

Developing and Validating a Qualitative Tool for Playtesting Service Learning-Based Accessible Games: A Comprehensive Approach

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Abstract

INTRODUCTION: The complex accessibility needs of some players and, in particular, of people with Intellectual Disability (pwID) require greater attention from research due to the lack of tools to support playtesting, particularly those of a qualitative nature and suited to their diversity of experiences and motor and cognitive characteristics.

OBJECTIVES: Recognizing the scarcity of research in media production, particularly games, the study pursues three objectives: firstly, to describe the accessible games developed through a multi-year service learning project involving students from the Videogames Bachelor's Degree and pwID; secondly, to approach the validation of the Gaming Observation Grid (GOG), a qualitative tool for playtesting sessions; and thirdly, to reflect on service learning as a strategy for bridging the gap between academia and civil society in the context of game design.

METHODS: The research employed a qualitative media ethnography-based approach involving students from the Videogames Bachelor's Degree. Over a span of three years and six consecutive semesters, 59 students actively participated in a service-learning project, engaging with pwID and Non-Governmental Organizations (NGOs) in the field. All playtesting activities' observations were based on GOG, with a total of 273 observed gaming sessions.

RESULTS: The development of 18 videogames, spanning diverse genres and themes, prioritized accessibility based on adjustment settings. GOG emerged as a tailored and feasible instrument, valuable in the broader landscape of inclusive game development. In terms of service-learning outcomes, results highlight students' reflections on the real-world impact of game design and development, underscoring the pedagogical value of service learning in bridging theoretical knowledge and practical application.

CONCLUSION: This study underscores the critical need for enhanced research attention to the complex accessibility requirements of players, particularly pw ID, while emphasizing the relevance of qualitative playtesting tools tailored to their diverse experiences and cognitive-motor characteristics, as well as the inherent value of the experience for the students involved.

Keywords: Accessibility, Inclusive Games, Service Learning, Intellectual Disability, Playtesting

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1. Introduction

In contemporary times, games have been increasingly recognized as an important form of culture [1]. Thus, full

citizenship will also involve improving their accessibility for people with specific needs and functional diversity, such as individuals with Intellectual disability (ID) [2].

In order to fulfil this premise, it is necessary to rethink the models of participation of people with Intellectual Disability (pwID) in the creative processes inherent in

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games, through: (a) comprehensive playtesting support techniques that consider human diversity in person-game interaction; and (b) models of involvement of game designers and developers with the community and, consequently, with their end users and their respective needs.

This study therefore presents a proposal to validate a qualitative instrument for playtesting, with a focus on cognitive and motor accessibility. The methodological disruption in its research design is introduced by service learning as a way of engaging with the community and potential players. At the same time, this strategy is also seen as a way of engaging with the community, aiming for the integral development of students and future game designers and developers.

1.1. Service Learning

Service learning is an educational approach that combines academic instruction with community engagement to create a Service learning is an educational approach that combines academic instruction with mutually beneficial experience [3]. Its key elements include academic rigor, community engagement, reflection, critical thinking, collaborative learning, fostering civic engagement and citizenship, and aiming for long-term community impact [4]. This pedagogical approach enriches students' educational experiences, promoting holistic learning, essential life skills, and social consciousness [5]. It also strengthens the connection between educational institutions and communities, fostering responsible and engaged citizens prepared to address societal challenges [6, 5, 7].

According to Lozano et al. [5], the pedagogical approach that is inherent to "community service learning" is the basis for the development of a set of competencies related to the community and social justice. This includes, in a direct manner, interpersonal relations, strategic action, and personal involvement. More indirectly, it can also promote students' competencies for interdisciplinary work, justice, responsibility, ethics, empathy and change of perspective, communication, and the use of media. Through a more cognitive lens, Novak et al. [8] reported results from a meta-analysis sustaining the impacts of service learning on students' "understanding of subject matter, skills learned, and ability to apply knowledge and reframe complex social issues" (p. 153).

While for fields such as health, the pedagogical value of service learning is already widely adopted as an asset in higher education, the same is not true for areas related to creativity and the arts [9]. More specifically, in the wider field of audiovisual and media production, the idea of service learning is even less explored. However, some good practices have already been explored. A relevant example has been developed at the University of Barcelona, most specifically within the Audiovisual Communication Degree, in which a wide range of entities can request the involvement of students and professors to

develop an audiovisual product in the context of a communication campaign. The obtained results emphasize the role of this pedagogical strategy on emotional learning, through the lens of positive psychology, valuing both tacit knowledge and students' well-being. Moreover, it also stresses how the obtained outcomes can sustain the university's alignment with the 2030 Agenda of the United Nations, considering their focus on equality and social action [10]. Despite the potential success of service learning in such fields, Bringle & Clayton [11] emphasized how integrating it with digital technologies, in the contemporary educational context, would imply the articulation of several pillars, including partnerships, co-creation, and critical reflection, through hybrid learning platforms.

This scarcity is reflected in games research. Some approaches are notable, such as the ones from Jacobs [12] or Jin, & Xu [13] where service learning served mainly as a peer-support and peer-learning mechanism but lacks an exploration of the impacts of community involvement in the game design process. Exploring this path may be even more relevant if we consider how the involvement of underrepresented communities in gaming is a priority, particularly in terms of improving the processes of representation [14, 15, 16] and accessibility in this industry [17, 18].

Considering this need to involve communities in creative processes and, in particular, game design and development, the inclusion of projects with the community in curricula seems to be a relevant strategy to reduce the gap between academia and the needs of the different stakeholders [2].

1.2. Accessible Games and Playtesting Tools

Game accessibility refers to the deliberate measures, designs, products, and technological elements implemented to ensure that games are playable by all individuals, with a particular focus on those with disabilities [19]. In a more comprehensive manner, exploring the accessibility of games entails understanding them as a crucial part of contemporary culture and, through a more sociological perspective that transcends technical accommodations, understanding the systemic exclusion of people with disabilities from gaming [20]. In the specific field of scientific research, this exclusion has also been conveyed, with a high prevalence of approaches to these people as passive and closed techniques that do not absorb the individuality of their experiences with games [17].

Iterative prototypes and playtesting have a role in shaping the design of both successful commercial games [21] as well as in the realm of "serious" game design or game development for specific purposes. Beyond the conventional refinement of game mechanics, playtesting serves as a pivotal mechanism for addressing conflicts that may arise among pedagogical objectives, content integration, and gameplay dynamics. Moreover, it

facilitates the transformation of theoretical debates into tangible outcomes by evidencing the efficacy or shortcomings of design concepts through practical demonstration of their success or failure [22].

One of the potential ways of including the voices and feedback of people with disabilities in the game design and game development process is, therefore, through frequent testing and concordant inclusion of their feedback and accessibility needs in new prototypes [23, 24], even from an early stage [25].

A wide range of techniques and methods can be used to support the playtesting process, under more quantitative or qualitative lenses. At the quantitative level, the scales—validated and standardized for specific purposes and populations—and the supporting guidelines stand out. In the first area, we can highlight approaches such as the Game User Experience Satisfaction Scale (GUESS) [26] or the User Engagement Scale (UES) [27]. Even so, it is important to emphasize the scarcity, or total absence, of instruments in this field, specifically validated for the needs of pwID, with a specific focus on accessible language, easy reading, and cognitive accessibility in general. At the qualitative level, the approaches to the study of the gaming experience of people with specific accessibility needs are broader but also scarcer, emphasizing the prevalence of a vision more associated with positivism in this field [17].

Considering this state of the art, the primary objective of this study is to comprehensively explore the impact of service learning in game design, centered around the creation of accessible games and the validation of a playtesting accessibility tool. The exploration of this path will be done through three specific objectives:

- O1. To describe the accessible games produced in the context of a multi-year service-learning project involving higher education students from the Videogames Degree program and people with ID from institutions in the community.
- O2. To validate a qualitative tool used in the playtesting sessions of this project, aimed at observing interaction with the games, including aspects of cognitive and motor accessibility and game experience.
- O3. To reflect on service learning as a strategy for reducing the gap between academia and civil society, considering the specific context of game design and game development.

2. Method

2.1. Participants and Procedure

The participants in this study were students from the Videogames Bachelor's Degree course at Lusófona University in Lisbon (Portugal).

The game development process took place over three years, i.e. six consecutive semesters. During this time, 59

students completed the project, considered for the purpose of this research as a "sample", since they were the ones who had direct interaction with the grid developed and participated in the so-called service-learning process.

The process of developing the games was based on the principles of inclusive research [28, 29] and the premises of service learning [8] and was carried out with the involvement of a wide range of adult with ID and Non-Governmental Organizations (NGOs) in the field, located on the surroundings of Lisbon.

Each project (game) was developed over two semesters, each of which involved playtesting with the pwID and then integrating feedback based on the observation grid developed. This study analyzes, jointly and qualitatively, the characteristics of a subset of the games produced in this period, as well as the uses and content of the grids used in the playtesting sessions.

2.2. The Gaming Observation Grid (GOG)

GOG is a qualitative tool adapted from previous empirical studies – both with other demographics [30] and within the same scope and field [24] – to support the observation of game playtesting sessions with a primary focus on motor and cognitive accessibility. In its scope, these are considered as two dimensions of the person-game interaction, in which barriers and obstacles to the full enjoyment of the experience can emerge.

Its aim is to establish categories to guide the observation of these playtesting processes, based on the premises of media ethnography, as “an effort to cover the full (and expanding) range of people’s relationship with consuming and/or making media” (p.295) [31].

Thus, observers must fill in each of the following categories with textual information:

- Interaction: It is a top observation category that, for the purposes of GOG, is made up of the motor and cognitive dimensions of accessibility that emerge from the interaction between the person and the game.
 - Cognitive accessibility: This category includes all the aspects that emerge from the interaction between the game and the player's different cognitive functions. All the barriers or difficulties observed in this area that impact the gaming experience should be recorded, examples of which are evaluating the learning curve, clarity of instructions, and memory demands.
 - Motor accessibility: This category encompasses observations related to the effectiveness of control schemes, the intuitiveness of input methods, and the adaptability of game mechanics to accommodate players with different motor skills. Observers should register

barriers or challenges in this realm, such as evaluating the ease of control, responsiveness of input devices, and the implementation of accessible features.

- Behavioral observations: This category should include players' actions, reactions, and interactions during gameplay. It involves capturing observable behaviors that manifest as a result of the player's engagement with the game, providing insights into their preferences, decision-making processes, and emotional responses.
- Game experience: This category aims to capture the subjective and holistic assessment of players' emotional responses done by the observer, as well as their overall enjoyment and immersion. This includes the qualitative aspects of the gaming encounter, including the aesthetic appeal, narrative engagement, and the player's sense of accomplishment or frustration.
- Main comments from the players: This category emphasizes the importance of directly quoting players to preserve, as much as possible, the original context, tone, and nuances of their comments.
- Other aspects or observations: Other aspects observed that have a potential impact on the way the playtesting went and are not covered in the previous categories are recorded here. It can also be a place to note bugs or other technical issues.

If the playtesting session tests more than one game, the grid should be adjusted to have one row for each, with the remaining columns always being similar.

In addition to the qualitative observation aspects, some specific questions should be recorded, such as: (a) date; (b) venue; (c) number of participants; and (d) material and equipment.

GOG can be filled in on paper, computer, or mobile devices. However, depending on the context, the team conducting the playtesting should reflect beforehand on the impact of the setting on the results obtained, including the excessive presence of computers in the physical space, for example. It is also important to point out that, although GOG can have different hypothetical uses, its validation in this context was based on the specific case study of pwID.

3. Results

3.1. Produced Games

To date, 18 video games have been developed and are at three different stages of development and publication: a) published on the website ($n = 5$); b) finalized and awaiting publication ($n = 3$); c) awaiting adjustments and/or validation ($n = 10$) – for the following description, the games in groups "a" and "b" have been described, as they are considered to be completed.

The videogames are organized by genre, with a brief description of the gameplay and notes on stimulation. Regarding accessibility, all the games include adjustment settings, such as speed and frequency, and have been developed to be accessible to pwID with high support needs and a functional diversity that enables the autonomous use of at least one hand.

3.1.1. Endless Runner

This game is a two-lane endless runner, where the player can switch between them or jump to dodge obstacles and catch the umbrellas. The action takes place in three different 3D environments (city, forest, and beach) in the rain, where you control the race of a lady in a tracksuit who protects her unfinished hairstyle with an umbrella. The game will be restarted if she hits any of the obstacles or fails to pick up one of the umbrellas scattered around the course before the umbrella's "expiry bar" runs out.

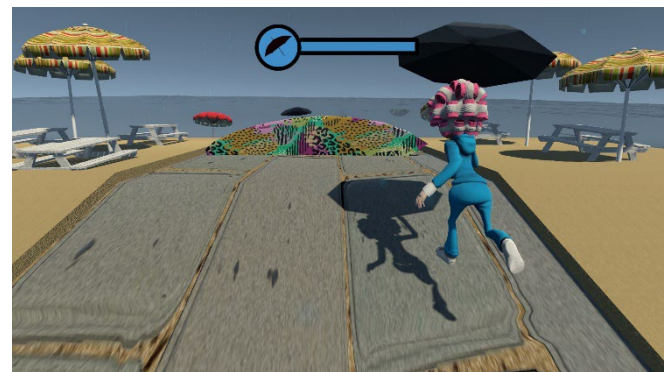


Figure 1. Screenshot from the game Endless Runner

3.1.2. SymphoNotes

SymphoNotes is a platformer in a 2D environment with an 8-bit aesthetic, where the aim is to reach the end of a platform course by collecting as many music notes as possible without colliding with obstacles or falling off platforms. Music is a crucial factor in this game, not only because of the objective of collecting the musical graphics that are positioned in tune with the sound rhythm, but also because of the intention to reinforce immersion in the three scenarios that make up the game and which refer to the 4 difficulty levels: tutorial, easy, medium and difficult. In addition to this possibility of adjustment, it is possible to remove the background image of the environments and the purely decorative elements in order to make it easier to focus on the actions of the game.



Figure 2. Screenshot from the game *SymphoNotes*

3.1.3. Orbiter

Orbiter is an arcade game in which you control a spaceship through space, avoiding asteroids, planetoids and enemy ships. The player is challenged to help an alien return to his home planet. The environment is 2D, with a top-down view, with the various obstacles represented in simple geometric shapes (hexagons, circles and stars) and arranged along concentric rings with a full circle in the center, alluding to a planetary system. The ship starts its journey in the largest ring and to reach the center it must jump from orbit (ring) to orbit avoiding collisions; once it reaches the center it moves on to the next planetary system (level). To succeed, you'll have to coordinate the timing of your jumps with your movement along the orbits to avoid obstacles - you can adjust the speed of your ship's movement and one or two directions of movement in the orbit. The game ends when there are collisions or when the last journey is successfully completed.

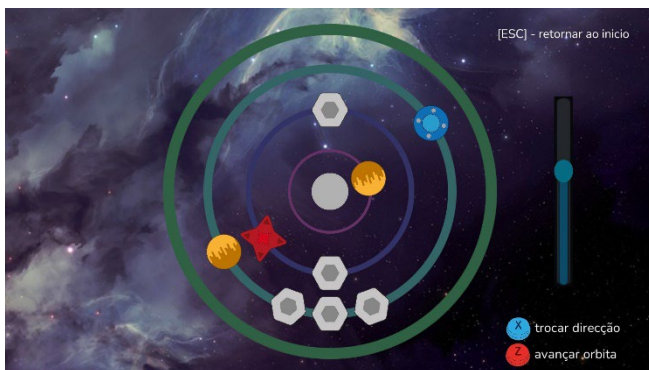


Figure 3. Screenshot from the game *Orbiter*

3.1.4. Space Conqueror

Space Conqueror is an arcade game inspired by classic spaceship games, in a 2D environment with an 8-bit aesthetic, where the aim is to survive a journey through space without being destroyed by enemy ships. The screen is divided into 4 horizontal lanes through which the ships are distributed, with the enemy ships on a collision course

with the player's ships. In order for the journey to end, you have to avoid the enemy ships by shooting them or changing lanes as you go up the difficulty level. In terms of difficulty settings, there are three game modes (easy, medium, hard) and a gradual progression option.



Figure 4. Screenshot from the game *Space Conqueror*

3.1.5. Chicken Shooter

Chicken Shooter is a first-person shooter set in a 3D environment at an amusement park. On a stand, the player is challenged to shoot at stuffed chickens that run along the four paths linking the building they come out of with the shooting stand. Eliminating a chicken result in an explosion of confetti, an option that was designed to fulfil the request of the partner institution's technicians to avoid the blood effect that is usually the option for this type of game. As far as the performance record is concerned, you can choose between a time limit, a maximum number of chickens that aren't eliminated, or just training mode with no conditions. These three options for customizing are combined with the possibility of changing various parameters of the game, such as the frequency of chickens leaving, speed, playing time, and lives.

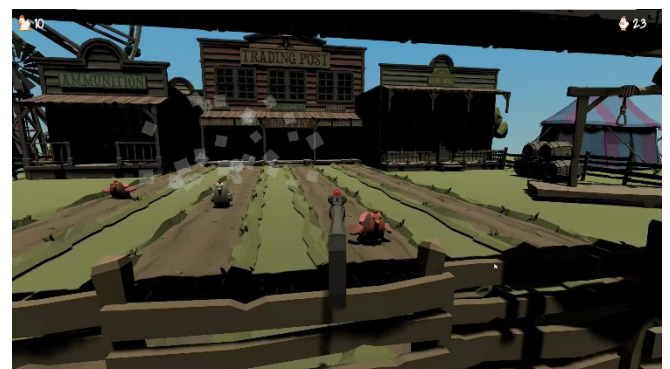


Figure 5. Screenshot from the game *Chicken Shooter*

3.1.6. Mini-Golf Extravaganza

Mini-Golf Extravaganza is a casual game in a 3D environment that explores the imagery of Mini-Golf parks, where the player has to get a golf ball into the hole at the end of the course with the fewest "hits" possible, being able to control the direction and force of the ball. The game is very rich in environments and types of obstacles, with various levels in each of the three possible universes—park, space, and medieval—which are unlocked as you progress through the game. In terms of player settings, it includes various options, such as three aspects of the sound environment, the speed of the power bar, the power of the ball and the speed of the dynamic obstacles.

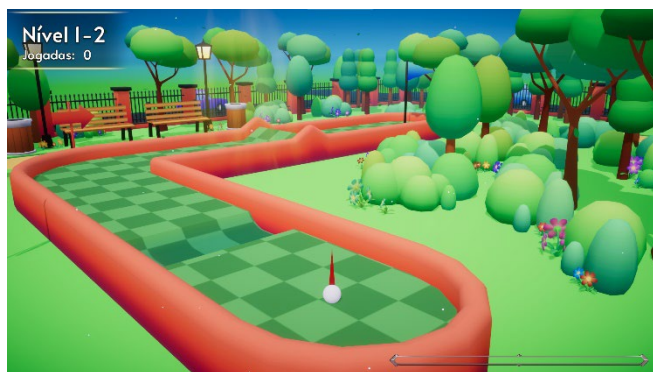


Figure 6. Screenshot from the game *Mini-Golf Extravaganza*

3.1.7. Canoe

Canoe is a first-person simulation adventure game set in 3D river and cave environments. The player is challenged to steer a canoe and collect objects to overcome obstacles along the way. Designed essentially as a multi-sensory journey of observation and exploration in nature, the few obstacles and tools that have to be overcome and collected along the way only serve as an incentive to observe the details of two different spaces in sound and image (the riverbank and the cave). If you want to enter the cave, you'll always have to find and collect the tool that will allow you to destroy the log that prevents you from accessing it, but it won't be any less valid in gameplay terms if you decide to "just" follow the riverbank.

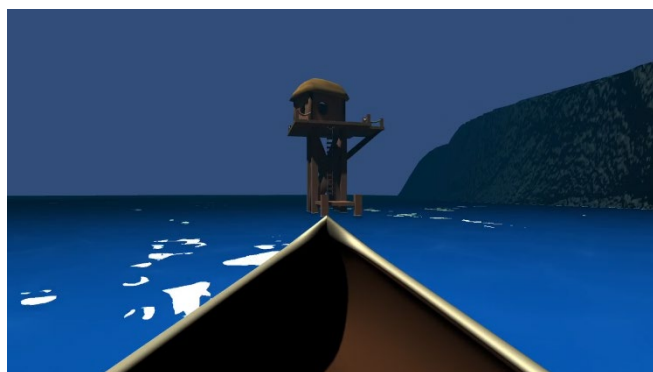


Figure 7. Screenshot from the game *Canoe*

3.1.8. Futebolástico!

Futebolástico! is a video game that explores the imagery of football, in a 2D top-down environment, that challenges players to overcome a series of labyrinths in order to win. So, we are presented with a football pitch, where in the first levels pins are scattered, and in the following levels the players of two teams. All the elements are static, except for the character controlled by the player who has to carry the ball from the left side of the pitch to the goal on the opposite side. The possible paths to this end, conditioned by the position of the players on both teams, become more difficult as the game progresses. There is no time limit and no possibility of conceding goals because the opponents are static, but the player is given feedback on his progress through the indication of goals scored.

To elevate the game's visuals and difficulty, each mini-golf board includes a fan near the edge. Players need to find a flower on the course and deliver it to the fan, introducing a thematic challenge for added complexity.

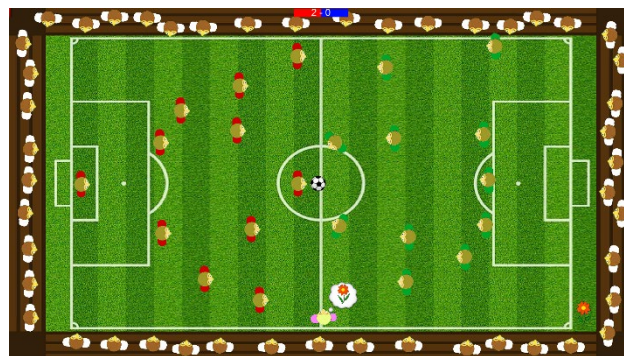


Figure 8. Screenshot from the game *Futebolástico!*

3.2. Grid Validation

During the three academic years covered by the study – 2020/2021, 2021/2022, and 2022/2023 – GOG was used to observe a further 273 game sessions, for the games described above and other that are still waiting for some adjustments and validation, as described in the previous section. Its validity was substantiated through its application in the analysis of observations from 59 students actively engaged in the game development process, and subsequent enhancement of the games. The grid demonstrated its relevance in discerning barriers and obstacles to the full enjoyment of the gaming experience, especially among pwID. The categories within the grid proved to be relevant, aligning with the defined inclusive research principles and service learning approach.

The "Interaction" category within GOG served as a comprehensive lens, combining motor and cognitive dimensions of accessibility in assessing the player-game interaction. For example, in *Orbiter*, observations captured the coordination of spaceship movements through space, evaluating the effectiveness of control schemes and the adaptability of game mechanics. This category facilitated a holistic understanding of how players with diverse abilities

engaged with the game environment, addressing both physical and cognitive aspects in tandem. Specifically considering cognitive accessibility, GOG provided a structured approach to identify and record barriers impacting the gaming experience related to cognitive functions. In *Futbolástico!*, the assessment of the learning curve and clarity of instructions fell under this category. Evaluating the cognitive demands allowed us to pinpoint areas where adjustments were necessary to ensure that individuals, including those with ID, could fully enjoy and comprehend the gaming experience.

The category of "Behavioural Observations" documented the players' actions, reactions, and interactions during gameplay. For example, observing *Mini-Golf Extravaganza* playing sessions provided us with insights into players' decision-making processes by examining how they approached the challenges presented in the mini-golf course, which was essential to fine-tune the game. Regarding "Game experience", and considering the case of *Canoe*, GOG facilitated the examination of players' subjective experiences in the serene river and cave environments. This qualitative assessment delved, therefore, into aesthetic appeal and narrative engagement.

Direct quotations in the "Main Comments from Players" category stood out as a robust means of preserving the authenticity of player feedback. For instance, a player's direct quote expressing frustration with the difficulty level in *SymphoNotes* allowed us to grasp the emotional nuances that might be overlooked in quantitative assessments. This emphasis on direct quotations ensured the grid's ability to capture the original context and nuances of players' comments.

The "Other Aspects or Observations" category served as a flexible space to record additional elements impacting playtesting sessions. In *SymphoNotes*, for example, this category allowed us to note the option to remove background elements for enhanced focus and avoiding sensory overload. By providing a catch-all space, GOG ensured that any noteworthy observations, including technical issues or unexpected insights, could be documented for comprehensive analysis and improvement.

3.3. Service-Learning Analysis

The service-learning framework implemented seems to represent a relevant and transformative educational journey for students. Over the course of three years, 59 students actively engaged in game development projects, collaborating directly with adults with ID and NGOs. This immersive approach not only upheld academic rigor but also fostered community engagement and collaborative learning, as explored in previous service-learning studies outside the field of game design and development [3, 4].

Students consistently engaged in reflective practices, and one student, as documented in the field researchers' notes, expressed "Interacting with pwID me realize the real-world impact of the games we make".

In the context of videogame development, service learning seems to hold the potential to act as a bridge between theoretical knowledge and practical application. Students seem to develop broader competences related to interpersonal relations, personal involvement, and, overall, soft skills. In this sense, a participant shared "Designing games that cater to different needs required a deep understanding of technical aspects too".

Results also demonstrated that service learning in the field of videogame development extends beyond traditional pedagogical approaches. The development of 18 videogames, each addressing accessibility and inclusivity, showcased the impact of service learning in promoting social justice and equality. Moreover, the approach seems to have played a role in narrowing the gap between academia and civil society, in its specific context. This firsthand engagement with societal challenges allowed students to transcend the traditional boundaries of academic learning, enabling them to actively contribute to and address real-world issues, as previously explored [2].

4. Discussion

The present study was organized around a primary aim – to thoroughly investigate the implications of service learning in game design, focus on the creation of accessible games and the validation of a playtesting accessibility tool (GOG). This aim thus contained three objectives (O1, O2, and O3), already explored above, which are integrated into the discussion of this study based on a complex vision of media ethnography.

Regarding the first defined research objective (O1), which focused on describing the accessible games produced in the context of a multi-year service-learning project in the field of game development higher education, it is possible to note that the study has resulted in the development of 18 videogames, each currently at different stages of development and publication. These games span various genres, encompassing themes and gameplay experiences that cater to a diverse audience. Accessibility was prioritized in the development process, with features like adjustment settings for speed and frequency implemented to ensure inclusivity for players with ID. Moreover, the intentional design allows for autonomous playability with at least one hand, further enhancing motor accessibility.

The objective to validate a qualitative tool – GOG – has also yielded substantial results and insights (O2). In catering to the distinct requirements of pwID, this grid has demonstrated its tailored and feasible nature. The validation process, grounded in a specific case study, has accentuated the tool's practicality and relevance in the evaluation of games designed for this particular demographic. Moreover, GOG's adaptability for various hypothetical uses is also a relevant highlight, emphasizing its versatility as a valuable asset not only within the scope of this approach but also in the broader landscape of

inclusive game development. The tool's qualitative validation insights underscore its significance as a comprehensive instrument capable of contributing meaningfully to the ongoing pursuit of creating accessible and enjoyable gaming experiences for individuals with ID.

The service-learning framework employed in the domain of game design and development has proven to be a significant educational initiative for students (O3), providing them with opportunities to participate in collaborative creative processes with pwID, while also fostering their civic engagement with NGOs, for example. The notes produced within this media ethnography approach allow us to highlight the students' growing awareness of the practical impact of their projects, and the development of soft skills, including adaptability to context and interpersonal relations. The hands-on engagement with accessibility challenges is aligned with the notion of service learning as a path for social justice and equity – previously documented in other studies, such as the ones from Fisher [32]; Mtawa et al. [33]; or Showstack [34] – but also plays a pivotal role in narrowing the chasm between academia and civil society, through creative processes, in this case, participatory game design and development [2].

4.1. Limitations and Future Directions

Although this study has provided valuable insights, it is important to acknowledge a few limitations. First, the focus was primarily on a particular academic program and its service-learning initiatives within the context of game design. The findings may not have universal applicability across different disciplines or educational contexts. Furthermore, the sample size, comprising 59 students, is also limited. Although the study focused on the depth and quality of engagement, including a larger and more diverse group of participants could improve the applicability of the results.

In addition, the analysis of game accessibility specifically targeted individuals with ID, and subsequent research should expand its focus to include a broader spectrum of disabilities, thus guaranteeing a more comprehensive viewpoint on the design of accessible games in the future.

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