

# Finding Harmony in Gamification: Examining the Role of Music in Gamified Learning

José Alexandre de Freitas<sup>1</sup>, Mateus Oliveira<sup>1</sup>, Carlos Martinelli<sup>1</sup>, Armando M. Toda<sup>2</sup>, Paula T. Palomino<sup>3</sup>, Ana C. T. Klock<sup>4</sup>, Anderson P. Avila-Santos<sup>1</sup>, Luiz Rodrigues<sup>1</sup>

<sup>1</sup>UniSENAI PR - Londrina - Brazil

<sup>2</sup>Durham University - Durham - UK

<sup>3</sup>São Paulo State College of Technology - FATEC - Matão - Brazil

<sup>4</sup>Gamification Group - Tampere University - Tampere - Finland

luiz.rodrigues@sistemafiep.org.br

***Abstract.** Gamification is a promising strategy to enhance learning experiences. Whereas most gamification studies are focused on traditional game elements (e.g., points and leaderboards), research often associates them with negative consequences (e.g., performance loss and demotivation). In contrast, game elements such as sound stimulation (or Sensation), which are prominent in games, have not been explored in gamified learning. Therefore, this paper presents a qualitative study, based on usability tests and interviews, that investigated how the Sensation game element, implemented as background music, influences gamified learning experiences. Our findings reveal that the impact of music on student experiences is nuanced, with individual preferences and characteristics playing a crucial role. While some students perceive music as enhancing their focus and creating a pleasant learning environment, others find them distracting and detrimental to concentration. Personalization and adaptability emerge as key considerations when incorporating music into gamified learning environments. Thus, this study contributes to understanding the role of music in gamification and emphasizes the importance of tailoring interventions to meet the diverse needs of students.*

## 1. Introduction

Gamification is the usage of game elements in non-gaming contexts [Deterding et al. 2011]. This approach has been applied in numerous domains, such as personal productivity, marketing, health, and especially education and teaching [Koivisto and Hamari 2019]. In the educational field, gamification has been widely adopted due to its potential to improve and motivate student engagement, making the learning process more enjoyable and, in turn, more effective [Sailer and Homner 2020, Huang et al. 2020].

Despite the great interest, gamification applied to education can sometimes lead to negative results [Toda et al. 2018]. In these cases, it is commonplace to attribute blame to some game elements, such as medals, scores, rankings, and points, used in the gamified intervention [Loughrey and Broin 2018]. This happens due to the use of these elements in gamification, when applied excessively or inappropriately, which can lead to unwanted

results, such as loss of attention from learning, and leading to a decrease in the interest of some students over time [Bai et al. 2020]. Furthermore, there are several game elements that can be used to gamify learning environments, as categorized in the Taxonomy of Game Elements in Education Environments (TGEEE) [Toda et al. 2019].

The *sensation* game element, for example, is rarely explored in gamification studies in education [Huang et al. 2020]. According to the TGEEE, sensation concerns using visual or sound stimulation to improve learners' experiences [Toda et al. 2019]. Sound stimulation, in the context of games, is available as audio feedback for some action, such as hitting an enemy, and background music (music, hereafter), aiming to create an atmosphere aligned to the current situation (e.g., raising tension during a boss fight). Furthermore, background music might help establish an immersive environment, facilitating students' concentration, providing positive emotions, and increasing motivation and interest in the content [Hallam and Himonides 2022, Kämpfe et al. 2011]. However, research on gamification tends to focus on elements of traditional games [Bai et al. 2020], leaving gaps in knowledge about the use of game elements such as sensation.

Therefore, this paper aimed to understand students' experience when interacting with a gamified educational environment based on the sensation game element, implemented as music. To achieve this objective, we report a qualitative study, based on usability tests and interviews, in which students performed educational activities while listening to music and, subsequently, discussed their experiences in a semi-structured interview. Thus, the contribution of this paper is an in-depth examination of how the sensation game element influences students' learning experiences, revealing insights into the potential of music for gamification applied to education based on empirical evidence in the context of online reading.

## 2. Literature Review

The TGEEE is a validated artifact that presents formal definitions for game elements used in gamified learning and that enables a systematic evaluation of gamification strategies [Toda et al. 2019]. Specifically, the taxonomy presents 21 game elements, which are categorized into five dimensions. Despite the broad body of options, gamification research is mostly focused on standard game elements, such as points, badges, and leaderboards [Bai et al. 2020, Huang et al. 2020]. Hence, there is a scarcity of studies that explore, for example, the sensation game element. Sensation might be implemented as music that provides sound stimulation, which has been studied from other perspectives.

In games, music plays a crucial role as a powerful tool to enhance the player's experience and guide their emotions. Whether it's the adrenaline-pumping beats of an action-packed sequence or the haunting melodies of a suspenseful moment, music sets the tone and creates a unique atmosphere. Music can heighten tension, provide a sense of adventure, or invoke nostalgia, effectively driving players towards desired emotional states and deepening their connection with the game. Thereby, by leveraging the emotive power of music, game designers add a layer of depth and engagement that is essential for a captivating gaming experience [Munday 2007].

In learning settings, music presents potential benefits and issues. Music might create a more immersive and stimulating environment, enhancing the sense of presence and making the learning experience more engaging. Additionally, it might help improve con-

centration and focus by blocking out distracting noises and providing a consistent sound environment, keeping learners engaged in the activity. On the other hand, music might become a distraction, making it difficult to concentrate and understand information. Individual preferences are also a consideration as musical tastes might vary among people. Sensory overload is another concern, as music might overwhelm learners' senses, especially if there are many visual and auditory stimuli happening simultaneously. Therefore, whereas music might enhance learning experiences, it should be carefully designed to prevent unwanted outcomes [de la Mora Velasco and Hirumi 2020].

In summary, this overview demonstrates that music plays a prominent role in games. In contrast, music has not been addressed from the lenses of gamified learning - wherein it should be seen as an implementation of the sensation game element [Toda et al. 2019] - possibly because of its complex relationship with learning experiences [de la Mora Velasco and Hirumi 2020]. In a similar direction, [Altmeyer et al. 2022] investigated sound feedback in a general-purpose context (i.e., image-tagging task) where users received points as they tagged images, and sound feedback was provided when points were awarded. However, due to inconclusive findings from background music in education and gamification applied to learning environments literature, we can not attest the benefits of applying music in gamified environments. Therefore, this paper expands the literature by investigating background music, as an implementation of the sensation game elements, from the lenses of gamification, to understand how this kind of gamification affects learning experiences.

### 3. Method

The purpose of this study was to understand the experience of students when interacting with a gamified educational environment based on music. To achieve that goal, we conducted usability tests, which have been used to grasp a deep understanding of one's experiences with a given product/design (e.g., studying in an educational environment gamified with music) and, accordingly, have been adopted as a means to conduct qualitative studies [Barbosa et al. 2021]. Hence, we considered a suitable approach to reach our primary goal.

To enable our study, we created a high-fidelity prototype aiming to simulate an online learning environment. Specifically, the prototype is a web application based on a four-section sequence. The first section served as an introduction, providing context and instructions regarding this study. The second section contained an expository text (see Table 1 for a snippet of the text), which was accompanied by a music (see details below), to replicate the reading from an online course. The third section consisted of a short quiz with five multiple-choice questions, which were presented individually (each one had its specific page) and aimed to simulate an assignment that follows the reading. Table 2 presents a sample question of the quiz. Finally, the fourth section served as a thank you page, displaying the number of questions that the participant answered correctly.

Within our prototype, we selected *basic nutrition* as the learning subject, which was selected by convenience [Wohlin et al. 2012]. Given that our focus was on understanding learners' experiences from the gamification perspective, we chose a general-purpose subject that could potentially benefit our participants and, given their profiles (see below), was unlikely to be discussed in their daily lives. In that context, one re-

**Table 1. Snipped of the text students read during the usability test.**

<b>Original Text</b>	<b>English Translation</b>
A nutrição é fundamental para a saúde e o bem-estar humano. Ela envolve a escolha de alimentos que fornecem nutrientes essenciais para o corpo humano, incluindo vitaminas, minerais, proteínas, carboidratos e gorduras. Quando uma dieta equilibrada é seguida, ela pode melhorar a qualidade de vida, prevenir doenças e manter um peso corporal saudável. Uma alimentação saudável é importante desde a infância, quando o corpo está em desenvolvimento. Uma dieta adequada pode ajudar a garantir que as crianças cresçam e se desenvolvam normalmente. Isso inclui o desenvolvimento do cérebro, ossos, músculos e sistema imunológico.	Nutrition is fundamental to human health and well-being. It involves choosing foods that provide essential nutrients for the human body, including vitamins, minerals, proteins, carbohydrates and fats. When a balanced diet is followed, it can improve quality of life, prevent disease and maintain a healthy body weight. A healthy diet is important from childhood, when the body is developing. A proper diet can help ensure that children grow and develop normally. This includes brain, bone, muscle and immune system development.

searcher developed the reading as well as the five questions. Then, a nutritionist provided feedback on those materials, which were revised accordingly by the researcher who initially developed them. Particularly, we aimed for the reading to have around 1000 words so it would take around five to seven minutes to read it, considering the average time for reading from a screen is 151 words per minute [Dyson and Haselgrove 2001]. Similarly, we limited the prototype to five questions to prevent maturation effects from a long study [Wohlin et al. 2012].

The gamification of our prototype was designed as follows. We explored the Sensation game element [Toda et al. 2019] to drive learners' mood, similar to music usage in games (see Section 2), by creating a calming, immersive experience that fa-

**Table 2. Sample question the students were asked to answer during the usability test.**

<b>Original Question</b>	<b>English Translation</b>
Quais são os nutrientes essenciais para o corpo humano? a) os nutrientes essenciais incluem vitaminas, minerais, proteínas, carboidratos e gorduras; b) apenas proteínas e carboidratos são nutrientes essenciais; c) vitaminas e minerais são os únicos nutrientes essenciais; d) gorduras e proteínas são os nutrientes mais importantes.	What are the essential nutrients for the human body? a) essential nutrients include vitamins, minerals, proteins, carbohydrates and fats; b) only proteins and carbohydrates are essential nutrients; c) vitamins and minerals are the only essential nutrients; d) fats and proteins are the most important nutrients.

vored concentration. The rationale is that mood and concentration are related to learning [Husain et al. 2002, Buil et al. 2019, Goldstein 2014]. For this, we gamified the learning environment with the following song: Coyote Beatz Best Seller of Djonga. This music, with its calm and linear rhythm complemented by distinctive beats, might serve as an audio backdrop that sets the mood and enhances the immersive nature of the gamified environment [Hallam and Himonides 2022]. This music acts as a subtle music that accompanies the reader on their textual journey, which might facilitate immersion, concentration, and absorption of the ideas present in the content [Ferreri and Verga 2016]. Thus, the choice of such a song is justified by the creation of a relaxing and inviting environment that drives learners' moods and creates a calming, immersive reading environment. It is important to note that the selected music is royalty-free, which ensures that there are no legal implications or limitations when using such music.

Building upon our prototype, the usability test procedure was as follows. Each test was carried out face-to-face, in a quiet room, and individually, in the presence of only one interviewee and one interviewer. Before starting the test, participants provided consent to participate in the study and agreed that the audio would be recorded. The first step was the explanation of the research. Then, the participant would start reading the instructions in the prototype's first section. If the participant had no questions regarding the study, they would move on to the prototype's second section. Once the participant reached the end of the reading, the interviewer asked some questions regarding their learning experience (see details below). Next, the participant proceeded to the prototype's third and fourth sections. Finally, the interviewer continues with additional questions regarding the experience in answering the quiz.

Table 3 summarizes the prompts asked for participants. Prompts 1 (P1) to P5 were asked after the participant finished the reading. P6, P7, and P8 were asked following the quiz section. Note that those are open-ended questions aimed to reveal subjective insights regarding the participants' experiences, according to the exploratory nature of our study's goal [Barbosa et al. 2021]. Importantly, the interviewer would ask follow-up questions (e.g., *why do you think so?*, *tell me more about it*, *anything else?*) to extract further insights as recommended by the literature [Blandford et al. 2016].

**Table 3. Script used to understand students' experiences from using the learning environment gamified with music.**

<b>ID</b>	<b>Prompt</b>
P1	What did you think of reading using the prototype?
P2	What did you think of the songs played during your reading?
P3	What did you think of reading the text with songs playing in the background?
P4	Is there anything else about the prototype that you'd like to comment on?
P5	Would you like to make any suggestions?
Q6	What did you think of completing the questions in the prototype?
P7	Is there anything else about the prototype that you'd like to comment on?
P8	Would you like to make any suggestions?

Based on that setting, a total of nine interviews were carried out. The participants were students of the Software Engineering undergraduate course at a private university in Brazil's southern region. Of those, eight were men and one was a woman. The students

were chosen through non-probabilistic convenience sampling [Wohlin et al. 2012], as the participants were students enrolled in classes where one researcher was the lecturer.

The data analysis was based on the following steps. First, one researcher transcribed the recordings from all interviews, which were then anonymized to protect the participants' identities. Second, another researcher used ChatGPT to aid in conducting a thematic analysis of the interviews' transcripts, similar to recent research [Zambrano et al. 2023, Blandford et al. 2016]. Specifically, the prompt was *I need you to run a Thematic Analysis on the transcripts of the interviews I conducted. The objective of the analysis is to understand students' learning experiences when reading while listening to music. In the transcripts, the person who conducted the interviews is identified as the Interviewer. Participants are identified as P1, P2, P3, P4, P5, P6, P7, P8 and P9. Here is the transcript:.* Following the prompt, the researcher pasted the nine interviews.

Next, the researcher used the following prompt to find the final themes: *Considering the transcripts of interviews conducted by the interviewer with participants P1, P2, P3, P4, P5, P6, P7, P8, and P9, perform a thematic analysis to obtain a more comprehensive view of the students' learning experience regarding reading while listening to music. In addition to themes, your answer should explain what the theme means and cite insights that support the theme. The answer should also identify which participants talked about the theme.* Finally, the same researcher reviewed the themes and their codes, contrasting the results to the interviews' transcriptions to ensure the results' validity. Accordingly, we use quotes when presenting our results in Section 4.

#### **4. Results**

From the analysis of the data, we identified four main themes: Influence of music on focus and concentration, Individual preferences towards music while reading, Impact of music on information retention, and Differing opinions on the effect of music on learning. Next, this section elaborates on each of them.

The first theme, the *Influence of music on focus and concentration*, revealed divergent opinions among the participants. While some of them mentioned that music can help them stay focused while reading, others highlighted that it can be distracting and make it difficult to concentrate. For example, P1 commented that *"It didn't bother. Well, as I have attention deficit, it's a little more difficult to pay attention to what I'm reading, but since it's a subject that I think is cool, so we make an extra effort to pay attention"* and P4 told *"Man, some specific tones within the song I think took away a little attention. The knocks made me go back to reread, for example, the sentence, half of the sentence"*. On the other hand, P7 commented that *"a little calm touch, relaxes and that helps to really concentrate"* and P8 agree, saying that *"For me to concentrate I like tranquility, peace, silence."*

The second topic addressed *Individual preferences regarding music during reading*. Participants express different emotions regarding the type of music they prefer to listen to while reading. Some mentioned prefer classical music, while others highlight a preference for instrumental music. In addition, it was observed that some participants avoid songs with vocals, as they believe that they can interfere with their ability to concentrate. For instance, P1 said *"I think the instrumental right? It's the quietest, because often what takes your attention is the vocals,"* P2? mentioned that *"Instrumental sound*

like, a Lo-Fi I think is very good.” On the other hand, P3 contented that ”I like both, I love Lo-Fi a lot, which is just the beat there and stuff, but I also love when there’s a voice too. I don’t necessarily need to understand”.

The third theme analyzed was the *Impact of music on information retention*. Participants’ opinions differed in this regard. While some stated that music can disrupt information retention, others mentioned that it does not negatively affect the ability to remember content read. For example, P9 mentioned they ”don’t think it’s so advantageous to read like that, because I go back a lot to what I’m reading now, normally, if I listen to music” whereas P4 said that ”answering [the question], you remember the touch of the song, so at a certain moment there, oops, it’s not this one, it’s this one. He remembered the touch right at that time at that moment there”.

The fourth topic addressed the *Difference of opinions about the effect of music on learning*. Participants had contrasting perspectives regarding the benefits or harms of music while reading. While some participants highlighted that music creates a more pleasant and relaxed environment for reading, others questioned whether students who claim to learn better with music are just looking for an excuse to listen to it. P3 argued that ”If I had read it without the music for me it would be more monotonous”, while P9, who is a teacher, said that ”most of my students say [music helps], I don’t know if it’s because they’re younger, I don’t know. They say they can learn more by listening to music.”

## **5. Discussion**

In summary, our results highlight the complexity of the relationship between music and the learning experience during reading. The individual preferences, the impact on the concentration and retention of information, as well as the divergences of opinions, evidence the importance of personalized approaches and adaptive strategies in the educational context. Based on this context, the remainder of this section further interprets our findings, elaborates on their implications for research and practice, and discusses their limitations along with recommendations for future research.

### **5.1. Findings’ Interpretation**

One of the emerging themes concerns the influence of music on students’ focus and concentration during reading. Our results showed divergent opinions among participants, highlighting that music can both help and hinder concentration. Research on background music in education has been concerned with this issue, despite evidence on its overall effect remains unclear [de la Mora Velasco and Hirumi 2020]. Hence, this finding corroborates the importance of considering individual student characteristics, such as working memory capacity [Lehmann and Seufert 2017], when integrating music into gamified learning environments. Some students may benefit from a music that helps them stay focused, while others may find it difficult to concentrate on reading with any type of music playing. This individuality must be taken into account when designing gamification strategies involving music.

Another relevant aspect identified in our analysis is the importance of individual preferences in relation to the type of music played while reading. While some participants express a preference for classical music, others highlight a preference for instrumental music. These inspirations can be influenced by different factors, such as

personal taste in music, familiarity with certain musical styles, and even the ability to filter out distracting stimuli [Mohan and Thomas 2020]. Similarly, recent research on gamification applied to education has been increasingly concerned with this issue [Rodrigues et al. 2020, Klock et al. 2020]. Therefore, when designing gamified environments that use music, it is essential to consider the diversity of students' musicality to ensure a personalized and engaging experience.

Retaining information while reading is a critical aspect of learning, and our results suggest that music can affect this process in a variety of ways. Some participants reported that music can interfere with information retention, while others claim that it does not impair their ability to remember content read. Despite researchers having explored this issue, there is no consensus on the predeterminants of those differences [Lehmann et al. 2019, Hallam and Himonides 2022]. Thereby, this divergence highlights the need to further investigate the control behind this phenomenon. For example, it is possible that the relationship between music and retention is mediated by individual factors, such as the ability to filter auditory stimuli or the ability to create associations between music and reading content [Goldstein 2014]. Future research could explore these aspects in greater detail, seeking to understand the cognitive and affective controls involved in this interaction.

Finally, an important point of discussion that emerged in our results is the divergence of opinions about the effect of music on learning. While some participants emphasized their perceived benefits of music in creating a pleasant and relaxed environment for reading, others questioned whether the perception of better learning from listening to music is genuine or just an excuse to engage in pleasurable activities while studying. This divergence of opinions highlights the need to critically approach the use of music as a gamification strategy in education, especially because of the subjective nature of how gamified strategies contribute to learning experiences [Palomino et al. 2023]. Although music can create a more engaging and enjoyable environment, it is essential to ensure that learning is effective and that students are really absorbing the content. Therefore, it is necessary to find a balance between using music and maintaining the focus and attention necessary for meaningful learning.

## **5.2. Implications**

Based on our findings, this study provides two main implications for research and practices. First, it is crucial to find a balance between creating a pleasant, stimulating gamified environment using music and ensuring that music does not become a distraction that compromises information absorption. Hence, those acting as gamification designers should carefully explore how to integrate music in a way that supports concentration and information retention while maintaining a focus on effective learning. Second, the results highlight the importance of personalizing learning experiences through the use of music. Thereby, both teachers and developers should consider students' individual music preferences. This will enable them to create more engaging and stimulating gamified environments, taking into account individual differences in concentration and performance related to music. Thus, this paper informs practitioners and researchers on the potential of using music to enhance gamified learning experiences, whereas it also highlights the complexity of deploying this approach within the educational domain without potentially harming the learning experience.



### **5.3. Limitations and Recommendations for Future Research**

This study's findings should be interpreted in light of its limitations. The small sample size ( $n = 9$ ) was a practical limitation due to resource constraints and the specific context of the study. Despite the limited sample size, the study aimed for initial insights into the experiences of students interacting with a gamified educational environment based on music, which has not been addressed in past research. Similarly, convenience sampling was chosen for participant selection due to the researchers' access to students enrolled in specific classes. While this sampling method may introduce biases, it allowed for a focused exploration of the experiences of students within a specific context, which is common to qualitative studies [Baldeón et al. 2016]. Future studies could expand the sample size to include a more diverse range of participants from different educational backgrounds and institutions to enhance the generalizability of the findings.

Another issue concerns our study's nature as qualitative data inherently rely on the participants' subjective interpretations and perceptions. While this subjectivity may introduce potential biases, the study aimed to capture rich, nuanced insights into the students' experiences, which is a valuable yet underexplored approach within gamification literature [Rodrigues et al. 2020]. Nevertheless, future research could employ additional methods, such as quantitative measures or mixed-method approaches, to complement the qualitative findings and provide a more comprehensive understanding of the impact of gamified educational environments based on music.

Additionally, the study prototype was designed to simulate a short reading and quiz experience within a limited timeframe. While this timeframe aligns with typical online reading experiences, it may not fully capture the long-term effects and sustained engagement that could arise from extended exposure to the gamified environment. Similarly, the use of a gamified educational environment based on music was a novel approach in the context of this study. Participants' experiences and responses may have been influenced by the novelty of the intervention, potentially affecting their perceptions and feedback, as have been often discussed in the gamification literature [Bai et al. 2020, Sailer and Homner 2020]. Future studies could incorporate extended engagement periods to assess the sustained engagement, learning outcomes, and potential habituation effects of gamified educational environments based on music.

Lastly, the study was limited to a single music in the context of a single subject. While these design choices limit our findings' generalization, they were important to enable us to grasp a rich understanding of an unexplored phenomenon (i.e., gamified learning based on music) within a specific context. Nevertheless, our results highlighted the importance and complexity of individual preferences toward different music styles in student learning. Therefore, future research should explore learners' experiences within educational environments gamified through distinct music, both in terms of the same subject as well as in different ones, to ground and expand our findings towards understanding which (kind of) music to use.

To summarize, future research should address the limitations of this study by employing larger, diverse samples, integrating quantitative measures, extending the timeframe for engagement, exploring the long-term effects of music-based gamified learning, and experimenting with varied music styles. By doing so, a more comprehensive understanding of the benefits and limitations of gamification in education can be achieved,

contributing to the advancement of effective and engaging educational practices.

## 6. Final Remarks

Gamification has gained significant attention as a promising approach to enhancing students' learning experiences. However, gamification is mostly based on the use of specific game elements, such as medals, rankings, and points, which might sometimes lead to unintended negative outcomes. In contrast, whereas music are prominent for games, holding the potential to provide immersive experiences, they have not been explored within gamified learning settings. To address this lack, this paper analyses the role of music in gamified educational environments through a qualitative study based on usability tests and semi-structured interviews.

In that context, our research sheds light on the potential of background music as a gamification element in educational environments. The findings indicate that the use of music can have both positive and negative effects on student engagement, concentration, and information retention during reading activities. The individual preferences and characteristics of students play a crucial role in determining the impact of music on their learning experience. Personalization and adaptability are key considerations when designing gamified learning environments that incorporate music. Furthermore, the study highlights the need for a balanced approach to using music in education, ensuring that they enhance the learning process without becoming a distraction. Overall, this paper provides insights into the complexity of integrating music in gamified educational settings and emphasizes the importance of considering individual differences to optimize the learning experience.

## Acknowledgments

We are deeply thankful to the students who participated in this study. This research was partially supported by the European Union's Horizon 2020 research and innovation program under the Marie Skłodowska-Curie (grant No 101029543, GamInclusive).

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