion U.S. dollars in 2011, with an annual growth rate of 2.19% at a slow rate. The traditional CD / VCD continued to decline till to 29% of the total sales, however the pay-for-download service for digital music has drove the development of music industry.

Digital music has been a primary source of revenues in the industry: As shown in Fig. 2 (a) - (b), based on data released by eMarketer, the global digital music revenue in 2006 reached up to $ 2.9 billion. The eMarketer predicts that the global digital

music industry will maintain its rapid development with market scale expanded continuously in the next few years. By 2010, it becomes stable. It is estimated that the whole market scale in 2011 reaches $ 14.8 billion. Digital music has been the primary income source for the music industry at a ratio of 22% in the whole industry.
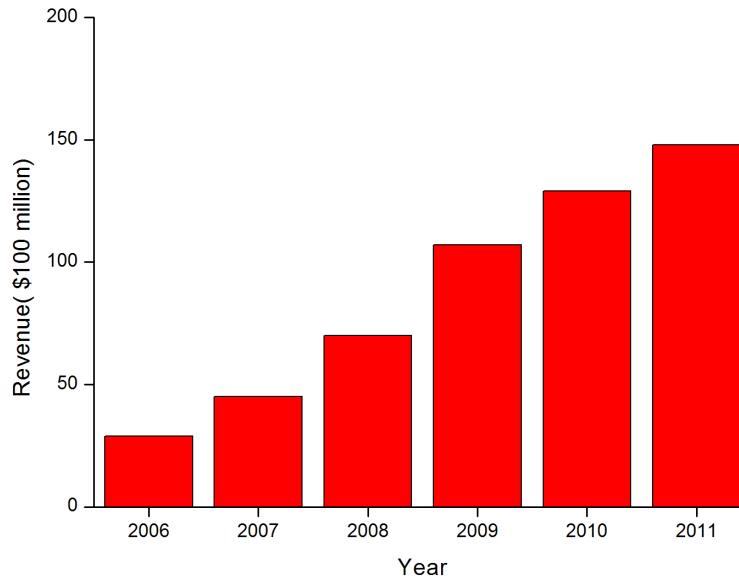
(a) Total revenue
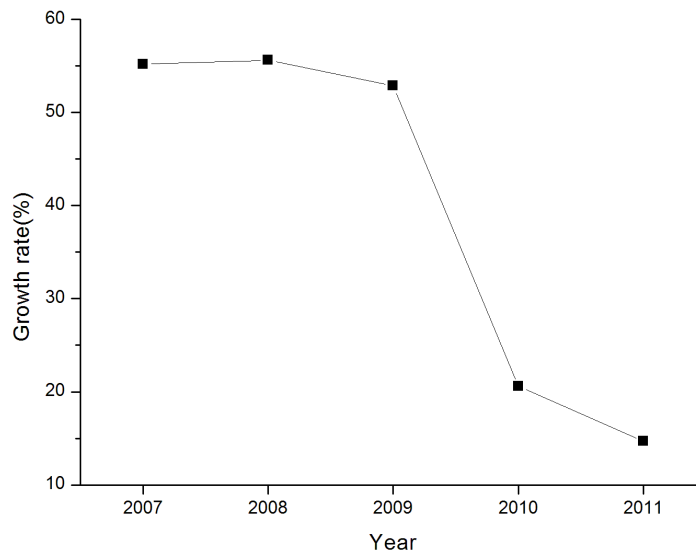
(b)Growth rate

Fig. 2. Revenue scale of the global digital music market

3G mobile phone subscription service has great potential for development: from the global market structure, as shown in Table 1, the mobile subscription services hit upon $2 billion in 2006, the next comes the monorail and broadband downloads. However, the United States made the leading monorail downloads reach $582 million in 2006, followed by mobile subscriptions, $194 million. Europe had the leading mobile phone subscriptions reached $ 656 million in 2006, followed by the monorail downloads of $ 111 million. It is noteworthy that in 2006 3G mobile phone subscription service grew rapidly with the global annual growth rate of 52%, while the United States up to 448%, Europe is 440%.

Table 1. Global Digital Music Market Structure (in $ millions)

| Year	Wideband	Online music catalogue	Monorail downloads	Subscriber	3G mobile subscription	Portable player sales
2005	209	2	420	2.8	90	84
2006	280	4	795	3.5	137	120
Growth rate	34%	100%	89%	25%	52%	43%

4.2 Feature Extraction Algorithm

This paper adopts the feature of frame calculation in the extraction process because the frame has more accurate feature expression than the segment. The extracted music feature parameters include the short-time average energy, the short-time zero-crossing rate, the frequency centroid and the bandwidth, etc. The MFCC coefficient (frequency cepstrum coefficient), a kind of techno-pop feature algorithm proposed based on the human auditory and sensory features, is also extracted in this paper. As the MFCC is nonlinear with the frequency of Hz, MFCC plays an important role and made a large stride in audio recognition by calculating the feature information in the term of the frequency spectrum [9].

MFCC is an extracted cepstrum parameter that reflects its nonlinear relation with the frequency as expressed by the following formula:

$$\mathrm{Mel}(f) = 2595 * \lg(1 + f / 700) \tag{1}$$

Where, f is the frequency, in Hz; the relation of Mel with linear frequency is shown as Fig. 3:
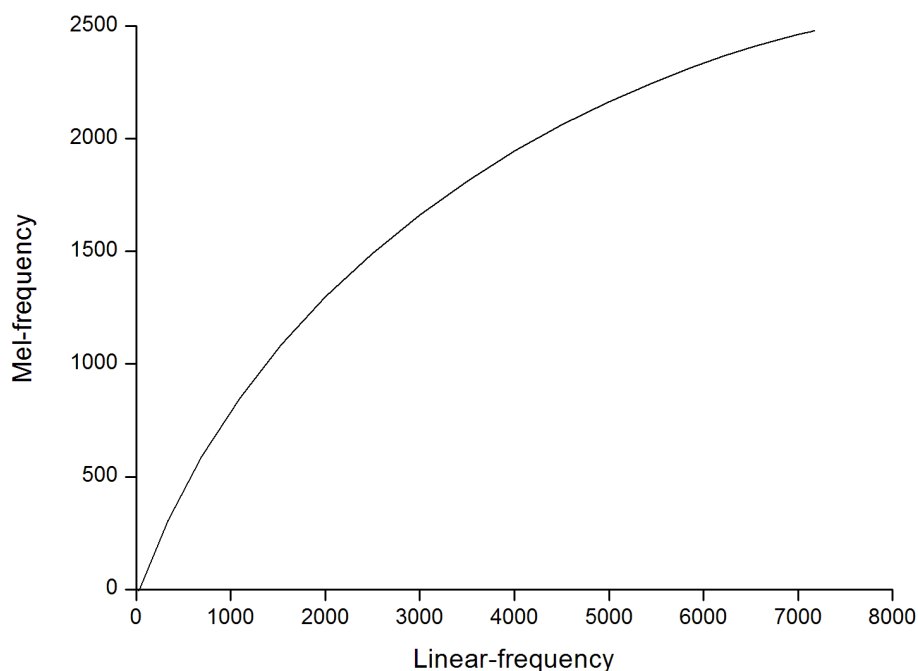
**Fig. 3.** The relationship between mel-frequency and linear- frequency

4.3 Analysis of audio features

Judgment of noises in music files must be dependent on file parser and feature extractor. In essence, an audio file is the data combination of various waveforms, however, an original waveform generates various data arrangement modes due to different compression algorithms. Pure data comparison will help occurrence of a fallacy. In order to better identification of the voice, the features of the audio file will be extracted, which can facilitate the identification and analysis of waveforms [10].

The analysis of audio signals focuses on two aspects: 1) intra-time-domain analysis; it aims to analyze audio time correlation information, such as energy, autocorrelation function; the analysis of time domain signal features convenience and simplicity, less calculations, instant. 2) Intra-frequency-domain analysis; the feature parameters extracted include pitch, formant. The time-domain and frequency-domain parsers for audio signals are shown in Fig. 4 (a) - (b), which are the different results on the one piece of audio signal.
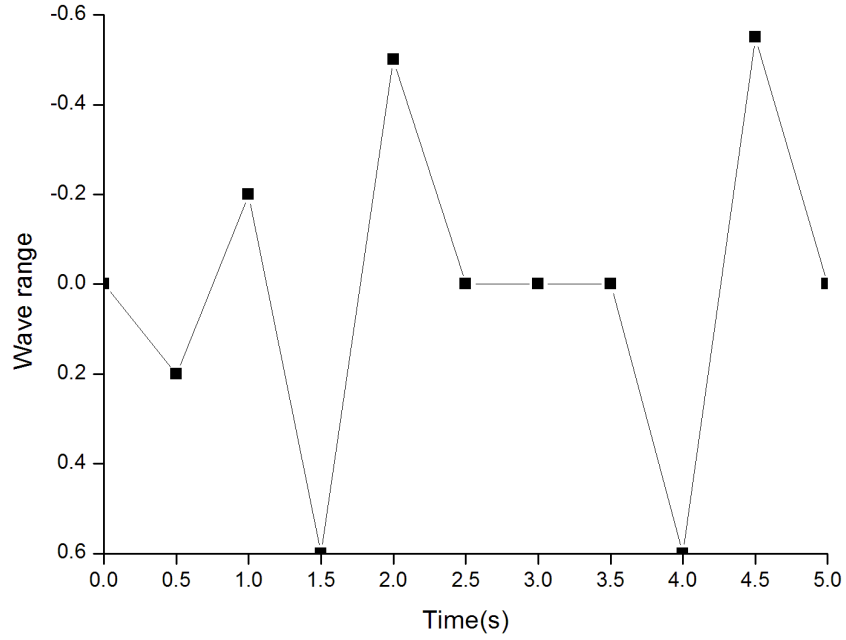
(a) Time domain analysis chart of audio signal
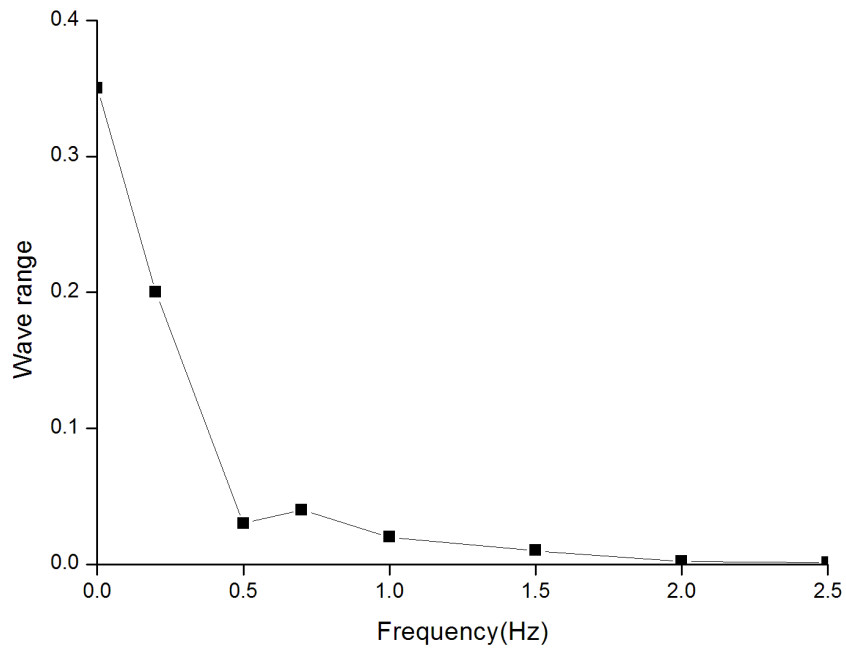
(b)Frequency domain analysis chart of audio signal

Fig. 4. Audio signal analysis chart

5 Conclusion

Music, as the most beautiful language of mankind, can not only mold our sentiments, but also keep up our spirits to help us erect a healthy and progressive outlook on life. Music curriculum in middle school is important for people to understand music with a great significance. In this times with rapid development, life is full of opportunities and challenges. The integration of traditional music arts and modern science and technology has given birth to the digital music technology, which can fill the gap of the traditional music pedagogy model in the middle school and present us a modern, novel, efficient classroom experience. The analysis of the current digital music technology proves that this technology has an important developmental significance in music pedagogy of middle school, therefore, the music education should be incorporated with modern technologies in order to expedite the long-term development of music pedagogy in middle schools.

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