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Research and development of a Role - Playing Game about blood donation: Integrating humanistic STS with science and health education

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ABSTRACT

The objective of this study was to research and develop a Role-Playing Game (RPG) on blood donation, aiming to integrate the Science Technology and Society (STS) approach in a humanistic perspective in Science and Health Education. This study is Design-Based Research, based on the methodological approach adapted from the ADDIE model, focusing on the description and analysis of the first three stages of such model, involved in the production of RPG, as well as its contribution to the educational process. Each of these stages will constitute different methods of data collection and analysis, in addition to carrying out tests with prototypes developed with the cooperation of Biological Sciences undergraduate and elementary school students, supporting the approximation of these subjects to the issues addressed by the game and also in the improvement of the educational material under development. Finally, the material related to RPG, Donating Blood without Mystery (*Doando Sangue sem Mistério* in Portuguese), is presented in detail as a result of this process and its possible contributions and learning are discussed.

KEYWORDS: Role Playing Game; Science Technology, and Society; Blood Donation; ADDIE Model; Science and Health Education.

1 INTRODUCTION

The blood donation demand has grown worldwide due to the increased number of accidents, violence, war, and illnesses. When researching students' concepts and values regarding blood donation, Bossolan, Perosa and Padovani (2011) verified a high level of lack of information among students in the first years of elementary school. Likewise, Figorelle *et al*. (2021) reported a high index of limited knowledge among students in the first year of the medicine undergraduate course at the Federal University of Rio de Janeiro. According to those authors, donation requirements, which are usually informed in campaigns and leaflets distributed by the blood centers to the population, were not entirely known by the study participants. Many confounded blood donation with blood examination, or mentioned concrete aspects such as collection materials and procedures.

A report put forward by Alves (2005) pointed out the fact that the knowledge acquired by the population during blood donation campaigns is not enough to change their life habits. A finding that is worth mentioning is the fact that the school was the least cited source of information by the students (BOSSOLAN; PEROSA; PADOVANI, 2011). This concern about making blood donation a theme to be addressed at schools is shared by several Brazilian researchers who conducted investigations among schoolchildren in elementary and/or high school in the last few years (PEREIMA *et al.*, 2010; BITTENCOURT; STRUCHINER, 2015).

Those authors, in general, reinforce the need to discuss the role of the school in Health Education programs. According to them children in the early years of their school education might be involved in activities including information and values, citizenship, and altruism, which can benefit the collective wellbeing and the future citizen. The activities listed might also contribute to students' scientific culture development (BOSSOLAN; PEROSA; PADOVANI, 2011).

Such lack of knowledge is also observed when part of the population states their wish to help others by donating blood, but also that they do not know what to do, despite all governmental campaigns and the reports presented by the media.

There are several ways to work the blood donation theme in schools, which might be developed in the curriculum. Traditional teaching, based on a vertical teacher-student relation and on content (MARANDINO; IANELLI, 2012), does not contribute to the construction of knowledge by the students regarding Sciences and Health. Such learning might occur by the development of their critical awareness of the phenomena studied, associating interdisciplinary knowledge, taking a position in relation to facts, and becoming protagonists of their learning.

The focus of Science Technology and Society (STS) in the curriculum (PINHEIRO; SILVEIRA; BAZZO, 2007) questions the way of studying and acting on nature. It opposes the segmentation of knowledge at all levels of education and aims to promote the democratization of scientific and technological knowledge. Therefore, STS curricula are articulated around scientific or technological themes that are socially relevant, which are known as socio-scientific issues (SSI).

In addition, a STS approach to Science Teaching aims at the students' development and their citizens' contribution to society as a whole. In this way, they ascribe meaning to the scientific and technological knowledge acquired and

can participate democratically in society, and express their opinions (AIKENHEAD, 2009).

Associated with the use of educational games, the STS focus might become a way to approach the blood donation issue as a SSI in science lessons. Teachers' interest in the use of educational games in their practice is not new. Ludic activities introduced in the teaching and learning process might result in enthusiasm, concentration, and motivation. They might also favor learning and contribute to the development of creativity, perseverance, and sociability.

Role-Playing Game (RPG) is a type of game in which each participant becomes a character and plays a role. In these games, personal attributes, features, physical, mental, and social abilities are described and used to solve issues and face challenges that appear during the game narrative (OLIVEIRA; PIERSON; ZUIN, 2009).

Several authors have deepened their studies on these games and the development of RPG to teach sciences. According to Pereira *et al*. (2019), these games present pedagogical potential, which enables knowledge construction by the students, and promote motivation, cooperation, interdisciplinarity, and creativity, as well as contextualized teaching (BITTENCOURT; GIRAFFA, 2003).

This study describes the process of development of an educational project based on an RPG about blood donation for elementary school students in the STS approach perspective. The RPG was chosen due to its characteristics of stimulating creativity and the solution of problem situations, in addition to enabling the students to relate the scientific and sociocultural content presented in the classroom to aspects of their daily life (GRANDO; TAROUCO, 2008).

2 THEORETICAL BACKGROUND

Regarding Science and Health Education, Struchiner and Giannella (2016) reported a great gap between the students' sociocultural daily life and the contents of subjects they study. Those authors pointed out that social factors that affect students' lives and the development of science and technology, as well as problems of contemporary society, are poorly addressed by the school, and are in general transferred in a banking system (FREIRE, 1993). Such findings confirm Martins (2019), who stated that discussions about health are detached from the students' social reality, which results in difficulties to dialogue about the causes and consequences of the problems faced and, consequently, to promote citizenship practices.

The authors Brasileiro, Lima and Leal (2019) presented a literature review about Health Teaching at school. They showed that different studies evidenced the pedagogical approach of themes related to Health with a preventive and biological trend, insisting in the concentration of science curricular content based on information about illnesses, symptoms, and prevention, and in the prescription of a behavioral model considered suitable. This school education conflicts with the World Health Organization definition of health as 'a state of complete physical, mental, and social wellbeing, not only the absence of illnesses or infirmity" (WHO, 1946, p.16). It also limits the articulation of the health theme as a transversal theme inherent in the students' and their community's daily lives.

One of the problems of low adherence to blood donation in Brazil results from the lack of a political project aiming at the education of donor citizens starting in childhood. Santos (1995) developed some research on blood donation in the contemporary Brazilian culture and society and reported different feelings involved in such action: compassion, moral obligation, altruism, need for social approval, and expectancy of reciprocity, among others. That author proposed an enrichment of the discussion from the public policy standpoint, with the possibility of suggesting pedagogical models in elementary and high schools. Such initiative could reinforce the blood donation value as an act of generosity from a pedagogical view.

The STS education proposals are a response to the need for the school to play its role as an educator for citizenship. They enable students to reflect critically, discuss, and make decisions about how these issues related to scientific and technological advances in our society affect our lives and our communities (SANTOS; MORTIMER, 2001).

This curricular proposal corresponds to the integration between scientific, technological, and social education in an interdisciplinary perspective. That is, scientific and technological contents are studied in their historical, ethical, political, and socioeconomic dimensions. Its main goal is to prepare students for a critical and reflective approach to their learning and to citizenship action. It also implies to raise students' awareness about their role in society, mainly in relation to their commitment to cooperation and social responsibility, in the collective search for solutions to existing problems (SANTOS; MORTIMER, 2001). Thus, the objectives proposed by STS also incorporate human values, mainly those of collective interest such as solidarity, fraternity, social commitment, reciprocity, respect to the other, and generosity. For being structured on social relevance, Aikenhead (2009) called this a humanistic STS since a humanistic thinking is developed when the social commitment is directed to human values and citizen education.

This study addresses citizenship as the individual's participation in the destiny of society, exercising one's rights and duties with responsibility and social awareness; and that individuals can be considered citizens when they see themselves as participant agents and responsible for their society (Gallo, 2001). For that author, citizenship is not born spontaneously in society, but it must be built up by the collective awareness. In this sense, the school plays a fundamental role in the students' citizen education, helping them to reflect upon their role and their insertion in society.

All these values are relevant for the development of the health theme at school and, specifically the blood donation theme, in its broad sense and in all its physical, biological, psychological aspects, at any levels, mainly in education.

According to Nogueira and Galdino (2012), in the teaching-learning process, contextualized and ludic activities are better accepted by students. Those authors also stated that the use of games in the school environment allows the approach to and exploration of contents that might have a less participant and more limited approach in a traditional class due to limited resources and time.

An RPG is accompanied by a physical or digital book containing all necessary information to start the game. The basic modules contain the necessary rules to play with comments regarding setting, rules, and explanations about the RPG

interactivity, in addition to tips for the narrators to create and narrate their own stories.

Role-playing games are made up of three great elements: (1) setting, which is the context of the story; (2) a story with an open script, containing scenes to be explored by the players inserted in the setting, as for example, in a medieval, futuristic, or historical scenery; and (3) the rule system, which consists of a set of codes and norms that can be modified, used in the definition of the character creation in the game fictional universe, the delimitation of the character's features, and the description of actions by the players. According to Bittencourt and Giraffa (2003), the RPG essence consists in the description of facts and sceneries, the application of preset rules, and the use of data, as a means to provide the game with randomness. Another characteristic of the RPG systems is the characters' evolution. They learn and progress, becoming stronger or wiser when compared to the start of the game.

Also, Nascimento Júnior and Pietrocola (2005) observed that the use of RPG must be viewed as a collective and organized way of producing coherent representations of the physical world and its phenomena. Those authors also stated that the main interest of using RPG in the education context is not to train RPG players among the students, or to provide stimuli to the creation of a consumer market of pedagogical tools represented by role-playing games, but rather to enrich students' relation with contents, colleagues, and the teacher through those games.

Likewise, Grando and Tarouco (2008) reported that the main characteristics that turn RPG into a powerful educational tool are: socialization, cooperation, creativity, interactivity, and interdisciplinarity.

In all its forms, either tabletop, live action, or electronic version, RPG appears as an educational tool, which stimulates the exercise of creativity and the development of problem-solving situations. It also helps students to relate school contents to their daily actions.

Using narrative, interactivity, quantification, and the creation of the character card, it is possible to promote teaching situations in an RPG. Researching activities to create certain character, building up a story, and making decisions based on critical and reflective thought and guided by a quantified system of rules, are examples of the RPG capability of offering the necessary input in teaching-learning relations.

3 METHODOLOGY

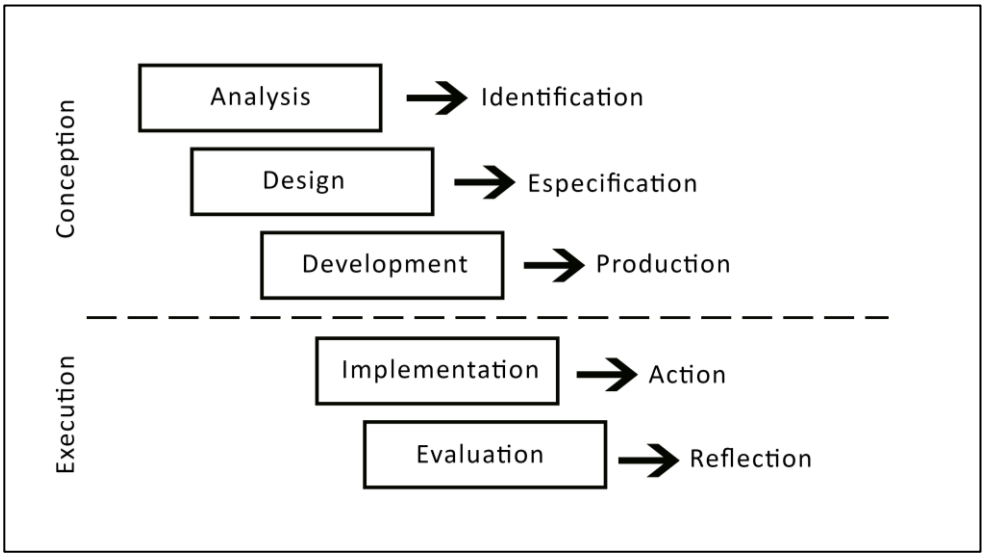
This is design-based research for dealing with a set of methods and approaches aiming to develop theories, artifacts, and pedagogical practices that explain and impact learning and teaching (BARAB; SQUIRE, 2004). According to Matta, Silva and Boaventura, design-based research:

> Is an innovative investigation approach that gathers the advantages of qualitative and quantitative methodologies, focusing on the development of applications to be carried out and really integrated to community social practices, always considering their diversity and specific properties, but also whatever can be generalized and thus facilitate the solution of other problems (MATTA; SILVA; BOAVENTURA, 2014, p.24).

According to Sena and Catapan (2016), the design of educational games became a recurring research activity in the academic field, including the most diverse areas of knowledge. Those authors surveyed ten studies found in the literature and mapped several frameworks and models adopted in the development of educational games. They found out that the design of this type of artifact does not follow a methodological pattern. They also pointed out that many methodologies consolidated in other areas of knowledge have been used for the design of educational games.

Considering such diversity of methods, this study adopted the ADDIE model to guide the development of the educational RPG. ADDIE (Figure 1) is an acronym related to the main phases of this process: Analysis, Design, Development, Implementation, and Evaluation.

Figure 1 – Phases of the ADDIE model



Source: Adapted from Filatro (2008).

Filatro (2008) defined ADDIE as a systematic and iterative process aiming at creating learning experiences. Thus, this study aims at describing and analyzing the phases of conception (identification, specification, and production) of the ADDIE model adopted in the development of an educational RPG about blood donation in the perspective of the humanistic STS approach. Each phase of this process involved different research methods and analysis of the data collected, aiming at a decision-making process guided by the research problem that motivated this study.

This study was submitted to the Research Ethics Committee to which the researcher is linked and to the Municipal Education Secretariat in Rio de Janeiro for their ethical approval, since the research includes students from a municipal school of that city.

Pursuant to Resolution nº 466/2012, this research was carried out preserving the autonomy, equality, beneficence, and justice, and guaranteeing the rights and duties regarding its participants and the whole scientific community and was granted the approval nº 4.128.613.

4 RESULTS AND DISCUSSION: RPG CONCEPTION

4.1 Analysis

Based on the research problem, the analysis phase included activities that led to the study of the blood donation theme, in the sociocultural context of RPG practice communities, and analysis of the students' profile regarding the use of games and responsiveness to RPG in the school context.

4.2 Study on the blood donation theme

First, we surveyed the scientific literature available (PEREIMA *et al*., 2010) and the official documents by the Health Ministry regarding blood donation in the country (BRASIL, 2015) to support content development.

In addition, to understand how the blood donation process occurs in practice, and identify its technical-scientific and social aspects, in September 2018, we visited the Arthur de Siqueira Cavalcanti Hematology State Institute (Hemorio). We observed the dynamics of the activities in spaces destined to the donors' circulation: reception, screening room, collection room, and snack room. The research team followed the donors' path, from their identification to the instructions received regarding blood collection, including the questions asked during the clinical screening. The professionals at the Hemorio answered questions about the donation practice and related to the blood collected processing up to its use in transfusions, indicating all phases and identifying the professionals involved, their knowledge, abilities, and tools used in their work. They also learned about the initial proposal of this RPG and reinforced the importance of this initiative for Public Health.

This phase was essential for the elaboration of an educational RPG, mainly for involving theoretical and practical knowledge in the actors' perspectives, that is, the donors and the health professionals. In addition, the observations and interviews provided information and visual resources to integrate the RPG. We could collect information to characterize, from the technical and social standpoint, the role of the health professionals involved, who became the characters in this game. We also identified the challenges to be proposed in the game dynamics, based on the reality of this Public Health service. Such service includes the blood pathway from the interview with the candidate to the donation moment and later transfusion, the educational role of health professionals. The relationships between professionals and between professionals and donors, in this case, aiming at the loyalty of the donors, was also investigated.

4.3 Visit to a sociocultural context of an RPG practice community

To experience an immersion in the game development, we visited a mall in São João de Meriti/RJ, aiming to observe RPG players. When searching the Facebook, we found out that some RPG players, narrators, and creators met regularly in collaborative spaces at shopping centers and public libraries in the Fluminense Lowlands (Baixada Fluminense in Portuguese).

We talked informally with players and narrators, and mainly with a teacher, historian, and writer who takes part in a collective that develops RPG and an advertiser who had started a project that took RPG and recreational activities to shelters of underprivileged children and adolescents in the metropolitan region of Rio de Janeiro. Such talks helped us to build up the educational RPG with information regarding the creation of characters, narration, campaigns, and materials such as character cards. They also aided the development of activities and information related to the RPG pedagogical practice aspects and academic research on its educational use. It seems relevant to emphasize the informality of these conversations, which were not semi-structured interviews since the meetings with those subjects were casual.

4.4 Students' profile analysis and their responsiveness to the RPG use in the school context

This phase was carried out in a public elementary school in the North Zone of Rio de Janeiro. Initially, we noticed that the science curriculum approached themes such as the circulatory system and blood types: ABO and Rhesus (Rh) systems, in the 3rd term of the 8th year. This information supported the definition of the research participants.

Eighteen students from the 8th year of elementary school accepted the invitation to take part in this phase, answering a questionnaire to assess their knowledge about blood, blood donation and playing habits and getting involved in a character creation activity, typical of an RPG.

When asked about what blood is, students answered: "red" (n=13), "a liquid" (n=3), "something we all have" (n=1); they also referred to the blood function as "important for people's organisms" (n=1), "to keep us alive" (n=4), "to make the body move" (n=1), "to transport DNA" (n=1)" , and "to transport energy to the body" (n=1). When the question about the ABO and Rh systems was asked, only two students answered that they referred to blood types.

Regarding blood donation and the reasons for this action, only three students answered that "it's a way to contribute to the community" (n=1), "to help people" (n=1), or "to help somebody in need" (n=1). When asked about who can donate blood, the group mentioned the donor's age group (n=8) and their health conditions with absence of diseases (n=9) as possible criteria.

The participants were also asked whether they had learnt sciences through games, six students answered affirmatively to this question, and exemplified having learnt sciences through quizzes and a surgery simulation game. All participants answered that they had already seen people learning through games and stated that "there are people who think that sciences is boring, and this is a fun way of learning" (n=1), "depending on the content presented in the game, it is possible to learn a lot of things" (n=1), "there are a lot of science games" (n=1) and "there are a lot of educational games" (n=1).

When asked whether they knew what RPG is, 12 participants answered negatively. Among those who affirmed to know the game, they said it was "a character creation game" (n=2), "an adventure and action free game" (n=1), and "a simulation game" (n=1), while two participants did not answer that question.

Most students stated having the habit of playing every day or almost every day of the week. As for the preferences of individual or collective games, they preferred group practices. When asked about their preferences regarding the types of games, their answers were diversified and included action (n=10); strategy (n=6); RPG (n=5); adventure (n=4); sports (n=4); race (n=3); simulation (n=1), and others (n=7).

Taking that into consideration, we observed that students in the 8th year have some spontaneous knowledge about blood and blood donation, which indicates how pertinent educational practices on this theme are. It was interesting to observe that, in general, students tend to associate blood donation to altruistic actions and solidarity to the others. Regarding science learning with games, the participants emphasized the possibility of the ludic experience to learn abstract themes that are difficult to grasp. Playing is a daily and motivating activity for these youngsters. Thus, their habit, their preferences regarding how to play, and what kind of games can be explored by the teacher in ludic activities inside the classroom established an inter-relation between the pedagogical activity and the fun provided by educational games.

In addition to the survey, we carried out a dynamic task of character creation, which is one of the basic tasks in RPG and enabled us to observe their responsiveness to the pedagogical proposal. To this end, we proposed the creation of characters representing professionals in the health area.

Each student received a printed copy of the book containing the rules of an RGP generic system. Aiming to approximate students to the health professionals, some cards were printed with images of those professionals, wearing proper garment, and carrying tools they usually use at work. For most students, this was their first contact with the tabletop RPG. After the students' doubts had been clarified, they started to build up their characters in a satisfactory way, indicating the feasibility of using the educational RPG in the school setting. The verbal and social interactions between the participants of this group during the dynamic task, their interest in the blood donation theme, and in the citizen education, as well as the use of the game in science teaching confirmed the choice of the educational RPG as an educational tool.

4.5 Design

Based on the material and information collected in the analysis phase, we could start the next phase, namely, the design. This phase included the planning and pedagogical specifications of the RPG, mapping the questions to be worked on (FILATRO, 2008; CZAUDERNA; GUARDIOLA, 2019). Thus, a prototype of an educational RPG was elaborated. It was as close as possible to the plan, and aimed to evaluate aspects related to character creation, game functioning, and decisions to be made about the theme, the graphical design, and the technological resources used in its development and use by the players. Other needs were also defined, so that the situations involving Sciences and Health Teaching could be included in the RPG. This phase was carried out in partnership with the science teacher.

In this phase, an RPG design support tool was adopted. It is called Power 19 and consists in a script with 19 questions to help the developers to organize ideas regarding their game creation (WHITE, 2020).

Based on the work put forward by Filatro (2008), the result of this phase was organized in an Educational Design Matrix for RPG, specifying objectives, activities, and materials to be used.

The design phase also included two pilot studies using the game prototype. The first involved students in the biological sciences undergraduate course, while the second was used with elementary school students in Rio de Janeiro. Each of the pilot studies included playability test and use analysis. Different studies already mentioned playability of educational games related to Science and Health Teaching (SERAFIM *et al*., 2019; NASCIMENTO; BENEDETTI; SANTOS, 2020).

According to Alves and Silva (2020), gameplay is the way the player develops throughout certain game, finding ways and alternatives to face the challenges proposed, within the scope of preset rules. Schuytema (2008) considers the gamers' actions, immersed in the ludic context, enable the aggregation of important values in the game context, which depends on the conditions given by the decision-making dynamics. Based on his studies, Duarte (2020) defined gameplay as the quality that characterizes the way the game is used or is able to raise the players' interest, taking into account aspects such as strategies, rules, and design, which are experienced qualitatively by the player (DUARTE, 2020).

In educational games, pedagogical aspects must also be analyzed, from the understanding that learning must be seen as a social process rather than a product. Gladcheff, Zuffi and Silva (2001) pointed out that educational games must be assessed using specific methodologies, since their application is only justified if they contribute to a qualitative advancement in the teaching-learning processes.

This study also considers the teacher's central role in this process, since the undergraduate students are future teachers, they are responsible for guaranteeing knowledge appropriation (PINHEIRO; SILVEIRA; BAZZO, 2007). For this reason, a playability test was carried out with a group of five undergraduate students in October 2020, using the Discord platform due to the social distancing imposed by the Covid-19 pandemic. The biological sciences undergraduate students received an introductory text with the game instructions and used the online platform Google Docs to create their characters by using a card designed with this purpose. Those students view and contributions helped the correction of the prototype elements, as well as the revision of pedagogical elements in the game, and resulted in adjustments of the educational design matrix. In addition, from the group's discussion and suggestions, a strategy was defined regarding the adoption of the RPG narrative about blood donation, based on the hero's journey (CAMPBELL, 1989). This approximated the game to the cultural context of the young players, who are used to adventures that adopt the same narrative in different formats and medias.

After these adjustments, the prototype was evaluated by a group of students in the 8th year of elementary school, who took part in an RPG practical workshop in a public school in Rio de Janeiro. They used the institution Moodle environment. Four students participated on the first day, and six took part on the second day. The RPG objectives and the blood donation theme were presented

to the students, as well as the instructions about rules, research resources for the blood theme and contents related to the sciences subject. They also received the cards needed for their activity, and instructions regarding how to build up their character's profile and the game strategies. The group understood the proposal immediately and created their characters as health professionals, describing how they should act, their tools, and necessary knowledge to develop their work. They also discussed ethical aspects involved in their Jobs, while articulating their characters' participation in the narrative. They elaborated the physical and psychosocial description of their characters at this point.

The prototype was used to introduce the science contents related to blood to those students. The participants that had never played RPG, reported having felt a bit suspicious when they started the activity, because it was an educational game. However, they changed their perspective after creating their characters and starting the narrative. This allowed the students to ascribe meaning to the game through reflection upon the challenges presented by the RPG. In addition, the students took over the agency of their learning process for carrying out a collaborative work in the different phases of the teaching-learning process experienced in the RPG simulated environment.

4.6 RPG Development

According to the ADDIE model, the development phase involves the production and adaptation of resources and printed and/or digital educational material to the RPG with the collected information treated in the previous phases, mainly in the decisions implemented in the design phase (FILATRO, 2008).

Therefore, we produced an RPG in which the participants start the game in the society sphere, with the introduction of a social issue, in this case, the problem of low levels of blood center stocks and its outcomes. Next, the technology related to the social theme is analyzed by the players, specifically blood donation. In the following step, the scientific content is worked, that is, the circulatory system, and the ABO and Rh systems. At this point, the technology is studied as a function of the content presented, and the players receive guidance regarding the health professionals involved, as well as their functions and the path taken by the blood and hemocomponents from the collection to the transfusion. The equipment used by those professionals and the human and ethical values involved are also addressed. Finally, the players have to deal with the initial social issue again (AIKENHEAD, 1994).

The RPG 'Donating Blood without Mystery' (Doando Sangue sem Mistério in Portuguese), as shown in the cover (Figure 2) contains a 45-page book in PDF format, where the necessary information for its use by teachers and students in the school environment is found, enabling its use even without previous experience with RPG games. The book was elaborated with explanations about RPG, the collaborative way of playing provided by the RPG, and the narrator's role description, which is in general the teachers' role, when working in the context of science classes to address socio-scientific issues.

Figure 2 – Cover of the educational RPG developed

Source: The authors (2020).

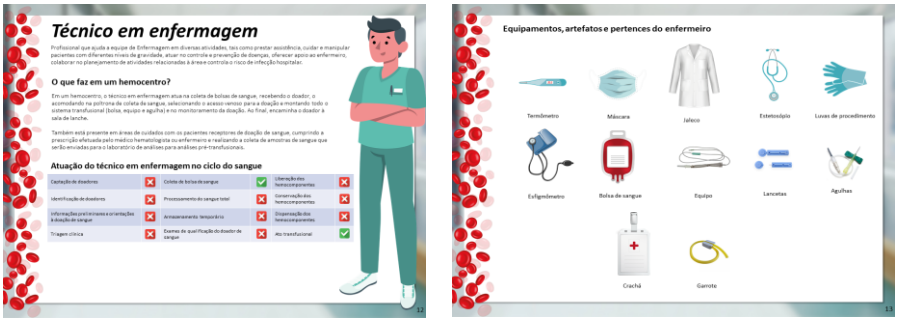
The material also includes contents, references and links to access knowledge related to sciences and associated with the school curriculum, with information about the ABO and Rh systems, data about blood donation in Brazil, and the requirements, rules and situations that prevent a candidate from donating, either temporarily or permanently. However, teacher and students are encouraged to seek other reliable sources of information to take part in the game.

This material was developed in the hypertext format, with links between concepts throughout its pages, allowing its users to navigate in a non-linear way, according to their needs and the level of information required, making its use more dynamic. All figures used in its layout were available on the Internet to use for free, provided that the source is cited, which allows a broad dissemination and distribution of this material in the school context.

A blank character playsheet was included in the material so that the students using it can create their characters according to the rules explained in the RPG. It also contains a clinical screening form and a donor registration form to simulate the attendance at the blood center.

Explanations are also provided of how the players can create their characters and provoke randomness moments during the narratives, by using a six-sided dice during the game. Detailed information is also found (Figure 3) about the health professionals working in blood centers: hematologist doctor, nurse, biologist, biomedical doctor, social worker, nursing technician, and clinical analysis technician. This information describes with text and illustrations the activities, knowledge, type of relationship with other professionals, and with the population assisted, and the tools used in their work by each professional involved, and a glossary containing those items.

Figure 3 – Pages describing the nursing professional.



Source: The authors (2020).

5 FINAL CONSIDERATIONS

This study aimed to present the phases of a research process and development of an educational RPG, articulated to the humanistic STS approach, and based on the educational design ADDIE method. We understand that the humanistic STS is characterized by the development of attitudes and values associated with the ability to make responsible decisions when facing real situations (AIKENHEAD, 2009).

Therefore, we produced an RPG in which the participants start the game in the society sphere, with the introduction of a social issue, in this case, the problem of low levels of blood center stocks and its outcomes. Next, the technology related to the social theme is analyzed by the players, specifically blood donation. In the following step, the scientific content is worked, that is, the circulatory system, and the ABO and Rh systems. At this point, the technology is studied as a function of the content presented, and the players receive guidance regarding the health professionals involved, as well as their functions and the path taken by the blood and hemocomponents from the collection to the transfusion. The equipment used by those professionals and the human and ethical values involved are also addressed. Finally, the players have to deal with the initial social issue again (AIKENHEAD, 1994).

The phases that involved the study on the blood donation theme, regarding the sociocultural context of the RPG practice communities and the analysis of students' profile in relation to the use of games, and their responsiveness to the RPG in the school context contributed to the planning, construction, and validation of the prototype, which resulted in the production of the RPG 'Donating Blood without Mystery'. However, we do not think that an educational material is only constituted of its planning and elaboration phases, but that it is main achievement is the several possible uses, created and recreated by those involved in educational practices. Therefore, we consider the product of this Project as an open material to be tried and studied in different sociocultural contexts and conditions.

The ADDIE model, adapted from Filatro (2008), was confirmed as a solid way to go forward in the development of innovative projects, which can contribute to changes in the education process, with more open and flexible curricula that link the school to local and global issues, which are relevant to the students, their community and society in general.

Although this is a time-consuming proposal that requires hard work, with several interconnected phases that can be worked in a spiral manner, aiming at its improvement and continuous evolution, it offers a space of construction and creativity to think educational practices and their resources. It also favors a type of planning that moves the teacher of the subject from its traditional centrality to an active and collaborative participation of students and other teachers regarding both the planning and the teaching-learning process. Thus, we propose that the ADDIE model, from the design-based research standpoint, should be discussed, analyzed, and improved through different educational projects. It seems relevant to emphasize the possibility of incorporating this method in the classroom context, integrating students and teachers as educational designers of other games or ludic activities addressing themes of interest for the group, in co-learning collaborative practices.

In the last few years, not many studies involving RPG and STS were published (PALMA-JIMÉNEZ; CEBRIÁN-ROBLES; BLANCO-LÓPEZ, 2020; BRASIL *et al*., 2020). We understand that the use of RPG to teach sciences in a STS education context requires more research. The creation of materials and techniques inspired in the RPG and their applications with educational purposes are not enough and deeper reflection is still needed regarding their insertion in education (SCHMIT; MARTINS, 2011).

The STS approach to Science Teaching does not only regard the use of certain methodology or the construction of a curriculum. In fact, it is a way of thinking education that requires changes of the educational goals. Such changes also require changes in the curricular structure to overcome methodological reductionism (MUENCHEN; AULER, 2007). In addition, the STS approach to teach sciences must be broadened aiming to promote knowledge on the nature of science and technology, educating the learners for investigation in sciences and for the activism regarding socio-scientific controversies (REIS, 2013).

The RPG 'Donating Blood without Mystery' integration is being implemented and its evaluation in the school context will be important to assess its contribution to Science and Health Education in a STS perspective.

PESQUISA E DESENVOLVIMENTO DE UM ROLE PLAYING GAME SOBRE DOAÇÃO DE SANGUE: INTEGRANDO CTS HUMANÍSTICO NA EDUCAÇÃO EM CIÊNCIAS E SAÚDE

RESUMO

O objetivo do presente estudo foi pesquisar e desenvolver um Role Playing Game (RPG) sobre doação de sangue, visando integrar a abordagem Ciência Tecnologia e Sociedade (CTS) em uma perspectiva humanística na Educação em Ciências e Saúde. Tal jogo foi desenvolvido com base na abordagem metodológica adaptada do modelo ADDIE. O foco deste estudo é a descrição e análise das três primeiras etapas de tal modelo, envolvidas na produção do RPG, bem como sua contribuição para o processo educativo. Cada uma destas etapas constituíra diferentes métodos de coleta e análise dos dados, além da realização de testes com protótipos, desenvolvidos com a colaboração de licenciandos de Ciências Biológicas e de alunos do Ensino Fundamental, contribuindo com a aproximação destes sujeitos em questões envolvidas no jogo e também no aprimoramento do material educativo em desenvolvimento. Finalmente, o material referente ao RPG, denominado Doando Sangue sem Mistério, é apresentado em detalhes como resultado deste processo e suas possíveis contribuições e aprendizagens são discutidas.

PALAVRAS-CHAVE: Role Playing Game; Ciência Tecnologia e Sociedade; Doação de Sangue; Modelo ADDIE; Educação em Ciências e Saúde.

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