

Despandemia: Serious Game in Alternate Reality for Reading and Rewriting Our Intercultural World during the Covid-19 Pandemic

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Abstract: The Covid-19 world pandemic and the ensuing closure of schools has resulted in unprecedented emergency remote teaching. In teaching-learning settings in Northeastern Brazil, teachers often face challenges when they try to use innovative pedagogical approaches and introduce innovative technologies to transform students into agents of change in our culturally diverse world through the application of learning. Such challenges were augmented further with the pandemic as the forced systemic use of these technologies was no longer a pedagogical choice but was quickly turned into the general rule for all educators – even those who were not familiar with these technologies. In addition, pandemic traumas such as domestic confinement, social isolation, fear, uncertainty, and anxiety about the future, weakened the emotional health of everyone involved in education by reducing or sometimes even paralyzing the creative processes essential to learning. The result of this new condition was a tangible increase in dropout rates, poor school performance and low self-esteem for teachers and students alike. Home confinement also increased domestic violence, including child abuse and particularly, violence against women. This paper presents a serious game, called *Despandemia*, for building libraries of interactive gamified books and ubiquitous reading communities. The game is accessible by cell phone and based on the humanistic performative attitude of a teacher-reader in collaborative projects of online socio-cultural entrepreneurship. *Despandemia* was used and evaluated by 119 students of an “Introduction to Computer Science” course, in which participants considered violence against women as a predominant theme of the pandemic. Results indicate that the game has a positive influence on 1) decreasing course dropout; 2) improving learning performance; and 3) creating connected communities of readers to prevent violence against women.

1 INTRODUCTION

The world’s Covid-19 pandemic caused schools to close and members of households to spend an unprecedented amount of time together at home. The pandemic and limited schooling also led to a multitude of remote teaching-learning issues, particularly in less-privileged countries (Asanov et al., 2021). Emergency Remote Teaching, ERT, is likely to worsen existing reading weaknesses in scenarios of ubiquitous communications (Santaella, 2014). Low levels of reading and writing capabilities

are indeed an important problem and affect many young people in several countries (PISA, 2019).

In the Covid-19 pandemic scenario, Emergency Remote Teaching appears to accelerate innovations in school practices but does not necessarily bring about an improvement in reading skills. In fact, weaknesses in reading skills appear to precede and transcend the pandemic.

According to Santaella (Santaella, 2014), even with the apparent excess of reading opportunities brought about in recent years by pervasive and mobile computing and ubiquitous communication, the

readers' low level of attention does not allow them to form their individual imaginary libraries that represents the history of his personal reading experience as presented by Manguel in (Manguel, 1998). These imaginary libraries are formed by the phrases, ideas, concepts and extracts of the essentials of readings that were created by the authors with such attention that they remained in readers' long-term memories. These libraries built by the reader during his life are available as sources whenever readers need to build a potential utopia for themselves or for others, or simply to remain resilient in a school's teaching-learning process with all its weaknesses.

At the same time, the pandemic also caused an increase in Intimate Partner Violence, IPV (Evans, Lindauer and Farrell, 2020). Intimate Partner Violence in practice is mainly oriented against women. According to the United Nations (United Nations, 2015), 50,000 women are murdered each year by their own partners. UN statistics show that one in five women and girls, have experienced physical and/or sexual and/or domestic violence by an intimate partner within the last 12 months. Yet, 49 of the member states have no laws that specifically protect women (or men) from such violence. This is an indicator of a great challenge for our societies, and it is recognised by the UN Sustainable Development Goals (No. 5 – “gender equality”), whose attainment unquestionably requires preparation of our youth, for example through developing reading and writing skills, in order to be able to contribute to the future of humanity in their own words and actions. The aim is to empower youth in a reading-acting revolution to understand and reduce violence in society. In Brazil, violence against women is taking on alarming proportions: Brazil ranks 5th place in the world ranking of femicide; in the first 20 days of 2019 alone, there were 107 cases of femicide in the country (Garcia, 2019). These numbers speak eloquently of the insufficiency and inefficacy of governmental strategies and actions to break the cycle of this systemic, gender-related violence, as well as of the need to apply existing knowledge to face sociocultural challenges of this dimension.

Pandemic traumas caused by Corona home confinement, social isolation, fear, uncertainty about the future and anxiety, have weakened the emotional health of many involved in education by reducing or even paralyzing the creative processes which are so essential to learning. At the same time, the situation of home confinement also increased the number of Intimate Partner Violence cases, particularly against women.

This paper proposes a computer supported educational approach to promote productive reading habits amongst its users and to address two pandemic-related challenges:

- i) to create an enchantment of educators and students with reading, with an emphasis on literature; and,
- ii) to make them multipliers of the idea of the reading experience as a process aimed at transforming people and creating utopian but thinkable violence-free worlds.

Related to challenge i) and according to Santaella (Santaella, 2014), readers have adapted themselves, assuming one or more new profiles that vary from the traditional contemplative or immersive reader, transforming the reader into the ubiquitous reader, who inhabits pervasive computing environments and mobile computing. In this environment of ubiquity, the ubiquitous reader inherits from the varying profile reader the ability to read and move between different forms, volumes, masses, interactions of forces, movements, directions, lines, signs, colors, lights with which texts are presented.

The ubiquitous reader also inherits from the immersive reader the ability to be physically present, while moving through physical environments (home, work, streets, parks, avenues, roads) reading the signs that these environments continuously present. That is why the attention of the ubiquitous reader is irreparably “continuously partial”. This attention responds to different focuses at the same time without lingering reflexively on any of them. The attention is continuously partial but insufficient to generate an emotional involvement with the text to the point of feeding the construction of ideals and utopias.

Challenge ii) consists in transforming the teacher into a source of inspiration and training to build practical meaning for the reading experience, and providing support to the student and future reader, by empowering them through awareness-raising to become autonomous. As a conscious reader of oneself and of the other as represented in the text, students try out their new role as re-inventor of the world which may have been shaken by a pandemic such as that of Covid-19 or by any other dystopian phenomenon.

This paper presents a gamified approach for educators to be transformed into inspiring readers themselves and to be able to build a virtual incubator structure for social entrepreneurial readers, in the form of a growing library of interactive gamified books and a ubiquitous reading community interested in addressing Covid-19” challenges.

We coined the neologism “*Despandemia*” for our gamified approach, by joining the prefix *Des* (from Latin and Portuguese - reversal of sense of succeeding word) to *Pandemia* (Greek and Portuguese - pandemic). The name implies the game seeks to ‘undo the pandemic’ and in particular its negative effects.

The approach uses the ReadAct platform for serious games meant for addressing social challenges (Barros et al., 2018). It has been experimentally applied by 119 teachers in Northeastern Brazil to challenges i) and ii). Results were evaluated by over 3,000 readers of produced material and they indicate the approach is potentially effective in addressing both challenges. The paper contributes to computer-supported education R&D efforts by offering new insights into applications for current social challenges in uncertain times like a pandemic.

The paper is organized in six sections, with this introduction as Section 1. Section 2 briefly discusses related work. Section 3 highlights methodological aspects. Section 4 introduces *Despandemia* and offers major details of its gameplay and other major characteristics. Section 5 reports a trial run of the game to validate its usefulness in supporting solutions for pandemic-related deterioration of schooling and IPV against women, i.e. the above challenges i) and ii), respectively. Section 6 concludes with suggestions for future work.

2 RELATED WORK

The application of serious games (SGs) to train people to address challenges has been the focus of many works. The systematic literature review in (Calderon and Ruiz, 2015) surveys several application domains before concentrating on software project management. Applications for other technical fields include but are not limited to, engineering (de Geus et al., 2020) and computer science (Vidakis et al., 2019). Applications to humanities and social domains may be found in the works on socially interactive constructivism based on each player’s needs when acquiring knowledge on Greek ancient theatre (Papadakis1 et al., 2020); reading fluency (Durski et al., 2020); and, on identifying emotional factors associated with lifelong m-learning (Dirin et al., 2020).

Despandemia is a SG to train players in writing and reading skills – in this, it is closely related to (Durski et al, 2020), and, as (Papadakis et al., 2020), aims at knowledge acquisition, skill-building and awareness raising in the literary and theatrical

domains. However, in contrast to these two works, this paper’s objective is to apply skills, awareness and knowledge to support activities towards solving social problems. Also, while (Dirin et al., 2020) identifies emotional factors linked to m-learning, *Despandemia* uses m-learning to trigger emotions that will lead its players to act collaboratively with other readers of literary artefacts produced by the players of the game, in order to create an awareness and solutions for social problems – pandemic-related deterioration of schooling and IPV against women, as it is the case here.

There are few reports so far on efforts to apply SGs to solve pandemic-induced social problems. One reason is that the Covid-19 pandemic is very recent; and two, the problems need to be identified first. One early work (Gutiérrez, 2014) identified the contents of certain videogames as a cause for gender-based violence – i.e., violence perpetrated against women. The author goes on to ask whether such content is actually legal. His question raises an important point: any effort to contain incitement to violence, like the use of SGs, would be made more efficient if backed up by proper government policies and laws.

In Brazil, governmental and non-governmental organizations initiated a National Pact and Policy to Combat Violence against Women. It promotes policies in pursuit of gender equality, as established in specific goals. Among them, there are policies for economic autonomy of women and for encouraging political participation, insertion in power positions and new educational approaches for tackling the multifaceted and structural character of gender violence linked to the patriarchal culture (Bugni, 2016). However, data by the Observatory on Dating Violence in 2018 show that related pedagogic efforts in schools do not show enough synergy with government strategies and lack in reach and impact for cultural change in gender consciousness (Neves, 2018). *Despandemia* may be one tool for introducing the desired change in schools.

The article (Barros, 2001) introduced the concept of Innovation Social Sense Making (ISSM) as a means to prepare ordinary persons to be the readers of themselves and of others, (re)inventing technological solutions for the other’s needs – becoming a “reader-inventor”. ISSM was later merged with the concept of Transformative Performance Reading (Andrade, 2019) that prepares ordinary persons to be readers of themselves and of others and who re-invent life stories, and thus, become readers-authors. The merged concepts lead to the concept of readers social entrepreneurs, implemented in the ReadAct platform (Barros et al.,

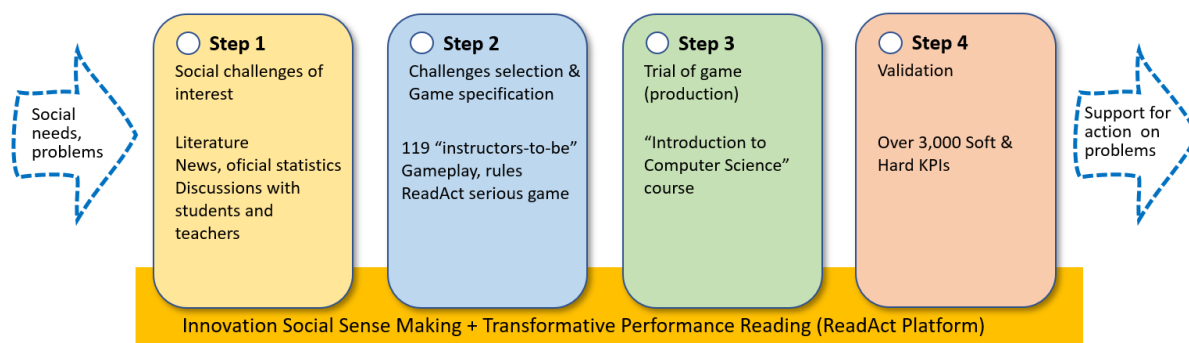


Figure 1: Methodology steps to build *Despandemia*.

2018). The ReadAct platform allows one to build alternate-reality serious games as one part of a solution for a given social problem. *Despandemia* is built on the ReadAct platform, and the focus is on ameliorating Covid-19 pandemic’s negative impact on schooling and on IPV against women.

3 METHODOLOGY

Efforts to specify, build, apply, use and evaluate the *Despandemia* serious game were carried out according to a 4-step methodology as conceptually illustrated in Figure 1. Each step is briefly described here for the purpose of providing a high-level, conceptual understanding of *Despandemia*’s dynamics, which include the game implementation itself.

In step 1, the Covid-19 pandemic served as a background to identify possible social effects of domestic isolation and distance-learning. Information was harvested from literature, from the news media, from government sites, discussions with high school teachers, students, and their parents and discussions with students and professors engaged in Emergency Remote Teaching (ERT) at universities in the city of Campina Grande in Paraíba state, Brazil and in Europe. Potential negative effects – i.e., “challenges”, such as IPV – were then organized for discussion and selection in step 2.

Step 2 used a group of 119 2nd and 3rd semester Engineering students of an “Introduction to Computers” course, offered in ERT mode in September-December 2020 at UFCG, to function as active *Despandemia* players who were trained as teachers to motivate and guide others in solving social problems. They analysed the organized challenges from step 1 and they were free to propose challenges of their own choosing. By simple majority they elected “violence against women” as challenge ii) to be addressed in later stages of the game. Game

components for later stages borrow from ReadAct’s generic facilities – e.g., theatre and transmedia artefacts (Barros et al., 2018), but other game requirements – e.g., gameplay, need to reflect characteristics of the elected challenge(s). Step 2’s output is a set of requirements to be implemented as part of and for *Despandemia*’s later stages.

Step 3 involves the implementation of Step 2’s requirements set by the same 119 players. Since these players are enrolled in a computer science course, one of the game’s missions involves software development – i.e., the game introduces the players to produce parts of the game itself. Implementation was carried out in three evolving versions in the free programming language Scratch (Moreno-Léon, 2016). Other *Despandemia*’s missions involve players’ creation of their own stories in the context of the chosen challenges.

Step 4 is dedicated to evaluation and validation of results. For that, three specific indicators were defined according to challenges i) and ii). Players were evaluated before and after playing the game concerning their perceptions and potential influences in addressing both challenges. Transmedia artefacts, i.e., interactive books in Scratch, produced to address the chosen challenges, were then read and commented by other readers, e.g., ordinary citizens and acquaintances of the players, in order to identify potential contributions to solving the challenges. Note that execution of steps 3 and 4 may not be sequential as Figure 1 seems to indicate. Steps 3 and 4 are interlaced and may show some overlap in time.

More details of steps 2, 3 and 4 are described in Sections 4 and 5.

4 DESPANDEMIA

Despandemia blends aspects of storytelling, tutorial-based education and theatrical reading and writing of

intercultural multimedia contents about a given social problem (Barros and Andrade, 2018). The game aims to empower teachers and students of a school to take individual or collective action towards a solution for a Covid-19 related social problem. The game encourages co-authoring interactive books and games for reading-acting ubiquitous communities. The game is based on principles of utopia to build new “utopian worlds” (More, 1985) – i.e., worlds without a pandemic’s negative effects in our case, while players live a hero’s journey (Campbell, 1949) that impacts their culture and dystopic situation in a gamified experience (Huizinga, 1955).

4.1 Gameplay

In *Despandemia*’s gameplay, players create books to sensitize and influence other people (readers) to show solidarity and leave a positive legacy. The readers’ legacy may be in the form of a comment on the interactive book they read or even in the form of writing their own book and this authorship reflects a change in their reaction to an aspect of the pandemic. The learning level design is included in a hero journey where players discover and develop hard and soft skills from a) their basic reading and writing experiences, motivated by their desire to improve the pandemic world; and b) the identity they create with the book they read and the book they write.

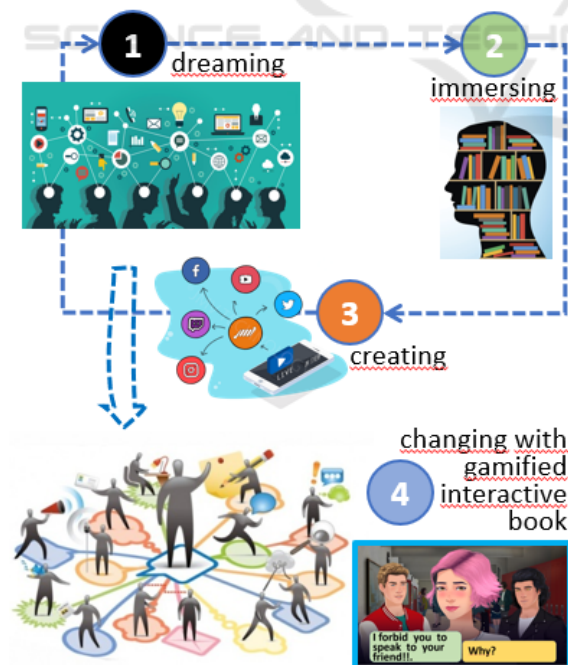


Figure 2: *Despandemia*’s gameplay and its 4 missions (dreaming, immersing, creating, changing).

Figure 2 illustrates the 4 missions that make up the experience of playing *Despandemia*, building access, status, powers and artefacts (interactive books) to transform people into readers of themselves and of others.

For the first mission, “dreaming”, the teacher creates and presents to the classroom a utopian world, described in texts (prepared or collected in step 1 of the methodology) in a repository with both dystopic and utopic views of the pandemic. The presentation is done in a performative way to encourage participants to dream of a theme that could overcome pandemic challenges i) and ii). The students may use contents of the course they are taking (in our case, contents include mathematical modelling, algorithms, programming, collaborative systems, tutoring education) to create interactive books about these challenges. The texts in the repository should be studied with a high degree of attention to the point that it turns the teacher into a dreamer. The teachers’ performance should be a natural result of their own imaginary library. The collective teachers’ and students’ dream experience aims to lead participants to dream together and then describe this dream in a recorded online meeting which is to be shared in an asynchronous way with participants who cannot participate. The presentation should inspire students to dream up their own libraries, which they will build as they play the game. The collective dream begins to materialize when the students do their own performances in the meeting.

In mission “immersing” players chose and read at least a couple of relevant texts (one literary and one journalistic) and immerse themselves intimately in the world built by the authors. This rule of the game aims to help the players, who are teachers in training, to build their work (interactive gamified book, video-letter or homelab) or “vaccine” as these artefacts are referred to in the game, in a way that it turns into an alternate reality experience. The reading of these two coupled textual genres naturally leads to a bridge between the utopian or dystopian worlds presented by the read authors on the one hand and the world that the player can change to become utopian, the present world in which the player lives, presented by the current journalistic truth on the other. Players will identify dystopias and utopias in the texts and choose the ones they want to reduce or amplify in their own construction of a new utopian world. Players infuse their dreams of the utopian world with the dreams of the author, with the dreams of the characters in the literary texts, and with the information gained journalistic texts.

In mission “immersing” the teacher ensures that the learning process can be guided. The teacher

- 1) facilitates a vote to select a single pandemic –related problem to be the topic of all the imaginary individual libraries that will be created or updated. This vote allows for more effectiveness of the crowdsourcing effect in the performance of the class on the problem in the community. It also facilitates the tutoring and evaluation work of the teacher in the community. In the case considered, the elected topic was “gender violence”;
- 2) prepares an open document with quality requirements for the books to be written in order to guarantee an appropriate level of application of course contents. In the present case, the essential contents were mathematical modelling, programming, and collaborative systems. The requirements document defined a simple game form, based on a 3-scene role-playing game, structured as an interactive book. The story told in this interactive book is meant to inspire the prevention of violence against women and should have scoring and personalization features for the readers. The document defines a simple solution model and is open to additional requirements by the participants by adding new challenges according to their different reading and computing skills.

In mission “creating”, the teacher defines a book building process based on the requirements document and on a series of creativity workshops in which the participants make intensive use of the camera and performance presentations of their stories during online meeting sessions. Their stories are reinvented and implemented in the form of an interactive multimedia application of the gamified digital book type. Each workshop is a dramatic performance where students enact roles and scenes implemented in their books. In this process, students receive feedback and suggestions from their teacher and their fellow-students. The teacher will propose a development platform that is adequate to meet the documented minimum requirements and that is accessible to students who cannot access the school’s facilities. Due to the great heterogeneity of programming skills of the participants, books were developed on the Scratch platform (Scratch, 2019).

In mission “changing”, participants create a social enterprise and use their books to win commenting readers through their social networks and through their personal relations. The objective of the

Despandemia game with this mission is to create and market a large interactive library built from individual imaginary libraries and positively affect the chosen social challenge. The tangible impacts are represented by the participants' self-assessment and documented by the comments generated by other readers. The process of winning readers combined with the collective reading process and the accumulation of a repository of comments generated by readers characterize the creation of a ubiquitous reading community.

5 A VALIDATION EXPERIMENT

A trial run to validate the *Despandemia* game was carried out with a community of 119 engineering students of the course "Introduction to Computer Science" offered in ERT mode by UFCG in Campina Grande, state of Paraíba, Brazil, during September-December 2020. These 119 students played *Despandemia* in its entirety (4 missions) during that period. Additionally, as many as 2,966 ordinary citizens and acquaintances of the players took part in the "changing" mission (4th and last mission) – where the ordinary citizens collaborated as "readers-actors" and offered anonymous comments on the books produced by the 119 players. The fact that the players managed to motivate so many contributors surprised the project managers.

The 2,966 readers-actors plus the 119 players together constitute a reading community with an initial library of interactive books with which participants attempt to change one or more aspects of the pandemic. The players then reported on comments by the reader-actors of each interactive book which had been produced. In order to increase the reach of the game and the access of authors and readers to the experience and the expected effects of the game (impact on challenges), players were free to use their various social networks as communication channels and to win over and motivate their readers to take an active part in commenting. In addition to verifying the influence of the approach on the pandemic challenges, the objective was also to win and prepare volunteer tutors. These tutors will facilitate a repeat of the *Despandemia* game in schools in 2021, this time in partnership with teachers and staff of these schools. Surprisingly, all 119 players volunteered to take the game to the next level.

5.1 Library and Ubiquitous Reading Community

The first impact of the experience of playing the *Despandemia* game is represented by a) the growing library of interactive, gamified books; and, b) its growing ubiquitous reading community (Figure 3), over 3,100 members strong if you count the full-game players.

Figure 3 shows part of an example of one (out of 119) of the library's interactive, gamified books, produced by the participants on the Scratch platform: the booklet entitled “*The Witch Her*”. It is a gamified story in the structure of a role player game (RPG) in which the readers play the main role and live in a home where they observe facts in the daily life of a couple. During the reading, the reader is challenged by a character who is an agent of the Ministry of Public Prosecution to help identify different forms of violence against women in three different scenes. The scenes in this book are animated, have a musical

soundtrack and the characters' lines are expressed in audio and text. The readers act on the story through the insertion of texts through specific interactive objects available in each scene and through the choices in proposed quizzes. The readers will modify the non-linear narrative of the story depending on the type of text they put in and their quiz responses.

Adequate responses that represent a good perception of the problem of gender violence or a constructive attitude towards reducing the risks of violence are computed as powers and experiences. Inappropriate responses that represent poor understanding of women's protection system in Brazil but also readers' indifferent attitude to the problem are countered by an immediate presentation of what should be done in view of the situation presented in the scene. In this last case, the reader will be confronted with to the same scene again and has a fresh chance to interact appropriately with the characters.

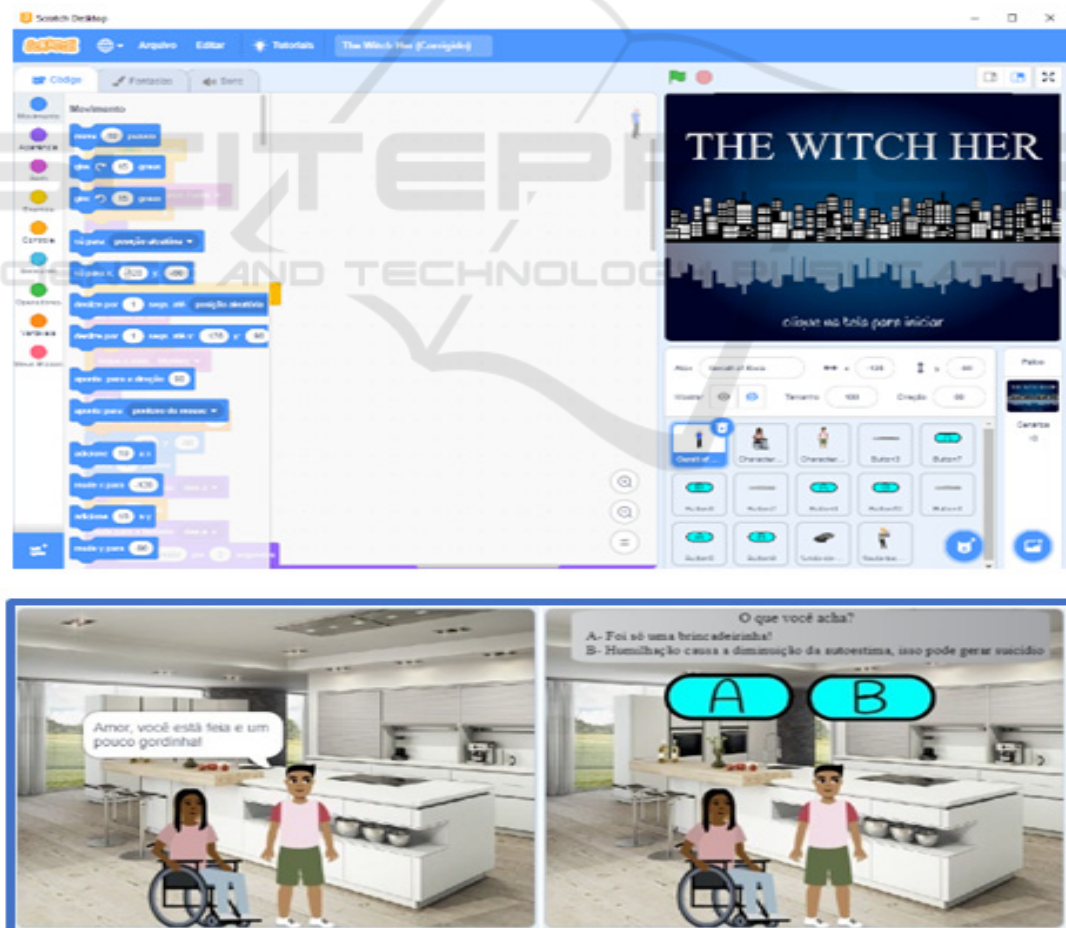


Figure 3: Example of interactive gamified books created by players when building new utopian worlds.

5.2 Some Testimonials

The resulting ubiquitous reading community of the library posted comments by 2,966 readers-actors who acted in the interactive stories of the library. Figure 4 shows an example of a commentary by a reader-actor who congratulates the authors of the game on their didactic approach for making readers critically aware of everyday challenges.

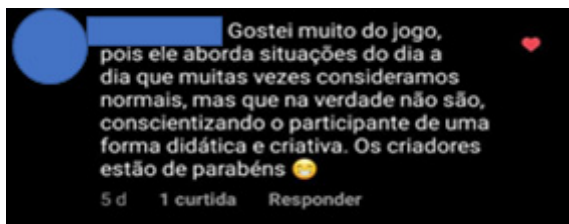


Figure 4: Example of a comment from a Despandemia read-actor (“I enjoyed the game because it deals with day-to-day situations which we often consider to be normal, but which are really not. The game brings awareness to the participant in a didactic and creative way. Congrats to the authors.”).

Other testimonials were extracted from the WhatsApp group of the course, which the 119 full players participated in. About 30 testimonials by the full players (translation below) have the level of expressiveness and orientation as those below. In addition, there are many other testimonials that were captured in the 11 recorded online meetings of the course / game.

“... with the course / Despandemia, I became a better person and I hope to be of inspiration for someone else. Thanks for everything.”

“I didn't believe in what I was able to do. Transforming.”

“...along with the pandemic came the diagnosis of cancer. I had the surgery and when I was doubly ill, Despandemia meetings each week were better than medicine, better than chemo for me. And, originally, I didn't even want to enroll in this course. Thanks.”

“Music, poetry, books and news to learn computer science? I never thought of that. Thank you for the opportunity to share my humble accordion.”

“The best part was to learn by building a game. And still use it to help others. Awesome. I will never forget.”

Note that comments by readers-actors and testimonials by the full players comprise some form of Despandemia’s soft Key Performance Indicators, i.e., derived from opinions or qualitative key performance indicators (DsoftKPIs) as opposed to hard (quantitative) KPIs (DhardKPIs).

5.3 Soft KPIs

Soft Key Performance Indicators (DsoftKPIs) were used to judge the influence, which the game Despandemia may have on the investigated challenges. These indicators were evaluated using structured interviews with the main players (teacher-trainers) before and after they played the Despandemia game. Each DsoftKPI took the form of a question the interviewee could answer with “No”, “Not sure” or “Yes”.

The following six DsoftKPIs were analyzed:

- 1) DsoftKPI₁ – Can you raise the interest of someone for reading using computer resources?
- 2) DsoftKPI₂ – Can you author an influential intercultural artistic work to lessen the negative impacts of the pandemic such as IPV against women using computer resources?

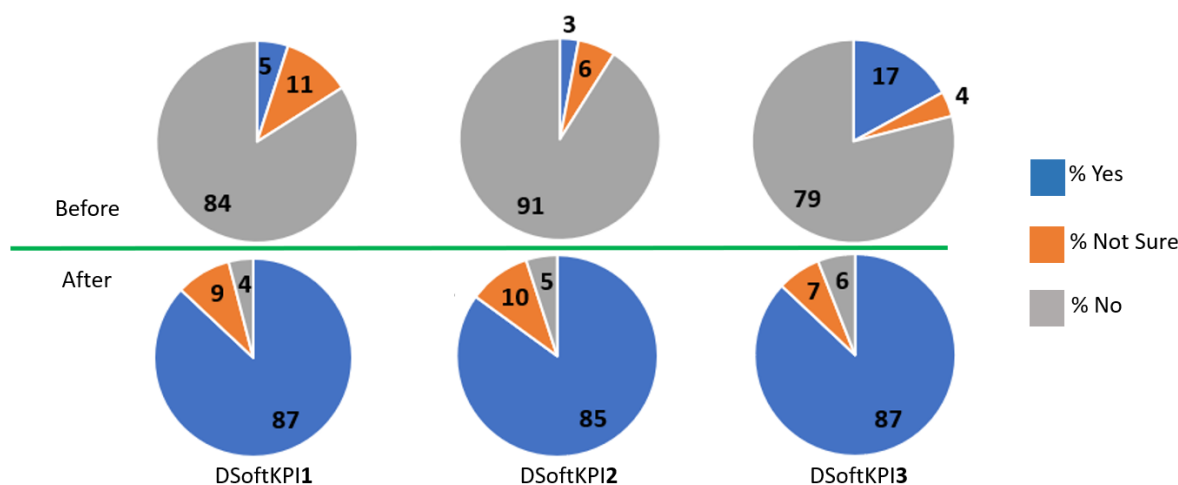


Figure 5: DsoftKPIs Before and After Despandemia.

- 3) DsoftKPI₃ – Can you create, feed and manage a community for online reading to train new readers to tackle a major challenge brought about by the pandemic?

The charts in Figure 5 illustrate results for the three DsoftKPIs, or rather, changes in the responses of the 119 main *Despandemia* game players. The numerical data correspond to the percentage of the total of 119 respondents.

Overall, the charts indicate an unexpectedly high positive change in attitude and a sense of empowerment for confronting IPV among the 119 players of the full game.

5.4 Hard KPIs

The 119 players of *Despandemia*'s full game in this trial run were all students of the "Introduction to Computer Science" (ICS) course and they played the game within the joint contexts of that course's syllabus and Covid-19 pandemic's negative effects on violence against women. The assumption was that, by playing *Despandemia*, students would improve their performance related to the contents of the ICS course and at the same time, they would have their awareness raised about gender-violence. It was expected that students would be able to create an IT tool including an online community to support actions to confront gender-violence during pandemics.

Despandemia's hard KPIs were anticipated in the Abstract:

- 1) DhardKPI₁ – "Introduction to Computer Science" course dropout rate. The course (mean) dropout rate was defined as the mean of the ratios of (number of students who did not complete the course) / (total number of initially registered students) for all the considered courses (or different classes of a same course).
- 2) DhardKPI₂ – Students' performance on the "Introduction to Computer Science" course. Performance in this case is summarized by the average (μ) and standard deviation (δ) of the students' grades (0% to 100%) in the course.
- 3) DhardKPI₃ – Establishment of a connected, organized community to foster awareness about violence against women.

In order to evaluate DhardKPI₁ and DhardKPI₂, 5 other ICS classes offered by UFCG for a total of 217 other students during the same time period (September-December 2020) were considered. Comparison of *Despandemia* and these other classes is offered in Table 1.

Table 1: Quantitative performance of *Despandemia*.

	Control		<i>Despandemia</i>	
	Dropout rate(%)		Dropout rate (%)	
DhardKPI ₁	21,8		0,8	
	μ (%)	δ (%)	μ (%)	δ (%)
DhardKPI ₂	77.4	19.7	91.8	8.2

DhardKPI₁, being lower for *Despandemia* (only one out of 119 students dropped out of the class), suggests the game may lower dropout rates for the course. As for DhardKPI₂, *Despandemia* class shows a higher grade average and a lower standard deviation suggesting that the gamified approach may improve learning and make the students' learning process more engaging and rewarding for students.

The discussions in subsections 5.1 to 5.3 indicate DhardKPI₃ has been attained. Produced artefacts (in Portuguese) by the community are available at <https://scratch.mit.edu/> (interactive books) and at www.felizcidade.org (readers comments can be found in BookTown and MathVille virtual spaces). Please note that the size of the created community, over 3,000 participants, far exceeded our expectations. Such a size signals a large potential for disseminating awareness on the considered challenges. The numbers in the chart for DsoftKPI₃ in Figure 5 also signal there were changes in the players' perceived capability to transform a reading and writing experience into a tool for building new utopian worlds – gender-violence free, in this case.

5.5 Discussion

Results for qualitative (soft) and quantitative (hard) indicators provide evidence that playing *Despandemia* improves the competence and interest of players to transform a reading and writing experience into a process for building new utopian worlds where Covid-19's challenges, in terms of worsening academic performance and gender-violence, can be addressed.

In the project research study, impressions were collected from over 2,900 readers of *Despandemia*'s gamified interactive books (so-called "vaccines") and 119 full-game players in Brazil. Even if these numbers may seem adequate for statistical significance, the collected evidence must be considered with care for authors' (i.e., players') bias and other undesired influencing factors, such as cultural and contextual aspects, which may be considered validation threats (Gravetter and Forzano, 2019). First, players were free to recruit readers for their books and to ask them for evaluations of the game's artefacts – such freedom could cause traces of

selection bias and social interaction threads to internal validity. Family or friendship ties may have caused favorable testimonials. Hence, such testimonials were not considered as any formal evaluation indicator as the soft- and hardKPIs were. But these testimonials indicate readers were made somewhat aware of the problems of interest here. DsoftKPIs' valuation by the 119 players was better controlled because it was done under the supervision of the course's professor using a same, structured questionnaire for all. DhardKPIs were used to compare students' performance in different classes of the same "Introduction to Computer Science" course, at the same university. Course instructors were different however and applied the tests as they saw appropriate. There was no intentional design for tests to have identical contents nor the same weight in grading. This, in turn, raised risks of instrumentation threat to internal validity of the experiment as well. These threats limit claims of external validity of the *Despandemia* approach to other contexts (e.g., geographical location, culture, time, pandemic's challenges).

Formally, the validation experiment can be considered to have produced "face validity" (Holden, 2010) – i.e., the *Despandemia*'s approach appears it will serve to improve players' chances of academic improvement and of gender-violence awareness. *Despandemia* developers and practitioners (i.e., teachers) should look at replicating the experiment with their players (students) to properly steer their game design decisions considering the reality of their target-context.

In spite of its limitations, the evidence in this paper contributes insights into alternate reality serious games design and development for computer-based education on Covid-19's social impacts.

6 CONCLUSION AND ONGOING WORK

The Covid-19 pandemic worsened social problems such as faltering school performance – due to emergency remote training (ERT), and gender-violence or more precisely, intimate partner violence (IPV) – because of domestic confinement in lockdowns. The United Nations consider these problems as important, attributing increases in the challenges they represent as implications of Covid-19 – as laid out in its sustainable development goals (numbers 4 and 5 respectively - <https://sdgs.un.org/goals>).

This paper presented a serious game in alternate reality, *Despandemia*, based on the ReadAct platform (Barros et al, 2018), which blends aspects of storytelling, tutorial-based education and theatrical reading and writing of intercultural multimedia contents by the players in order to address problems with three quantitative indicators in mind: 1) decrease course dropout in ERT; 2) improve learning performance; and 3) create a connected community to raise awareness about gender-violence.

A trial run of *Despandemia* was carried out with 119 engineering students of an "Introduction to Computer Science" (ICS) course in ERT mode in September to December 2020 at the Federal University of Campina Grande (UFCG) in Brazil. Pre- and post-game qualitative evaluations by the players showed improvements in their perceptions of their own competence to address the problems. Results for quantitative indicators 1 and 2 showed gains when compared to other ICS courses at the same University and during the same period and also in ERT mode, but which did not apply *Despandemia*. Indicator 3 was achieved with an over 3,000-member community around the game's artefacts they produced: the gamified, multimedia books which readers can interact with, inserting their own comments and twists to the stories which are being told. During the running of the game, it seemed as if the books functioned as a "virtual vaccine" against (some of) the Covid-19 pandemic's woes.

Despite observed gains, one needs more experiments with *Despandemia* to better ascertain its effectiveness. In order to achieve this, the 119 initial main players who played the game during the ICS course volunteered and were trained to serve as (auxiliary) tutors of an online "Introduction to Computers" course for public intermediate and high schools in the state of Paraíba in 2021. Also, this approach is being used in the training of tutors for the training of health professionals and managers in the primary care of diseases during the pandemic such as obesity, diabetes and hypertension, in state units of SUS (Unified Health System), in Brazil. These new experiments will be conducted as ongoing work under the sponsorship of the Public Prosecutor's Office of Paraíba state, and of the Ministry of Health of Brazil, respectively. The authors also plan to adapt the game interculturally for a re-trial in Germany in 2021. The gamified hero journey of the *GreenErasmus* game will help exchange students develop hard and soft skills for reducing their carbon footprint. Before and during their semesters abroad the mobile agents of change will identify, research and document innovative ecological approaches in their host

countries. Like in *Despandemia* they will create ReadAct communities with the help of social media in order to manage and facilitate the transfer of ecological innovation back to their home countries after their return to their home universities.

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