COGNITIVE SCIENCES AND HUMAN DEVELOPMENT

Gamified Learning Intervention to Promote Music Literacy and Creativity in Elementary Music Education

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ABSTRACT

Music education often emphasises the acquisition of practical components, with students assessed on their ability to handle and operate musical instruments. The theoretical aspects of music education, particularly music theory, have been relegated to a secondary role. However, recent research has shown that music creativity, including composition, improvisation, performance of composed music, and ideation, is a core element in music studies. Teaching music theory is becoming less popular among music teachers, and consequently, the stigma associated with learning music theory limits students' ability to explore music independently. This study proposes a gamified learning intervention through Music Rhythm Tour Board Game to promote music literacy and creativity in elementary music education. Observations on players' behaviour were conducted to test the efficacy of the board game in promoting music composition. The gameplay analysis showed how the intervention successfully reduced the stigma associated with constructing rhythmic phrases, facilitating a smoother transition to music composition and rhythmic sight reading (kinetic responses of players). The findings showed that Music Rhythm Board Game effectively reflects the potential of capitalising on collaborative structures of cooperative board games. It provides a promising avenue for improving music education by encouraging students to develop their creativity and musical skills through gamified learning.

Keywords: music education, music theory, gamified learning, board games, music board games

1   INTRODUCTION

Music education has not been emphasised much, let alone the effort to promote creativity through music education (Mustafa, 2018). It is utilised as a tool to promote the learning of language subjects, especially English (Abdullah, 2021). The current music education, especially in private music studios and tuition centres, emphasises its practical components, where students are assessed on how well they handle and operate musical instruments to produce good sound. The phenomenon has resulted in segregating practical and theoretical aspects of music learning. In comparison, music theory exam structures were revamped to test students' ability to answer right or wrong questions. The recent removal of the "rhythm writing, melody writing and word settings component" from the Associated Board Royal School of Music (ABRSM) music theory exam syllabus has been quite disappointing (ABRSM, 2018). A study among higher music education students appraised four main music activities: composition, improvisation, performance of composed music, and ideation (i.e., creating ideas for making music) (Huovinen, 2021) as core elements in music studies. Based upon an informal observation by the authors and personal interviews (Robert, Personal Communication, 2023), it was found that music theory teaching is gradually dwindling. Teaching these topics is timely, coupled with so little exposure for learners to experience creativity, would negatively impact music learning in many ways.

This matter is complicated by the "play by ear" courses available online, which promote instrumental learning without music theory are increasing. Such a learning approach may benefit students in preparation for performance but limits learners to explore more music independently (Cremata, 2013). Rhythm is music's most primal element and the fundamental layer of music composition skills. It is most commonly taught in tandem with pitch alongside psychomotor skills during lessons. Furthermore, music theory is often associated with boredom, and the lack of readiness by students to learn, considering the amount of information they have to absorb in a lesson (Ericplayskeys, 2021), will only add to the unfavourable stigma.

To address these issues, an intervention through gamified learning was initiated in the hope of reducing the stigma of learning music literacy at its most elementary level, at the same time, opening a pathway for a smoother transition to music compositional skills.

2   BACKGROUND

Gamified learning involves incorporating game-like elements into traditional, non-game educational settings (Miller, 2014, pp.188-190). Kapp (2012) defines gamification as the application of game mechanics, aesthetics, and thinking to non-game contexts in order to motivate and engage individuals in problem-solving and achieving goals (i.e., "winning the game"). Gamification uses game design principles to enhance learning experiences and increase learning motivations. Thus, gamified learning encompasses a wide range of instructional strategies for this research a) interaction (Sfikas et al., 2020; Khaleel et al., 2018); b) tracking progress (Glover, 2013); c) collaboration (Anania et al., 2016); and d) fun elements (Khaleel et al., 2018) were considered.

Interaction refers to the reciprocal of two encounters that requires at least two objects (entity) where both are influential towards each other (Wagner, 1994). While according to Brym (2018), social interactions involve reciprocal activities during a social event. Both statements suggest strong engagement or involvement of an individual with others in their surroundings, typically involving exchanging information, ideas, and emotions through verbal and nonverbal communication. Wagner (1994) further explains that interactions in a learning environment are directive towards attaining specific goals through instructions.

Player engagement in gamified learning is a critical factor in making it enjoyable. Minecraft and Roblox are examples of highly interactive online games, whereas Settlers of Catan, Ticket to Ride, and Pandemic are examples of highly interactive board games, which explains their popularity due to the magnitude of interactions involved (Khaleel et al., 2018). Some interactions are triggered by Artificial agents (AI) built into the game mechanics. An example is the Pandemic Board Game. The Artificial Agent's actions of spreading diseases create a sense of urgency for players to contain and defeat the AI agent. It forces the players to communicate and collaborate. On the other hand, Minecraft requires players to collaborate on a construction project, share resources, or both.

Progress tracking also plays an integral part in gamification, giving players a sense of achievement. Players progress further from the game's starting point as the difficulty level increases. Often more variables will be introduced as the difficulty level increases. Gameplay developers will study how variables are introduced to scaffold players' knowledge helping them to progress. In addition, progress tracking also reduces cognitive load by helping players to identify remaining tasks in completing the game. Otherwise, noticing the winning conditions would be too tricky (Glover, 2013). In the case of computer games, tracking is done automatically by the game system, whereas physical board games require players to manually track game progress, usually at a specially designated area on the board.

Collaborative gaming, including video and board games, has become increasingly popular worldwide. Popular video game titles such as Defence of the Ancients (DotA), Genshin Impact, and PUBG: Battleground, and cooperative board games like Pandemic and Betrayal at Baldur's Gate, emphasise collaboration among players. These games have unique game mechanics and engaging gameplay, but their defining feature is their focus on teamwork and joint problem-solving. For example, in the Pandemic Board Game, players work together to prevent the spread of a deadly virus, each taking on unique roles and using their strengths to overcome the challenges presented. Similarly, in DotA, players can join a game as a team or opposing teams, working together to devise strategies and assist one another in achieving common objectives. Such collaborative gameplay promotes teamwork, decision-making, problem-solving, and analytical thinking skills among players (Sörman et al., 2022).

From an educational perspective, the collaborative nature of these games has contributed to developing the theoretical framework of collaborative learning. Collaborative learning is an educational approach emphasising active participation, group work, and cooperative problem-solving to promote learning outcomes. Therefore, collaborative gaming evokes essential language, dialogue, negotiation, and agreement skills synonymous with interactions in a learning environment (Wagner, 1994). These skills form one core value, "making meaning," through group

cognition in any gamified environment, binding the meaning of learning, as exemplified through the collaborative nature of this genre.

Khaleel et al. (2018) found that gamified learning can promote a sense of user enjoyment, which has been shown to affect learning positively. Specifically, their research suggests that users had positive experiences and enjoyed using gamified learning tools, highlighting the importance of the enjoyment factor in promoting effective learning. One key aspect of gamification is using rewards and feedback systems, which can motivate and engage learners. For example, Duolingo, a language-learning app, rewards learners with badges and points for completing language exercises and achieving certain milestones. The app also provides immediate feedback on learners' progress and performance, which can help to sustain motivation and improve learning outcomes. According to Llorens-Largo et al. (2016), all of these trigger the release of dopamine precisely at successful attempts that causes positive feelings, which translate to fun.

Game aesthetics (Hunicke et al., 2004), such as storytelling and narrative, are also essential sources of fun in gamified learning. These elements provide context and purpose during the learning experience and can help learners connect with the content more profoundly. For example, Minecraft: Education Edition, a popular game-based learning platform, uses storytelling and interactive gameplay to teach various subjects, from history and geography to coding and problem-solving.

2.1   Board Games

Board games involve placing, moving, or removing pieces on a game board, using specific game mechanics to determine how they are moved in a particular way. For example, snake and ladder use roll and move game mechanics to determine the number of moves a player requires while following the pattern designed on the board. Some board games use multiple game mechanics, such as Ticket To Ride, which uses set collection, area control, and route building as their game mechanics. A successful board game design requires strict scrutiny from various standpoints, namely its entertainment, motivational, and pedagogical factors. The MDA framework (Hunicke et al., 2004) enlisted the nature of game mechanics as "Mechanics, Dynamic and Aesthetics". An online search revealed an abundance list of game mechanics, and each game mechanic corresponds to specific thinking skills (Suttie et al., 2012).

Mechanics is like the blueprint of a game design that defines the various actions, behaviour and control mechanisms afforded to the players (Hunicke et al., 2004). different games can use different combinations of mechanics to create unique gameplay experiences. For example, a turn-based strategy game might incorporate mechanics such as resource gathering, unit placement, and turn order, while a role-playing game might focus on character development, quest completion, and decision-making.

Dynamics are the emergent patterns of player behaviour that result from the interactions between the mechanics and the players. It shows the "big picture" of how a game unfolds over time, as players react and adapt to changing circumstances and the gameplay evolves in response.

Similarly, it is essential in creating players' experiences during gameplay. For example, in a game with a resource-gathering mechanic, players might compete for limited resources, leading to a dynamic of resource scarcity and strategic resource management. In a game with a role-playing mechanic, players might develop relationships with non-player characters, leading to a dynamic of social interaction and character-driven storytelling (Hunicke et al., 2004).

Game aesthetics are responsible for creating an immersive and engaging experience for players. Hunicke et al. (2004) identified eight aesthetics contributing to the player's overall experience: sensation, fantasy, narrative, challenge, fellowship, discovery, expression, and submission (see Table 1). The aesthetics include visual design, audio design, narrative design, gameplay design, and social design. These elements work together to create an overall perception of the game that engages players on multiple levels. Game developers exploit these design elements and aesthetics to create visually appealing games that resonate with their players providing a lasting impression.

One example of a game that effectively incorporates these aesthetics is Ticket to Ride, which emphasises sensation, challenge, discovery, and submission. The game's attractive design, simple graphics, and unique player pieces create a visually stimulating and enjoyable experience. Its narrative involves connecting different cities and building a train network, while the randomised destination tickets add a sense of discovery and challenge. Finally, the game provides a sense of submission as players claim train routes and complete their objectives.

Table 1. Game aesthetics.

Game Aesthetics - General Explanation			
Game Aesthetics	**Explanation**	**Game Aesthetics**	**Explanation**
Sensation	Game as sense-pleasure	Fellowship	Game as social framework
Fantasy	Game as make-believe	Discovery	Game as uncharted territory
Narrative	Game as drama	Expression	Game as self-discovery
Challenge	Game as an obstacle course	Submission	Game as pastime

2.2   Cooperative Board Games

The cooperative board game was made famous through the publication of the Pandemic Board Game in 2008 by Z-Man Games in the United States of America. In 2009 it won the Origin Award as "Best Board Game" and many subsequent awards. Due to its remarkable gameplay design, it puts forward the element of an Artificial Agent that controls all players' actions in either winning or the risk of losing in a highly unpredictable environment (Sfikas & Liapis, 2020). In a nutshell, Pandemic is a multiplayer board game where all players collaborate to eradicate diseases worldwide. The game comprises a world map divided into four regions with colour coded in red, black, blue, and yellow. As the game progresses, players will draw infection cards indicating the prevalence of disease in that particular city. Each can conduct four actions by moving to another

location, treating, or curing diseases using five cards of the same colour. The game exploits many random variables into account, from the initial occurrence of diseases at the start of the game, the moves that every player decides to take, and the role each player takes, which will determine the unique ability they can do in each gameplay.

The Pandemic Board Game promotes team adaptation, a complex process that emphasises how a group of collaborators understand their complex environment and combined coordination processes to reach an adaptive outcome (Rico et al., 2020), also defined by Maynard et al. (2015) as the "adjustments to relevant team processes (i.e., action, interpersonal, and transition) in response to any trigger causing the requirement for adaptation". In other words, it creates opportunities for players to collaborate through teamwork, allowing players to strategise using their skills to solve problems. (Best Board Games, 2022). While collaboration and cooperation are synonymous, both are constructed of similar considerations as listed (Salas et al., 2014), which is adopted by the Pandemic Board Game (Anania et al., 2016) as Composition; Cognition; Communication; Cooperation; Coordination; Coaching; and Conflict (see Table 2).

Table 2. Definitions for considerations of collaborative elements.

Critical Considerations	Definitions *(Source: Salas et al., 2016)*	Definitions *(Source: Anania et. al., 2016)*
Composition	The individual factor and constitution of the team members. The type of knowledge, skills and attitude of each individual may contribute to the success of the collaboration.	The diverse roles and unique abilities each team member has.
Cognition	The common and shared understanding and objectives amongst team members from the collaboration	The understanding of the special abilities of each member and the familiarity with their team members
Communication	The reciprocal process of team members exchanging information and influencing each other's attitudes, behaviours, and thoughts	The exchange of knowledge and information between members of the team
Cooperation	The factors that motivate teamwork include the team's attitudes, beliefs, and emotions that drive their actions	A mixture of intrinsic and extrinsic motivation that encourages collaboration to achieve common goals
Coordination	The actions and cognitive processes required to complete a task and convert the team's resources into desired outcomes.	Coordinated efforts required to accomplish a set of common objectives
Coaching	The leadership actions that establish goals and guide the team towards achieving them successfully	The display of leadership in connection to goal setting and resource management
Conflict	Situations where team members hold conflicting views, interests, or beliefs that are perceived as incompatible	The absence of continuity between the opinions of several team members

2.3 Gamified Learning in Music Education

Gamification has become an increasingly popular approach in music education; for instance, the Simply Piano App, Piano Marvel and Flowkey are digital online piano educational games (Zou, 2020) that employ game concepts in piano playing. Beyond digital platforms, board games such as The Lord of the Chords were developed to improve knowledge about chord progressions and concepts in a game-based format. However, these commercialised games are often expensive. On the other hand, more affordable options can be found online. These games are specifically designed only to understand a specific topic, typically simple games like puzzle solving, connecting lines and crossword puzzles can be found in music workbooks.

Other musical games may involve singing, psychomotor activities, and movement and are usually custom-made with a specific aim that teaches students the elements such as rhythm, melody, harmony, and composition.

While custom-made music games have the potential to facilitate engagement and motivation in music education, one concern is their limited replay value, as learners may quickly lose interest in a game once they have completed it or may not find it challenging enough to warrant a replay (Krall & Menzies, 2012). Research suggests that varying difficulty levels, completion, social aspects, randomisation, and user experience can enhance replay value. (Frattesi et al., 2011).

3   METHODOLOGY

3.1   Game Development

The ideation of the game design process calls for a Design Sprint (see Table 3), a problem-solving cum productivity cycle that guides a group of participants through a series of processes over five days developed by Google Venture (Knapp et al., 2016). The processes are summarised as follows:

Table 3. Design sprint process.

Day 1	Day 2	Day 3	Day 4	Day 5
Understand & define	**Diverge**	**Decide**	**Prototype**	**Validate**
Involve discussion, mapping out the target, and defining the challenges on hand.	Sketch solutions to problems and challenges on hand—ideation process by reviewing existing ideas to adjust or improve.	Decide and vote to select the best idea. Further detailing the plan for the prototype. Conduct enquiries with specialists for opinions.	Develop the prototype using available low-cost platforms to test run. Make necessary adjustments and improvements.	Test product on targeted audience/customer. Get feedback by way of interviews and record their responses for future reference.

Frugal Education Action Cards (Clarke et al., 2020) were employed in game development. Alex Masters of GameChangersUK at Coventry University developed the frugal education action cards as a tool for educators to design educational interventions based upon three main principles: "*Design with an Open Mind, Leverage available resources,* and *Build at the speed of need*". These guiding principles umbrella three aspects, and each aspect branches into three considerations (Arnab et al., 2021). For this game development, not all twenty-seven considerations are mandatory. However, it is sensible to embrace the three main principles.

Guiding Principles No. 1 Design with Open Mind

Design with an Open mind spreads three aspects listed creative, collaborative, and open. Gameplay should be creative, allowing learners to solve problems and experiment with innovative ideas while encouraging learners to combine various skills and disciplines to create solutions. It should reflect elements of collaboration, encouraging players in critical dialogue, allowing them to listen to each other, empathising, and creating a supportive environment to achieve common goals jointly.

Guiding Principles No. 2 Leverage available resources

An abundance list of game mechanics can be repurposed for educational intent. It triggers the mind to improvise solutions, explore alternatives and utilise potential resources to resolve the challenges. Much consideration was given to its usability, that it must be user-friendly where gameplay should not be too complicated, and at the same time, elements in the game should reflect its educational aims. While it is crucial to consider elements of resiliency, the gameplay should be flexible enough to embrace the diverse backgrounds of the players (i.e., various levels of knowledge and players of different musical instruments).

Guiding Principles No. 3 Build at the need of speed

Game development should be done with minimal resources, similar to the gameplay. The gameplay shall not involve much intervention from a teacher. It should be able to be played amongst players with the same level of subject knowledge. The mechanics should reflect its ultimate function (enabling learning to happen). While aesthetics is important, they should reflect its functionality within the game, and any unnecessary components should be appropriately excluded from the design.

The ultimate goal of the gameplay is to encourage creativity for music learners in creating rhythmic motifs and patterns according to musical rules. Based upon the Grade One Theory of Music and their instrumental performing syllabuses prescribed by the Associated Royal School of Music (ABRSM) and Trinity College London (TCL), the following items were included in the game design:

1. Time Signature in simple duple and simple quadruple time;
    Time signatures defined the number of beats in each bar and were given terms for counting them. Simple duple is portrayed as (2/4) whereas simple quadruple as (4/4).
2. Key Signatures up to two sharps and flats;
    Key signatures depict the tonality of a piece of music. Most common key signatures in the earlier grades of music learning cover up to two sharps or two flats.
3. Note values ranging from semiquavers up to minims (rests included);
4. Rhythmic patterns;
5. Musical forms; and
6. Performance directions.

The performance directions are instructions for how a particular piece of music should be played.

3.2   The Music Rhythm Tour

In deciding the best gameplay for developing music compositional tools, a board game is created as an intervention to disseminate such knowledge. Besides that, it can be custom created for various purposes and simultaneously involve considerable thinking skills and is known to have increased knowledge of a particular field (Wanyama et al., 2012), (Charlier et al., 2013). The basic gameplay of this game involves placing items into the game board, whereas the Pandemic board game does otherwise. The remaining actions are designed similarly, similar to the Pandemic games. The following (see table 4) compares the features that can be found in both games.

Table 4. Features of the proposed game and The Pandemic Board Game.

Attributes	The Music Rhythm Tour	Pandemic
Basic Form	Placing items onto the board	Remove items from the board
Actions	Requires players to arrange items in a particular order (*rhythm cards*)	Collect a certain number of cards to ***cure*** diseases.
Logistics	Consist of accessible transportation and paid transportation	Free transportation
	Locations are more easily accessible	Locations are not easily accessible
Players Role	Each player has a unique ability	Each player has a special ability.
Number of locations	7	48

a) Game Mechanics

The proposed game adopted the Pandemic board game as its base mechanics while converting all the elements into musical context while sustaining the logistical movements of the board game. An initial prototype was created to assess the time needed to complete the game logistically using cut-out papers and coloured tapes (diagram 1).

Figure 1. Draft prototype

During this test run, components of the games (see Figure 2) have been defined as follows: -

1. Players (composers and their unique abilities);
2. The number of locations on the board;
3. Route to each location;
4. Event cards (actions players are required to complete);
5. Two beats non-rhythmic cards;
6. Season Tokens;

It is vital to simulate such gameplay, as the time limit to complete a game is crucial in determining the game's playability. Although there were no definitive rules to the time limit of a board game, an empirical search suggests that the typical timeframe lasts from 45 minutes to 60 minutes, while any prolonged gameplay may affect players' engagement and interest. To overcome timing issues, season tokens were used to restrict the maximum number of rounds per gameplay.

Variables and interdependencies will affect the behaviour of a game; for instance, the components mentioned above are examples of variables used in the game whereby their occurrence will be random. Considering Frattesi et al. (2011) ways to enhance the game's replay value, the variables are categorised into six elements: time signatures, key signatures, rhythm and event cards, season tokens, and composers. These variables are randomised during the set-up to generate different motifs and phrases, creating distinct outcomes.
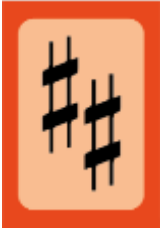
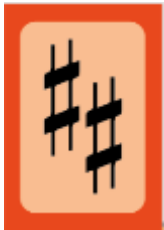| Time signature & Musical Forms	Key Signatures	Rhythmic Patterns & note values
Performance Directions	Season Tokens	Players Role

Figure 2. Components of game cards.

Figure 3. The game board.

b) Learning Mechanics

The abstract and concrete aspects of learning mechanics were considered in mapping the pedagogical constructs into gameplay. The abstract components allow less explicit learning, while concrete learning involves observable actions (Arnab et al., 2013). Learning in this context can vary according to the player's prior knowledge level, where beginners will experience identifying, discriminating, exploring, discovering, observing, motivating, and participating, whereas more advanced players will benefit from experimenting, analysing, simulating, and even reflecting. The game and learning mechanics will form a robust interdependent relationship by utilising various variables (see Figure 4).

Variables	Number of cards	Knowledge intention
	A total of eight cards were divided into two groups; simple duple (2/4) and simple quadruple (4/4). Each group has different musical forms (for example, AABC and ABAC).	Learning about the total number of beats in a bar. Encourage learners to count accurately. Promote learners to set up pulses.
	A total of eight cards are designed in pairs to represent: ● One sharp ● Two sharps ● One flat ● Two flats	Key signature cards come in pairs, assigned to various locations on the board. It signifies the relative keys in their major and minor form.
	86 cards are divided into two main categories: "can end" and "cannot end." ** can end means it can be used as the last card for every phrase constructed. (Refer to game rules)* Can end = 45% Cannot end = 55%	Each card equates to two crotchet beats. Learners will learn note groupings *(how shorter value notes are beamed together)* and, at the same time, promote visualisation techniques for sight-reading purposes.
	A total of thirty-five pieces were used as gameplay instructions. It uses all the performance directions and Italian terms taken from the theory of music syllabuses and performance syllabuses.	A way to familiarise players with foreign terms that usually appear in music scores. The three categories will include "dynamics, phrasing, transport."

Variables	Number of cards	Knowledge intention
	Four seasons represent composition by various composers. It is used to limit possible prolonged gameplay.	Exposing players to different musical works by composers, especially those that use the same title. *Vivaldi's Four Seasons* *Beethoven's Spring Sonata*
	Composers represent a player's role, and each has their unique ability to increase winning chances.	It is an opportunity for players to explore composers in different periods/eras. The instruction may trigger learners to explore the different compositional and performing styles in different periods. For instance, Baroque, Classical and Romantic.

Figure 4. Types of variables in the form of cards.

c) Game instruction

This section provides a detailed explanation of the game instructions. The game set-up is not included as they are written in the game's guidebook.

1. Draw one event card from the event deck and place them side up on the discard pile;
2. Execute any event as instructed by the event card first.
   a) Event cards are labelled with music directions such as dynamics, tempo, phrasing, and articulations.
   b) Instructions are written on some of the event cards in red. This instruction only applies to the music hall the current player is in.
   c) Global event cards appear in dark red. The instruction applies to all music halls across the board.
   d) If you draw a superpower card, keep the card on hand and draw another event card.
3. Sometimes, event cards may require you to remove rhythm cards from the board. All these cards will be discarded back into the bag. If all the event cards have been drawn, and not all music halls have a complete 4-bar phrase, the game ends, and your team has lost! (Do not reshuffle the discarded event cards to form a new deck);
4. You may do up to three actions;
5. Select any combinations of the actions listed below; you may do the same action several times, each time counting as one action.
   a) **Place a rhythm card** = 1 action
   b) **Move to another music hall** = 1 action
   c) **Rearrange by swapping two rhythm cards** =1 action
      All players can rearrange the sequence of the cards on the board. It does not include rotating a card. Do not swap a rhythm card from the board with a card from your hand.

  d) **Rotate a card** = 1 action
   The rhythm card on the board can be rotated to change its rhythmic pattern.
  e) **Swap a card with another player** = 1 action
   When two players are in the same music hall, they can swap cards. One card swap is considered one action.
  f) **Arrangement** = 1 action
   It involves changing the position of a card.
 6. After doing three actions, draw rhythm cards from the bag.
  a) Draw two cards from the bag in Spring and Summer
  b) Draw three cards from the bag in Autumn and Winter
   As if you are about to draw, fewer cards are in the bag, the game ends, and your team has lost!

d) Data Collection

The study was intended to examine the effectiveness of the Music Rhythm Tour Board Game in triggering effective learning strategies (i.e., interactions, tracking progress, collaboration, and fun element) and learning outcome during board game playing sessions. This study uses Participant Observational Study for data collection. According to both Jorgensen (1989) and George (2022), data are commonly gathered through casual conversation and informal and unstructured interviews where the observer or researcher immerses in the participant group.

Direct observation technique was employed to collect players' behaviour during gameplay. This technique is effective as it allows researchers to watch a process or a situation as it occurs (U.S. Department of Health and Human Services. (n.d.); Holmes, 2013). Data collected is commonly in narratives, notes, videos, or photographs. It portrays the highest degree of ecological validity (a measure of how test performance predicts behaviours in real-world settings) (Holmes, 2013; Baker et al., n.d). Players' behaviour was duly recorded in the form of written notes, including players' musical knowledge background, age, and the environment in which the gameplay took place, and players' behaviour adopting the Cooperative Performance Metrics (CPM) (see Table 5) developed specifically to identify gameplay behaviour. The identifiers adopted for this research include "Workout strategies, Helping Each other, Laughter or excitement together and Global strategies" (Seif El-Nasr et al., 2013). Players' behaviour was also included in the metrics to provide insight into responses that is difficult to pinpoint or identify through conversations (Gemmae M et al., 2022)

In a broader sense, the game may trigger meaningful conversations between players. The opportunities for conversation would not only improve their social skills but would also trigger players to negotiate an agreement with each other and work out a plan to win the game before time runs out. Cooperative games allow the following five elements to happen: 1) laughter or excitement together; 2) working out strategies; 3) helping; 4) global strategies; 5) waiting for each other; and 6) getting into each other's ways (Seif El-Nasr et al., 2013). All these elements pointed out the Social Designs of the game. The gameplay becomes a more natural platform to work collectively as a team than cooperative approaches (Beznosyk et al., 2011; Baek et al., 2019).

Table 5. Identifies cooperative performance metrics.

Identifiers	Descriptions
Laughter or excitement together,	- Laughed at the same time due to a specific game event - Expressed verbally that they are enjoying the game, looking for utterances such as "sweet," "it is a lot of fun," - They shook their heads and displayed nonverbal facial expressions that clearly expressed happiness or excitement.
Workout strategies	- Talked aloud about solving a shared challenge. - Divided a game zone into various parts in order to divide and conquer. - Navigated the world while consulting with each other.
Helping Each other	- Talked about controllers and how one can use the game mechanics. - Told each other the correct way to pass a shared obstacle. - Saved and rescued the other player while he or she was failing;

For the online version of the gameplay, a video recording was made after obtaining permission and agreement from the participants to ensure study ethics. To ensure the confidentiality of participants in this project, the identities of interview and focus group participants were not revealed.

4   GAME TESTING AND OBSERVATION

Test Play 1 involved a mixture of a teacher and students who played the game online (Table 6). Two groups of players were introduced to the game during the test play, and their gameplay was observed. On the other hand, in test Play 2 (Table 7), four orchestral performers (participants) were introduced to the physical version of the board game. The findings from these observations are tabulated into five different themes, as follows:

Table 6. Test Play 1 – Complete the board game (online version).

Total players: 4 (*3 students and one teacher*)
Game set up (*randomly assigned*): 4 simple duple times + 3 simple quadruple time
Game platform: Miro and Google meet
Players' relationship: two siblings, one peer, and one teacher (administrator)
Total time: 75 minutes
Conversational medium: Mandarin

Work Out Strategies	Helping Each other	Laughter or Excitement together	Global Strategies	Personal Behaviour
"Later you place this card over here."	*"You move to this hall; then I swap one card with you."*	-	*Moving to a location in advance while anticipating another player to use their special ability to swap rhythm cards.*	*A bodily movement of a player in a stable pulse*

In Test Play 1, the players comprise two siblings, a friend, and a teacher (the researcher). The gameplay is carried out online using Miro, while the gameplay is recorded using Google Meet. The game was set up using four duple time signatures (2/4) and three quadruple time signatures (4/4) with a total gaming time of 75 minutes. During the gameplay, the players were observed helping each other out in several ways. They provided advice to one another and worked together to solve problems. They also utilised their special abilities to swap rhythm cards and rearrange phrases on the board, all while anticipating the moves of their teammates. The players' bodily movements were identified as a learning outcome, as they would either nod their heads or tap their fingers while reading the rhythm cards on the board.

Table 7: Test Play 2 - Complete the board game (face-to-face).

Total players: 4 (*all were orchestra performers*)
Game set up (*randomly assigned*): 4 simple duple times + 3 simple quadruple time
Game platform: Face-to-face (hotel room)
Players' relationship: four friends (inclusive of one administrator)
Total time: 60 minutes
Conversational medium: Mandarin and Bahasa Sarawak

Work Out Strategies	Helping Each other	Laughter or Excitement together	Global Strategies	Personal Behaviour
"You stay within this region as long as possible while I will try to move around the other region." *"I will place a card here, and later, you use your special ability to rearrange the phrase ya"*	*"You move to this hall; then I swap one card with you."* *"Here I come, to help you since I only need one action to travel here."* *"Watch out; this hall is 2/4 time!"*	*"Getting softer haa... (winking).* *"Getting louder ha... (winking)."* *"Yes! You see, I am the saviour for you all to win the game hahahahah"*	*Moving to a location in advance while anticipating another player using their special ability to swap rhythm cards.*	*A bodily movement of a player in a stable pulse while tapping the rhythm on the board.* *Humming the rhythm out verbally using funny voices.*

During Test Play 2, the game was played by four orchestral players, including the author, in a physical format, with the actual game boards and accessories. The game was set up similarly to Test Play 1, and the total gameplay time was 60 minutes. The players were seen to be helping each other by giving strategic advice, such as "*You move to this hall; then I swap one card with you.*" and "*I will place a card here, and later, you use your special ability to rearrange the phrase ya.*" These conversations were aimed at solving problems and assisting each other in winning the game.

Compared to Test Play 1, there was more fun involved in Test Play 2, as players expressed themselves through laughter more often. Learning outcomes were more evident in this gameplay,

as players had bodily movements and hummed the rhythm using funny voices and worded the patterns jokingly with funny sentences.

5   DISCUSSION

The CPMs annotate the two gameplay sessions on two different platforms (online and face-to-face), totalling up to 135 minutes of gameplay. The labelling occurrence of the CPMs reviewed notes taken. From the above table, conversations appeared less than in the face-to-face platform. It is also noted that online gameplay takes longer to complete due to the functionality of the Miro Application, such as drawing cards, shuffling, and moving around the game board are seemingly tedious. However, face-to-face gameplay offers much freedom regarding space and movement, which enhances the situated cognition (*learning In Situ*) of the players.

Consequently, players have more direct experience of body language, utterance, and spatial factors, giving players the interactions needed to solve problems, especially in the learning environment (Wagner, 1994). Resulting of the interactions, players are required to collaborate by helping each other, negotiating, and agreeing to possible moves through meaningful dialogue that leads to players working together as a team to win the game. This put forward the idea of group cognition as Ongaro et al. (2022) concluded that the human mind can be extended to include other people when working together as a group (*the collective mental process*) in any given task. In such collaborative situations, team members may share more information and knowledge. According to Khaleel et al. (2018), enjoyment is a crucial factor in the success of gamification, as it motivates players to engage with a game and continue playing. Designers can increase engagement and enjoyment by optimising the challenge level to provide small successes and quick feedback. For instance, the proposed game utilises game cards to prompt challenges that evoke various emotions, leading to an enjoyable gaming experience. Miller (2014) also supports this idea, stating that small successes and feedback can lead to increased engagement in a game.

The Music Rhythm Tour Board Game is created at best to adhere to the Game Design thinking proposed by Hunicke et al. (2004) as described in the literature review as Mechanics, Dynamics, and Aesthetics. These three elements have been successfully incorporated. For instance, the various game mechanics involved promotes an elevated level of interactions and collaboration (cooperative games), while as the game continues, it unfolds many events by drawing even cards which give elements of surprises or relief. As this game requires players to create rhythmic phrases using musical notes, famous historical composers were chosen with assigned special abilities. The board uses a vintage colour palette to create a sense of historical feel in the modern context (aircraft, music performance hall, etc.). Furthermore, colourful, and functional icons were used to embellish the board, while the game narratives involved players placing rhythmic cards creating motifs and phrases.

In sum, Music Rhythm Tour Board Game fulfils the criteria of a cooperative game. Findings from this study also revealed the learning behaviour of the players through their kinetic responses, which were evident as they read the motives and concurrently hummed or tapped the rhythmic pattern. It is crucial because it signifies players were practising their sight reading in an enjoyable and self–

passed environment. The game rules imparted gameplay knowledge and stimulated creativity by allowing players to rotate the rhythm cards to create different patterns (*Refer to Game instruction 5d*). Furthermore, the variables incorporate various musical terms (*performance directions, Italian terms, dynamics, tempo, articulation, signs, and symbols*), time signatures (*including musical forms)* and key signatures, serving as rules for creating motifs and phrases. While players engage in gameplay, they repeatedly encounter these variables, helping them learn their (*the variables*) significance and meaning. This form of learning is deemed less explicit Arnab et al.'s (2013) and more individualised, depending on their prior knowledge.

The knowledge threshold for this intervention is not limited to the above. Players are also exposed to different musical forms that can be translated into larger musical works, such as the Binary Form, Trio, Sonata, Dances, and Concertos. However, these elements are not expressed clearly in any part of the game as the current game is designed for music learners in their early stage of learning.

6   CONCLUSION

The study aimed to create and evaluate the effectiveness of the Music Rhythm Tour Board Game as a learning tool in music education, specifically musical forms. The participants' gameplay experiences and learning outcomes across online and face-to-face platforms were examined. The results positively indicate that the game successfully incorporated the Game Design thinking proposed by Hunicke et al. (2004) using the MDA framework. It also fulfilled the criteria of a cooperative game that promotes interaction, collaboration, and creativity. Moreover, using randomised variables in the game creates replay value, giving players unique experiences when approaching the game the second time. It further exposed players to different musical terms, time signatures, and key signatures, making learning less explicit but more personalised according to the players' prior knowledge. The game was an enjoyable and engaging way for music learners to practice rhythmic sight reading and possibly explore musical knowledge from different perspectives.

The findings from the study have important implications for music educators, game designers, and researchers as a whole. The Music Rhythm Tour Board Game has the potential to be a learning intervention in music education for beginners. The success of creating a game like The Music Rhythm Tour Board Game illustrates the viability of using Game Design thinking and Game Design Sprint in the development of other educational games. Game Design Thinking and Game Design Sprint are pedagogical approaches used by CreativeCulture (Mohamad et al., 2018) to guide the co-creation process for learning game development. While the current study's findings provide valuable insights into the potential of the Music Rhythm Tour Board Game as a learning tool, limitations need to be acknowledged. Firstly, the study was conducted with a small sample size due to limited time and funding. Although findings cannot be generalised, the study has shown the potential use of such learning interventions to instigate creativity.

The learning intervention was tested using an online platform (Miro app). The online gameplay presented a few predicaments; while Miro supports the collaborative nature of the game, the

platform's interface appeared tedious and time-consuming to use, which may have affected the quality of data collected. Future research could explore the possibility of adapting the game for different skill levels by incorporating irregular time signatures, lesser beats in a card or other music-related topics, including pitches, chords, and scales and evaluating its effectiveness in a larger sample size and over a more extended period

It is essential to realise that board games used in music education have the power to teach learners skills beyond just music. By integrating game design principles, learners can develop essential critical thinking, problem-solving, and collaboration skills that are valuable in today's world. Additionally, technology incorporated in board games can help learners develop digital literacy skills, which are increasingly critical in the modern workplace.

As teaching strategies continue to advance, board games are increasingly prevalent in various subjects, including music education. The success of the Music Rhythm Tour Board Game is evidence of the potential of board games in music education. In the future, educators and game designers should continue exploring the possibilities of board games in music education, using game design thinking to create customised and engaging learning experiences that encourage the development of musical and broader skills.

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