

Talking to Machado de Assis: Generative Artificial Intelligence to Simulate Dialogues with Prominent Figures

Adilson Vahldick, André Luiz Cordeiro Gomes, Marcelo de Souza and Scheila Patrícia de Borba Curry

Universidade do Estado de Santa Catarina, Brazil

adilson.vahldick@udesc.br

andre.cordeiro0612@gmail.com

marcelo.desouza@udesc.br

scheila.curry@udesc.br

Abstract: Generative artificial intelligence encompasses techniques for automatically generating content such as image, music, and text. A common application of these techniques, especially involving text generation, is the construction of conversational agents. In education, generative artificial intelligence has the potential to transform the learning process and enable new forms of teaching, such as the practical application of concepts studied in class and the acquisition of new knowledge through the interaction with computational tools. In Brazil, literature teachers often complain about students' resistance to the content and insufficient reading practice. To address these challenges, this work presents a serious game in which students can chat with Machado de Assis, an important writer of the Brazilian literature. The game was developed by integrating with ChatGPT. The validation was conducted with 15 high school students for them to interpret the book "Dom Casmurro". The MEEGA+ instrument was used to evaluate the usability and the experience with the game. The main findings were that students better understood the book, found the game easy to use, and felt immersed in the conversation with Machado de Assis, although they assessed the texts as long and tiring. In a world dominated by faster and visually stimulating forms of entertainment, such as video games and social networks, students may have different expectations regarding the reading experience. If they are not used to reading denser and more introspective texts, they may find it difficult to maintain interest when chatting with Machado de Assis. Finally, another implicit point in the game dynamics is observed: the (re)signification of the methodology to be adopted by the teacher, who will perceive the need to complement interactions with the writer in class according to what he can or should answer, tending to responses that stimulate students to study more about what is within the realm of knowledge about Machado de Assis.

Keywords: Literature, Serious Game, Educational Game, Generative Artificial Intelligence.

1. Introduction

Generative artificial intelligence (GAI) creates and interprets data, generating new information or artifacts based on learned patterns (Hu, 2022). In education, some reported benefits include the use of conversational agents, automated grading of essays, and personalized learning (Baídoo-Anu and Ansah, 2023). Overall, teachers believe that GAI can positively contribute to their pedagogical practices, especially those who have already experienced techniques of this nature (Kaplan-Rakowski *et al.*, 2023). Indeed, many research studies are focused on identifying the impacts of GAI in education and research, with a special emphasis on its contributions to learning (Cooper, 2023; Peres *et al.*, 2023).

Conversational agents built on generative AI models have made notable contributions in education by allowing personalized and interactive learning. These agents leverage natural language processing capabilities to engage learners in dialogues, offering real-time feedback, elucidations, and customized educational materials. By emulating human-like conversations, they promote active engagement and deeper understanding of concepts in fields of knowledge (Bozkurt, 2023). Examples of conversational agents for education include the simulation of medical patients (Anubharath *et al.*, 2019), writing assistants (Resch and Yankova, 2019), and language tutors (Pham *et al.*, 2018). Besides, there are several examples of GAI's contributions in different areas of education, including chemistry (Atmosukarto *et al.*, 2021), geography (Wilby and Esson, 2024), and languages (Pack and Maloney, 2023).

This article presents an experiment involving 15 high school students using a serious game that, through a conversational agent provided by ChatGPT, reproduces a famous Brazilian literature writer named Machado de Assis. Their performance was measured through a pre- and post-test protocol with 10 multiple-choice questions. The MEEGA+ instrument was used to measure how enjoyable the game was (Petri, Wangenheim and Borgatto, 2018). The objective of this work is to verify whether this conversation with the author can improve students' understanding of one of his works and relate students' impressions to this experience.

The following section describes some theories and related work that served as inspiration for some aspects of our work. Section 3 presents the game mechanics and its elements. Section 4 describes the research questions

and the methodology used in our research. Section 5 presents and discusses the results obtained. The paper concludes with a summary of the main findings and some ideas for future work.

2. The use of Games to Overcome Challenges in the Teaching of Literature

Almeida (2007) identified that there are difficulties in all disciplines but observes that Literature is one of the most problematic area. One of the reasons is that teachers insist on recommending readings that are not highlighted in the media (the bestsellers) (Zamariam, 2016), or that are difficult to interpret due to elaborate vocabulary. Additionally, the intensive use of social media distracts students, constituting aspects contrary to literary reading (Mbamalu and Onyido, 2019). The provision of short and disposable information has accustomed individuals to rapid and chaotic consumption, the opposite of the concentration and slowness required by the reading of literary texts.

It is worth noting that Almeida (2007) highlights issues in the content of Literature disciplines. The contents are focused on the history of Brazilian literary movements, rather than on reading literature, which further distances students from an interest in reading. Almeida (2007) suggests doing the opposite: starting from the interpretation of the works to identify characteristics that position them within a literary school. Thus, studying Brazilian literature from this perspective represents imprinting a memory in the language (Payer, 2007), which valorises it as Brazilian cultural heritage and strengthens literature in the country's identity formation.

Games have been used as motivators to get students interested in reading (Silva and Fernandes, 2015). Learning is stimulated by curiosity through the presentation of new challenges that arise as the game and the story progress (Gee, 2004). Learning should be subordinate to the plot, but fun should come first, with instruction following afterwards (Zyda, 2005). For a serious game to be effective, it is necessary to strike a balance between teaching without losing the significant aspect of fun (Breuer and Bente, 2010), meaning that learning should be embedded directly in the flow of the game. Games can be used as a complement to literature teaching in schools to empower students in understanding and perceiving the poetic language from the books (Silva and Fernandes, 2015).

Furtado, Vallerius and Barone (2013) and Record Jr *et al.* (2023) proposed digital games to reproduce the book "Vidas Secas" by Graciliano Ramos (Brazilian writer). The first game is a proposal in which the character embarks on exploring the scenarios to experience the plot of the book. The second is a game that presents a visual novel, with some decision points by the player. The 13 chapters of the book were developed, and the game was evaluated by Computer Science students and Literature teachers, highlighting that the game is like a graphic novel that easily promotes understanding of the work.

Zamariam (2016) presented a tabletop RPG proposal based on the book "A Cartomante" by Machado de Assis. After evaluating it with three groups of four students who claimed not to enjoy reading, the author observed the recovery of the students' affection for reading, enabling them to become more immersed in performing the roles of their characters. Furthermore, in Roiphe (2020), 34 physical games were organized with applications for literature, taking into account students' low interest in activities directed towards text reading and textual production. This work presents inspirations for memory games, question and answer games, card games, and many other types.

These studies highlight a gap in student engagement with reading habits, pointing to the need for innovative strategies that can arouse students' interest and curiosity. The lack of motivation for reading not only affects students' academic performance but also compromises the development of critical skills and the appreciation of the cultural richness present in literary works. Therefore, the analysis of these works reinforces the importance of alternative approaches, such as the use of educational games, to reverse this worrying trend and promote a more vibrant and participatory reading culture in classrooms.

3. The Game: Historical Chat¹

Machado de Assis, son of poor mulatto parents and born in Rio de Janeiro in 1839, faced a difficult childhood and had limited access to formal education (Miguel-Pereira, 1938). However, his early intelligence and passion for reading led him to work as an apprentice typesetter, where he came into contact with various literary works. His works, which address themes such as society, human psychology, and the contradictions of urban life, are

¹ In Portuguese the game is called "Chat histórico".

known for their psychological depth and his ability to explore the complexity of the human condition. Machado de Assis passed away in 1908.

The application was developed for Windows 10 or upper using Unreal Engine 5.3.0. Unreal Engine is a game engine widely used for developing interactive digital games, creating immersive virtual reality experiences, and various other applications such as simulations and visualizations for medical and scientific visualizations (Epic Games, 2024).

To enable ChatGPT to mimic a personality, it is necessary to provide it with certain information when sending each sentence. For this experiment, the following text is transmitted with each interaction, to answer in the manner of Machado de Assis (translated from Portuguese).

Machado de Assis, one of the foremost figures in Brazilian literature, was born in Rio de Janeiro in 1839 and departed this mortal realm in 1908. A maestro of realism, his astute and perspicacious prose captivates readers worldwide. His mastery in delving into the human psyche and unveiling the intricacies of interpersonal relationships rendered him an iconic luminary of literature.

His refined and elegant prose, coupled with a discerning critique of society, established him as a paragon of literary excellence. Among his most renowned works are "Memórias Póstumas de Brás Cubas" (The Posthumous Memoirs of Bras Cubas), "Dom Casmurro," and "Quincas Borba." Furthermore, he distinguished himself in the realm of short stories, as exemplified by the narrative "O Alienista" (The Psychiatrist).

Please feel free to engage in dialogue, and I shall endeavor to respond in a manner reflective of Machado's distinguished style.

When entering the application, the welcome screen is shown as illustrated in Figure 1. After the user clicks in any place, the application displays the main menu with three options: play, about and exit.



Figure 1: Application Home Screen

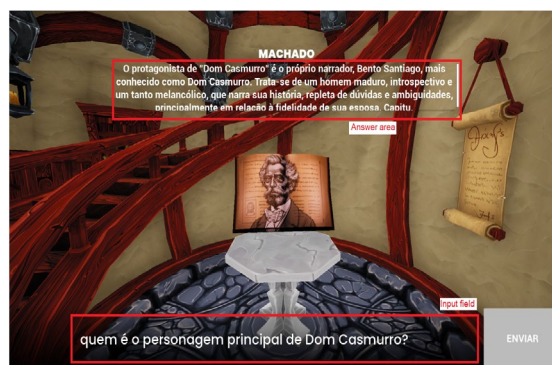


Figure 2: Main Screen

To start the interaction with the application, the user clicks Play, and he/she is transported down the stairs from a library to a Magical Book where the face of Machado de Assis is displayed.

From this moment the user can chat with Machado de Assis. Figure 2 demonstrates the corresponding graphical user interface. There is an input field where the user types his/her questions and sends them to Machado de Assis by clicking the button “Enviar”². Next, the application answers through a text above the book (the answer area).

4. Methods and Materials

4.1 Research Purposes, Questions, and Hypothesis

Even in serious games where learning is the main purpose, the game design must also take the enjoyment into consideration. This is important to promote student motivation, which is one of the reasons to use games in learning contexts. Furthermore, as previously described, students have lost interest in extensive and complicated readings in favour of the immediacy of social media and mobile device apps. Therefore, a conversational agent that reproduces Machado de Assis could be a way to try to increase students' interest towards literature.

The main purpose of this study is to assess whether the use of a conversational agent can increase students' motivation and interest in learning literature. The hypothesis examined in this study is as follows:

H₀: There will be no difference in students' knowledge about the book “Dom Casmurro” of Machado de Assis after the intervention with the game.

Also, as research questions we considered:

1. Did the students enjoy the game?
2. Did the students find the intervention with the game interesting for fostering their motivation in reading?

4.2 Participants

This study was conducted in August 2023 in a second year of high school with 15 students aged 16, comprising 8 males (53%) and 7 females (47%).

4.3 Procedure

The validation protocol was determined as follows (Figure 3): the teacher led the students with activities and tasks to develop their knowledge about Brazilian literature. One of the researchers attended a class to present aspects of the software development profession, discussed this research, and provided a consent form for their parents to sign. Along with the teacher, students were suggested to read the book “Dom Casmurro”. Another class was scheduled for them to return the form enabling them to carry out the experiment. Next, the students answered a pre-test (Figure 4) with ten multiple-choice questions. The researcher conducted the experiment initially by asking them to greet Machado de Assis to familiarise themselves with the application. Then, he asked the students to pose questions to Machado de Assis to comprehend the book “Dom Casmurro”, e.g., where the story takes place, who the characters are, what a 'casmurro' is, and events that occurred in the plot (as illustrated in Figure 5). After this period of interaction with the application, the post-test (again Figure 4) was applied with the same questions as the pre-test, but with a different order for questions and alternatives of answer. Then the researcher asked the students to express their opinions about the game using the MEEGA+ assessment instrument. To conclude, the researcher conducted a semi-structured interview (Figure 6) to gather the students' suggestions and impressions regarding the experience.

² In English is Send

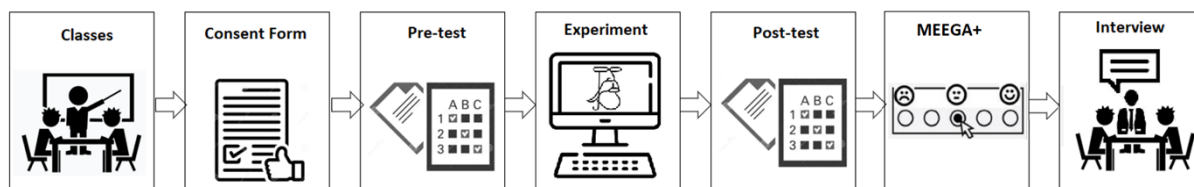


Figure 3: Validation protocol

1. What is the nickname that gives rise to the title of the book?
 a) Capitu Casmurro b) Bento Casmurro c) Dom Casmurro d) Doutor Casmurro
2. What is the central event that triggers Bentinho's jealousy towards Capitu?
 a) A wedding party b) Escobar's death c) Capitu's wedding d) A trip by Capitu
3. The narrator of the book is known by what nickname?
 a) Santi b) Bentão c) Ben d) Bentinho
4. What is the name of the protagonist in "Dom Casmurro"?
 a) José Dias b) Ezequiel c) Bento Santiago d) Capitu
5. In which city does most of the story take place?
 a) Rio de Janeiro b) Minas Gerais c) São Paulo d) Salvador
6. What is Bentinho's ultimate fate at the end of the book?
 a) He becomes a priest b) He marries Capitu and they live happily ever after c) He isolates himself from the world as a hermit d) He travels abroad
7. Who is Bento Santiago's best friend during his childhood?
 a) José Dias b) Escobar c) Padre Cabral d) Capitu
8. Which of the following statements describes the reliability of the narrator in Machado de Assis's "Dom Casmurro"?
 a) The narrator is completely reliable and reports events impartially.
 b) The narrator is a fictional character and does not influence the story in any way.
 c) The narrator is biased and tendentious, distorting events from his own perspective.
 d) The narrator is reliable but occasionally forgets details of events.
9. What is Escobar's profession?
 a) Lawyer b) Doctor c) Teacher d) Merchant
10. The book "Dom Casmurro" is an example of which literary style?
 a) Romantic Novel b) Realistic Novel c) Epic Poetry d) Science Fiction

Figure 4: Knowledge test questions

- 1) Greet Machado de Assis and ask to discuss the book "Dom Casmurro."
- 2) Try to find out about the book: how the story is constructed, who the main characters are, where the main locations are situated, etc.
- 3) What is the central part of the story? Who is involved?
- 4) Why is the book called "Dom Casmurro"? What is a "casmurro"?
- 5) What happens at the end of the story?

Figure 5: Suggested script for the students

1. What did you learn from playing this game?
2. What did you enjoy about this experience?
3. What did you not like?
4. Any other comments?

Figure 6: Semi-structured interview questions

5. Validation and Discussion of Results

The study aimed to assess the knowledge acquired between the two validation moments, as per the statistical hypothesis below.

$H_0: \mu_{pre} = \mu_{post}$ There will be no difference in students' knowledge about the book "Dom Casmurro" of Machado de Assis after the intervention with the game.

In Figure 7 is illustrated the frequency at which of 15 students play digital games. We can observe that the majority of students play at least once a week.

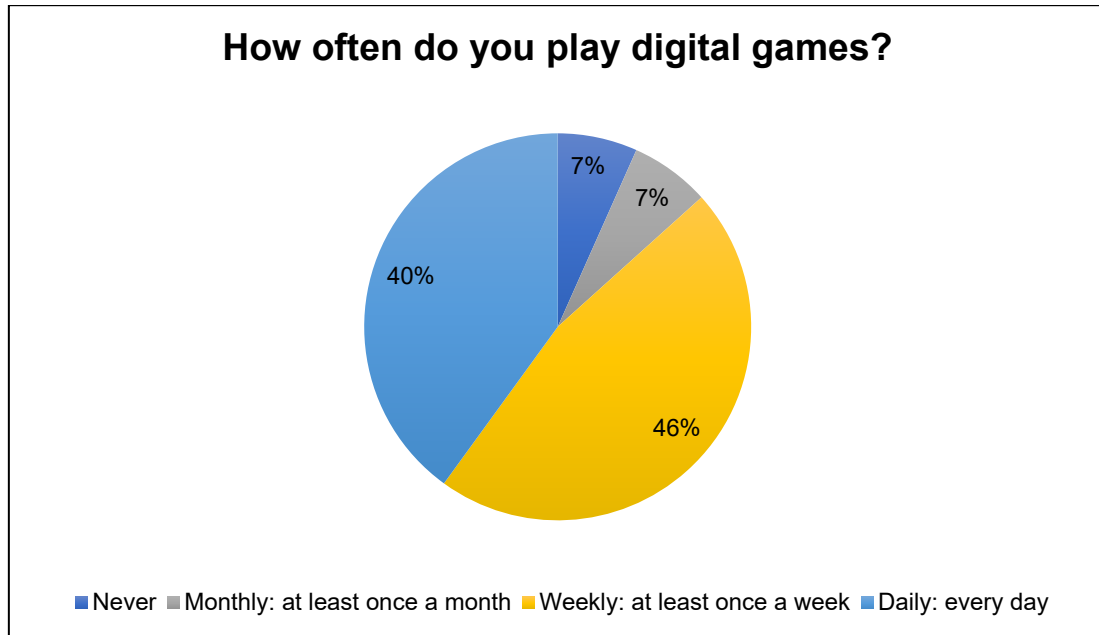


Figure 7: Frequency of students to play digital games

Table 1 presents the descriptive statistics of the tests. The questionnaire had 10 questions and 15 students participated, so total possible points are $10 \times 15 = 150$. It is evident that both the mean and median were higher in the second test compared to the first. Another interesting point is that the variation among students in each test remained similar. Additionally, Figure 8 displays the scores obtained by each of the 15 students in each test. Fourteen out of the 15 students improved their performance between the Pre-Test and Post-Test, while one student (number 2) maintained the same performance between the tests.

Table 1: Descriptive statistics of the knowledge tests

	Total possible points	Total points achieved	Mean	Median	Standard deviation	Variance
Pre-test	150	92	6.13	6	1.46	2.12
Post-test	150	131	8.73	9	1.53	2.35

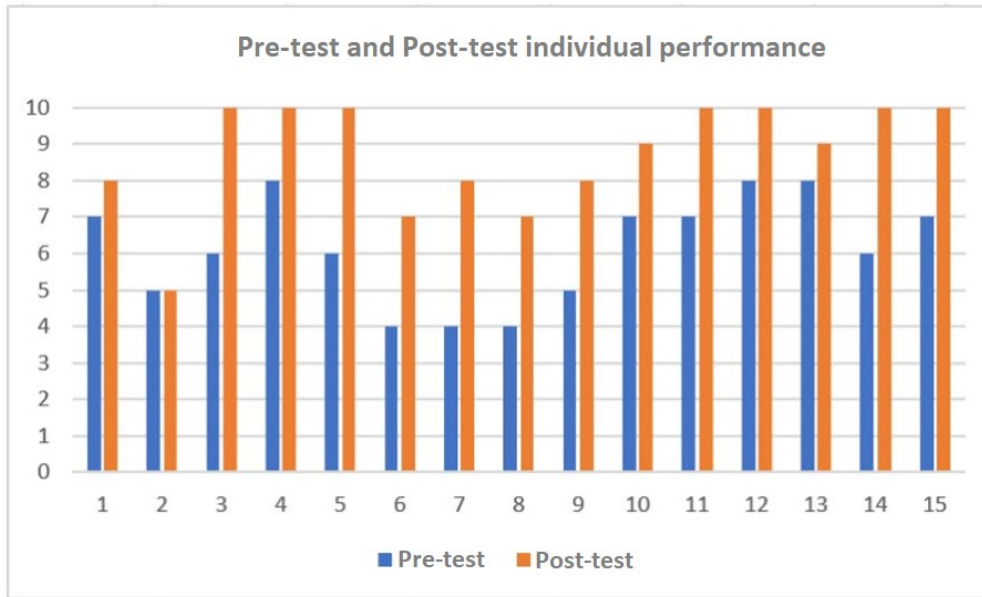


Figure 8: Individual performance on the tests

To verify whether the difference is statistically significant, the statistical hypothesis was evaluated using a paired t-test. The result of the *p-value* is 1.64×10^{-6} , so rejects the null hypothesis that the performance was the same between the two tests with over 99% confidence. Since the mean of the post-test was higher than the pre-test, it can be concluded that the performance improved after the application.

After the post-test, students answered the MEEGA+ instrument. It is composed by 27 items organized into 12 dimensions (aesthetics, learnability, operability, accessibility, confidence, challenge, satisfaction, social interaction, fun, focused attention, relevance and perceived learning) divided by two factors: usability and player experience. The graphs presented in Figures 9 and 10 show the distribution of each item among the five levels of agreement, from completely disagree (value=-2) to completely agree (value=2). The medians represent the most frequent level of agreement on that item. Almost all the medians show values of agree or strongly agree. Figure 9 show the items of usability factor. We can conclude that the lowest level of agreement was in the accessibility dimension, where students encountered some difficulty in reading due to the fonts size and styles. In Figure 10 are the items related to the player experience factor. Only the item describing the possibility of improvement in understanding the book did not reach the agreement of most students.

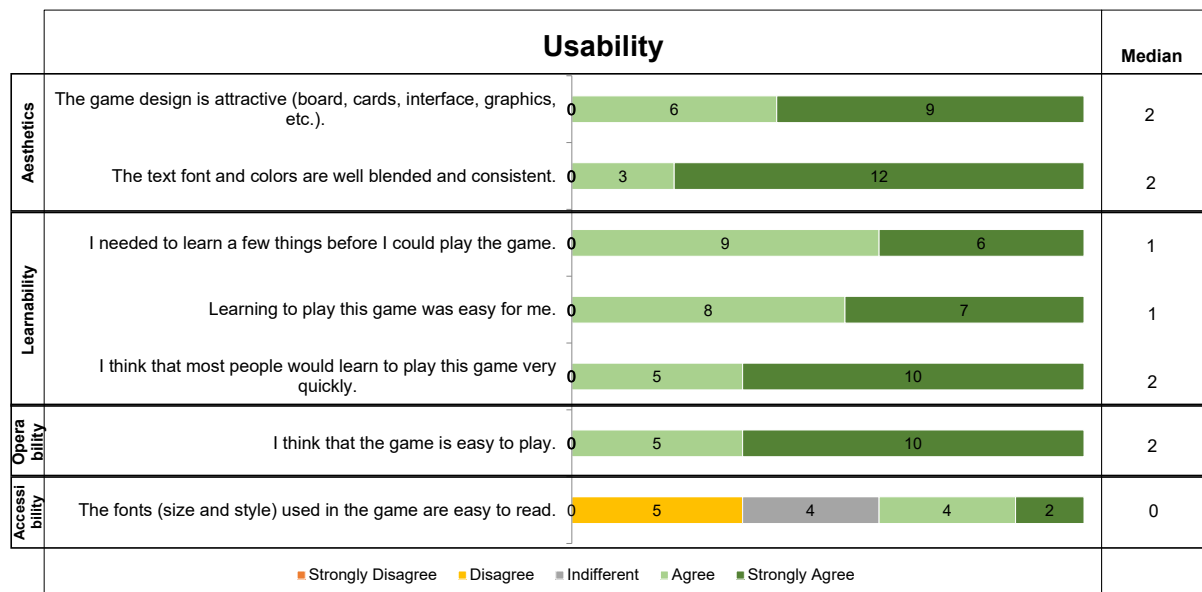


Figure 9: Usability evaluation

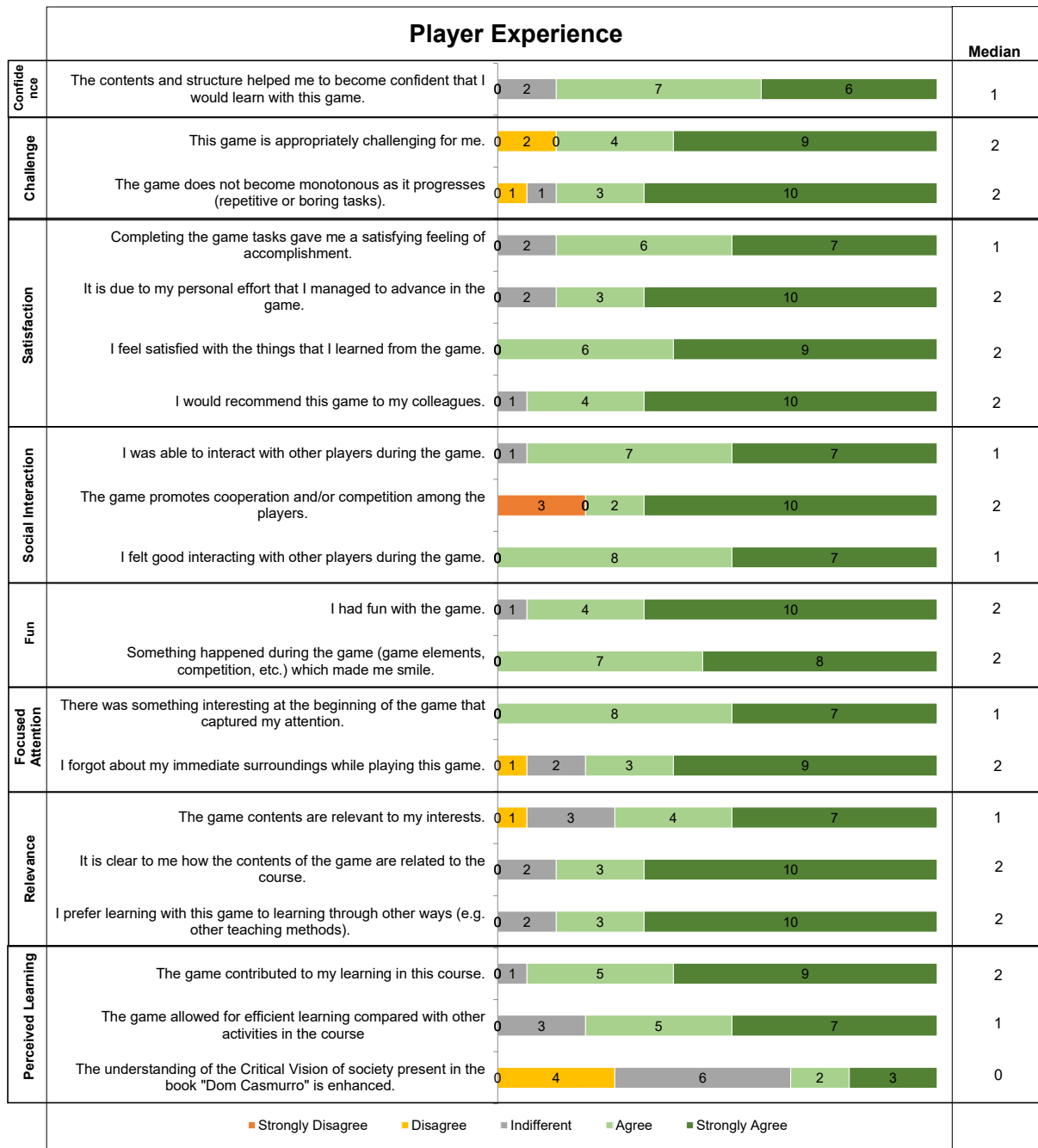


Figure 10: Player experience evaluation

To better understand these agreement values pointed out by the students, a semi-structured interview was conducted. The students commented that they enjoyed the activity of talking with Machado de Assis, as it allowed them to create a more intimate connection with him and the book, enabling them to explore other interpretations and aiding in the understanding of his messages and symbolism. However, the students highlighted the author's long and tiring responses, which required the use of a dictionary and a more accurate interpretation of what he was saying.

From a technical standpoint, the responses were coherent with the author's personality and the era he lived in. However, Machado de Assis' dialogues are structured in long narratives, and as reported by the students, they became tired very quickly with the stories presented. As an example of this, in the work "Dom Casmurro", the narrator-character, a 60-year-old man, recounts a love story with his neighbour, as well as a supposed betrayal. For a young person of the 21st century, in a context filled with technology, what interest is there in this plot? Presumably: none. Thus, literature is losing its value because the way it is brought into the classroom no longer

engages with the way contemporary youth construct knowledge. As a result, they do not read, cannot develop a habit because there is always something more interesting on the internet or in online games.

However, the students rated the game as easy to use and the gaming experience rewarding. Furthermore, as evidenced by the performance in the post-tests, interacting with Machado de Assis, even just within the context of reading one of his works, can be an educational and enriching experience that goes beyond simple literary analysis and extends to the personal and intellectual development of the students. The teacher's habit of engaging in this type of activity can modify the motivations and intentions of these young students.

6. Conclusions

The love for reading isn't "teachable", but young people can be guided on what to read if they find pleasure in reading. Differentiated and challenging activities can promote motivation in the pleasure of reading. The use of games, as presented in this paper, can be an effective alternative to awaken interest in reading. The interactive approach of games can make the reading experience more fun and stimulating.

Corroborating Gee (2004), learning does not simply occur through contact with technological tools, but rather through interaction. The game presented in this work demonstrates that. It was a fun interface with ChatGPT that mimicked Machado de Assis' responses, and its use showed that students achieved a better understanding of the book "Dom Casmurro". According to the results of the MEEGA+ instrument, the students enjoyed the game. However, as discussed at the end of the previous session, due to various factors, it is not possible to determine that the students found the intervention with the game interesting for fostering their motivation in reading.

The game configured as Machado de Assis can be used by the teacher to explore other books. Nevertheless, it demonstrated the potential for further research to investigate its effectiveness with other authors and, perhaps, the creation of more complex games involving different types of interactions with the author as an NPC (Non-Player Character), and even consequences based on the player's decisions according to the NPC's responses.

Acknowledgement

The authors acknowledge Udesc, through the Proeven 2024-1 notice, is offering funding for participation in ECGBL. We also want to thank the students that played the game and their teacher that allowed us to play with them.

References

- Almeida, S. M. J. (2007) 'Literatura serve para...? Questionamentos sobre ensino de literatura na educação brasileira', *Revista Científica da FASETE*, (1), pp. 17–24.
- Anubharath, P. et al. (2019) 'Usability and user experience evaluation of Virtual Integrated Patient', in *36th International Conference of Innovation, Practice and Research in the Use of Educational Technologies in Tertiary Education: Personalised Learning. Diverse Goals. One Heart.*, pp. 18–28. doi: 10.14742/apubs.2019.1.
- Atmosukarto, I. et al. (2021) 'Enhancing Adaptive Online Chemistry Course with AI-Chatbot', in *IEEE International Conference on Engineering, Technology and Education, Proceedings*, pp. 838–843.
- Baidoo-Anu, D. and Ansah, L. O. (2023) 'Education in the Era of Generative Artificial Intelligence (AI): Understanding the Potential Benefits of ChatGPT in Promoting Teaching and Learning', *Journal of AI*, 7(1), pp. 52–62.
- Bozkurt, A. (2023) 'Generative artificial intelligence (AI) powered conversational educational agents: The inevitable paradigm shift', *Asian Journal of Distance Education*, 18(1), pp. 198–204.
- Breuer, J. and Bente, G. (2010) 'Why so serious? On the relation of serious games and learning', *Journal for Computer Game Culture*, 4(1), pp. 7–24.
- Cooper, G. (2023) 'Examining Science Education in ChatGPT: An Exploratory Study of Generative Artificial Intelligence', *Journal of Science Education and Technology*, 32(3), pp. 444–452.
- Epic Games (2024) *Unreal Engine: The most powerful real-time 3D creation tool*. Available at: <https://www.unrealengine.com/> (Accessed: 13 March 2024).
- Furtado, A., Vallerius, D. and Barone, D. (2013) 'O Jogo Digital como Motivador do Interesse pela Literatura Brasileira em Alunos do Ensino Médio', in *Nuevas Ideas en Informática Educativa*, pp. 723–726.
- Gee, J. P. (2004) 'Learning by design: Games as learning machines', *Interactive Educational Multimedia*, 8(April 2004), pp. 15–23.
- Hu, L. (2022) *Generative AI and Future*. Available at: <https://pub.towardsai.net/generative-ai-and-future-c3b1695876f2> (Accessed: 9 March 2024).
- Kaplan-Rakowski, R. et al. (2023) 'Generative AI and Teachers' Perspectives on Its Implementation in Education', *Journal of Interactive Learning Research*, 34(2), pp. 313–338.

- Mbamalu, B. O. and Onyido, J. O. (2019) 'A Critical Analysis of Social Networking and its Influence on Undergraduates' Reading Habit', *International Journal of Scholarly and Educational Research in Africa*, 12(5), pp. 07–16.
- Miguel-Pereira, L. (1938) *Machado de Assis (estudo crítico e biográfico)*. São Paulo, Brazil: Companhia Editora Nacional.
- Pack, A. and Maloney, J. (2023) 'Using Generative Artificial Intelligence for Language Education Research: Insights from Using OpenAI's ChatGPT', *TESOL Quarterly*, 57(4), pp. 1571–1582.
- Payer, M. O. (2007) 'Processos de identificação sujeito/língua: Ensino, língua nacional e língua materna', in Orlandi, E. P. (ed.) *Política linguística no Brasil*. Campinas, SP: Pontes, pp. 113–123.
- Peres, R. et al. (2023) 'On ChatGPT and beyond: How generative artificial intelligence may affect research, teaching, and practice', *International Journal of Research in Marketing*, 40(2), pp. 269–275.
- Petri, G., Wangenheim, C. G. von and Borgatto, A. F. (2018) *MEEGA+ : A Method for the Evaluation of Educational Games for Computing*. Florianópolis: UFSC.
- Pham, X. L. et al. (2018) 'Chatbot as an intelligent personal assistant for mobile language learning', in *2nd international conference on education and e-learning*, pp. 16–21.
- Record Jr, C. R. et al. (2023) 'Vidas Secas: Jogo Sério para Ensino de Literatura', in *Congresso Brasileiro de Informática na Educação*. Passo Fundo, RS.
- Resch, O. and Yankova, A. (2019) 'Open knowledge interface: A digital assistant to support students in writing academic assignments', in *1st ACM SIGSOFT international workshop on education through advanced software engineering and artificial intelligence*, pp. 13–16.
- Roiphe, A. (2020) *Literatura em Jogo: proposições lúdicas para aulas de português*. 2nd edn. Aracaju, Brazil: Criação Editora.
- Silva, A. V. B. da and Fernandes, F. (2015) 'Leitura em Jogo: Considerações sobre o Ensino de Literatura e Jogos Digitais no Paraná', *Revista Língua & Literatura*, 17(30), pp. 133–159.
- Wilby, R. L. and Esson, J. (2024) 'AI literacy in geographic education and research: Capabilities, caveats, and criticality', *The Geographical Journal*, 190(1), p. e12548.
- Zamariam, F. (2016) 'Literatura em jogo: Ensino de literatura por meio do RPG', in *Congresso Latino-americano de Formação ed Professores de Línguas*. Londrina, PR.
- Zyda, M. (2005) 'From visual simulation to virtual reality to games', *Computer*, 38(9), pp. 25–32.