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RESEARCH ARTICLE

Enhancing Artistic Heritage Education through Gamification: A Comparative Study of Engagement and Learning Outcomes in Local Museums.

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Abstract: This study investigates the impact of gamification on a museum visit compared to a traditional guided tour. A quasi-experimental design with pretest and posttest tests is used to evaluate the effects of each type of visit through statistical analysis of comparison of means with Student's t-test or Wilcoxon test. The research, carried out over several years, involved 68 students of the master's degree in Teacher Training, evaluating both the knowledge acquired after the visit and their ability to explain the museum and its cultural and artistic heritage to future students. The results show significant differences between the gamified visits and those carried out with a traditional system. It is evident that gamification not only increases participation and motivation, but also improves knowledge about the exhibition space, suggesting that this methodology promotes a more immersive and participatory learning. These findings may be useful for designing educational experiences in museums that wish to improve their didactic proposal, as well as for teachers interested in conducting excursions that reinforce learning about local heritage.

Keywords: Gamification; Museum Education; Heritage Didactics; Art Education; Comparative Study; Art Didactics

INTRODUCTION

Gamification as a learning strategy in non-formal contexts

Gamification has been recently incorporated in education, with a remarkable expansion in the last decade (Alonso-Sánchez et al., 2025; Zeybek & Saygı, 2024). Its effectiveness depends on the content, target group and educational level (Gil-Quintana & Prieto Jurado, 2020). Although initially focused on higher education, its implementation in primary and secondary education has grown (Lozada-Ávila & Betancur Gómez, 2017). It is based on game mechanics applied to educational contexts, encouraging participation and playful thinking (Deterding et al., 2011; Khaldi et al., 2023).

Unlike serious games, where learning occurs directly through the content, gamification influences the student's attitude through the use of motivational elements (Díaz-Ramírez, 2020; Rivera & Garden, 2021). Gamified applications combine learning objectives with playful experiences (Dichev et al., 2020). Although it has been shown to improve motivation and engagement (Gamarra et al., 2022), inadequate design can affect learning (Bai et al., 2020).

Gamification and serious games are different concepts in the application of games to education. While serious games are designed as complete games with explicit educational objectives, gamification focuses on the incorporation of game elements in non-game contexts to encourage participation and learning (Paciarotti et al., 2021). In serious games, game play is the primary vehicle for learning, while in gamification, elements such as points, levels, badges and feedback mechanics are added in a traditional educational environment to generate motivation and engagement. The main purpose of gamification is to transform a passive learning experience into a more active and interactive one, using extrinsic and intrinsic motivation to improve knowledge retention and participant engagement (Murillo-Zamorano et al., 2021). In this sense, its implementation requires careful design to balance challenges and rewards, avoiding learner fatigue or loss of interest. Moreover, it can generate negative effects if not implemented correctly (Sousa & Rocha, 2019; Oliveira et al., 2022; Toda et al., 2019). A gamified environment should have clear instructions and avoid distractions.

Rodrigues et al. (2021) have pointed out that the impact of gamification depends on the individual characteristics of the students, which has led to propose the personalization of the gamified design as a solution to improve its effectiveness (Hallifax et al., 2020). It has been evidenced in several studies that adapting gamification to different user

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profiles optimizes the learning experience (Orji et al., 2013; Vassileva, 2012). Personalization arises from the diversity in personality, behavior and needs of learners (Shemshack et al., 2021). Ferro et al. (2013) have proposed models that link player types with gamified systems, allowing more effective approaches to motivate different profiles. However, since it is a recent field, there are still few studies that analyze in depth its impact on learning (Zainuddin et al., 2020).

Educational gamification incorporates elements such as points, badges, levels and roles to motivate students and influence their behavior (Landers, 2014). It has been observed to improve students' activation, motivation and emotional response (Barbosa & de Ávila Rodrigues, 2020), developing skills such as leadership, communication and problem solving (Sousa & Rocha, 2019). However, its implementation presents challenges, such as the time required and the perception of excessive difficulty (Domínguez et al., 2013). One of the main challenges in arts education is the lack of student interest, influenced by factors such as reduced hours and lack of resources (Peppler et al., 2022; Wei & Broome, 2022). Gamification has emerged as a strategy to improve engagement by providing a safe environment for experimentation (Pan & Mow, 2023). Despite the challenges, it remains a tool with educational potential if designed appropriately (Zainuddin et al., 2020; Jones et al., 2023).

The museum as a space for experiential learning

Throughout the 20th century, the educational value of museums and their potential as learning spaces have been studied. Previous research has analyzed the impact of museum field trips on students, showing that these experiences contribute significantly to the acquisition of knowledge and the development of critical thinking about art (Escribano-Miralles et al., 2021). It has been shown that students accurately recall information discussed in museums, improve their knowledge, and develop skills such as historical empathy and tolerance (Ziebell & Suda, 2020; Feliu-Torruella et al., 2021). In addition, these visits increase their interest in culture and the likelihood that they will attend cultural institutions in the future (Greenslit et al., 2021).

Field trips to art museums offer important learning opportunities (Yoo, 2023). Art can be used as a tool for teaching history, enriching cultural education and historical learning (Escribano-Miralles et al., 2021). Integrating museum visits into the school curriculum fosters experiential learning through interaction with the environment and hands-on activities (Weisberg et al., 2023).

Museum education takes place within non-formal and informal learning models, while school education follows a structured approach. Museums have expanded their mission beyond the preservation of historical objects, becoming educational spaces where learning is placed in a real context (Nofal et al., 2020; Ziebell & Suda, 2020). The origin of museums is linked to regional and local identity. Many institutions emerged to preserve the educational history of their communities, reflecting the need to safeguard historical heritage (Arrieta Urtizberea et al., 2020).

Influence of gamification on museum visits

The use of game design elements in museum education seeks to increase student engagement and enhance the learning experience through badges, leaderboards, stories, objectives and rewards (Garris et al., 2002). The contextual characteristics of the museum environment offer great potential for gamification, allowing for more dynamic interaction with exhibits.

The implementation of reward systems, narrative structures and aesthetic components makes learning in museums more engaging (Kapp, 2012). Skydsgaard et al. (2016) found that combining narrative elements with exhibits increases visitor interest and understanding. In addition, personalizing the visit allows visitors to choose narrative routes tailored to their experience. Nelson et al. (2020) observed that in a gamified environment, visitors asked nearly twice as many questions as in a traditional museum, indicating greater curiosity and interaction.

Gamification also fosters collaborative learning. Designing interactive experiences in museums promotes information sharing and verbal collaboration (Cabrera et al., 2005). Previous studies found that adding collaborative elements to a mission-based experience in a museum positively impacts visitor satisfaction. Despite its benefits, gamification in museums remains an underexplored field, although it represents a promising strategy to improve engagement and long-term learning (Sailer & Homner, 2020). Its success depends on thoughtful design and implementation tailored to the needs of the audience and the characteristics of the museum (Donadio et al., 2022).

Numerous research studies have analyzed the impact of gamification in museums from different perspectives. Klopfer et al. (2005) designed a digital game in which visitors assumed interdependent roles (technologist, biologist, detective) to solve a mystery, encouraging collaboration and analysis of exhibits. Similarly, Hope et al. (2009) studied family interactions with an interactive museum guide, highlighting how parent-child dynamics influenced technology use. Nelson et al. (2020) developed an application that allowed collaborative interaction with exhibits in real time, increasing engagement. In addition, Galindo-Durán and Sánchez-Fuentes (2024) compared the impact of knowledge acquired in gamified visits versus traditional visits, demonstrating their effectiveness in learning.

Gamification is particularly relevant in art and museum education because of its ability to transform the learning experience into a more interactive and meaningful one. Museums, traditionally conceived as passive viewing spaces, can benefit from gamified strategies to foster experiential learning and visitor engagement (Marques et al., 2023). Learning about art and history in museums depends on the visitor's ability to connect the exhibits to their context. However, static displays can make the experience passive and unengaging. Gamification introduces mechanics such as quests and rewards, allowing for autonomous and personalized exploration. This favors knowledge retention and emotional connection with the artistic heritage (Kupriyanov, 2023). In addition, active interaction with objects through gamified activities stimulates critical thinking and creativity, key skills in art education.

Despite the studies carried out in the field of education, there is still a long way to go for the real connection between the application of gamification in museums and the view of educational centers. The challenge faced by museums to increase the interest of young people in their visit can be solved through the game, therefore, this study will help to contribute to the field of knowledge as well as to promote the application of gamification in museum environments in collaboration with teachers, by analyzing the impact on the understanding of the artistic elements on display.

In relation to this, this study will also bring the empty research field of the connection between gamification, museum and didactics of artistic expression. Finally, this

research will serve as a basis for future research on the integration of gamification in heritage and artistic learning.

Objectives

The increase in motivation for learning after applying gamification in the classroom or other similar situations has been demonstrated in recent literature, however, few studies have analyzed the impact on the knowledge of the artistic works or the ability to understand the whole museum by the student reaching the ability to explain the museum by themselves.

Therefore, the main objective of this research is to verify the impact of this active methodology on higher education students in relation to the acquisition of knowledge of the museum from different perspectives. In turn, this analysis aims to check if the gamified visit is even more powerful than a traditional guided tour, or if the game inside the museum favors the understanding of knowledge compared to the knowledge acquired through a professional guide.

METHOD

Research Design

This research has been approached through a comparative of several tests where different concepts are analyzed after a visit to a museum. For this purpose, the group of students was invited to visit the museum on their own individually without giving any kind of instruction about the visit. Then, a group of students made a second visit, but this time with a professional guide who explained the pictorial works exhibited as well as the origins of the museum and its context, and at the same time, another group of students made a gamified visit prepared ad hoc. The aim is to observe the significant differences between the groups and to check to what degree and to what extent a gamified visit affects the knowledge of the works and the museum.

In order not to interfere with the results of the gamified visit compared to the rest, the individual visit had no time restrictions, so visitors could stay as long as they deemed appropriate, although the average duration was 35 minutes. However, in the guided visit, the duration was 60 minutes, as this was the time stipulated by the company that manages these visits. In this visit, the students received a structured tour with detailed explanations about the works exhibited and the historical context of the museum. Finally, the gamified visit lasted 75 minutes, of which, the first quarter of an hour was an explanation of the dynamics and the remaining hour of the visit to the museum with the dynamics of the game proposed in which students interacted with the exhibits, but also participated in the narrative of the game and performed activities designed to reinforce their understanding. Therefore, this analysis is a quasi-experimental study with pretest-posttest design for related samples where a comparative analysis of means will be used to evaluate the impact of gamification on the learning of the pictorial works.

Design of the gamified view

The gamification consisted of representing a (fictitious) race war, where they had to conquer a territory to win the game, for this, the narrative of the game through an initial story elaborated by artificial intelligence (AI) introduced them to the game. The group of students who participated in the gamified visit was divided into subgroups according to different races, such as Elves, Dwarves, Orcs, Humans, Fairies, etc., each of these races had a number of benefits and specific score for the battle. In addition, there was a fight to conquer territories in a fictitious map whose objective was to reach the largest part of territory that corresponded with the acquisition of points and therefore of knowledge. There were a series of levels, which supported the story and increased the strength or capabilities of each race. At the same time, a series of roles were randomly assigned to different players in order to introduce dynamic variables, such as thief, mage, warrior, sorcerer, etc. These roles allowed them to steal or convert or increase points in battle among other actions, making the game a motivating dynamic for the students.

Once the mechanics of the game had been elaborated, the didactic objective was to represent different elements of the museum through drawings, which they had to find, represent and write down certain characteristics (author, date, material, etc.). The delivery of the drawings to the teacher allowed them to acquire points for the conquest of the territory and future battles. The introductory story that was presented to them and the tests were these:

History: The War of the Lost Kingdoms.

Centuries ago, the Five Kingdoms lived in harmony, protected by the Great Orb of Knowledge. However, one day, the Orb's energy fragmented, scattering its wisdom across the world. Since then, Elves, Dwarves, Orcs, Humans and Faeries have fought battles to regain their power and claim supremacy over the vast lost territory.

Today, the armies have gathered their champions. Each race possesses unique skills: Elves, with their keen perception, decipher hidden secrets; Dwarves, masters of forging, interpret ancient inscriptions; Orcs, with their brute strength, advance without fear; Humans, born strategists, draw up plans of conquest; and Fairies, with their subtle magic, alter the destiny of war.

As the heroes explore the halls of the Great Archaeological Museum, they must find sacred artifacts, capture them in drawings and decipher their history. Each recovered piece strengthens their race and gives them points to expand their dominance on the map. However, mysterious hidden forces may turn the tide of battle... Who will rise to the power of the Orb and rule the realms?

As drawing tests and objects to locate, there were, among others, the following:

Objects to locate and draw:

Object over 5000 years old - Representation of an ancient civilization.
Ceremonial vessel - Decorated with inscriptions.
Ancient toy - Play item with historical engravings.
Ritual mask - Used in sacred ceremonies by an ancient culture.

Participants

The group of students who participated in the session make a total of 68 master students in teacher training over several years of study. The gender distribution has turned out to be fairly equal with 51% male versus 49% female. Ages ranged from 26 to 38, with a mean age of 31.29 and a standard deviation of 4.16.

Prior to the first individual visit, students were asked if they had visited the museum before, and 73.5% of students did not know the museum and had not visited it previously, compared to 26.5% who did remember having visited it, although they recognized that it had been more than 5 years

since that visit. Participation in the activity is part of the development of the course, which aims to show future teachers a dynamic way of teaching local cultural heritage outside the classroom context. In each type of visit, half of the student body participated, so 34 values were obtained for each type of visit.

Procedure

The study consists of several phases in its elaboration and execution. On the one hand, in the initial phase, the gamified visit was designed, as well as the elaboration of the questionnaires that would evaluate the knowledge of the museum and the capacity to explain its artistic heritage to future students. The questionnaires used to collect data were validated through a pilot test conducted in a previous academic year with a comparable cohort of students enrolled in the same course, ensuring clarity and reliability. Moreover, they were reviewed by experts in education (two Ph.D. assistant professors and one tenured associate professor) to ensure their content validity. The next phase consisted of a brief evaluation with demographic data including age, gender, studies and previous knowledge of the museum.

Finally, the two most relevant phases of the analysis, the first one, the initial evaluation of the knowledge about the pictorial works and the museum after visiting it individually with different questions all evaluated with a likert scale of 1-5. And a next phase with a subsequent evaluation with the same questions, after having made the visit through a traditional guided tour or a gamified visit. Finally, the data obtained were analyzed with statistical analysis programs to locate significant differences in the results obtained. The data collected were obtained during 3 academic years using QR digital forms as a data collection instrument.

Data analysis

The procedure used for data analysis looking for significant differences between the different visits performed has followed similar steps in pretest and posttest educational studies between paired samples such as those offered by Rivera Mata (2020) for the t-test for related samples or by Štiglic et al. (2018) for the Shapiro-Wilk Normality Test.

Therefore, initially the Shapiro-Wilk Normality Test was performed to determine whether the data follow a normal distribution. mostly obtaining that the collected data appear to follow a normal distribution, thus applying the t-test or if the data were non-normal and the Wilcoxon test would be used, calculating the t-test or Z-test Statistic depending on this casuistry.

After choosing the appropriate statistical test for each case, t-test for related samples if the data are normal or the Wilcoxon test for paired samples if the data do not follow a normal distribution, the following values have been shown in each case: p-value, which gives us a valid significance for p-values < 0.05. Mean (M) and Standard Deviation (SD) in each phase of the visit. Test statistic (Student's t or Wilcoxon's Z as appropriate). Effect size (Cohen's d), which helps in the interpretation of the results obtained, whether small, moderate or large according to these values: d = 0.2, Small; d = 0.5 Moderate; d ≥ 0.8, Large.

RESULTS

The results obtained in this study have been distributed according to the different types of visits and differentiating the items evaluated.

The first analysis is carried out for the comparison of knowledge about the museum, after obtaining an average of the different questions posed in the questionnaire. Next, the perceived ability to be able to explain the museum to their students in the future was studied, and finally a global comparison, with the average of all the values obtained from the pretest and the posttest.

Knowledge of the museum

The knowledge acquired by the students after the museum visits was evaluated considering three fundamental dimensions. First, their understanding of the historical and artistic context of the works exhibited was assessed, ensuring that they were able to interpret the periods, styles and artistic movements represented. Secondly, their abilities to correctly identify authors, materials and artistic styles present in the pieces observed were measured. Finally, their ability to establish relationships between the works and their cultural context was analyzed, demonstrating an integrative vision of the exhibited heritage.

The values obtained in table 1 show that there is a great difference between the guided or gamified visit and the individual visit with an average of 1.54 versus 2.68 and 3.04 for the guided and gamified visit respectively. This shows how either of them offer a greater knowledge of the museum versus the individual visit, supported with a p<0.00001. Cohen's d shows a significant effect in both comparisons: 1.56 between individual and guided visits, highlighting the improvement of learning with explanatory structure, and 2.1 between individual and gamified visits, indicating that gamification further enhances museum knowledge.

Tabel 1. Comparison of knowledge about the museum in the different types of visits

Variable	Mean (M)	SD	Test Statistic	p-value	Cohen´s d
Individual	1.54	0.67			
Guided	2.68	0.79	-7.23	<0.00001	1.56
Gamified	3.04	0.76	-9.89	<0.00001	2.1

Table 2. Comparison between the guided visit and the gamified visit in the knowledge of the museum

Variable	Mean (M)	SD	Test Statistic	p-value	Cohen´s d
Guided	2.68	0.79			
Gamified	3.04	0.76	-2.4	0.02233	0.47

Table 2 shows the comparison between the guided visit and the gamified visit in the values that evaluate knowledge of the museum. In this case, it can be seen that both the p-value and the Cohen's d value show little significance in relation to the difference between them. Although the mean of the gamified visit is higher than that obtained in the guided visit, no relevant conclusions can be drawn about the differential impact between the two. Cohen's d = 0.47 reflects a moderate advantage of the gamified tour over the guided tour in knowledge acquisition.

Ability to explain the artistic works to future students

On the other hand, the results obtained in the comparison between the ability to feel empowered to explain the museum, its heritage and its pictorial works to future students in Table 3, show how there is a great difference between the different visits. On the one hand, the difference in means is again significant, with a value of 1.88 for the individual visit compared to 2.79 and 3.32 for the guided and gamified visit respectively. In this case, the Wilcoxon test was performed, obtaining a p-value and Cohen's d values that demonstrate the large significant differences between these visits and the individual visit with p=0.00124 and p=0.00003. Cohen's d = 0.69 and 1.2, meanwhile, indicate that the guided tour has a moderate impact on students' confidence in explaining the museum, as well as revealing that gamification not only increases knowledge, but also significantly improves students' perception of their teaching ability.

In turn, Table 4 shows the comparison between both visits, the gamified and the guided visit, obtaining significant differences between them, with a p=0.01474 which implies that the gamified visit provides more value and capacity to explain the museum in the future compared to a traditional guided visit. Cohen's d = 0.45 reflects a moderate difference between the visits, highlighting that gamification improves students' autonomy to communicate acquired knowledge although the difference is not significant, gamification strengthens learning.

Global comparison.

Finally, all the values obtained in the pretest and posttest have been grouped to make a comparison between the guided tour and the gamified tour represented in Table 5. The data show that there are differences between both visits with a mean of 2.74 versus 3.18 for the gamified visit, their standard deviations are similar, close to unity and the t-test shows a p=0.00246, which is less than 0.05 being the limit to consider significant differences between both variables. On the other hand, the Cohen's d value was 0.44, which implies a moderate difference. A Cohen's d = 0.44 indicates a moderate impact of the gamified tour on knowledge retention versus the guided tour, highlighting interaction and motivation as key learning strategies.

Table 3. Comparison of the perceived ability to explain the museum and its works according to the type of visit

Variable	Mean (M)	SD	Test Statistic	p-value	Cohen´s d
Individual	1.88	1.32			
Guided	2.79	1.34	Z = 51	0.00124	0.69
Gamified	3.32	1.09	Z = 34	0.00003	1.2

Table 4. Differences between the gamified and the guided visit in the ability to explain the museum

Variable	Mean (M)	SD	Test Statistic	p-value	Cohen´s d
Guided	2.79	1.34			
Gamified	3.32	1.09	Z = 67.5	0.01474	0.45

Table 5. Overall comparison between the guided visit and the gamified visit in terms of learning

Variable	Mean (M)	SD	Test Statistic	p-value	Cohen´s d
Guided	2.74	1.09			
Gamified	3.18	0.94	-3.15	0.00246	0.44

DISCUSSION

The results of the study indicate that gamification improves learning in museums compared to individual visits. Both guided and gamified visits favor the understanding of the works, although with differences in their impact. While the traditional guide provides structured information, gamification encourages active exploration. Although the gamified visit showed a higher average in knowledge acquisition, the difference with the guided visit is not conclusive, suggesting that its effectiveness depends on the design and student profile.

The study reveals that gamification significantly improves students' ability to explain the museum and its works, surpassing the guided tour in confidence and autonomy in the transmission of knowledge. This effect can be attributed to the active interaction with the content, the resolution of challenges and the visual representation of museum elements, which facilitates the consolidation of learning. In addition, the assignment of roles in the gamified dynamic fosters greater emotional and cognitive involvement. These findings suggest that gamification enhances knowledge appropriation, favoring more autonomous and meaningful learning.

Gamification in museums can be explained from the theory of intrinsic motivation (Xu et al., 2021), since the playful elements reinforce the student's personal interest and sense of competence. In addition, it is linked to experiential learning, as it encourages active exploration and reflection on the experience (Morris, 2020). The

calculated effect size suggests that gamification has a moderate impact, indicating that, although it is a useful strategy, its implementation must be carefully designed to optimize its effectiveness. These findings reinforce the idea that the museum can benefit from gamified experiences, but not as a replacement for traditional visits, but as a complementary tool that enriches the visitor experience.

This study addresses a key gap in the literature on gamification in museums by demonstrating that, beyond motivating visitors, this didactic strategy directly influences the consolidation of knowledge and the improvement of participants' explanatory capacity. Unlike previous research focused on interaction or subjective enjoyment, our findings provide empirical evidence on how the playful structure enhances the understanding of exhibition content and its subsequent transmission, suggesting that gamification not only stimulates momentary interest, but also leaves a more lasting impression on the visitor's education.

In particular, the elements of gamification used in this study, such as immersive narrative, role assignment and structured competition, have proven to be determinant in the appropriation of knowledge. These dynamics have generated an environment where students not only acquire information, but must process, reorganize and explain it within the framework of the game, fostering a deeper internalization of the content. This approach allows museums and teachers to design more effective educational experiences, where interaction is not merely contemplative, but becomes a reflective and communicative practice, promoting a more dynamic and meaningful art pedagogy.

CONCLUSIONS AND RECOMMENDATION

This study shows that gamification helps to improve learning in museums, increasing visitor motivation and engagement. Comparing different types of visits, it is observed that both guided and gamified visits improve the understanding of the museum. However, gamification brings an extra benefit, as students feel more confident in explaining the content. This research contributes to the field by demonstrating that gamification not only improves knowledge acquisition but also strengthens explanatory skills, a key component in pedagogical development. This suggests that this strategy can make learning more autonomous and engaging, especially for higher education students interested in artistic heritage.

The moderate effect size indicates that gamification is a valuable tool to complement guided tours in museums, fostering learning autonomy without completely replacing the traditional pedagogical structure. By integrating playful dynamics into the museum experience, the visitor's interaction with the exhibition content is enhanced, generating more meaningful and participatory learning. These findings highlight that gamification can serve as an innovative educational methodology, bridging the gap between passive observation and active engagement with cultural content. From a practical perspective, this suggests that museums can design gamified experiences adapted to different visitor profiles, allowing students not only to retain information more effectively, but also to develop a deeper connection with cultural heritage. In addition, the implementation of gamification can contribute to audience diversification and knowledge accessibility by offering more dynamic and engaging experiences for audiences with different levels of familiarity with art and history.

Despite the positive results, it is important to consider that gamification is not a universal solution. Its effectiveness depends on the design of the experience, the profile of the participants and the balance between the playful component and learning. Further studies should investigate how different gamification mechanics interact with various learning styles to optimize their impact. In this sense, future research could focus on analyzing the long-term impact of gamification on knowledge retention, as well as exploring the combination of different didactic strategies to optimize its effectiveness. Additionally, expanding research to broader museum contexts and diverse educational settings will help validate the scalability of gamification as a transformative approach to museum education.

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Conflicts of Interest/Competing Interests

The author declares no conflicts of interest related to this study.

Ethics Approval

Not applicable. This study did not involve human subjects requiring formal ethical approval.

Consent to Participate

Not applicable.

Consent for Publication

Not applicable.

Availability of Data and Material

The data supporting this study are available upon reasonable request from the corresponding author.

Code Availability

Not applicable. No custom code or software applications were used in this research.

Authors' Contributions

This study was conducted by a single author, who was responsible for conceptualization, data collection, analysis, and manuscript writing.

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