The Design of Adaptive Error Feedback Music Ear-Training System with Image Cues

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Abstract. This paper describes the design of AEFMES (Adaptive Error Feedback Music Ear-Training System). It is an assessment analysis engine designed to provide immediate diagnostic feedback on the melodic line assessment with pitch recognition, interval recognition and rhythm recognition. The AEFMES with image cues could move learners beyond basic drill exercises to a competence that is tailored to the content of individual needs in the ear-training process. Many misconceptions of students can be cleared up through the combination of practice and immediate adaptive error feedback with image cues.

Keywords: Ear-Training**,** Pitch Recognition, Interval Recognition, Rhythm Recognition.

1 Introduction

Music ear-training includes identifying pitch, intervals, chords and rhythm which are essential elements to successful music world. The inherent abstract complexity of extraction of identification in musical variation is hard for learners to comprehend and learn. The move to use technology to support learning has become an emerging development in the recent music pedagogy [4, 5]. Many learners in traditional learning environment have limited immediate learning feedback which allows them to review, reinforce, and develop such aural skills. As the difficulty of the music texture increases, so does their frustration. Therefore providing mistake analyses in music ear-training learning is needed to consolidate their own aural skills [2, 6].

Musical auditory processing with image cues possesses educational implications. Studies showed the effects of verbal labels on music recognition could facilitate memory recall of musical passages [1, 3]. This paper tried to use technology to practice using assessment analysis engine with image cues as individual's error feedbacks. Learners could facilitate their ear-training through self- drill tasks.

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2 Adaptive Error Feedback Music Ear-Training System

The Adaptive Error Feedback Music Ear-Training System (AEFMES) in this study, integrating the Microsoft Agent as a verbal tutor, is composed of assessment analysis engine (Fig. 1) and piano drill engine (Fig.2). The assessment analysis engine is designed to provide immediate diagnostic feedback on the melodic line assessment with pitch recognition, interval recognition and rhythm recognition. For pitch recognition or interval recognition practice, each item in the online assessment responds to specified pre-analyzed error type respectively. And each error type in pitch recognition and interval recognition is further classified into subtypes. Each feedback of error type associates with image cue in different color, and each feedback of error subtype associates with image cue in different shape.

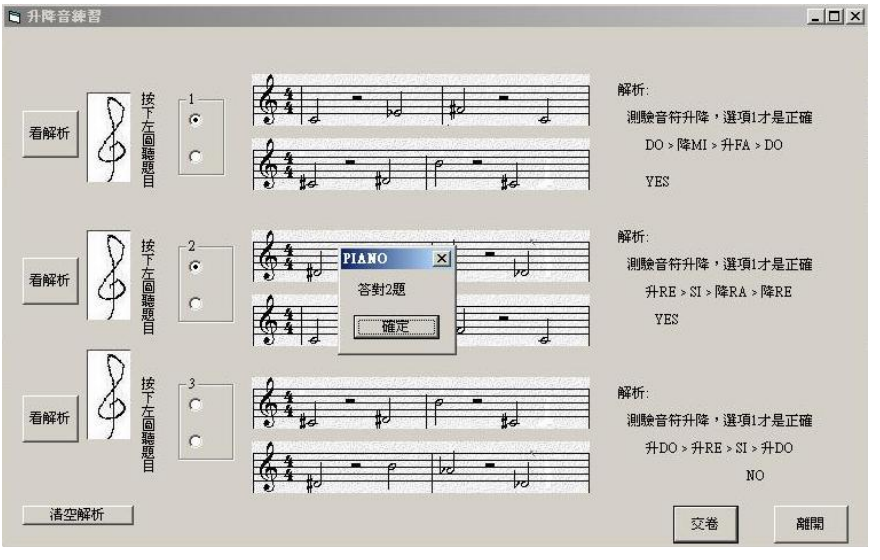

Fig. 1. Assessment analysis engine

Learners could retrieve personally error feedbacks that they made during the assessment process. All the practice items together with corresponding information are saved into XML file. The assessment analysis engine could thus analyze and search the XML tree to provide individual feedbacks. And the piano drill engine is designed to provide immediate practicing feedback on the melodic line assessment with pitch recognition, interval recognition and rhythm recognition.

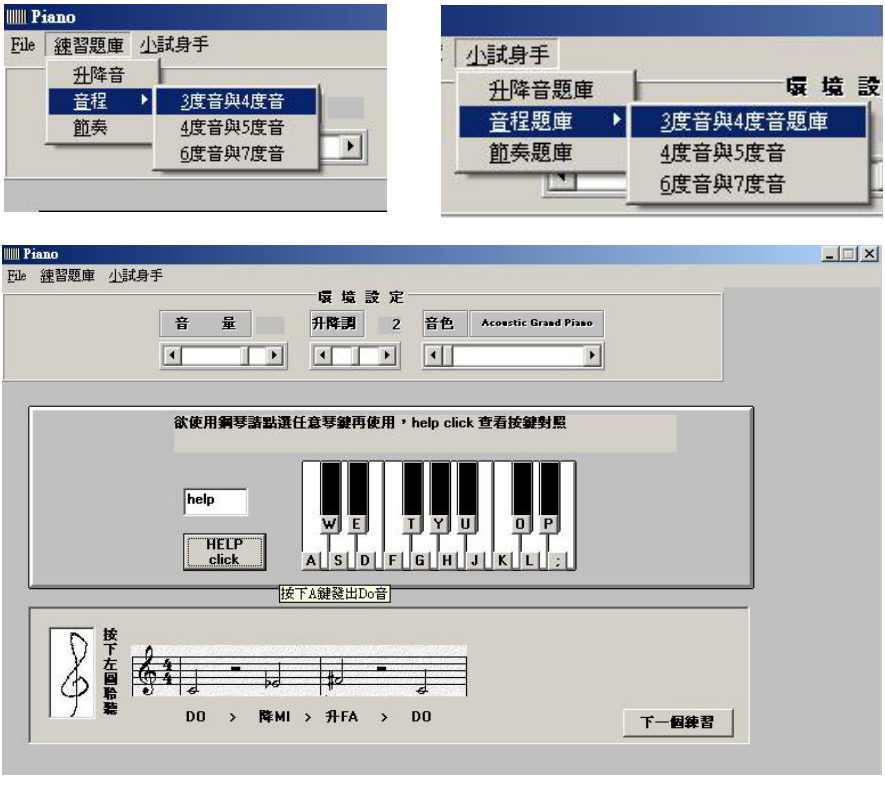

Fig. 2. Piano drill engine

3 Evaluation of AEFMES

The subjects in the study consisted of 23 university students who do not have a strong music background. The experiment involved the use of AEFMES integrated into the music interval instruction program. The assessment analysis engine could distinguish total fourteen major error types for each pitch recognition and interval recognition respectively that were verified with expert validity. Each error type associates with different color as the image cue background for the assessment feedback, including red, orange, yellow, green, blue, white and purple. And each subtype error which could be further analyzed by the assessment analysis engine associates with different shape, including circle, triangle, square and diamond in corresponding background color. After every assessment analysis, there will pop up a verbal agent with tutoring information and image cue.

Learners were given three different musical intervals to recognize (Minor 2nd, Major 3rd, and Perfect 4th). While listening to the intervals they could request piano drill engine to practice what that interval sounds like. According the personal error feedback from the assessment analysis engine, learner could then focus interval recognition on verbal tutoring information with the image cue. And the specific image

cue could be triggered for the corresponding error type of practicing with piano drill engine. A post-test was administered with all the data collected to a server database.

The initial analysis showed a significant increase from the pre to post-test scores ($F=7.75, P<.05$), indicating that the AEFMES with image cues was effectively teaching the given material. And Pearson correlations were conducted between the post-treatment scores. The results showed no significant relationships existed. The image cue does not exist in the relationship between an auditory occurrence and the visual signal of that occurrence, but the learner had been conditioned to create something meaningful to themselves that could be used as a visual cue in the treatment.

4 Conclusions

The AEFMES with image cues could move learners beyond basic drill exercises to a competence that is tailored to the content of individual needs in the ear-training process. Music ear-training development occurs when learners interact with AEFMES in a continuous drill. Many misconceptions can then be cleared up through the combination of practice and immediate adaptive error feedback with image cues.

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