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Integrating video-game music into Electone pedagogy in China: investigating learning process and outcomes

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Available studies have examined game's impact on music education from the learning outcome perspective. This sequential mixed-method design attempted to explore the impact of video-game music as Electone pedagogy on students' learning process and outcome. The study aimed to explore learners' motivation, engagement, skills, and creativity and teachers' challenges in applying this approach. The participants involved 50 students and 2 Electone teachers. The quantitative and qualitative data were collected using *t*-tests and interviews. The quantitative results exhibited that incorporating the video game Honor of King could boost students' levels of motivation, engagement, Electone skills, and creativity. The challenges to utilising this game were the necessity of aligning game mechanics with Electone theory. Students may occasionally prioritise gameplay over instrumental accuracy, which could potentially detract from the achievement of Electone learning objectives. This study also offers pedagogical implications on how to apply games as a pedagogical tool in the Electone course.

KEYWORDS

Electone pedagogy, video game, honor of kings, learning process, engagement, outcome

Introduction

Video game music as Electone pedagogy uses interactive digital games within educational music contexts to teach students' musical understanding of basic Electone technical skills, theory, notation, rhythm, and performance. In music education, video games offer a dynamic and engaging platform for teaching music theory, basic composition skills, and performance techniques in an engaging and accessible way (Clark et al., 2016). Music video games such as "Rock smith," "Honor of Kings," and "Sound Shapes" serve interactive environments where learners can learn musical instruments and music theory and even create their music compositions, fostering motivation and creativity for music in learners of various ages (Thompson, 2015; Robert et al., 2023). Music gamification can foster learners' motivation and retention, incentivizing them to reflect on their learning progress through game levels and challenges. This platform offers an enjoyable and rewarding learning adventure (Pelizzari, 2023).

As with many cultural dynamic changes and issues, the popularity of video games in education has yet to be universally accepted, and there has been much research into the risks of video games to children. Despite their benefit and popularity, music video games entail some negative impacts, especially for young learners. Prolonged exposure to computers or gadget screens often causes physical disruption, less enjoyment and monotony, passive music

appreciation, emphasis on hitting the right keys and notes rather than understanding the artistic depth of the music, and social isolation (Chen and Law, 2016). Behind the above controversies, integrating video games into music education provides an innovative pedagogical approach to engage students' learning activities and motivation and enhance learning outcomes. One of the integrations of applying video games in music education involves using music-based video games as interactive learning media for teaching basic music theory and skills. Games such as "Rock Smith," "Guitar Hero," "Journey" and "Bioshock Infinite" give students virtual songs and instruments that allow them to practice and learn various musical techniques, chord progressions, rhythm, dynamic, expression, and accuracy patterns in an engaging way (Whalen and Kallen, 2018). Music video games such as "Rock Band" and VR music applications such as "Tilt Brush" are considered to encourage teamwork, collaboration, and hands-on experience for composition and production (Hsu et al., 2016; Chen and Law, 2016).

However, challenges remain in fully integrating video games into music education as many previous studies endeavor to examine the impacts of music-based video games from the perspective of students' learning outcomes using pretest and posttest analysis. Understanding learners' learning outcomes could provide accurate data regarding learning improvement. However, theory often suggests that learning improvement cannot be separated from the learning process, such as engagement with the game and their motivation to use the game during learning activities (Li and Suh, 2021; del Barrio and Arús, 2024). The researchers often separate process from product and outcome of learning. Therefore, this research will explore how integrating music and video games using "Honor of King" facilitates Chinese learners' learning motivation, engagement, and basic technical skills in Electone Piano classes.

Literature review

Honor of kings as a MOBA game

Honor of Kings is a type of music game that commonly applies to a Multiplayer Online Battle Arena (MOBA) game (Qu et al., 2023). Tencent Games created this, and it is a very popular multiplayer feature that was globally played around the world when it was released in 2015 and was nominated as the most downloaded App worldwide. As of November 2020, this MOBA Honor of Kings game was reported

to have more than 100 million daily active players around the globe, and recently, it reached approximately 200 million users, making this game one of the hottest MOBA games in China (Qu et al., 2023). This game provides an engaging experience, making the players go deep into fantasy. Each player can select a roster of heroes with unique roles and abilities to create team players and engage in strategic battles against opponents. The game aims to beat and destroy its enemy's or opponents' base while defending one's own (Wei et al., 2022).

The great success of this "Honor of Kings" game can be reflected in its dynamic gameplay features with regular updates and high-quality graphics that introduce new game modes, heroes, and appearances. Because of its popularity and reputation, this game has also been built for a strong e-sport tournament and leagues around the globe (Qu et al., 2023; Wei et al., 2022). Figures 1a–c illustrate the player's feature of the bottom left steer button that can be utilized to steer the flexible movements of a hero, and the feature in the bottom-right set of buttons can be utilized to control the hero's diverse skills. To be the champion in this game, players must take action with strategic planning and defending and attacking abilities (Qu et al., 2023).

From a more specific perspective, this type of game has some challenges concerning generalization issues. The first issue refers to generalization across players of the opponent. This issue happens when the players try to control one target of the hero and its opponent. Players vary in different game levels (Wei et al., 2022). The game has more than 20 options of opponent heroes in the game arena, and the original game provides more than 100 heroes, each with different impacts in the game settings. Thus, based on these elegant features, Honor of Kings 3v3 and 5v5 modes will be applied in this current study.

Video games as pedagogical tools: theoretical framework

One of the most outstanding social theories posits that learning occurs when there is social interaction between learners and adult learners or more knowledgeable peers or others (Vygotsky, 1987). This theory also implies that learning, such as musical theories, knowledge, and technical skills, is facilitated by engaging in social interaction through mobile video games as they incorporate social elements of the game that promote multiplayer interaction (Robert et al., 2023). The concepts of social interaction theory are rooted in the study conducted by Vygotsky (1987) and facilitate as a core aspect of cognitive



FIGURE 1
The feature of honor of kings.

development theory. This theory underlines the significant focus on the critical role or function of social interactions that contribute to the process of learning. According to this notion, learners' cognitive development is connected to social interactions and cultural dimensions. The initiator of this theory [Vygotsky \(1987\)](#) also publicizes the concept of the “zone of proximal development” (ZPD), which pertains to the disparity between learner's independent capabilities and their potential or targeted abilities with the mediation or assistance from a more peers, knowledgeable individual or interaction through mobile video games as they incorporate social elements of the game that promote multiplayer interaction.

Stemming from the above sociocultural or interaction theory, this study will adopt this social interaction theory as one of some theories to understand and explore the effects of the MOBA video game platform called *Honor of Kings*, the learners' learning processes, development, and outcome among beginner Electone course students in Chinese primary education context. As [Vygotsky \(1987\)](#) posits, through social interaction, learners acquire knowledge and skills and undergo cognitive development through their engagements with peers and the surrounding environment. The process of acquiring new knowledge, skills, and behaviors is facilitated through engagement in social activities, which frequently involve the exchange of ideas, strategy, and information during game interaction. In addition, a current study [Chen \(2020\)](#) reported that the use of mobile games or video games has the potential to enhance learners' cognitive growth, musical theory, and skills, even in situations where physical distance becomes an obstacle. Multiplayer video games frequently require collaboration, strategic planning, and effective communication among players to accomplish shared objectives collectively.

Previous research on game as pedagogical tools in music education

Previous research applying games as a pedagogical tool in teaching music education has been classified into several issues, such as investigating the effectiveness of video games in music learning through experimental studies, exploring learners' motivational factors in utilizing games to learn a particular musical instrument, and analyzing the element of the game, benefits, and weaknesses without relating to specific musical learning.

The first category of research often examines the effectiveness of utilizing games in music teaching and learning ([Birch, 2017](#); [Eyles, 2018](#); [Guillén-Gámez et al., 2018](#)). The first study, [Birch \(2017\)](#), explored the potential of sound cloud for game-based learning in music education. He examines the effectiveness of this mobile App in enhancing students' musical skills. The participants involved high school students who applied this platform to record, share, and criticize students' musical skills and performance. The game was selected because of its ubiquity, accessibility, ease of use, and multiplayer features, which could provide peer learning and feedback. The findings showed that learners who learned music using this game performed better musical skills and had greater engagement than those with traditional teaching strategies. The game features allowed learning access and promoted a more participatory and interactive learning atmosphere, essential for practical music training. Overall, the findings [Birch \(2017\)](#) underscore the potential of game platforms to enrich music education by making learning more motivating, flexible, accessible, and interactive.

Similarly, [Chen \(2020\)](#) conducted a study using video games to compose musical notes and its impacts on students' motivation in popular music. The mobile game is named the *GarageBand* application. This game could be incorporated into popular music education to foster students' learning motivation and engagement. The study involved 159 participants from the secondary school level in China who participated in a 12-week virtual learning designed for teaching famous music composition using mobile games. The study results found that implementing mobile video games significantly facilitates secondary school students' motivation across several dimensions, such as intrinsic motivation, attainment value, utility value, and learning expectancy.

The majority of the studies mentioned above frequently distinguish between learning processes and learning outcomes, focusing on the impact of games on motivation or outcomes in isolation ([Robert et al., 2023](#)). Nevertheless, recent research has underscored the necessity of concurrently incorporating these perspectives. For example, [del Barrio and Arús \(2024\)](#) emphasised the importance of adjusting Electone paedagogy to the learning processes of children, rather than solely concentrating on outcomes. [Qu et al. \(2023\)](#) introduced novel datasets and analytical benchmarks for Honour of Kings, which serve to further illustrate the educational potential of video games beyond mere entertainment. [Manca and Delfino \(2021\)](#) similarly underscored the importance of adaptive gamification strategies in music education to accommodate a variety of learners.

Discussing those research coverages tends to separate learning outcomes from learning processes. They commonly examine the impact of game integration using a single perspective, such as game and learning outcome, game, and motivation. There has been relatively sparse research applying games examining comprehensive perspectives from a motivational lens, processes, and learning outcomes simultaneously under a single study. The following parts elaborate on these issues and propose novel research with a research novelty in the area of game and music education.

- 1 Is there any significant difference in learning motivation between the students who are taught using music video games in Electone courses and those students who are taught using traditional teaching methods?
- 2 Is there any significant difference in learning engagement level between the students who are taught using music video games in Electone courses and those students who are taught using the traditional teaching methods
- 3 Is there any significant difference in basic Electone (musical) skills between the students who are taught using music video games in Electone courses and those students who are taught using the traditional teaching methods
- 4 What challenges do the teachers face when implementing the music video game into Electone teaching and learning practices, and how do they overcome the challenges?

Method

Research design

This study explores the impact of music video games as Electone pedagogy to enhance beginner Electone students' learning motivation, engagement, technical skills, and challenges. A sequential mixed-method

paradigm combines the principles of a quasi-experimental approach (which involves the manipulation of the independent variable without random assignment to research participants or groups) with survey methods that collect data through observation and questionnaires (Creswell and Clark, 2017). In this study, a quasi-experimental approach using a music video game in an Electone class involves examining the impacts of the game on students' engagement and musical skills without random assignment to control and experimental groups. One group of students will apply music and video games as supplementary teaching media in the Electone learning sessions, while another group will be taught using traditional Electone teaching approaches. The control group will follow a standard pattern based on traditional Electone keyboard music practices. The experimental group will use the "Main Theme" from "Honor of Kings," a music video game composed by Hans Zimmer (Qu et al., 2023; Wei et al., 2022).

Study participants

The research participants consist of 50 students from grade five who learn the Electone keyboard and two Electone specialist music teachers who teach the two groups (experimental and control groups). The study participants were drawn from a public elementary school in China. This school is very popular with the Electone keyboard curriculum. Electone keyboard is a compulsory subject for students. The student participants needed to gain experience with various music-making practices using the proposed game in their school experience and elsewhere.

Since the research design is quasi-experimental, non-random sampling will be applied to select the two cohorts. The author selects and classifies two students into the experimental and control groups based on their abilities playing introductory Electone keyboards and their music cores from the music classroom.

Instrument

Pretest and posttest

Test is designed to evaluate students' musical understanding of basic Electone technical skills, theory, notation, and rhythm. The two groups (experimental and control groups) will be assigned to perform a Chinese folk song entitled 'Jasmine Flower.' This song is very well-known in Chinese culture, and its difficulty level has been adjusted to students' abilities and curriculum standards (Wang, 2019). The author has consulted this song to three music education experts to ensure the relevance, simplicity, familiarity, and difficulty levels for grade 5 based on the Chinese Musician Association's Electone (CMAE) grading exam materials (Wang, 2019).

In addition, to ensure consistency in scoring and assessment, the author will undergo training of two music experts to assess students' technical skills and creativity in playing the music using an Electone keyboard. The scoring rubrics consist of several indicators: (a) rhythm and timing over a sequence of notes, (b) Smooth and accurate transitions between notes sequences, (c) consistency in playing notes at the indicated dynamic levels, and (d) expressiveness of musicality and dynamics. These indicators are adopted from Cassidy and Paisley (2013) and Wang (2019) which together represent the Chinese basic standard of Electone keyboard training.

Self-reported questionnaire

A posttest self-reported questionnaire will be utilized to assess the students' self-reported account of applying music video game experience with Honor of Kings and Electone musical learning. The questionnaire is theoretically grounded in the previous literature review about the experience during Electone learning and video music gameplay (Cassidy and Paisley, 2013). This questionnaire will measure students' perceptions and feelings throughout all experiences and activities concerning criteria that meet the achievement of an engaging and enjoyable experience and motivation in learning Electone music using the game. The questionnaire was piloted to participants with characteristics similar to those of the experimental group and an online alpha score of 0.92.

Interview

A semi-structured interview will be carried out during the posttest session to attain a more in-depth understanding of the overall challenges and the solutions while applying music and video games as Electone pedagogy. The interview questions will be simultaneously applied to address the perceived teaching and learning potential of applying video music games in the current study as part of school curriculum implementation. The semi-structured interview consists of 5 questions, from teaching and learning experiences with music video-game as Electone pedagogy to perceived challenges and solutions in Electone classroom teaching and learning.

The items are derived based on theoretical frameworks such as Electone pedagogy, engagement theory, motivational theory, and positive psychological theory of motivation. The construction items are then reviewed by three experts who hold PhD and are professors in Electone music teaching and learning using the games. Revisions will be made based on the comments and notes from the three experts. The results of the tryout (inter-coder reliability scores) are presented in Table 1.

Data analysis

The author applies two different types of data analysis because the research questions, especially questions one to three, belong to quantitative experiment design, and question four requires a qualitative interview. Therefore, data analysis for the first category of experimental design with three quantitative research questions will be analyzed utilizing independent samples *t*-tests. This test to determine whether the differences in students' mean scores between the two cohorts are statistically significant.

Finally, for the analysis of research question number four on how the participants perceive challenges and solutions to address the challenges during learning Electone music with music video game Honor of Game, the author will use thematic analysis reflected in the interviews from students and teachers' experiences during teaching and learning processes. The thematic analysis were conducted based on the dimensions of motivation, engagement, skill, creativity, challenges, and solutions based on Creswell and Clark (2017). The process involved the transcription of interview recordings, the generation of initial codes, the grouping of codes into categories, the identification of themes related to motivation, engagement, skill, creativity, challenges, and

TABLE 1 Inter-coder reliability between coders for teachers' interview.

No	Item category	Kappa
1	Can you describe your teaching experience in the Electone class? Did you enjoy the teaching process of Electone composing with <i>the game of Honor of Kings</i> ?	0.90
2	What is the difference between teaching using <i>the game of Honor of Kings</i> and everyday teaching in an Electone music classroom? Which one do you prefer? Why?	0.92
3	Do you think using <i>the game of Honor of Kings</i> is an effective way of teaching Electone music class? Why?	0.86
4	Do you face difficulties teaching Electone class using <i>the game of Honor of Kings</i> and what are they? How would you solve the challenging parts?	0.90
5	What do you think about using <i>the game of Honor of Kings</i> as a pedagogical tool in Electone class?	0.94

solutions, and the verification of coding consistency through inter-coder reliability checks by three experts. The credibility and trustworthiness of the qualitative findings were guaranteed by this step.

Result

RQ1: Is there any significant difference in learning motivation level between the students taught using music and video games in Electone courses and those taught using traditional teaching methods?

In order to address this research question on whether there is a significant difference in learning motivation level between the students who are taught using music video games in Electone courses and those students who are taught using the traditional teaching methods, the author would like to explain the analysis procedure of conducting quasi-experimental research especially for homogeneity of the two groups: experimental and control group, conducted *t*-test to understand the differences of learners' motivational level. Tables 2, 3 illustrate the results of analysis for the mean differences and independent *t*-test results for both groups.

Table 2 illustrates that the students who learned Electone keyboard music using the game Honor of Kings reached a mean score of 41.85 in the pretest score with the score of standard deviation (SD) = 5.42, while their posttest mean score achieved 66.25 (SD) = 10.90. Conversely, the students who learned Electone keyboard music using traditional teaching, gained a mean of 39.65 with SD = 7.68, while their mean scores of the posttest were 51.29 with SD = 12.91.

Table 3 reports the result of the independent *t*-test of the two groups. This score reported a significant difference in the motivational level index or score between the students who were taught Electone class using games and performed better than those in the traditional Electone class. In comparison to the traditional cohort, students in the experimental group who learned Electone using Honour of Kings demonstrated significantly higher levels of

motivation. The experimental group's mean difference was 15.07 points, suggesting that the integration of Honour of Kings into Electone pedagogy effectively increased students' motivation to learn.

RQ2: Is there any significant difference in learning engagement level between the students who are taught using music and video games in Electone courses and those students who are taught using the traditional teaching methods.

To answer the second research question, the author also applied two statistical analyses using mean and *t*-tests, just like the first research question. Tables 4, 5 illustrate the analysis results for the mean differences and independent *t*-test results for both groups in terms of learners' engagement levels.

Table 4 illustrates that the students who learned Electone keyboard music using the game Honor of Kings reached a mean score of 45.65 in the pretest score with the score of standard deviation (SD) = 5.47, while their posttest mean score achieved 71.50 (SD) = 10.39. Conversely, the students who learned Electone keyboard music using traditional teaching, gained a mean of 40.88 with SD = 7.69, while their mean scores of the posttest were 56.46 with SD = 12.41.

Table 5 reports the results of the independent *t*-test of the two groups. The significance value level (sig. 2- two-tailed) is $< 0.000 < 0.05$ from the table. It indicated convincing data that H_0 was rejected, and H_a was accepted. This score reported the fact that there was a significant difference between the students who were taught Electone class in terms of their engagement levels.

RQ3: Is there any significant difference in basic Electone (musical) skills between the students who are taught using music and video games in Electone courses and those students who are taught using the traditional teaching methods.

To analyze the significant differences in Electone's skills and creativity, the author asked the two groups to perform classical Chinese music, as mentioned in the previous chapters. Then, the two Electone teachers assessed the students' performance using the pre-determined rubric (Electone skills and creativity scoring rubric). Tables 6, 7 illustrate the results of the analysis of the mean differences and independent *t*-test results for both groups regarding their Electone performance skills and creativity.

Table 6 illustrates that the students who learned Electone keyboard music using the game Honor of Kings reached a mean score of 61.05 in the pretest score with the score of standard deviation (SD) = 5.99, while their posttest mean score achieved 86.25 (SD) = 11.90. Conversely, the students who learned Electone keyboard music using traditional teaching, gained a mean of 60.65 with SD = 7.90, while their mean scores of the posttest were 65.77 with SD = 12.61.

Table 7 reports the results of the independent *t*-test of the two groups. The significance value level (sig. 2- two-tailed) is $< 0.000 < 0.05$ from the table. This score reported the fact that there was a significant difference between the students who were taught Electone class using games and those who had higher musical skills and creativity than those in the traditional group.

TABLE 2 Comparison of average learning motivation scores.

Group	N	Pretest	Posttest	Change	Std deviation	
					Pretest	Posttest
Learning Electone with the game	25	41.85	66.25	25.60	5.42	10.90
Learning Electone with the traditional approach	25	39.65	51.29	11.62	7.68	12.91
Difference	0	1.20	15.06	+13.98		

TABLE 3 The results of the independent t-test for learners’ motivation level.

Learners’ motivation level	Levene’s test					
	F	Sig	T	Sig. (2-tailed)	Mean scores	Mean score difference
Equal variance assumed	2.142	0.148	5.038	0.000	66.28	15.07
Equal variances not assumed			5.068	0.000	51.32	15.07

TABLE 4 Mean scores differences in engagement level.

Group	N	Pretest	Posttest	Change	Std deviation	
					Pretest	Posttest
Learning Electone with the game	25	45.65	71.50	25.85	5.47	10.70
Learning Electone with the traditional approach	25	40.88	56.34	15.46	7.69	12.41
Difference	0	4.77	15.16	+10.39		

TABLE 5 The results of the independent t-test of learners’ engagement level.

Learners’ engagement level	Levene’s test					
	F	Sig	T	Sig. (2-tailed)	Mean scores	Mean score difference
Equal variance assumed	2.323	0.135	5.088	0.000	71.50	14.23
Equal variances not assumed			5.078	0.000	56.34	14.57

RQ4: What challenges do the teachers and students face when implementing the music video game into Electone teaching and learning practices, and how do they overcome the challenges?

To address this question, the author presented the results of an interview with the two Electone teachers to understand their challenges and ways of applying the games as Electone pedagogy.

As stated in the previous chapter, the Electone keyboard teachers involve two teachers: Teacher Lao (anonymous) and Teacher Shu (anonymous). Teacher Lao was a young man who was 38 years old and had been teaching Electone keyboard for more than 5 years. They had a master’s degree in music education from a reputable university in Chinese. The next is Teacher Shu; she is a young woman who is 34 years old. She had been teaching for more than 5 years and holds an MA degree in music education from the same university as the first research participants. The interview was delivered in Chinese for the participants’ convenience and to avoid misunderstanding the interview questions’ contents.

Analysis of interview with teacher 1: Mr. Lao

The first interview with Teacher 1 focused on his experience applying the Honor of Kings game in his Electone class. Teacher 1, Mr. Lao, believed that teaching Electone music through music games, Honor of King has proven to be one of the most effective strategies for him and his students. He mentioned, “One of the main advantages is the increased level of engagement from the students. “Music video games could transform his traditional Electone lessons into more interactive and enjoyable activities, allowing his students to grasp comprehensive musical theories and concepts quickly. For instance, the game’s rhythm could help his students understand various time signatures and improve their beat or timing. He also noted that his students often indicated improvement in rhythm, sensing, and coordination while participating in his Electone teaching activities.

Mr. Lao reported that his students, who usually felt shy or hesitant in his traditional Electone classroom, often came out of their shells and contributed more during the implementation of video-game Honor of Kings activities, leading to a more dynamic

TABLE 6 Mean scores differences of learners’ musical skills and creativity.

Group	N	Pretest	Posttest	Change	Std deviation	
					Pretest	Posttest
Learning Electone with the game	25	61.05	86.25	25.20	5.99	11.90
Learning Electone with the traditional approach	25	60.65	65.77	5.12	7.90	12.61
Difference	0	0.40	20.48	+20.08		

TABLE 7 The results of the independent t-test of learners’ musical skills and creativity.

Learners’ musical skills and creativity	Levene’s test					
	F	Sig	T	Sig. (2-tailed)	Mean scores	Mean score difference
Equal variance assumed	2.213	0.169	5.092	0.000	86.25	15.72
Equal variances not assumed			5.084	0.000	65.77	15.42

and inclusive Electone classroom. Further, he appreciated the flexibility that the music games Honor of King offered in tailoring lessons to students’ learning and target needs. By observing his students’ Electone skills and performance, he could identify areas where his students might be struggling. For example, Mr. Lao might notice one of his students having difficulty with finger dexterity during gameplay, and he then incorporated specific training and exercises to respond to this issue.

In responding to the second and third research questions about the differences between teaching English utilizing traditional Electone teaching and games as Electone pedagogy and its effectiveness, Teacher 1, Mr. Lao, reported that teaching Electone using his old approach or traditional method, he typically focused on Electone methodical practice and repetition only based on his musical expertise and experience. Conversely, when he applied the game in his Electone class, he felt that his Electone class was more engaging and motivating. He also felt that his new approach of applying games in his Electone class could develop students’ Electone technical skills and discipline.

This game introduced features of fun and competition that resonated with his students, making them more eager to participate and practice in the classroom. He found that this game could turn routine exercises into exciting and challenging tasks, which not only made learning more fun and more accessible but also encouraged them to learn more frequently, with tremendous enthusiasm, and more substantial progress in their Electone musical abilities. Another core difference is that he highlighted the game’s impact on students’ confidence and creativity.

In other veins, music video games Honor of Kings provided a more exploratory individual learning environment. Mr. Lao observed that his students are more willing to take risks and experiment with their playing when engaged in games, leading to more creative musical expression and a more holistic understanding of music. This approach also supported his students’ fostering of repetitive practice with mistakes, perceiving them as the subject or core of the learning process rather than the learning objects.

Regarding interview questions four and five, Teacher 1, Mr. Lao, expressed his efforts in addressing the challenges of applying the music video game Honor of King to his Electone class. The results of the analysis of the interview with Mr. Lao, he mentioned that there

were three potential challenges or three main themes of applying music video games in Honor of Kings in his Electone class, namely: (a) balancing between game features and Electone learning, (b) addressing individual differentiated learning inclusivity, (c) potential of overreliance.

Analysis of interview with teacher 2: Ms. Shu

Ms. Shu focused on her experience applying the Honor of Kings game in his Electone class. Teacher 2, Ms. Shu, also believed that teaching Electone music using the games Honor of King could be an effective teaching pedagogy for learning Electone class. Like the first Teacher 1 and Teacher 2, Ms. Shu also positively responded to implementing the game Honor of Kings in her Electone class. The interview result analysis is presented below.

First, for interview question number 1 and 2, Teacher 2, Ms. Shu, reported her experience after applying the game Honor of Kings in her Electone class and the differences between teaching Electone music with the game and traditional approaches. Teacher 2, Ms. Shu, who had successfully integrated the game “Honor of Kings” into her Electone course, reported a range of positive experiences that underscored the potential of the game as a helpful educational learning media. One prominent advantage is the improvement of students’ learning engagement in his Electone class. She also reported that the game provided interactive and immersive features that could captivate students’ motivation and attention. Ms. Shu noticed that her students are more enthusiastic about participating in her Electone classes and willing to invest time and effort into practicing Electone.

Another good experience reported by Teacher 2, Ms. Shu, was the enhancement of students’ Electone musical skills through the game’s interactive features and challenges. The game “Honor of Kings” needed the players to have strategic and quick thinking, quick reflexes, and precise timing practices; these elements became essential for learning the Electone music class. She also found that her students, who often played the game Honor of Kings, revealed noticeable progress in their Electone skills in coordination, balance, rhythm, and overall Electone musicality.

Next, the game “Honor of Kings” also provided a platform for multiplayer elements for collaborative learning. This feature became a significant element for learners to practice problem-solving and collaborative learning. This element also fostered teamwork and learners’ communication ability. In the context of Electone learning, this collaboration could be translated into collaborative musical Electone projects where her students could coordinate and synchronize their playing to achieve a shared learning goal. Teachers.

Second, in interview question number 3 regarding the effectiveness of utilizing the game Honor of Kings in her Electone class, Teacher 2, Ms. Shu, reported that the utilization of the game “Honor of Kings” in her Electone class could promote an effective Electone teaching strategy, enhancing both students’ motivation, engagement, and learning outcomes. One of the most significant aspects of the effectiveness of the game Honor of King was its ability to captivate students’ interest and autonomy. Meanwhile, her traditional Electone music teaching approach could often fail to attract students’ learning engagement, especially for students with learning preferences for digital and interactive game content. By incorporating the game “Honor of Kings,” Ms. Shu could tap into students’ familiarity and enthusiasm for learning with that game, creating more fun and engaging learning activities.

Third, in interview questions number four and five concerning the difficulties in applying the game Honor of King for Electone pedagogy, Teacher 2, Ms. Shu, faced a unique set of difficulties or challenges that were generated from balancing the Electone music value of the game in its games as an entertainment tool. One main difficulty was that her students remained stay-tuned on the Electone learning purposes rather than playing the game itself. “Honor of Kings,” a viral music video game, could easily distract her students from the main Electone learning goal.

To address these issues or difficulties, Ms. Shu suggested adopting several teaching strategies, such as setting clear Electone learning objectives and explicitly linking game features to maintain the focus. She also suggested designing specific learning tasks within the “Honor of Kings” game that required her students to utilize musical knowledge and skills learned in her Electone classes.

Discussion

Learning motivation in gamified Electone pedagogy

Regarding the result analysis of the first research question, whether the students who learned Election using the game as a learning tool had higher motivation levels than the students who learned Electone using the traditional approach. The findings indicated that applying the game of Honor of Kings could enhance learners’ learning motivation in Electone class. In this case, learners’ learning motivation was reflected in five dimensions: intrinsic value, attainment value, utility value, perceived cost, and expectancy (Chen, 2020). From the mean score and *t*-test results, the findings revealed that the integration of games as Electone pedagogy could significantly foster students’ motivation levels. The mean differences and *t*-tests have positively verified the findings. In this part, we do not analyze the dimension of motivation separately because the author’s study was already comprehensive, exploring motivation, the

learning process, and the outcome at the same time (Robert et al., 2023). Therefore, this limitation could be recommended for future studies if they want to elaborate on which dimension has a higher and lower contribution to motivation level.

The results of this study align with Vygotsky’s social interaction theory, particularly the concept of the zone of proximal development (ZPD), which emphasizes the importance of social interaction and environmental support in the music learning process. The increased student motivation and engagement through the integration of the video game ‘Honor of Kings’ suggests that game-based interactions can serve as an effective form of scaffolding. These findings support the research of Chen (2020) who highlighted the role of mobile games in enhancing motivation to learn music, as well as Carrión Candel and Colmenero (2022) who emphasized the importance of teacher training to maximize gamification. Furthermore, these results align with Manca and Delfino (2021) who emphasized adaptive gamification strategies to meet the needs of diverse students. Thus, this study strengthens empirical evidence that gamification in music education not only improves learning outcomes but also students’ cognitive and affective processes.

Research on the positive impact of applying video games on learners’ learning motivation has indicated similarities and differences in the research findings. The most common finding across a plethora of studies is that video learning elements can enhance learners’ learning motivation. For example, (Kühn et al., 2014) found that incorporating video game elements into music learning could significantly enhance students’ learning practice time and enjoyment. This enhancement in motivation becomes a crucial indicator as it gears to more frequent practice sessions, which are very important for developing learners’ musical abilities (Lyu and Sokolova, 2023).

Another relevant finding is the importance of automatic feedback in maintaining students’ learning motivation. Video games could provide immediate or real-time feedback, which is very important in Electone learning. For example, Chen and Law (2016) found that students Electone learning through video-game media that provided immediate feedback on their Electone learning were more motivated than those who were learning Electone using the traditional approach. This instant feedback could help students identify and correct their mistakes, guiding them to more motivated learning activities.

Behind the above findings, however, there are several notable differences in how available studies report the effects of video game learning on students’ learning motivation based on the students’ game experience and their ages. For example, Hamari et al., (2016) reported that younger Electone students or beginning learners revealed significant levels of motivation when video game elements were introduced during the teaching and learning processes. The research contribution or novelty of video game learning was particularly appealing features of the game, making the learning activities more flexible and engaging. Conversely, older students with more advanced musical experience reported a different level of increased learning motivation. They reported that they often preferred traditional learning that offered more in-depth musical comprehension and learning challenges (Edward et al., 2018).

The finding in the current study highlighted the implementation of video-game Honor of Kings as a pedagogical tool to improve students’ motivation level in Electone class. The findings indicated that

the student's level of motivation could significantly increase after they learn Electone using video games. In the previous findings, most researchers applied different motivation questionnaires using different theoretical frameworks of motivation dimension. Therefore, the findings of this study have some differences regarding the dimension of motivational level compared to the previous findings.

Engagement through play: increased participation with honor of kings

Previous studies examining the positive impacts of video games on students' learning engagement in the Electone music class—a sophisticated keyboard electronic organ—show mixed research results. One remaining finding across different studies is that video games could significantly foster students' learning engagement. The reasons behind these findings indicated similar findings to motivation issues. The students felt more engaged after learning the lesson using *Gathe Me* because of the exciting features and game elements, the narrative of the game, and the positive aspects. For example, [Manca and Delfino \(2021\)](#) conducted a study that applied video-game elements like badges, points, and interactive features into Electone music classes could significantly increase learners' learning engagement levels. These video-game elements offered a sense of progression, accomplishment, and achievement, which made the students actively engaged in their Electone learning activities.

In response to the [Chen and Law \(2016\)](#) research findings, the authors argue that immediate feedback can foster students' ability to master Electone skills and creativity. It happens when the students try to play the game many times and receive immediate feedback for their learning improvement—receiving immediate feedback individually from the game feature versus collectively from the classroom causes different consequences. When the students receive learning feedback individually from the game, they do not feel anxiety about making mistakes and are psychologically more relaxed as no one knows it. Conversely, in the context of the classroom, the students have high anxiety when the teacher corrects their mistakes or errors in front of their peers or classmates, as other students will know their learning deficiencies. Consequently, students prefer video games as learning media rather than traditional classroom teaching.

However, there remain notable differences in how previous research reports the effects of video games on students' learning engagement, especially concerning the student's gender, age, and prior musical experiences ([Crawford, 2018](#)). A study [Crawford \(2018\)](#) reported that younger music learners or beginners in Electone courses were more engaged when learning Electone was exposed to game elements. The video game's dynamic features and playful elements captured students' learning interest and made the music learning class more appealing. Conversely, older female students with more advanced Electone musical skills did not reveal the same increase in their learning engagement.

Since the author did not analyze each variable, the dominant category of engagement dimension could not be generalized in this study. In discussing the findings, the author needed help locating the instrument applied by other researchers in the research findings. As a result, it is hard to differentiate between the author and other previous studies regarding the dimension of engagement. If it is compared to previous findings, the present study's findings are similar to other findings, indicating increased engagement.

Video games enhance Electone skills and creativity

Previous studies also confirmed that incorporating video games into Electone courses has positively affected students' Electone skill development. They reported that video games can be applied as powerful learning tools or media to foster musical skills, like musical abilities, performance, and accuracy of notation. The commonalities of the findings indicated that video games could be specifically beneficial for Electone skill development, such as the incorporation of elements of the rhythm of the Electone derived from the game, timing, and hand-eye coordination, which are essential for mastering the Electone conception. A quantitative study conducted by [Madureira and Mendes \(2021\)](#) found that rhythm-based video games such as “Dance-Dance Revolution” and “Rhythm Heaven” were very beneficial in improving students' Electone timing accuracy and synchronization abilities, directly translating to better performance on Electone musical arrangement that requires accurate skill coordination ([Madureira and Mendes, 2021](#)).

Beyond the similarities of findings, there are several differences in the integration of video games into Electone learning. One area of difference lies in the extent to which different types of video games impact different musical skills and creativity. For example, when Electone rhythm and pitch-based video games reveal positive merits for Electone technical skills, their impact on learners' creative aspects of Electone music composition, such as improvisation and composition, is less reported in the current studies ([Gee, 2003](#)), for example, he reported that video-game in his study result could not develop learners' higher-order Electone musical creativity, but other research findings indicate that certain video games can foster students' creativity in Electone composition through exploratory and intensive learning experiences ([Frischen et al., 2019](#)).

Through more comprehensive research, as the author stated in the research gap, this study shows that integrating video-game Honor of Kings (different from other games in the previous studies) could facilitate or enhance students' learning outcomes and learning motivation and process. Previous research findings should have simultaneously addressed the impact of video games on comprehensive variables such as motivation, process, and outcome. However, they tend to separate the variable into the most minor units. Therefore, they could not provide comprehensive findings in their previous studies. Again, this study provides novelty, especially examining the integration of video games into learning motivation, learning process, and outcome simultaneously.

Challenges and solutions in integrating games into Electone education

The findings indicated that both Electone teachers and students had similarities and differences in the challenges and solutions. The Electone teachers expressed their challenges and solutions to curriculum issues and learning objectives. They suggested integrating video games into Electone teaching and learning should be relevant to the curriculum. Therefore, finding relevant game features that match the curriculum should be considered. They also suggested combining video games and

traditional teaching approaches in the Electone classes to learn complex Electone composition and notation.

The above findings. It reveals several similarities and differences with previous findings and the alternative solutions to the challenges above. The most common challenges are the technical and logistical complexity of integrating video-game elements into traditional music Electone learning frameworks. A study [Manca and Delfino \(2021\)](#) noted that most Electone music teachers need more technical skills and resources to incorporate video game-based learning media. Most needed to gain experience applying video games to their Electone classes. They need to obtain game literacy training in order to apply video game pedagogy. This difficulty occurs specifically in the context of where Electone teachers are unfamiliar with digital game technologies or have limited access to digital game technologies ([Crawford et al., 2019](#); [Hamari et al., 2017](#)).

Some researchers have indicated some alternative solutions to address these challenges. The first solution is to provide comprehensive training for music Electone teachers before they utilize video games in their Electone teaching and learning activities [Carrión Candel and Colmenero \(2022\)](#). Professional learning activities such as seminars, workshops, and other professional development programs can effectively equip Electone teachers with the adequate skills to incorporate video games into their Electone curriculum. These models of professional training can be beneficial for Electone teachers to understand how to balance the utilization of video-game elements into Electone pedagogy for optimum learning process and outcome. Another solution is that the design of video game learning should be adaptable to learners' learning preferences, styles, and needs. For example, a study conducted by [Manca and Delfino \(2021\)](#) reported that using adaptable video-game learning tools suitable for learners' learning preferences and styles could enhance their learning process and outcome.

The main contribution of this study lies in its comprehensive approach, assessing motivation, engagement, skills, and creativity simultaneously within a single Electone pedagogical framework. This differs from most previous studies, which tend to examine these variables separately. Thus, this study provides novelty in the literature on gamification of music education. Furthermore, the results challenge the long-held view that games contribute little to musical creativity. Recent research suggests the opposite: [Lyu and Sokolova \(2023\)](#) reported that a gamified board game significantly improved elementary school students' musical literacy and creativity, while [Yu et al. \(2024\)](#) demonstrated how a LEGO-based gamification system (ArchiTone) can enhance both theoretical understanding and student engagement. Consistent with these findings, this study provides empirical evidence that Honor of Kings not only improves Electone technical skills but also fosters students' creative musical expression. This confirms that a game-based approach can enrich music education in multiple dimensions, going beyond technical training to fostering creativity.

Conclusion

This study addressed four research questions: the impact of video-game as Electone pedagogy on students' learning motivation, engagement, and skills in Electone classes in the Chinese music education context, as

well as challenges and potential solutions. The findings indicated that incorporating the game Honor of King could foster students' levels of motivation, engagement, Electone skills, challenges, and way out for the teaching and learning difficulties in integrating both variables of video-game and Electone pedagogy. The findings indicate that incorporating video-game Honor of King could enhance students' levels of motivation and engagement. Video game integration also increased students' learning outcomes, especially Electone skills and creativity. The video-game instructional approach makes repetitive learning practice more disciplining, encouraging students to refine their Electone skills effectively. The instant feedback from the features of the video game can help students analyze areas for musical improvement and track their Electone learning progress, promoting and supporting continuous skill development and creativity. Overall, the integration of the video game Honor of Kings into an Electone course or class provides a more comprehensive pedagogical strategy (than the traditional Electone teaching and learning) that fosters students' cognitive development, motivates affective learning engagement, promotes positive behavioral dimension, fosters both Electone technical skill and creativity.

Data availability statement

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

Ethics statement

The studies involving humans were approved by Dr. Akharasit Bunsongthae, Institute of Science Innovation and Culture Rajamangala University of Technology Krungthep. The studies were conducted in accordance with the local legislation and institutional requirements. The participants provided their written informed consent to participate in this study.

Author contributions

JW: Data curation, Investigation, Writing – original draft, Writing – review & editing. SS: Project administration, Resources, Validation, Visualization, Writing – original draft, Writing – review & editing. YL: Conceptualization, Methodology, Supervision, Writing – original draft, Writing – review & editing. TL: Funding acquisition, Software, Writing – original draft, Writing – review & editing.

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