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Initial teacher education and rural education: a game for teaching parasitology

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ABSTRACT. Rural Education lacks methodologies consistent with its theoretical-epistemological paradigms and only a few studies were developed in a dialogical approach with its needs that would result in educational products for the field itself. In this article we present a game to teach parasitology in a more attractive and efficient way. The game *Barbeiragem* focuses on Chagas disease. This trypanosomiasis was chosen because it is a neglected and endemic tropical disease in Minas Gerais. In addition to the conceptual and prophylactic aspects, the game highlights the social function of scientists and health care agents, the importance of scientific dissemination, and investment in Science as well as in the primary care service. The activity was carried out by 22 students of the Degree in Rural Education, with an emphasis in Life and Nature Sciences, from Federal University of Minas Gerais. There was a good acceptance of the game as observed by several positive opinions of the students. We hope that this playful activity and carried out outside the classroom can contribute to the training of Teachers and instrumentalize them to develop it in their communities.

Keywords: rural education, playfulness, health education, parasitology, chagas disease.

A formação inicial de professores e a educação do campo: uma proposta de jogo para o ensino da parasitologia

RESUMO. A Educação do Campo carece de metodologias consoantes com seus paradigmas teórico-epistemológicos. Poucos estudos são desenvolvidos de maneira dialógica com o campo para resultar em produtos educacionais para o próprio campo. Neste artigo, apresentamos uma proposta de jogo para que a parasitologia seja trabalhada de maneira mais atrativa e eficiente. O jogo *Barbeiragem* tem como foco a doença de Chagas. Essa tripanossomíase foi escolhida por ser classificada como doença tropical negligenciada e endêmica em Minas Gerais. Além dos aspectos conceituais e profiláticos, o jogo destaca: a função social dos cientistas e agentes de saúde, a importância da divulgação científica e do investimento em Ciência e na atenção básica. A atividade foi realizada por 22 alunos do curso de Licenciatura em Educação do Campo, com ênfase em Ciências da Vida e da Natureza, da Universidade Federal de Minas Gerais. A avaliação mostrou uma boa aceitação do jogo, uma vez que foram verificadas diversas opiniões positivas. Esperamos que essa atividade lúdica e realizada fora da sala possa contribuir na formação de professores e instrumentalizá-los para desenvolvê-la em suas comunidades.

Palavras-chave: educação do campo, ludicidade, educação em saúde, parasitologia, doença de chagas.

La formación inicial docente y educación rural: una propuesta de juego para la enseñanza de la parasitología

RESUMEN. La educación rural carece de metodologías consistentes con sus paradigmas teórico-epistemológicos. Pocas investigaciones se desarrollan de manera dialógica con sus necesidades, lo que resulta en productos educativos para el campo en sí. En este artículo presentamos una propuesta de juego para que la parasitología se trabaje de una manera más atractiva y eficiente. El juego *Barbeiragem* se centra en la enfermedad de Chagas. Esta tripanosomiasis fue elegida porque está clasificada como una enfermedad tropical endémica y descuidada en Minas Gerais. Además de los aspectos conceptuales y profilácticos, el juego destaca: la función social de los científicos y agentes de salud; La importancia de la difusión científica y la inversión en Ciencia y en la red de atención primaria. La actividad fue realizada por 22 estudiantes del Grado en Educación Rural, con énfasis en Ciencias de la Vida y la Naturaleza, de la Universidad Federal de Minas Gerais. Notamos una buena aceptación del juego, ya que se verificaron varias opiniones positivas. Esperamos que esta actividad lúdica y realizada fuera del aula pueda contribuir a la formación de los docentes e instrumentalizarlos para desarrollarla en sus comunidades.

Palabras clave: educación rural, lúdico, educación para la salud, parasitología, enfermedad de chagas.

Introduction

Concerning science and biology teaching, for the education process to be emancipatory and decolonial, it needs to regard the different strategies for didactically approaching pedagogical contents, considering the particularities and the reality of rural people (Melo & Cardoso, 2011). It is in this context that rural education and health education intertwine. One cannot work with rural education without considering the administrators' neglect towards the health system that attends rural subjects and how it impacts their lives (Schönardie, 2018). Thus, a pedagogical practice planned by those own subjects and articulated with health education allows for them to become independent in the prophylactic aspect and to transform themselves into multipliers of this kind of knowledge in their community. In addition to that, since education is an act of political emancipation (Freire, 1991, p. 21-22), a pedagogical project that raises awareness of the transversal issues related to rural health education - such as the lack of interest in funding research that could develop treatment for diseases that majorly affect rural people–empowers these people to demand greater investments in research and better conditions in the health system from the administrators (Dias, 2007; Caldart, 2009). Thus, this article presents and analyses an activity proposal for rural students from different educational stages based on conducting a game that intends to teach parasitology through a playful, contextualized, critical approach.

It is known that games correspond to an important teaching resource, since they give the student the opportunity to playfully experience knowledge (Cunha, 1988). Hence, new abilities can be developed and pedagogical strategies can be diversified, deviating from transmission pedagogy, or the banking model of education, characterized by a mere receptivity and reproductivity teaching (Freire, 1975; Aguiar et al., 2015). However, games in the educational context must go beyond the solely recreational purpose, offering problem situations and functioning as an anchor for the student to reach more complex levels in the social-emotional and psychomotor domains. That is, stimulating physical and cognitive abilities together (Vygotsky, 1989; Macedo, Petty & Passos, 2000). The use of games makes it possible to transform common classes into efficient, creative, and pleasing teaching experiences, even for high schoolers (Ferreira & Santos, 2019).

Usually, formal instruction is restricted to the classroom. However,

activities outside of the classroom enable a diversification in the school routine. That being so, the outdoor spaces of the school, such as the court, the library, the schoolyard, and others, must be used and understood as an extension of the classroom. Despite the lack of resources and collaboration, it is necessary to stimulate activities that break out of the classroom routine, since young people feel motivated when activities outside the classroom are proposed (Tapia & Fita, 2006; Santos et al., 2016).

Considering what was previously mentioned, this work presents a game that intends to promote the integration of two distinct degrees that form teachers of the same field of expertise (Science and Biology). It also aims to establish a dialogue between traditional and scientific knowledge, since it was developed and assessed by students from the teaching degree in Rural Education (Lecampo), with a minor in Life and Nature Sciences (CVN), along with students from the teaching degree in Biology from Federal University of Minas Gerais. Thus, we expect that the participants consolidate new and relevant knowledge on parasitology teaching, especially Chagas disease. Additionally, the game also explores scientific, social and politic issues, e.g., the importance of science dissemination and fundings for science and primary care. This way, as stressed by Ferreira de Jesus e Souza (2018, p. 1070), we hope to "contribute to their social, political, cultural and economic formation, so as to make the student a reality changing agent."

Parasitology teaching in primary education is generally restricted to the pathogen, the vector, and the host, while also presenting the cycles of the diseases and preventive measures (Dias & Kovaliczn, 2014). The topic is discussed with a strictly traditional approach, without any connection to the social context to which it is aimed, contributing to the lack of interest from students and lower learning quality (Nascimento et al., 2013; Sousa & Chupil, 2019).

The game has Chagas disease as a central theme and is called *Barbeiragem* (a word play with the popular name of the triatomine bug in Brazil). This trypanosomiasis was chosen due to its classification as Neglected Tropical Disease (NTD) by the World Health Organization (WHO), since it leads to several cases of morbidity and mortality in endemic countries. In Brazil, it is estimated that 4,543 people died of Chagas disease in 2017 (Brasil, 2019). In the state of Minas Gerais, in the same year, the mortality rate reached 5.03 per 100 thousand inhabitants,

being the Brazilian state with the highest number of deaths (Brasil, 2019). The north of Minas Gerais is considered a hyperendemic area, representing a major public health issue, mainly due to the difficulties for the people that live in rural areas to reach reference centers (Sanches, 2018; Ricardo, 2020).

Considering the alarming data, Sousa and Chupil (2019) conducted a literature review reporting eight works which proposed the use of games to teach parasitoses. In addition to these eight, we found one extra article proposing a game oriented to teaching parasitology (Silva & Fontes, 2017). From those nine works, none regarded Chagas disease. It is also worth noting that none of them was developed considering the importance of promoting interculturality and reaching the traditional people from rural areas.

Although this is not a literature review, we decided to analyze articles that focus on games in the context of Rural Education. Those articles were chosen from the database of three important scientific journals in the area that publish works with different didactic approaches (Brazilian Journal of Rural Education, Popular Education Journal and Brazilian Journal of Agroecology). We found only two articles: the first concerns the continuing formation of quilombola teachers of mathematics through games of African origin (Ferreira de Jesus & Souza, 2018), and the second deals with an activity sequence that includes a game on agroecology conducted with students from sixth grade (Melo & Cardoso, 2011). These findings highlight the unprecedentedness and relevance of the present pedagogical proposal as a possible methodology and prophylactic measure to be worked in the initial education of teachers and in the primary education.

Our objective is also grounded on the development of research associated with a pedagogical praxis that questions the prevailing logics and empowers subordinated groups, such as the rural population. Thereby, students from Lecampo CVN actuate in the present research under four perspectives: (i) teaming up with the other authors to structure and make adjustments on the game; (ii) conducting a diagnostic assessment on their experience with games in the school context, besides identifying their knowledge and practices in relation to Chagas disease in a way that they can be incorporated to the game, aiming to contextualize the game with the local reality; (iii) introducing the game as a way of training and raising awareness of the necessity of diversifying pedagogical strategies, so that they can conduct it with

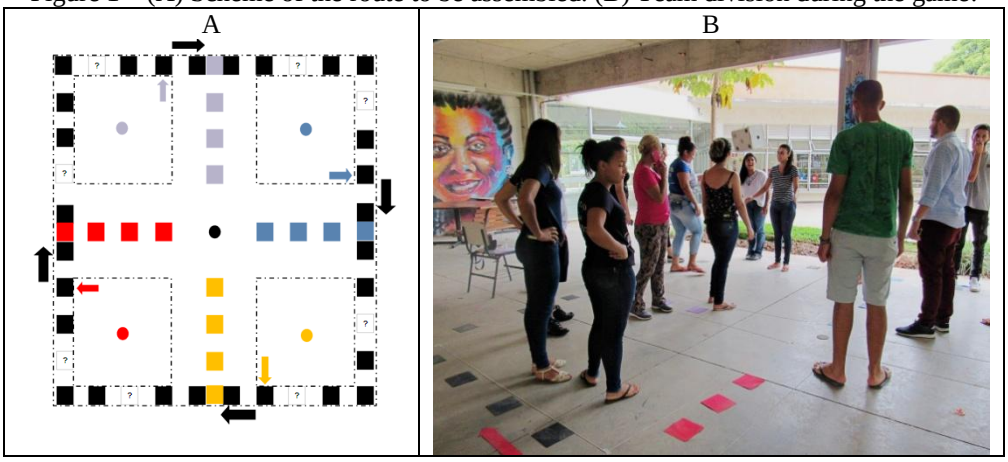
students from schools in their communities; and (iv) underscoring the importance of science dissemination, primary care and science funding in rural communities detached from big urban areas that gather research institutions.

Methodological procedures

Game elaboration

The game *Barbeiragem* was conceptualized to have an easy preparation, involving simple and accessible materials: craft foam, ribbons, strings, A4 paper, cardboard, and adhesive tape (see additional documents). If some of the recommended materials are lacking, even chalk of various colors can be used to make the necessary markings. The route is assembled on the ground (Figure 1A) and it should preferably be conducted in other spaces than the classroom. The students themselves have the role of pawns, being split into four teams: triatomine bugs, scientists, community health agents and citizens. Up to 24 students can play at the same time, six on each of the four groups (Figure 1B):

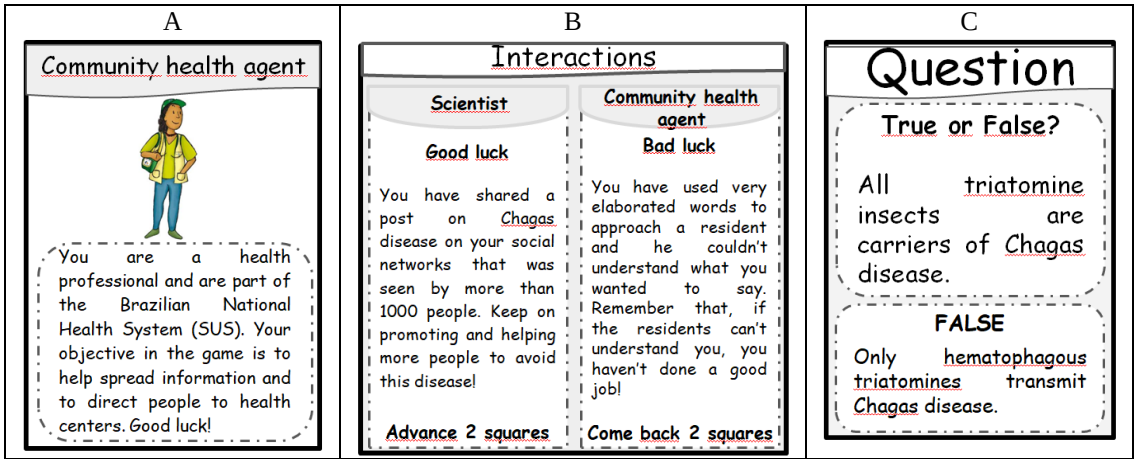
Figure 1 – (A) Scheme of the route to be assembled. (B) Team division during the game.



Source: Data from the present research.

The game has also three sets of cards, called “characters”, “good luck and bad luck” and “question” cards (Figure 2A, 2B and 2C), as well as a dice (with 30 centimeters of edge, made of cardboard) to draw how many squares the players should move. Each player receives a ribbon to be placed in their arm as a means of identifying the team.

Figure 2 – (A) Example of card from the "characters" group. (B) Example of card from the "good luck and bad luck" group. (C) Example of card from the "question" group.



Source: Data from the present research.

The "characters" cards are responsible for determining the teams to which each player will belong. Besides, those cards present the social function/participation of the characters in the Chagas disease cycle and, also, in the game (triatomine bugs, scientists, community health agents and citizens). The cards "good luck and bad luck" are used when one character surpasses other from another group. They define which participant will continue to advance and which will go back, according to the situation presented in the card. Finally, the "question" cards are drawn when the player reaches the squares of the route signaled by question marks, so that it is necessary to answer correctly to the questions to keep advancing.

Each team begins the match from different points of the route, and, as players move forward, they may stop in squares of preestablished questions, in which their knowledge on the subject is tested. Besides, to make the game more dynamic, whenever two players from different teams meet during the route, an interaction card ("good luck and bad luck") is drawn. It will then define, randomly, which player will move forward and which will retrocede in the route (we made sure that the probabilities for advancing and retroceding were the same for all players). This way, the participant's aim in the game *Barbeiragem* is to be the first player from one of the four teams to reach the center of the route after walking all the squares.

Pre-evaluation

While the material was being produced, two tests (called pre-evaluation) were conducted aiming to verify the rules,

assembling, relevance, dynamics, theoretical depth, and game acceptance. Then, it would allow us to make eventual adjustments before presenting the final version.

The analysis methodology chosen for the pre-evaluation was participant observation, that, according to Angrosino (2009), advocates for the insertion in the context where the phenomenon happens, while the field notes are being elaborated. Thus, the comments given by the participants during the game were registered in the field notes, and, later, analyzed.

The pre-evaluation was conducted with 26 participants, aged from 19 to 30 years. They were undergraduate Biological Sciences students from the Teaching and Bachelor's degree and one of them was a doctorate student, all of them from Federal University of Minas Gerais.

Final evaluation

The final evaluation was conducted by the students of Lecampo CVN, during the school period (a portion of the academic term which is spent in the university space, in opposition to the community period) of the first semester of 2020. The project was approved by the Research Ethics Committee from Federal University of Minas Gerais under the number CAAE: 24891019.0.0000.5149. It consisted of conducting the game *Barbeiragem* with students enrolled in a subject about food culture, after attending a class on agricultural parasitoses (dialogued expository class, lasting 2 hours and 40 minutes with a 20-minute break). In this class, the main verminoses that affect the rural area and that are transmitted orally were discussed, being them: ascariasis, enterobiasis, trichuriasis, taeniasis and cysticercosis, giardiasis, amebiasis and Chagas disease. During class, the interactive-dialogic discourse was adopted, aiming to engage the students intellectually and emotionally, besides exploring their knowledge (Mortimer & Scott, 2002). Towards the end, the instructions of the game were given.

After class, the students were asked to go to the courtyard, located on the Institution building, to play *Barbeiragem*. Because of the limit of time available for the final evaluation, the game was assembled previously by the authors, since it was already known that the assembling would take almost 25 minutes (measured in the pre-evaluation). The participants were introduced to the route, split into four teams (triatomine bug, citizen, community health agent and scientist) and the rules were revised. The separation into teams was realized by randomly distributing the

"characters" cards, that presented the name of the character, a picture, a description of their social function and their objective in the game.

For the final evaluation, a quantitative approach was adopted by using a de-identified questionnaire (available on Google Forms), answered after playing the game. The students were advised to not search for information on the internet. The questionnaire method was chosen because: (i) it allowed for evaluating specific aspects that probably would not appear spontaneously with participant observation; (ii) the students could evaluate anonymously, ensuring a sincere opinion pertaining the studied object; and (iii) by the size of the sample, we would be able to have all participants under our scope, something that would not be possible if we opted for a qualitative methodology approach (Chaer, Diniz & Ribeiro, 2011; Minayo & Sanches, 1993).

The questionnaire had three questions related to the characterization of the sample, in addition to ten questions related to Chagas disease, being five of those about conceptual contents (three objective and two subjective questions) and five others that dealt with regional knowledge. To assess the game's educational impact, fourteen statements/questions were elaborated, adapted from Silva et al. (2014) and Oliveira et al. (2015), based on the Likert scale (1932). Thus, the participants should mark their level of agreement in relation to the statements, considering the original 5-point scale: 1) strongly disagree; 2) disagree; 3) neutral; 4) agree; 5) strongly agree.

The close-ended questions were analyzed and will be represented with absolute value, in a percentage in relation to the total of participants or in means and standard deviations from means. The answers for open-ended (conceptual) questions were classified as "right", "wrong" or "incomplete". Lastly, an open-ended question was proposed, in which the students had to criticize the game and/or leave suggestions. The comments on these questions were classified as "positive", "negative" or "suggestion". The answers originated semantic units (parts of the text that determine a judgement). Then, it is possible for an answer to have more than one semantic unit; that is, an answer can receive more than one classification (begins with a praise, classified as "positive", and ends with a suggestion, classified as "suggestion", for example).

The classification of the open-ended questions was validated inside the group, by the authors themselves, independently,

according to the contents discussed in the activity.

Sample characterization

In the final evaluation, 22 students from Lecampo CVN were participants, being 18 of them females (81,8%) and four of them male (18,2%). All of them were on the 6th semester, aging from 20 to 41 years old (average of 24,3 years). We also verified that 21 of the participants were residents of 12 different cities from the countryside of Minas Gerais and one of them was a resident of the south of the state of Bahia.

Results and discussion
Pre-evaluation

For the pre-evaluation, one of our objectives was to find out whether participants would be able to organize the game without aid. Then, it was possible to observe that they could assemble the route but showed some difficulties in understanding the rules. This stimulated us to propose some changes in the instructions.

During the game, we verified that some "good luck or bad luck" cards raised a few doubts due to the way they were written and, therefore, they were modified too. Still, we noticed a good acceptance of the game, since a lot of positive reactions were manifested by the participants. The game seems to have promoted a pleasing environment, even for the adult public, highlighting its playful character. In addition to that, as players advanced in the game, motor and cognitive skills were stimulated, i.e., assuming a key-role in the learning process.

Following its initial structuring, the game lasted 1h25min (25 minutes of those dedicated to the assembling), which motivated us to implement some changes in the rules, aiming to improve the dynamics, so that its duration could be adequate for the school reality. By the end, the participants manifested unanimously that the game would be relevant for basic education, besides being a good strategy to diversify the pedagogical practice, and stressed that they would like to have access to the final version for future usage. These results were important, since this group is also one of our target audiences.

Final evaluation

When we conducted the game with Lecampo CVN, the game lasted 50 minutes, a period considered adequate that was predicted by the modifications implemented in the rules after the pre-evaluation. After finishing the game, the participants did the final evaluation through a link that we provided which gave

access to the online survey. The analyses of the answers obtained for each question are discussed below.

Initially, we made sure that Chagas disease was part of the context of the studied group, since that would justify the importance of the pedagogical proposal developed. Then, analyzing the answers provided for the question "Do you know anyone that has or has had Chagas disease?", we verified that 19 participants (86.4%) answered that they knew, and only three (13.4%) answered negatively. We also verified that, among those that may know someone that has/has had the disease, four students (21.1%) said they knew one person, six students (31.6%) said they knew two people, two students (10.4%) said they knew three people, three students (15.8%) said they knew four people, no student indicated that they knew five people and four students (21.1%) said they knew more than five people that had the disease.

Through this data, it was possible to confirm that Chagas disease presents itself as a major public health issue in the countryside of Minas Gerais. This evidences how the disease shows itself in the daily life of the participants. The familiarity with people with the disease is part of their routine, showing that it is crucial that this group, as future educators oflife and nature sciences that will work especially in rural areas, is familiar with prophylactic measures against the disease and know how to publicize those measures. One of the major rural education's bottlenecks lays in the distancing between biology classes in rural schools and the daily affairs of students and their families (Oliveira, Camargo & Santos, 2016). Thus, we hope that the game offers an alternative to change this situation.

Another question asked if "There are community health agents in your region to educate people on the disease prevention?". We noticed that 17 students answered positively (77.3%), while another five (22.7%) answered negatively. No participant reported not knowing the presence of these professionals in their cities, showing that they are aware of the assistance the government provides the population. On the other hand, eight (36.4%) participants said that, in the area they live, there are no hospitals to treat Chagas disease, another four (18.2%) didn't know the answer, and only ten (45.5%) affirmed that their region has one of these hospitals. This shows that more than a half of the participants may be unassisted concerning specialized hospitals, which is very preoccupying, since most of them know at least one

person that has or has had Chagas disease, as we pointed previously.

As the local context and traditional knowledges (disseminated in the communities, e.g., prophylactic measures and home treatments for the disease) of rural students are identified, they can be incorporated into the game through new cards. Then, by identifying the participant's traditional knowledges, we can stablish a dialogue with scientific knowledge and also construct a game that is contextualized with the reality of its target audience. Thus, we consider it extremely important to evaluate the existence of home treatments for the disease. Still, we could not identify any.

Regarding Chagas disease, it is known that the sooner the diagnosis is given and the treatment starts, the bigger are the chances of healing (Pedra et al., 2011). Therefore, it is important to identify and analyze possible home treatments, ensuring that they do not dismiss efficient medical treatments, as we emphasized in the proposed activity. Nonetheless, as stressed previously, many communities are not assisted by hospital networks. This is a significant observation that must be problematized during the activity, so that the participants understand the need for demanding primary health care initiatives from the government. Then, a new card was conceived, concerning this aspect, after the final evaluation.

Analysis of the conceptual contents

The following questions from the questionnaire concern the conceptual contents relative to Chagas disease. That is, by the end of the activity (dialogued expository class, followed by the game), we wanted to verify which information on Chagas disease the participants were able to consolidate.

When asked "Do you think it is possible to contract Chagas disease after making contact with an ill person?", 18 students (18.8%) answered "no" and another four (18.2%) answered "yes". Therefore, most of the students answered correctly. The congenital form, blood transfusion, and organ donation are person-to-person transmission modes, but it is evident that superficial contact does not spread the disease (Neves, 2016). This information is very important to make sure that no stigma is produced in relation to ill people, something that would hinder their social relations.

When questioned if there is a cure for Chagas disease, 21 of them answered that there is no cure and only one student (4.5%) said that there is. It is known, besides being informed during the first part of the activity, that it is possible to treat

and cure the disease, although the chances are higher on the acute phase (up to 80% of cure chance), while in the chronic phase the chances of cure are lower and do not reach 10% (Pedra et. al, 2011). In addition to that, some researchers consider that when the patient does not develop severe cardiomyopathy, although there is not a complete eradication of the parasite, the person can be considered cured, as explained by Pedra et. al (2011). Then, we use the conclusion reached by Araújo et. al. (2000) to justify the students' answers for this question. These authors verified that "according to popular knowledge, Chagas disease does not have a cure". Thus, although this issue was discussed during class, it was clear that it needs to be more emphasized in order to shred this alternative conceptualization on the disease.

Still regarding the part of the final evaluation dedicated to conceptual contents, open-ended questions were chosen for the analysis of two aspects: modes of transmission and prophylactic measures. The answers were classified as "right", "wrong" or "incomplete" by the authors, independently from one another.

When the question "Which is(are) the mode(s) of transmission of Chagas disease?", we collected 21 answers (because the question was optional, one of the participants did not answer), out of which nine (42.9%) were classified as incorrect for considering that the triatomine bug's bite alone would be able to transmit the disease. They, therefore, did not pay attention to the fact that, after biting, the triatomine bug needs to defecate next to the spot. When the bitten person scratches the area,the infectious form of the protozoan *Trypanosoma cruzi* present in the feces will be able to penetrate the tissue and reach the bloodstream, provoking the disease in the host (Neves, 2016). We understand that, being a complex conceptual question, it clearly required a specialized attention in the expository part, ensuring that the students consolidate this information adequately. Another 11 answers (52.4%) were classified as incomplete, because, although they were correct, at least one form of transmission was forgotten. It is worth noting that two answers denominated the triatomine bug as a fly or a beetle, however, since they only presented this conceptual error, they were not classified as wrong, once this denomination of the bug was not discussed during the class or the game. From this observation, it was also possible to improve the activity, given that this information was added not only in the expository part but also in a new card. Finally, one answer was classified as

correct, because it correctly addressed all modes of transmission. We recognize that Chagas disease has four modes of transmission (vectorial, vertical or congenital, accidental and oral) (Neves, 2016) and that it would be hard indeed for students to remember them all by the end of the activity. This signals that this information needs to be more revised during the formative process.

The question in which participants should classify preventive measures of Chagas disease obtained 16 answers (six participants did not answer). Non-specific answers, such as "avoid the bug", were disregarded for the analysis. Table 1 shows the number of prophylactic measures cited by each participant. The average number of prophylaxis cited for each answer was 1.7, and no participant cited more than three measures.

Table 1 – Number of prophylaxis cited by each participant.

Prophylaxiscited	**Participants**
None	6
One	7
Two	6
Three	3
More thanthree	-
Total	**22**

Source: Data from the present research.

No answer could comprehend prophylactic measures for all four modes of transmission (vectorial, vertical or congenital, accidental and oral). For a better understanding of the data, since some answers cited more than one prophylactic measure, we decided to quantifythe measures and relate them to the different forms of transmission (Table 2).

Table 2 - Prophylaxis cited and the corresponding modes of transmission.

Prophylaxis	**Frequency**	**Mode of transmission**
Avoiding contaminated food or food whose safety you are unsure about	7	Oral
Cleaningtheresidence	5	Vectorial and oral
Food hygienization	5	Oral
Usinginsectrepellents	2	Vectorial
Cooking food thoroughly	2	Oral
Installing mosquito nets in windows	2	Vectorial
Using a mosquito net canopy	2	Vectorial

Avodingrubbles	1	Vectorial and oral*
Usingcondoms	1	Vertical
Housingimprovement	1	Vectorial

*Considering food rubble, such as *paneiros* (açaí berry baskets).

Source: data from the present research.

We identified 28 prophylactic measures, and most (19) of them aimed at preventing oral transmission. It was interesting to observe that no answer mentioned the population control of the triatomine bug as a prophylactic measure, something consistent with the ecological importance of the animal, as approached in the game.

As it occurred with the previous question, we understand that the students would hardly be able to recover all the prevention measures discussed in the final evaluation, bearing in mind that there is a lot of new information for them. We infer that, although the activity helped, it is clear once again that these concepts need to be revised during the learning cycle.

Educational impact and applicability of the game

The evaluation of the game's educational impact, as well as its applicability, was made through 14 positive/negative statements, according to the 5-point Likert scale, being 1 equal to "strongly disagree" and 5 equal to "strongly agree".

The first three questions aimed at identifying the students' perceptions of games, as well as their experience with this didactic resource. Most participants informed they have not engaged in educational games in high school (15, or 68.1%), showing that this pedagogical practice seems to be absent in schools from the countryside of Minas Gerais. When asking about the realization of games during undergraduate studies, we verified that half of the students never engaged in didactic games. It appears that games are not widely explored, both basic education and in initial teacher education. Those results are in line with the findings of Nicola and Paniz (2016). Conducting a study with science and biology teachers, those authors observed that - although didactic games are envisioned in official curricula and many studies affirm that they are recognized as auxiliaries in building knowledge - many teachers do not make use of those resources, especially due to the lack of time and structure. This puts the

need of having games that are easy to play and are compatible with the time available to teachers into evidence. Only fulfilling this need can we shift this paradigm; exploring games in initial and continuing formation courses will enable teachers to understand the real importance of these resources and make them feel more assured to introduce them in their planning.

Regarding this matter, the Indigenous Pedagogy course at the Center-West Paraná State University (UNICENTRO), which comprises a subject called "Practices of Games and Playful Activities" in its curriculum (Gehrke, Sapelli & Faustino, 2019), is a good example to follow. Perhaps the creation of a subject specifically addressing the topic of games is not the most appropriate strategy when considering different realities. On the other hand, what we have already mentioned emphasizes that this approach can no longer be detached from the teaching and learning processes.

When asked if they enjoyed didactic games, 19 (86.4%) students strongly agreed and no student disagreed or strongly disagreed, showing that this pedagogical practice is largely accepted by students. This, therefore, puts into evidence that a planning that includes games will be in accordance with the students' preferences. Thus, it could achieve better engagement and, consequently, better pedagogical results.

In relation to playing the game, we observed that more than half of the participants (54.5%) did not find the game difficult, which shows that it is replicable and/or consistent with the participants' knowledge.

From the answers obtained for the statement "I like it when my teacher/professor uses games in class", it was possible to observe that 17 (77.3%) strongly agreed and 4 (18.2%) agreed. It is worth noting that no student disagreed or strongly disagreed. Based on these answers, we consider the game as a tool that parts with traditional teaching methodologies and awakes the playfulness in the teaching and learning processes, even in adult individuals. Therefore, it would be a well accepted didactic resource. This seems to safely indicate that the game can become a means for learning about, raising awareness of and teaching prophylactic measures of Chagas disease.

Regarding the statement "The game was NOT important for my learning", 20 students (90.9%) strongly disagreed, one student (4.5%) was indifferent and only one student (4.5%) strongly agreed with the statement. Thus, we can confirm that *Barbeiragem* was a valid complementary

resource to reinforce conceptual knowledge previously discussed in class, justifying its importance as a didactic-pedagogical resource.

When asked if they would like to play other games like this one, we could notice that 18 (81.8%) strongly agreed, three (13.6%) agreed and one student was indifferent. Again, no student disagreed or strongly disagreed with the statement. This percentage conforms with the previous answers, which showed that (i) the game was important for learning the subject; (ii) students like games and (iii) students like when teachers introduce games into their teaching practice.

Through the statement "The class would have been better without the game", we observed that all students were unanimous when strongly disagreeing. Thus, we can infer that the students approved the inclusion of the game in the class. We verified, as presented in the theoretical basis of the work, that by breaking out of the expository class routine and enriching the planning with games it is possible to offer a pedagogical practice more adjusted to the preference of the students.

Regarding the idea of playing the game in a different environment from the classroom, the results reveal that 20 students (90.9%) strongly agreed and two (9.1%) agreed. This result corroborates our hypothesis that it is important to explore the underused spaces of educational institutions, not restricting the pedagogical practice to the classroom, because other spaces can be as or even more enjoyable. We concluded that every environment is conducive to learning, and it is especially important to remove students from their comfort zone, imposing new challenges on them.

Concerning the applicability of the game in basic education, most students (86.4%) strongly disagree that it is not possible to apply the game in schools. One student disagreed and two were indifferent. No student agreed or strongly agreed, that is, the participants recognized that *Barbeiragem* would be suited to school reality. This is very important information, because the game was designed to be developed at both levels (basic and superior). It aims to serve teacher formation, functioning as a form of instrumentation so that teachers can, besides learning in a diversified way, develop it with their future students. At the same time, we intend to offer the students from basic education a playful way to learn about a theme of great relevance to their communities.

We also asked if the game was fun and we found that 21 students (95.5%)

strongly agreed and one (4.5%) agreed. We concluded that the positive responses in relation to the amusement provided by the game are in line with a playful teaching style, since it advocates an active process, which arouses curiosity and in which there is the enchantment of teaching and, especially, learning (Zuanon, Diniz & Nascimento, 2010).

One of the negative statements questioned whether the participants did not intend to play this game with their students. We observed that 17 (77.3%) strongly disagreed, two (9.1%) disagreed and two (9.1%) were indifferent. Only one student strongly agreed, the same student who informed previously that the game was not important for the learning process.

Considering the precarious situation of most public schools, the game was developed with the concern of finding alternative material to replace what was suggested, to make it more accessible. Then, when asked whether they found the material unconventional and easy to acquire, 14 participants (63.6%) strongly agreed, another three (13.6%) agreed, four (18.2%) were indifferent, and one participant (4.5%) strongly disagreed. The game is composed of many materials; then, no matter how low the cost is, this may have influenced the evaluation of some participants. Even so, in the absence of the recommended material, we also suggest in the rules using chalk to make the necessary markings.

Another important point concerns the time dedicated to the game. We are familiar with the busy routine of schools and the scarce class time, so it was important to assess if the duration of the game would be adequate for the school reality. A very time-consuming game, besides not being applicable, can become boring. When asked if the game was too long, we noticed that half of the students (11) strongly disagreed, seven (31.8%) disagreed and 4 (18.2%) were indifferent. No participant thought that the game took too long. In our count, the execution of the game took 50 minutes, which would be in accordance with the time available for a class.

Table 3 shows the ranking of the statements (by positives and negatives) and the means (and standard deviations of the means) of the responses. We can see that, in a general analysis, the means of the positive statements ranged from 4.3 to 5, indicating a high agreement. The only exceptions correspond to the two statements related to previous performances of games, where the disagreement of the students was evident. The negative statements presented means between 1 and 2, indicating a higher

disagreement (expressing a good evaluation of the game). In addition to that, the variation between results was very small, both for positive and negative statements, as can be seen by the low standard deviations.

Table 3 - Positive and negative statements and their corresponding means (and standard deviations).

Kind of statement	Statement	Mean and S.D.
Positive	I have played games during high school	2,1 ± 1,63
	I have played games during college (not counting this one)	2,8 ± 1,76
	I like games	4,8 ± 0,61
	I like it when my professor uses games in class	4,7 ± 0,55
	I would like to play other games like this one	4,8 ± 0,53
	I enjoyed the game being conducted outside of the classroom	4,9 ± 0,29
	The game was a lot of fun	4,9 ± 0,21
	The materials are unconventional and easy to acquire	4,3 ± 1,09
Negative	The game was too difficult	1,9 ± 1,15
	The game was NOT important for my learning process	1,3 ± 0,94
	The class would have been better without the game	1 ± 0
	It is NOT possible to apply this game in schools	1,2 ± 0,50
	I do NOT intend to conduct this game with my students	1,5 ± 1,01
	The game took too long	1,7 ± 0,78

Source: Data from the present research.

Final comments analysis

Thirteen participants left comments at the end of the evaluation. Those were classified as “positive”, “negative” and “suggestions”, according to their semantic units. Comments that presented more than one semantic unit were dismembered and classified in more than one category.

In total, fifteen semantic units were identified. None was classified as negative; seven were considered positive and were accompanied by praises of different natures, such as: "the game was great"; "I loved having participated in the game";

and "fun way to learn". One of the positive comments was not about the game itself, but about the class given previously: "Explanations with great technical background. Perfect presentation". Finally, eight semantic units presented suggestions to improve the game. Among those, six insisted on more question squares along the route, showing that testing the knowledge of the group seems to have motivated the students. One pointed out that there was a lack of organization on the participant's part; and the last suggestion could also have been classified as positive, since the participant pointed out that "I suggest that they make more games, also from other modalities".

The suggestions made by the participants were discussed among the authors and, later, in the post-game class with the students, so that they could contextualize their suggestions. Thus, these comments were used as a basis to formulate new adaptations aimed at improving the game's structure and inserting new cards that would match the target audience.

In accordance with Ferreira de Jesus e Souza (2018), we believe that works that combine interculturality and teacher education establish themselves as one of the bases for achieving real equity in socio-cultural relations. Domite (2004, p. 419) emphasizes that "the one being educated has not been fully outside the proposals of teacher formation, but he or she has not been inside either". Therefore, giving voice to the participants and counting on the co-authorship of students from both the degree in Biological Sciences and the Lecampo CVN, involving them directly in all the stages of game construction and validation, means responding to the most valuable demands of the formative process they are going through. It is through an initial formation of teachers focused on research, with creative autonomy and based on interculturality that we will be able to modify the status quo perpetuated by the rural-hegemonic paradigm, based on coloniality and vertical relationships with the university. Therefore, through dialogic work, which actively involved students from both courses, we value the insertion of both in the scope of scientific formation, thinking especially in reaching the rural populations.

According to Lara (2003), educational games can be classified as: construction; training; deepening; and/or strategic. The game we have developed falls into the category of training games, as it helps to consolidate concepts already discussed. Thus, it is a type of activity conducted after the presentation of conceptual contents. Its relevance consists

in verifying if the students were able to assimilate the concepts about the topic, besides helping their consolidation. Finally, it also allows the characterization of the most critical points of the subject, since they can be revisited during the activity (Lara, 2003).

Thus, we hope to offer a means for parasitology to be better approached in schools, since it involves a public health issue and is of significant social relevance, especially for the most vulnerable populations, attended by rural schools. We agree with Oliveira, Camargo and Santos (2016) when the authors explain the need for an education that takes the particularities of each location into consideration, because each spatial area presents different ways of living, which requires pedagogical actions contextualized with such differences, always recognizing the social knowledge of the community that produces and reproduces its social identity in that location.

Final considerations

The game *Barbeiragem* proposes to help students fix the concepts that involve Chagas disease in a playful way, besides disseminating prophylactic measures using simple materials. Moreover, the game was developed so that the teacher adopts a mediating posture, being a link of motivation, stimulating the participation, debating and questioning, in order to sharpen the curiosity of the students without centralizing the learning in the teacher. Thus, students can feel more involved and confident, better enjoying the activity. As the students themselves play the role of pawns, being divided into four teams (triatomine, scientist, community health agent and citizen), the social role of each team is highlighted, whether in the disease cycle, prevention or health promotion.

The results showed that the students are aware of Chagas disease and are acquainted with many infected people, since they live in rural areas that are at risk for the disease. Thus, pairing up the game with theoretical contextualization was an important pedagogical resource, because it allowed students to obtain and discuss knowledge based on studies and reliable data, making them aware of the prophylaxis, at the same time as it addressed the importance of scientific dissemination and investment in both science and primary care.

The development of the game in a different space from the classroom seems to have been a stimulating factor, as students were able to experience outside the traditional, bringing dynamism to the

teaching and learning process, making it more enjoyable. Additionally, the pedagogical practice that deviates from the traditional seems to have kept the students more involved with the activity, improving concentration without punishing the social interactions, as occurs in the traditional teaching approach.

The incomplete answers (about the prophylaxis and forms of transmission) show that the class and the game can still be improved and that these contents need to be revisited throughout the formative process, since a lot of new information is presented. In this way, we understand that the students will be able to better consolidate the conceptual contents.

The work with the students from the teaching degree in rural education (Lecampo), with a minor in Life and Nature Sciences (CVN), had as its principle the valorization of the rural context, since rural education is conducted with the participation of its subjects as protagonists. Thus, the participation of a Lecampo CVN student as co-author of the work, together with the dialogical relationship established with the other participants during the entire activity, fostered a collective construction that was important not only for the evaluation and improvement of the game, but also to promote a fruitful articulation between the two courses.

The students from Lecampo CVN, were encouraged to act as mediators of the activity in the schools of their communities, where they work as interns. Hence, we suggested the possibility for them to identify new regional knowledge, such as home treatments, which could be incorporated into the game so that it would be under permanent construction and increasingly contextualized with the reality in which it is located. We realized that bringing playful and everyday elements to the initial formation of teachers can arouse the interest of students and enhance learning.

Through this work, we hope to have sensitized the students, both from Lecampo CVN and from the degree in Biological Sciences, to the importance of a dialogical work, of contextualization, of playful teaching, of the diversification of pedagogical practices and of the use of the different spaces of the school. Besides the conceptual and prophylactic aspects, we expect that the activity may have helped to develop its participants' critical thinking, through the recognition of: the social function of the work of scientists and community health workers; issues concerning science dissemination; health education and the concern of public

administrators towards science and the primary care network. Finally, we hope that the participants have been properly instrumentalized and can be multipliers of this activity with their future students, in their localities, increasing the dissemination power of such knowledge.

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