

# Design and Implementation of Teaching Assistant Software for Vocational Undergraduate Music Education in Digital Environment

## -Design and Analysis of "Mentor", an Auxiliary Software for Solfeggio Teaching

Chunbao Cai\*, Chuanli Liu<sup>a</sup>

\*klk058@126.com, whn34562022@163.com<sup>a</sup>

Nanchang Vocational University, Jiangxi, Nanchang, 330000., China

**Abstract.** With the rapid development of digital technology today, how to develop and design efficient music teaching software has gradually become an important topic that needs urgent research in the music and education circles. Starting from solving the practical problems existing in digital music education in colleges and universities, this paper expounds in detail the design idea, function and usage of the software through the design and analysis of the "Mentor" solfeggio-assisted teaching software. And put forward its main characteristics, that is, it is practical and convenient, rich in content and more targeted. The author hopes that the research in this paper can play a positive role in the digital reform of solfeggio education.

**Keywords:** digital environment; Music teaching software; "Mentor" solfeggio teaching assistant software; Design and analysis

## 1. Introduction

With the in-depth development of modern educational technology in all aspects of contemporary higher education in China, it has become a major feature of music education in China to apply multimedia digital creation technology to undergraduate music education [1]. With the development of computer technology, the development of solfeggio education technology is also facing new challenges. Digital music is made and processed by computer-simulated musical instruments, which is also called "computer music" or "MIDI music" [2-3]. However, for the digital teaching of solfeggio, it does not abandon the traditional teaching mode.

## 2. Comments on common solfeggio teaching software

As early as the beginning of computer music software teaching in China, many similar softwares have been designed in western countries, and they have been tested in the market for a long time-such as Listen Ear Power Practica Musica and Civilian Music Coach [4-5]. AuraliaSampler and EarMasterPro/School are two widely used and popular softwares.



**Figure 1.** Generating Midi files

This software uses acoustic 2 MIDI tone recognition technology, which can accurately identify the tone of the microphone. Its layout is simple and easy to operate [6]. The 26 units are divided into four categories, namely "interval scales"; And from the three dimensions of teachers, students and classes, the daily teaching work such as courses, exercises and tests is planned and managed in an all-round way; With rich music language and image settings, it provides students with a relaxed interactive learning environment, which can not only enable students to master the classroom content faster, but also replace teachers to make necessary judgments on students' learning effects, thus consolidating teachers' teaching content and improving students' learning interest [7]. Finally, an excellent and popular teaching software is developed. As shown in Figure 1.

### 3. The system design of "mentor" solfeggio teaching software

The basic system of "Mentor" solfeggio teaching software designed by the author (hereinafter referred to as this software) includes three parts: architecture design, database design and system function design: Component connection refers to the combination and connection of various parts in the architecture. In order to realize the reliability of system operation, professional algorithm simulation is carried out on the system by using software technology, and the core code is as follows:

```

csv_data = pd. read_csv("./train.csv",converters={'id': str},iterator=True)

loop=True while loop: try: chunk = csv_data. get_chunk(1000000) except StopIteration loop =
False                                     print("Iteration                               is
stopped." DfTo_csv('train.csv',header=None,mode='a',index=0)#header=None

csv_data = pd. read_CSV (" . / train_pos.csv", converters={'id': str}) \
csv_data = pd. read_table('train_0.txt',header=None,sep='\t',names='user_id','item_id','rating')
#Read TXT

DF = chunk [chunk. Click. Isin ([1])] \
df['date'] = df. To_datetime(df['date'])
DF_sort=df. sort_Values ('date') # sort by date
DfFillna ('-1', inplace=true) # replace Nan in the table with '-1'

def deal_feature(col_list, csv_data):
for re in col_list:df=csv_data[re]

```

```

pos_list={ }for i in range(df.shape[0]):sid=df. iat[i]
if sid in pos_list pos_list[sid]. append(sid) else:
cur_map={ }for i in pos_list:if len(pos_list[i])>=20:
cur_map[i]= else:cur_map[i]=-1 csv_data[re]=csv_data[re]. map(lambda x:cur_map[x])
print(re)

```

(1) Analysis of basic entity set:

① Basic functions of entities: From all the functions of the software, we can extract a set of basic entities with different distinguishing standards, such as "scales, intervals, chords, melodies, multi-voices, solfeggio courses and modern music", which are independent of each other.

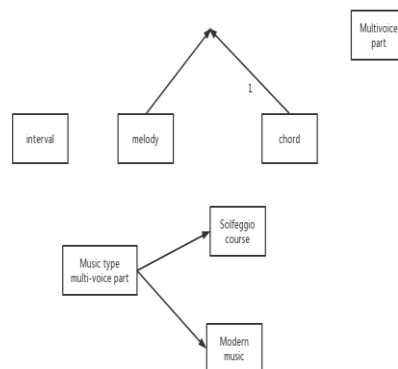
A scale: master the progressive characteristics and sound sense of the mode and solve the problem of out of tune. B. interval: master the progress characteristics and sound sense of interval and establish a fixed concept.

C. Chord: Master the sense of longitudinal and transverse sound of each part of chord, and lay the foundation for multi-voice solfeggio.

D. Melody: Master all kinds of organic combinations of melody tone, experience melody style, establish fixed concepts and tone sense.

A. Solfeggio type: training content attribute: A scale: mode attribute; B. interval: distance attribute; C chord: structural attribute; D melody: interval combination attribute;

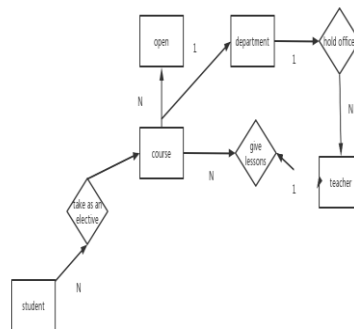
Creating E-R diagram: Through the above analysis, the E-R diagram 1 of the database can be designed. As shown in Figure 2.



**Figure 2.** Software database E-R diagram 1

According to the above figure, the corresponding database relational model can be designed: a solfeggio type (solfeggio type number [keyword]; Solfeggio type attribute); B. scale (mode number [keyword]; Mode attribute file name file path); C. interval (distance number [keyword]; Distance attribute, file name, file path); D chord (structure number [keyword]; Structure attribute, file name file path); E melody (interval combination number [keyword]; Interval

combination attribute file name, file path);Tonality attribute file name file path). According to the entity and its attributes, the relationship between entities can be analyzed: for example, there are many teachers in a department and there are many courses, and each course has one teacher. Students can take multiple courses in different departments. From this, we can draw three pairs of entity relations, such as "one-to-many", "department and teacher" and "teacher and course", and "many-to-many", "student and course". Therefore, according to the above information, the E-R diagram 2 of the database can be obtained. As shown in Figure 3.



**Figure 3.** Software database E-R diagram 2

According to the above figure, the corresponding database relational model can be designed:  
 ① department (department [keyword], department name, teacher number);  
 ② Course (course number [keyword], department, teacher number, course name);  
 ③ Students (student number [keyword 1, student name, gender);  
 ④ Teachers (teacher number [keyword], teacher name, department);  
 ⑤ Course selection (student number [keyword], course number [keyword], course name).

#### 4. System function design:

(1) Introduction of system functions: The questionnaire survey and its analysis show that users have the following requirements for the overall functions of this software:

① Classified access to solfeggio items: different types of solfeggio exercises are provided for users, and each type also contains a number of subspecies. When the user selects different types, the pop-up dialog box will display all the exercises that meet the requirements.

② Speed setting: Adjust the playing speed of any solfeggio practice by setting the metronome.

(2) Main system functions written in Java language: The main system functions written through Java API6 include:

① Interface function design of solfeggio: J-Frame class or its subclasses are used to generate the interface, and JDBC is used to read the file list in the database. Open the File according to the selected path with the file class, read the music or audio in the file with the BufferedReader,

and present it in the music column of the main page, so as to jump out of the operation interface for further selection by the user.

② "General operation" function: a. "Save exercise settings as": open the selection box with Java's JFileChooser class, read the recording module data with BufferedWrite class, and save it in the specified file. You can save the completed exercises in the designated equipment;

B. "Export": Open the selection box with Java's JFileChooser class, encode the score/accompaniment with Mp3 decoding module, and save the specified file. Music score/accompaniment can be exported in Mp3 format.

## 5. The operation design of this software

The author's operation design of this software includes two functional areas: "control menu" and "content menu":

Control menu: contains settings such as "File, Exercise, Exercise Settings, Score Management, Tools, Help";

(1) The file contains contents such as "Save Practice Settings as, Export, Print";

(2) Practice solfeggio including "scale, interval, chord, melody, multi-voice, modern music, solfeggio course";

The design and analysis of the software are also explained. At the same time, the stability, cross-platform and high efficiency of JAVA language also provide strong technical support for the development of this system. It can stimulate students' interest in learning and optimize the teaching effect. It is expected that the research of this topic will inject new vitality into the teaching technology reform of solfeggio in the digital environment [8].

## 6. Conclusion

This paper tries to start from the personal idea and computer principle, the characteristics of "Mentor" concrete, emphasize the change of individual differences and means of teachers and teaching time binding, help students from abstract music vocabulary, more intuitive music content training, expand the students' learning practice content, with more convenient, more interesting, more free way for teaching and learning, effectively improve the efficiency of teachers' teaching and students' learning.

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