

# Remote Meetings in Problem-Based Learning: A Tool for Selection Research in Times of Pandemic

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## Research Article

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# Abstract

Active methodologies have been widely used in education to provide greater involvement in the teaching-learning process. In the face of the current pandemic scenario, remote activities are strategies to spread knowledge but require adaptations of face-to-face education. However, no records were found of its use to support research groups, which traditionally are based on personal contacts. The article reports the experience of selecting participants in the development of research in the area of starch prospecting, with an adaptation of the Problem Based Learning (PBL) technique. The proposed problem was the characterization and evaluation of cassava starch for food industries application, using a sample limited to one gram. The PBL technique used research with a qualitative approach, applied nature, descriptive objective, and action research procedures. The five members that constituted the discussion group were from different professional areas and were selected among those who made up a larger group, with starch as the central theme. The PBL technique was adapted to be completed in three videoconference meetings, with intervals of 15 days. Based on the suggestions proposed and improved during the event, it was possible to outline the solution right at the first meeting. An analytical methodology can also be established within the specified limit, capable of prospecting its food industries application. Therefore, PBL as a strategic tool to develop research topics proved effective and flexible, and suitable for remote activities. It is recommended that it be better explored as a team leader and scientific research growth.

## Introduction

The teaching-learning process faces constant challenges to engage and motivate students in the digital age. It is necessary to plan attractive actions and, in addition to facilitating the student's path to learning, helping him to build his life projects and socializing the planned activities (Morán, 2015).

Traditional methods, which favor the transmission of information by teachers, made sense when access to information was limited (Valente, 2014). With technological advances, this scenario has changed significantly, putting pressure on teachers to seek new alternatives and teaching methodologies that focus on students' protagonism and involvement. Besides, attitudes such as providing opportunities for students to listen, valuing their opinions, and exercising empathy are essential factors for stimulating, motivating, and creating a favorable learning environment (Berbel, 2011).

Teaching based only on the transmission of content is based on the student's passive attitude, who receives and absorbs a large amount of information provided by the teacher, without having a big place for his questions and criticisms. In contrast, pedagogical practices guided by the active method transform the environment, place the teacher as a mediator and reveal a participative and constructive posture on the students' part (Berbel, 2011; Souza et al., 2014). Active methodologies aim to condition the student to become a protagonist, develop the critical sense, skills, and abilities to be a high-performance professional, and meet the market's needs (Cobucci, 2017).

In this sense, the methodology known as Problem Based Learning (PBL) has been considered one of the most attractive teaching methods in higher education courses. With the adoption of the PBL technique, the responsibility for the learning process becomes the responsibility of the student, as a stimulus to the development of skills, seeking alternatives to solve problems in collaborative work, and the teacher becomes a facilitator (Dolmans et al., 2015; Krzic et al., (2015); Silva et al., 2018; Krzic et al., 2020).

Research on the PBL methodology has been supported by studies on the genesis of the cognitive process (Hmelo et al., 1997; Nakamura and Lajoie, 2004), adult learning, and the physiology of memory (Norman and Schmidt, 1992), emphasizing the importance of previous experience and active participation as fundamental points for motivation and knowledge acquisition (Sobral, 1994). PBL develops in the student the ability to "learn X to learn", work as a team, listen and respect opinions and induces him to assume a participatory and responsible role for learning (Ribeiro and Mizukami, 2005) with an emphasis on relevant issues, reducing overload information (Jones, 2006).

Thus, the PBL has been used as a methodology that deepens a previously established theme based on the commitment of small groups that complements and interacts (Dolmans et al., 2015). In this respect, it could also serve research activities, adapting to the structure established for teaching.

Another aspect that needs to be overcome is the fact that, in general, PBL applies to face-to-face activities. However, the pandemic event of the new coronavirus (Sars CoV-2) decreed by the World Health Organization (Who, 2020) promoted the suspension of classroom activities in all educational institutions, forcing the search for remote learning means, extending the use of this tool in remote activities.

It also needed to be adapted to the new reality, the fact that scientific research is carried out by teaching-researchers linked to the institutions. Thus, the inclusion of virtual environments in teaching and research professionals' training has become essential to broaden the horizons of learning and the transmission of knowledge among people worldwide (Park and Ertmer, 2014; Trust, 2016).

As a result, the application of PBL for remote use is an excellent didactic and stimulating alternative for facing the pandemic and maintaining teaching and research activities in Brazil and worldwide.

However, even though the PBL methodology has been used in higher education for more than two decades in Brazil (Lopes, 2007), few reports are on its use in scientific research activities, mainly remotely (Gao, 2015; Mikhailova et al., 2015). It is noteworthy that researches carried out by professionals to solve real problems with the use of PBL are still unknown.

No citations were found by specific authors of the PBL technique applied to the research itself's development. Dolmans et al. (2005) conclude that there is evidence that group discussion in PBL stimulates the activation and elaboration of prior knowledge, which facilitates increased retention of knowledge. Thus, PBL enables students towards constructive and collaborative processes.

These positive characteristics are important for teaching as research, which is much more comprehensive when developed in researchers' groups.

Vilpoux et al. (2020) proved that there is greater genetic variability in cassava landraces grown by small producers in isolated regions in the commercial starch recovery sector. This variability can be detected in samples of one gram of starch, using the infrared analysis technique. The same article reports that the limiting factor for its users to search for starches of interest for application in the food market is to complement these starches' identification with the food industries' indication of use, but the analysis methods available for this evaluation use almost 1 kg of starch.

Seeking to disseminate experiences and stimulate research development using the PBL technique, this work aimed to evaluate the application of this tool to debate, interpret, and produce solutions for the characterization and evaluation of cassava starch.

## **Methodology**

The methodology used in this work was the PBL technique. It was necessary to establish a group of up to ten researchers, which was done by the tutor's invitation to characterize voluntary participation differently from what is done at PBL in teaching/learning. The tutor has been a researcher expert in the starch area for over 50 years, which guaranteed enough experience to establish a real problem to be solved.

The challenge attracted researchers from different levels and academic backgrounds. The formalization of the group's activity and consolidation was done by completing a simple identification form after the selected ones received the first instructions via email.

The meetings were scheduled every 15 days on a videoconference platform, which should be sufficient for the problem to be solved. The planning of dates and times was established in common agreement between all participants.

At the first meeting, the members introduced themselves briefly, and the group's tutor explained the proposal based on the PBL and adapted from the classic format (Berbel, 1998). As with the traditional PBL tool, reinforcement activities were planned, and in each section, the support of a volunteer rapporteur was requested. This member was responsible for organizing the group's comments and suggestions, aiming to establish a memo document and discuss it at each meeting.

The proposed challenge was to select or develop characterization and application analysis methods for cassava starch, targeting the food industry and using samples of a maximum of 1g. At each meeting, the group members should confirm, seek alternatives, and offer strategic solutions to solve this problem with tutoring.

## **Results And Discussion**

A total of twenty-six researchers showed interest in participating in the proposed challenge, of which 21 provided their data. The fact that drew attention was many participants that the challenge managed to attract, showing that the survey met a pre-existing need among those consulted. From the identification

form of those interested in composing the group in question, it was possible to notice that participants' participation took place with a profile of different academic backgrounds, experiences, and Brazil regions (Figure 1).

The fact that the members already had an affinity with the main theme allowed the optimization of activities, eliminating the need to pass on basic information about starches and their main functionalities.

On the first scheduled day, after the Discussion Group members' presentation, the tutor commented on adapting the PBL methodology used to realize to stimulate scientific discussion among the researchers. A total of 8 members participated in this stage.

After the presentation of the problem, it was justified by a lecture given by a starch market expert who addressed a topic related to the area and based on his research (Vilpoux et al., 2020). Emphasizing the problem, the tutor encouraged the tutor to identify, adapt, or develop a methodology to evaluate the starch properties of more than 120 cassava landraces to allow directing which industrial application is feasible in food. The application area was selected from the three major industrial areas: textiles, paper, and cardboard (Li et al., 2019) and food. It is important to emphasize that food choice does not invalidate the other two application areas, precisely because it is the greatest complexity (Ogbo and Okafor, 2015; Luallen, 2018; Pérez-Vergara et al., 2020).

Starch serves different industrial applications, emphasizing that each botanical source, as well as climatic conditions, agronomic variables can give other properties to the final product (Themeier et al., 2005; Polthanee et al., 2014; Liu et al. 2018; Yazid et al., 2018). Therefore, this problem to be solved is extremely important to provide preliminary information on the characteristics that starch can offer and to support the producer on the potential for use, and also, as a way to add value to its raw material.

Also, according to the basic characteristic of the PBL, participants brainstorming freely on the topic, mediated by the tutor. At this moment, there was no need for bibliographical or scientific evidence. All participants were able to identify factors that were considered important to be researched and answered at the next meeting. The Rapporteur then drew up a list of the main key points for solving the problem. The first meeting's conclusion occurred with the summary's reading, which was subsequently forwarded to all group participants.

They had two weeks to review and then selected individually or collaborated with the other group participants to be resolved and confirmed at the intermediate meeting. When appropriate, they include the bibliographic references used or their results from research scientific. To this end, and adapting itself once more to the techniques for working at a distance, the support tool chosen was google docs, due to easy access, quick editing, and sharing among participants to follow changes in real-time (Rodríguez et al., 2011).

Five participants remaining from the opening of the problem attended the intermediate meeting. It isn't easy to discuss this result because when PBL is applied in teaching/learning, it is strongly encouraged to participate. There is no voluntary participation. However, all selected entrants who were absent fully justified claimed to regret leaving the group. They tried to present themselves for the last meetings, which does not contradict the original PBL (Dolmans et al., 2005).

In order to give relevance to the application of the methodologies suggested among the members, it was required that they have a scientific basis. To this end, the tutor presented a summary of all suggestions previously sent by the researchers, initiating the group discussion.

The PBL technique allowed selecting the most relevant and consistent methodologies, as long as it used the sample amount in question. For the next meeting, scheduled to close the problem, the group should describe the suggested analyses, detailing them with scientific support.

The discussions were based on the premise that a wide variety of cassava landraces in nature has not yet had the physical, chemical, rheological and morphological characteristics investigated. Possible variations in the composition of each cultivar suggest that starches obtained from a standardized extraction method, using water as a solvent, may reveal starches with unique technological, functional properties of interest for different industrial applications and purposes of use (Leonel and Cereda, 2002; Leonel et al., 2005; Fan et al., 2016).

The problem's critical point was presented as the difficulty researchers find to select the analytical methodologies that characterize the starch from the small amount of available sample. Therefore, the strategies for solving the problem were based on technical and methodological suggestions adapted or not, so that it was possible to obtain results. Thus, from their personal experiences in the research, each researcher could interact and share their results in each analysis suggested.

This stage was a rich moment, where different points of view were presented, exchange of individual experiences, interaction, and the group's maturity was being built. This demonstrates the PBL methodology's efficiency in the teaching-learning process, which encourages cooperation, which encourages participants to continuously improve, develop new skills aimed at possible and well-structured solutions for solving the initial Problem (Borochovicus and Tortella, 2014).

It is worth mentioning that the group's tutor exercised his role and sought to motivate the members, stimulating thinking, developing reasoning in some situations posed by it, valuing teamwork, and critical reflection.

The final meeting remained with five members but maintained its multidisciplinary character, two food engineers, two agronomists (including the tutor), and one food technologist. In closing the problem, the methodologies to be carried out with the respective materials and samples were consolidated. From them, it is possible to characterize and prospect for industrial application of cassava starch with a small sample, with great potential to replace the traditional methodology (Figure 2).

At the end of the activities of this last distance meeting, the tutor consulted the participants if they felt comfortable to affirm that the proposed problem had been solved.

After the end of the activity, the researchers who concluded the proposal maintained contact, establishing and strengthening the partnership to carry out new scientific projects. This result had not been predicted.

## Final Considerations

The application of PBL in the development of research-based on real problems from remote meetings was carried out satisfactorily. Characterize as a real problem of research and PBL and summarize and consolidate the differences of PBL applied to research and teaching/learning.

The theme focused on starch selection for application in food processing by starch industries proved to be adequate and presented promising results for using this technique also from a distance.

It was possible to promote interaction and critical discussion among researchers distributed in different places in the country, stimulating scientific research and exchanging experiences among the participants.

No major difficulties were encountered in carrying out the activity. The only limiting factor was the initial group's availability to continue with the research, resulting in these members' evasion.

The final group extended the partnership to carry out new projects, highlighting the effectiveness of PBL in research and other teaching and extension activities in the remote mode.

## Declarations

### AVAILABILITY OF DATA AND MATERIAL

'Not applicable' for that section.

### FUNDING

'Not applicable' for that section.

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Included this in the cover letter.

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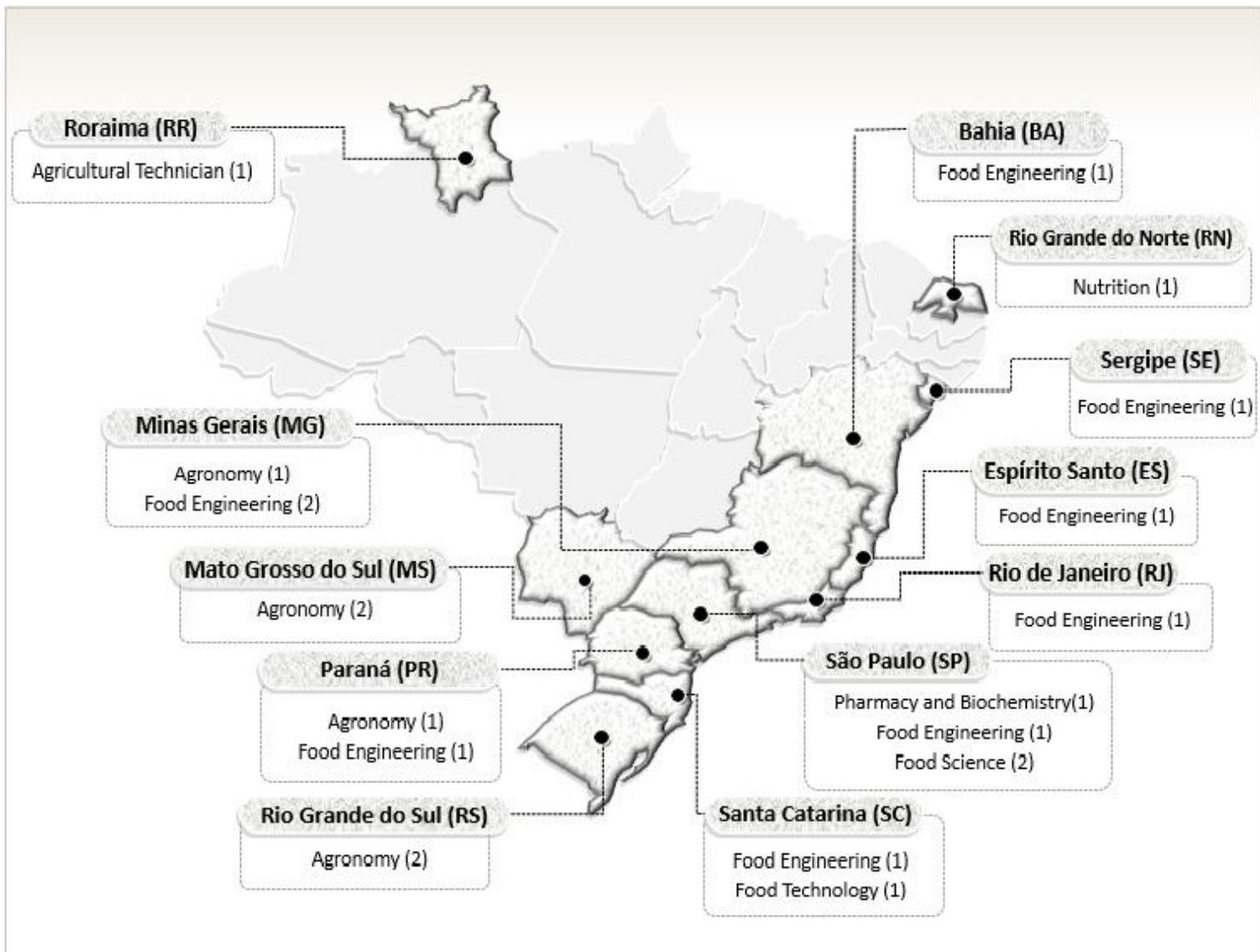
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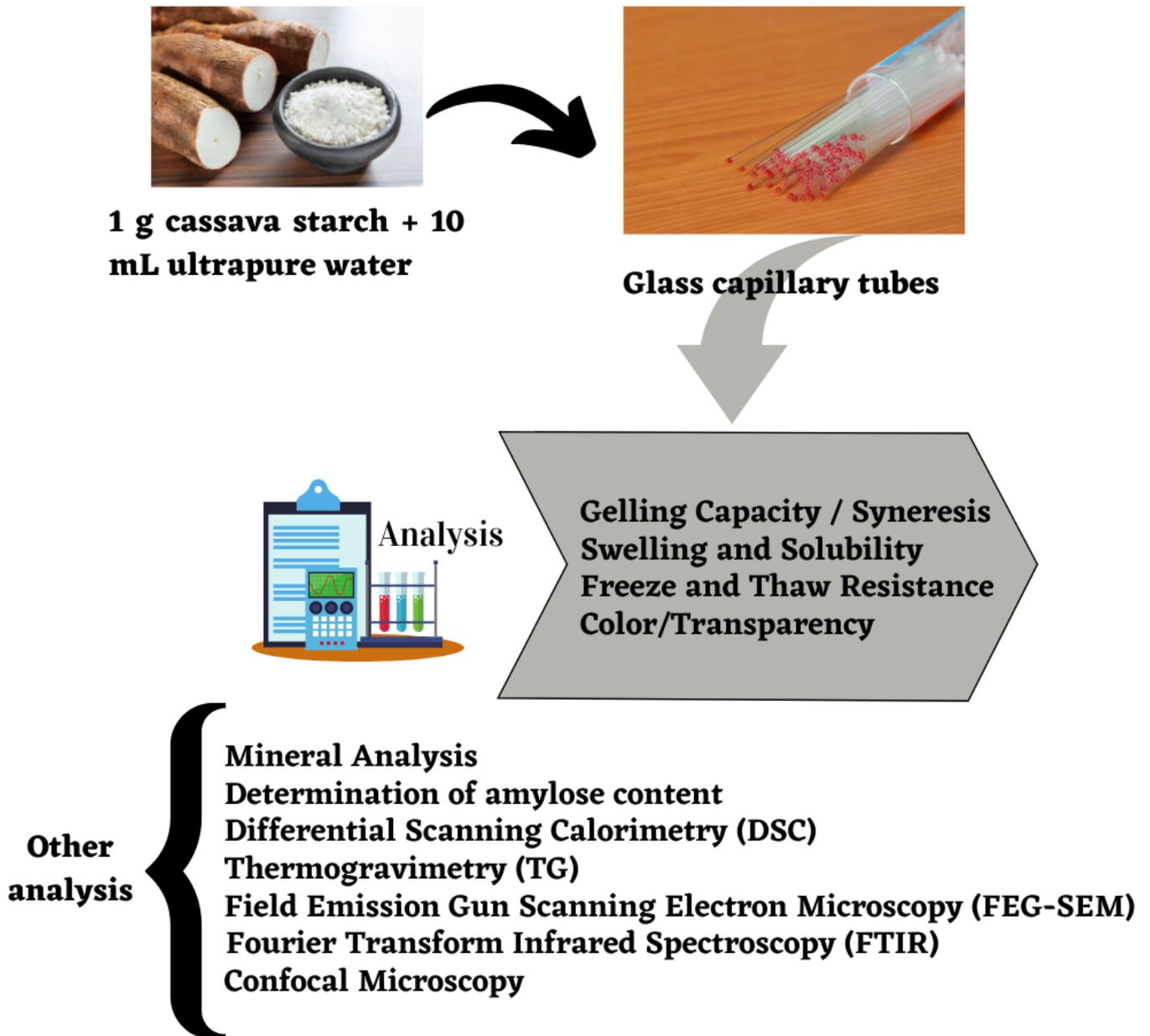
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## Figures



**Figure 1**

Group participants by training area and region of Brazil. Source: materials created by the author(s)



**Figure 2**

Scheme showing the solution of the problem found by the PBL group. Source: materials created by the author(s)