Development of a Music Educational Board Game with Mobile Device: Learning Musical Theory and Emotional perception through Gameplay

Song-Zhu XIAO, Chih-Chen KUO, Huei-Tse HOU*
Mini Educational Game Development Group, Graduate Institute of Applied Science and Technology, National Taiwan University of Science and Technology, Taiwan
**hthou@mail.ntust.edu.tw*

Abstract: Music appreciation is one of the most important courses in arts education. In this study, we designed a music education board game "*Soul Mate*" with mobile devices, which provided learners with multiple representations learning context. In the game, learners scan the QR codes on the cards with their mobile devices to listen to the music. Through the process of listening experience, learning experience and observing interaction, learners can make judgment, understand their own emotional perception of listening to music, and learn about music theory. Preliminary results indicate that gamified learning is effective in enhancing learners' learning outcomes and is able to maintain learners' flow and keep them engaged in learning.

Keywords: mobile device, music educational board game, music theory, emotional perception

1. Introduction

Music appreciation is one of the most important courses in the arts field of higher education, and it can cultivate the art appreciation ability of university students (Lv, 2022). Thompson et al. (2022) refer to the fact that art appreciation education often treats the learner's level of enjoyment as a response to a work of art and neglects the importance of intellectual understanding. Over the years educational research has explored the effectiveness of many applications of technology in the teaching and learning of subjects such as language, science, and mathematics, but few studies have been conducted on subjects in the field of music (Wang, 2021). Research has found that the use of technology in music education can be very effective and the use of games learning can help music skills and knowledge acquisition (Gower & McDowall, 2012). After the epidemic, the interactive use of mobile devices in arts education has gained wider attention (Vorontsov, 2021), because mobile devices can offer the possibility of presenting musical works (Ouyang, 2022). In this study, a music education board game with a mobile device was developed to allow learners to learn music theory, to be aware of their own emotional perceptions when listening to music, and to promote the flow of the learners' mind through the game.

2. Method

This board game contains four types of cards: Music, Music Theory, Emotion, and Event (Figure 1). The Music card is presented by QR code, using Chopin's 24 preludes as the source material (including 24 major and minor keys). The music theory cards, divided into two categories: tone and tempo, e.g., listening to the music and identifying the tempo of the piece as Allegro Major, Allegro Major, or Allegro Minor, can help learners to acquire knowledge of music theory. The emotion cards are designed with reference to Russell's (1980) model of the dimensions of emotion, and they contain a total of 12 emotions, including excitement, relaxation, sadness, and fear, etc. The content of the event card is about daily topic, which can be used to stimulate interactions and discussions among the learners. This board game is

divided into two stages. In the first stage, after listening to a piece of music, learners choose the corresponding music theory and emotion cards (Figure 2), learn music theory from checking the correct answers, and at the same time observe their own emotional perceptions of the music. In the second stage, learners take turns to act as a guide, and the other three learners guess the guide's emotional feelings towards the music based on the observations made in the previous stage to achieve the learning interactions and to confirm the knowledge of the emotional feelings. The participants in this study were 20 students (12 males and 8 females) from a university in Taiwan. After the learners enrolled online, the researcher assigned four people into a group to play the game according to the participation time. The pre-test and post-test of this study were based on the same assessment of learning effectiveness, which was divided into two parts, namely, music theory and emotion perception. The questions were developed by music teachers with more than 5 years of teaching experience in universities. The Kiili Flow Scale (2006) translated and revised by Hou & Li (2014) was referred to in this study. The flow scale includes two dimensions: Flow Antecedents and Flow Experience. All scales were scored according to the Likert scale, and the reliability of the flow questionnaire (Cronbach's alpha= 0.914) indicated a high degree of internal consistency. The learning process included game explanation (10 minutes), pre-test (20 minutes), game activities (50 minutes), post-test and flow questionnaire (30 minutes).

Figure 1. Cards and Instructions for Games

Figure 2. Playing "*Soul Mate*"

3. Results and Discussions

The purpose of this study is to investigate the music theory, emotional perception, and flow performance of learners on the music education board game "*Soul Mate*". Table 1 showed the results of the learners' learning performance of music theory and emotion perception before and after participating in the game. The post-tests of music theory ($z = -3.03$, $p = 0.002 < 0.05$) and emotion perception ($z = -3.73$, $p = 0.000 < 0.05$) were significantly higher than the pre-tests, and it suggested that the use of game learning in the subject of music domain can effectively enhance learners' effectiveness and emotion perception. The results showed that the use of game-based learning in the music field can effectively enhance learners' learning. Table 2 shows learners' state of flow during the game and, the result revealed that the overall mean of the flow ($M = 4.15$, $SD = 0.52$) was significantly higher than the median 3 of the scale ($z = 3.853$, $p < 0.001$). Most of the Flow Antecedents and Flow Experience sub-dimensions were also significantly larger than the median of 3 on the scale, and many sub-dimensions were even higher than 4. This result suggested that the overall game mechanism enables learners to clearly understand the activity goals of the game and engage in the game to achieve a high flow experience.

Table 1. *Music Theory and Emotion Perception Descriptive Statistical Analysis*

Dimension		*M*	*SD*	*Z*	*p*
Music Theory	pre-test	44.70	19.04	-3.03**	0.002
	post-test	64.30	11.64		
Emotion Perception	pre-test	8.75	5.83	-3.73***	0.000
	post-test	16.90	3.32		

**p <0.01 · ***p <0.001

Table 2. *Flow and Game Acceptance Descriptive Statistical Analysis*

Dimension	*M*	*SD*	*Z*	*p*
Overall Flow	4.15	0.52	3.853***	0.000
Flow Antecedent	4.07	0.56	3.801***	0.000
Challenge-skill balance	4.05	0.71	3.706***	0.000
Goals of an activity	4.35	0.69	3.862***	0.000
Unambiguous Feedback	3.97	0.72	3.510***	0.000
Sense of Control	4.30	0.71	3.760***	0.000
Action-awareness Merging	3.68	0.75	2.995**	0.003
Flow Experience	4.09	0.49	3.873***	0.000
Concentration	4.30	0.75	3.681***	0.000
Time distortion	4.10	0.66	3.750***	0.000
Autotelic experience	4.60	0.68	3.914***	0.000
Loss of self-consciousness	3.35	0.86	1.576	0.115
Overall Acceptance	4.15	0.52	3.853***	0.000
Perceived Usefulness	4.07	0.56	3.801***	0.000
Perceived Ease-of-use	4.05	0.71	3.706***	0.000

$^{**}p$ <0.01 · $^{***}p$ <0.001

4. Conclusion

In this study, we developed a music education board game "*Soul Mate*" with a mobile device. The game combines emotion perception, contextual interaction, and cognitive design through the medium of music, allowing learners to learn in a multi-character board game. This board game is for 4 players to play together, use the mobile device to scan the QR code on the cards to listen to the music, and then realize their own emotional perception and music theory through self-feeling. According to the results of the study, *Soul Mate* had a positive effect on the learners' knowledge of music theory and emotional perception, and the learners were highly engaged in the process. For the future study, we will continue to explore the effect of the study on the learners compared to the control group (traditional teaching) and collect more qualitative data such as interview and behavior pattern analysis.

Acknowledgements

This research was supported by the projects from the Ministry of Science and Technology, Republic of China, under contract number 110-2511-H-011 -004 -MY3, MOST-111-2410-H-011 -004 -MY3.

References

Gower, L., & McDowall, J. (2012). Interactive music video games and children's musical development. *British Journal of Music Education, 29*(1), 91–105. https://doi.org/10.1017/S0265051711000398

Hou, H. T. & Li, M. C. (2014). Evaluating Multiple Aspects of a Digital Educational Problem-solving-based Adventure Game. *Computers in Human Behavior, 30*, 29-38.

Kiili, K. (2006). *Evaluations of an experiential gaming model*. Human Technology: An Interdisciplinary Journal on Humans in ICT Environments.

Lv, H. (2022). Analysis of the Basic Characteristics and Teaching Environment and Mode of Music Appreciation Course Based on Core Literacy. *Journal of Environmental and Public Health*, 2022.

Ouyang, M. (2022). Employing Mobile Learning in Music Education. *Education and Information Technologies*, 1-17.

Russell, J. A. (1980). A circumplex model of affect. *Journal of personality and social psychology, 39*(6), 1161.

Thompson, W. F., Bullot, N. J., & Margulis, E. H. (2022). The psychological basis of music appreciation: Structure, self, source. *Psychological Review*.

Vorontsov, C. O. (2021). Mobile devices in teaching information technologies at institutions of higher art education. *Information Technologies and Learning Tools, 83*(3), 100–112.

Wang, Y. H. (2021). Exploring the effects of using various designs of game-based materials on music learning. *Interactive Learning Environments*, 1-15.