Exploring the Effects of Digital Game-Based Learning on Music Education

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Abstract

Digital game-based learning (DGBL) has been proven its potential and benefits in educational fields, including musical education. Yet, there remains a paucity of robust quantitative evidence on the effects of DGBL on enhancing students' piano performance, particularly in Chinese tertiary levels. Therefore, this current research aims to conduct a quasi-experimental design to investigate the impact of DGBL on Chinese university students' piano performance. Participants were recruited in a southern Chinese university with 30 intermediate-level piano major students. Whilst the experimental group received the DGBL during classes, the control one used the traditional method to learn piano. Quantitative findings showed that the posttest of the experimental group students was higher than their pretest. Moreover, students from the experimental group performed better than the control group. This study may shed some light on implicational practices for teachers and educators with regard to using DGBL to teach students piano.

Keywords: DGBL, music education, piano instruction, quantitative method

1. Introduction

In the world of education and learning, the digital revolution has introduced an era of unprecedented possibilities and difficulties. Among these, Digital Game-Based Learning (DGBL) stands apart as an appealing frontier that weds the involvement of gaming with academic results. There remains a paucity of robust quantitative evidence on the effects of DGBL on enhancing students' piano performance, particularly in Chinese tertiary levels, where typical approaches of music practices are still the dominant roles. As Liu et al. (2021) suggest, while DGBL has been embraced in various educational contexts, its application in improving piano performance amongst university trainees has not been thoroughly explored. This oversight is striking due to Chinese rich music heritage and the critical role of piano education and learning in its cultural and instructional establishments.

The possibility of DGBL to transform piano discovering right into a more engaging and reliable process can not be underrated. Previous studies indicated in the more comprehensive context of digital education and learning indicate considerable gains in learners interaction and inspiration (e.g., Nijs & Leman, 2014; Xie et al., 2022), but falls brief of supplying concrete proof within the domain name of piano performance. This inconsistency increases an essential question: Can DGBL improve piano efficiency amongst Chinese college student, or is its effectiveness limited to even more general educational end results? By contrasting the progress of students involved in DGBL with those sticking to standard learning methods, this research intends to supply robust, quantitative evidence to inform educators and policymakers. The hypothesis assisting this research study is that DGBL, with its immersive and interactive top qualities, will significantly improve piano performance abilities, using a beneficial supplement to traditional instructional approaches.

In short, this research study not only just deals with an essential space in the literature however additionally lines up with the more comprehensive instructional goals of boosting finding out results through ingenious methods.

By exploring the efficacy of DGBL in piano education, it looks for to lead the way for an extra effective and vibrant technique to musical training in China and beyond.

2. Theoretical Framework

This study is grounded in two theoretical foundations. We drew from both constructionism and embodied cognition. First, Constructionism (Papert & Harel, 1991) suggested that knowledge can be acquired through active knowledge artifact construction rather than passive acquisition. This idea is particularly relevant to DGBL as it creates an interactive learning environment in which learners are actively participating in constructing musical knowledge. For example, the DGBL platform enables learners to manipulate musical elements and create their own musical artifacts. This indicates the underpinning of constructionism and transforms the learning process from a passive recipient of information to a proactive endeavor. Thus, we believe that DGBL could be effective in music education, where the act of creating music is not only an approach to understand musical concepts, but a means to develop creativity and personal expression.

Second, embodied theory provides us a lens where we could understand the role of bodily interactions in learning. Embodied cognition claims that cognitive processes are deeply rooted in the interaction of body and the environment. This suggests that physical engagement is essential for effective learning (Wilson, 2002). In this study of DGBL, it means that the importance of tactile feedback and motor engagement. For instance, the platforms of DGBL could utilize tactile sensitive keyboards or incorporate rhythmic games that require physical interaction, which could promote the development of motor skills and rhythmic recognition and increase learners' overall engagement with the musical material.

3. Literature Review

Gordon (2007) posits effective learning through three major sequences, namely skill, content, and pattern. These three sequences were achieved through discernment and reasoning. Unlike discursive learning, which is characterized by students' awareness of learning objectives, inferential learning relies on learners' capability to identify independently and understand new knowledge without any teacher intervention as well as to obtain knowledge implicitly. Within discrimination learning phase, this is divided into five stages: oral, verbal association, partial synthesis, symbolic association, and synthesis. In the initial stage, namely the oral phase, instruction begins with the establishment of tones, which the teacher produces using neutral syllables. Subsequently, in the verbal association phase, learners associate tones and rhythms with rhyming syllables, and the teacher chants the identified tonal patterns using appropriate rhymes. In the second phase, the part-synthesis stage, learners identify tones from familiar patterns while the teacher leads them in comparison exercises to develop their ability to recognize tones by ear. In the symbol association stage, students encounter musical symbols for pitches they have previously learned by ear and incorporate the reading and writing of tonal symbols. Finally, there is the synthesis stage, where learners integrate partial synthesis and symbolic association skills to recognize tone rows, culminating in activities in which learners sing back, notate, and write tone patterns.

Game-based learning has been extensively studied in various educational fields, such as STEM, language education, and music education as well. Prior studies have proven that game-based learning is effective in fostering student engagement and facilitating the mastery of abstract concepts in an enjoyable manner (Margoudi et al., 2016). The engaging attributes of games have been recognized as effective tools for encouraging educational engagement in a fun-filled environment, such as simulation, visualization, and the ability to capture learners' interest (Robertson & Howells, 2008). As a result, game-based learning has been identified as an effective strategy for engaging student interest (Xie & Huang, 2022) and supporting the learning of techniques and contents in music (Lesser, 2020).

Music educational games have diverse forms, such as skill practice, melodic games, to name but a few. For instance, a study described one gamified approach to yangqin learning that included modules ranging from conceptual learning of music notation to sound recognition and self-assessment exercises (Yazdi & Lee, 2011). The integration of educational games was found to be effective in integrating theoretical and practical knowledge, maintaining student motivation, and improving musical comprehension.

More studies have delved into understanding interactive technology in music education, such as the use of Kinect to track learners' movements for the improvement practice methods, and the analysis of data to instruct students to play the clarinet (Nijs & Leman, 2014). Although no statistical significance was found between learners who used and did not use the learning system, there remained transferring impact of technological enhancement on conventional instructional methods within music learning was observed. A subsequent study by Chung and Wu (2017) examined the impact of game-based design on musical study by developing an application catered to musical lessons as well as evaluating its effectiveness. The game design included aspects of a steady beat tapping game, a pitch learning ladder game, and a marble game with melodic line concepts, suggesting that

game-based music learning fosters positive attitudes and encourages interactions between learners. It has also been proposed to use gamification to increase creativity and emotional engagement in preschoolers learning the basics of piano and music notation (Raziunaite et al., 2018). It has also been suggested to investigate the impact of the integration of music games on students' interest in music education.

In conclusion, effective games learning is needed to combine gamified components with educational results to enhance knowledge, and music pedagogical theories, musical skill development, together with procedures in learning should be considered concerning musical games. Game-based design combined with efficient assignments is demanding, since it requires a great deal of time, experience, and expertise. Despite the wealth of research supporting music learning, few studies have provided robust quantitative evidence to show the effectiveness of DGBL on learners' piano performance among Chinese university students. Therefore, the aim of this study was to investigate the effects of DGBL that can motivate students to engage in music learning and improve their academic performance.

3.1 Research Question

1) What is the effect of DGBL on students' piano performance among Chinese university students?

4. Methods

Given the purpose of this study, we adopted a quasi-experimental design (Johnson & Christensen, 2019) to examine the effectiveness of Digital Game-Based Learning (DGBL) in improving the piano efficiency skills of Chinese intermediate-level college student.

4.1 Participants

In this study, we recruited 30 intermediate-level piano major students by convenience sampling from a Chinese Southern university in the 2023-2024 fall semester. None of them have experienced DGBL prior to this study. These participants were then equally divided into two groups, namely the experimental group (i.e., DGBL) and the control group (i.e., traditional study). Prior to the intervention, they were assigned based on their previous standardized piano assessment scores to ensure that the two groups of students were at comparable levels.

4.2 Data Collection & Analysis

In order to answer research question 1, we utilized a standardized musical assessment provided by an expert who has over 15 years of piano teaching experience. Each student's performance was scored out of a total score of 100. For the quantitative analysis, we adopted a paired t-test and an independent t test to measure whether there is any significant difference using SPSS 27th version application.

4.3 Results

The experimental group had a mean score of 70.2 (SD = 8.4) on the initial assessment, which significantly improved to 82.5 (SD = 5.3) on the subsequent post-test assessment. A paired-samples t-test resulted in $t(14)$ = -5.76, $p < 0.001$, indicating a significant improvement in the group's performance. In contrast, the control group's mean score of 69.8 (SD = 7.9) on the pre-test was almost equal to that of the control group, while it increased slightly to 71.6 (SD 6.8) on the post-test assessment. However, as the results of the paired samples t-test ($t(14)$ = -1.23, $p = 0.236$) indicate, this slight increase did not reach the threshold for statistical significance and therefore exceeded the traditional p-value threshold of 0.05.

5. Conclusion

In this study, we have demonstrated the effect of DGBL as a novel approach embedded in traditional piano teaching classroom. Specifically, the experimental group using DGBL outperformed the control group in overall piano playing. Based on the quantitative finding, we hope to call for incorporation of DGBL into piano teaching, given that it shows the potential to revolutionize music education by making learning more interactive and effective. Our study emphasizes the importance of innovative educational practices to improve students' musical skills and demonstrates that DGBL can serve as an important complement to traditional teaching methods in music education. However, there still remain some limitations in the study. First, the sample size of this research is relatively small. Future research should continue to explore the wider use of DGBL at different levels of music training to fully understand its potential for developing musical skills.

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