PBL method in the formative process in postgraduate courses: An evaluation from students' perception

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Abstract

Several teaching and learning methods, alternative to the traditional method of content transmission and reception, are being proposed and discussed by researchers, aiming to improve the professionals' formation. One of the methods being applied in various educational areas and at different levels of education is the Problem Based Learning (PBL). However, there is still not much evidence about the advantages and disadvantages of applying this method in the formative process of students in postgraduate courses. Consequently, the objective of this work is to evaluate the perception of postgraduate students of a Stricto Sensu course after experiencing the PBL method in their formative disciplines. Through the application of a questionnaire, the perceptions of students who used the PBL method and the traditional teaching method, respectively, were collected in two disciplines of the Interdisciplinary Master's Degree in Sustainability, from a private university in the state of São Paulo - Brazil. The results show the feeling at the beginning and during the learning process using PBL; the perception of the PBL when compared with the traditional teaching method; and the perception of specific skills developed with the PBL. Finally, it can be said that PBL is a teaching method with broad potential in the learning process of a postgraduate course, both for the possibility of building knowledge autonomously, and for the development of specific competences and skills related to postgraduate study and research activities.

Key-words: Problem Based Learning (PBL). Teaching and learning method. Competence development. Post-graduation.

1. Introduction

The classic classroom scenario has been challenged internationally, either for its low efficiency in the construction process of knowledge, or also for the impossibility of building competences that allow better team work, critic analysis, the exercise of bibliographic and documentary research, among others (Cyrino & Toralles-Pereira, 2004).

There are several efforts to innovate the teaching and learning processes, which oppose the didactic models of teaching supported by the so-called traditional perspectives, in which the teacher is the center of the process of transmitting knowledge to students who only receive and memorize this transmitted knowledge (Souza & Dourado, 2015).

The active methods – Inverted class, Problematization, Portfolio, Peer instruction, Teaching case, Team-based Learning (TBL), Project-based Learning, and Problem-based learning (PBL) – are all examples of these efforts (Diesel et al., 2017). Unlike the traditional method, active methods propose that the process is student-centered, encouraging them to seek, understand and use information autonomously and reflexively, helping in discussion and proposing solutions with their peers (Kwan, 2000).

PBL emerges as one of these innovative method strategies in which students work to solve a real or simulated problem from a context. Therefore, it is a method that the student leaves the role of passive receptor of knowledge and takes the place of protagonist of his own learning through research (Souza & Dourado, 2015).

According to Borochovicius and Tortella (2014), for the learning to occur, it must be necessarily transformational, requiring from the teacher an understanding of new meanings, relating them to previous experiences and student experiences, allowing the formulation of problems that stimulate, challenge and encourage new learning. In this context, emerges the possibility of applying the PBL, with the purpose of encouraging the dynamic learning of theoretical content, strengthening its problem-solving capacity and involving it in the learning process.

In the national and international scientific literature there are reports indicating successful experiences in the use of the PBL method in basic education (Carvalho, 2013; Dourado & Souza, 2015), in the undergraduation (O Doherty et al., 2018; Park et al., 2007; Escrivão Filho & Ribeiro, 2008; Escrivão Filho & Ribeiro, 2009; Spronken-Smith & Harland, 2009) and in the *Lato Sensu* postgraduation (Araújo et al., 2010; Erapuro-Piila et al., 2014; Ribeiro & Mizikami, 2005). However, there are few reports on the experiences of using the PBL method in the *Stricto Sensu* postgraduation (Master degree and PhD) (Martins et al., 2015). It is based on this that this study aims to present its contribution, with the objective to broaden the discussion about the use of PBL as a teaching method in *Stricto Sensu* postgraduate courses.

2. PBL origin and conception

PBL was developed in the field of medical education in Canada, the Netherlands, and the United States in the early 1970s and has been adopted and adapted by other academic areas, such as administration, architecture, law, engineering, social work, and education (Christopoulos & Steinbeck, 2016; Cyrino & Toralles-Pereira, 2004).

There are several PBL conceptualizations. For Delisle (2000, p. 5), the PBL is “a teaching technique that

educates by presenting students a situation that leads to a problem that has to be solved". PBL can still be conceptualized as a curiosity that leads to the action of asking questions in the face of doubts and uncertainties about the complex phenomena of the world and everyday life. In this process, students are challenged to engage in the pursuit of knowledge through questioning and investigating to provide answers to identified problems (Barell, 2007; Savery, 2006).

Souza and Durado (2015, p. 184 e 185) presentes PBL as a student-centered learning method strategy that needs individual and group research using critical analysis techniques to understand and solve problems in a significant way and in continuous interaction with the tutor teacher.

The challenge of PBL is to transform the student into an independent and autonomous being in the learning process (Frezatti et al., 2018). Compared to the traditional method, PBL offers several advantages, such as the development of autonomy, interdisciplinarity, the inseparability between theory and practice, the development of critical thinking and communication skills, and continuing education (Borges et al., 2014).

For Ribeiro and Mizukami (2005), PBL is considered an innovative method as it can incorporate and integrate concepts from various educational theories and operationalize them in the form of a consistent set of activities. For example, some activities involved in PBL, such as identification, research and problem solving, teamwork, among others, are indicated by cognitive psychology theory as ways of improving teaching and learning processes.

According to Ribeiro and Mizukami (2005), the PBL method brings changes to students and teachers' roles. A tutorial group is created, consisting of a tutor (teacher) and five to eight students, one of whom will be the leader and the other the secretary. Teachers become tutors with the task of guiding, facilitating, explaining concepts, helping students to outline questions, answer questions about project requirements and the tasks to be accomplished. A good tutor, according to Araújo et al. (2010), must have the following characteristics: knowledge, personal attributes (acceptance and responsibilities) and relational skills.

Araújo et al. (2010) state that the changing roles of teachers and students usually have some advantages and disadvantages for teaching and learning. The main advantages are: i) Student-centered PBL: nurtures active learning, improves understanding, conservation and development of lifelong learning ability; ii) generic skills: allows students to develop attitudes and generic skills desirable for their future practice; iii) integration: facilitates a core of an integrated curriculum; iv) motivation: it is fun for students and tutors, and the process requires all students to be involved in the learning process; v) deep learning: nurtures deep learning (students interact with learning materials, connect concepts to everyday activities, and improve their understanding) and vi) constructivist approach: students activate prior knowledge and build existing conceptual structures of knowledge.

According to the authors, the main disadvantages are: i) tutors who cannot teach: tutors like to transmit their own knowledge, understanding that PBL facilitation is difficult and frustrating; ii) human resources: higher faculty to reach part in the tutorial process; iii) other resources: large numbers of students need access to the same library and technological resources simultaneously; iv) Information overload: Students may be unsure of what self-study to do and what information is relevant and useful.

In the PBL method, the problem, based on meaningful and contextualized real-world situations, is the starting point for the learning process (Masetto, 2004). Ylitalo et al. (2012) emphasize the importance of using real cases for the learning process in the PBL method, as this facilitates and improves the efficiency

of laboratory activities and bibliographic and documentary research, which will be fundamental for the construction knowledge and the solution suggested to the proposed problem.

The problem precedes theory, acting as the focus of learning, promoting the integration of the concepts and skills needed for its solution. Then, resources and guidance are provided to the student as the solution of the proposed problem and the course content evolution (Barrows & Tamblyn, 1980; Mayo et al., 1993).

Hallinger and Lu (2011) point out that the PBL method occurs in a learning environment that involves the development, application and assessment of relevant team leadership skills. In their study, it was found that undergraduate business students were able to understand how to apply theory in practice. Sherwood (2004) agrees that problem centered learning can help to fill the gap between theory and practice.

In this context, Carvalho (2018) highlights that the PBL method meets the need for a curriculum that develops skills and attitudes to solve problems, improve communication, leadership and interpersonal skills, and develop critical thinking. In other words, PBL provides students a training closer to professional practice. Cooms and Elden (2004) point out that organizations need people who specialize in teamwork and leadership, communication, critical thinking, and dealing with unstructured issues.

Sherwood (2004) considers that a particularly promising aspect of PBL is the opportunity to work with situations of solving relevant problem.

For Silva et al. (2017), the PBL teaching strategy has positive implications for student' learning as it promotes the integration of theory and practice, which increases motivation to learn and also promotes greater integration with professional activity. Additionally, the PBL strategy allows the students to become responsible for their own learning, which helps in other daily activities as they can analyze data and propose solutions through an investigative process.

However, some negative aspects of the application of this teaching strategy must be considered, as Carvalho (2018) mentions, the unstructured and open PBL can cause anxiety and insecurity in students. In addition, Silva et al. (2017) argue that teamwork can present some inconveniences, such as passivity, lack of commitment of some group members, and difficulty in reaching consensus on proposed solutions to solve a particular problem.

Figure 1 presents a circular and dynamic sequence of the activities involved in the PBL method.

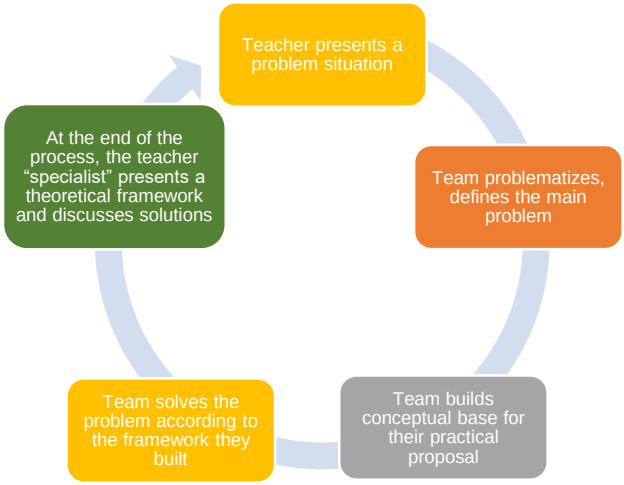

Figure 1 – Sequence of activities involved in the PBL method.

Source: Carvalho (2018).

3. PBL applied in various areas

Álvarez García et al. (2011) published a study case of the adapted use of PBL in the Web Programming discipline in the computer science course at the University of Oviedo, Spain. The search for new learning methods was influenced by the perception of students' lack of motivation regarding the traditional method used and also by the opportunity to develop new skills, such as self-learning and teamwork. The choice for PBL was based on research showing scientific evidence of results obtained with the PBL method at many universities and on literature reviews discussing the efficiency of the method (Albanese & Mitchell, 1993; Bridges & Hallinger, 1997). The results showed better student performance and lower absenteeism in class.

Gibbings and Morgan (2005) present the experience of the University of Southern Queensland, Australia, that implemented the PBL method in all their engineering courses through a manual created by their own. The search for new methods, specifically the PBL, was based on the understanding that an engineer needs skills that allow the solving of different and constant problems in the practice of the profession, creatively, relying on new technologies and working as a team (including multidisciplinary teams). The elaborated manual sought to facilitate the application of the PBL in new classes and in the integration of new teachers (to accept the role of facilitators). The research results showed the gains in the students' formative process through the PBL and the manual for the method application allowed them to overcome difficulties such as the teachers' lack of experience and the students' difficulties in adapting to the new method.

Haigh (2010) published a research conducted in the environmental management course at the University of Oxford Brookes, in the United Kingdom, which uses PBL as a method in practical classes after the lecture stage. The use of PBL was motivated by the possibility of providing students the opportunity to develop skills to solve real problems, proper in the fieldwork. The article reports the use of a problem related to erosion control techniques and the validity of alternative solutions. In addition, the problem worked through PBL encouraged students to consider land use as an important issue in sustainable management. The survey results indicated that most students were motivated to perform more field activities and recognized the importance of the method in the professional training process. They also highlighted the possibility of developing skills to understand problems in the profession and the analysis and application of the respective solution alternatives.

Podges and Kommers (2016), through an experimental study were able to show the PBL as a complementary method of teaching and learning at Walter Sisulu University in South Africa, the authors evaluated the performance of undergraduate electrical engineering students through PBL as a teaching method combined with the traditional lecture method, first in a situation where PBL was applied before the lectures and, in a second moment, after the lectures. The result of the work indicates that PBL, when assisting method and applied after the lectures, presents the best results in relation to the students' performance.

However, Godinho, Oleniki and Baroneza (2017), in a study conducted in the second semester of 2015 with 56 students, with no previous experience in PBL, in the Embryology discipline of the Biomedicine course at Positivo University, in Curitiba, Brazil, applying the questionnaire to 29 randomly selected students to answer about the traditional lecture classes and the other 27 to answer the questionnaire focusing on the PBL, they identified that for the students PBL was disadvantageous in relation to the lectures.

Finally, Celinsek and Markic (2008) published the study case of the use of PBL in foreign language teaching, in a language course of an educational institution in Slovenia, aiming to evaluate the institution's organizational learning process in relation to the use of PBL method. The motivation for using PBL arose from the possibility of enrich collaborative learning and teamwork. The results show, from the institution's side, the need to plan the entire teaching process to make PBL more effective, as well as to train teachers with professional with experience in using PBL. On the student side, the collaborative environment and teamwork contributed to the performance and communication between students and teachers.

4. PBL in post-graduation

PBL promotes autonomous and effective learning that takes place in a supportive and collaborative environment where the teacher acts as a facilitator and advisor, transferring many responsibilities to students. It should discourage the single correct answer and help students outline questions, identify other problems, and seek alternatives. Thus, they develop skills that go beyond those directly related to the subject matter (Souza & Dourado, 2015). As Berbel (2011) points out, PBL arouses the curiosity of students when they are inserted into the theory that contemplates new elements, which have not yet been seen in regular classes.

Ribeiro and Mizukami (2005), when implementing PBL in a postgraduate engineering discipline at a public university in São Carlos, State of São Paulo, Brazil, concluded that despite increasing the study time and workload of the students most students positively evaluated the use of the PBL method.

Araújo et al. (2010) evaluated the application of PBL in a postgraduate course in Controlling and Finance at an educational institution in the state of São Paulo, Brazil. The research showed the following results: i) most students adhered to the method as being better, compared to the traditional teaching with lectures; ii) the students expressed satisfaction regarding the knowledge acquired through the PBL; iii) the students evaluated the acquired knowledge, regarding the applied cases, as “very important” in the learning process; iv) With regard to problem-solving skills, there was a high level of acceptance and approval; v) regarding the development of skills in learning to work in a team, the same satisfaction was maintained.

Still according to Araújo et al. (2010), the PBL, as a teaching method in the postgraduate course in Controlling and Finance, meets the need for both teachers and students regarding the teaching and learning process. From the teacher, because he will be acquiring knowledge concerning the teaching method and participating in discussions with the students. From the student, because the method can enable, by solving real problems, curiosity, search, research, making it able to learn to learn, to be critical and to take such knowledge to situations outside the academy.

Erapuro-Piila et al. (2014) developed a research seeking to evaluate the psychological issue in relation to the preference for a learning method, in this case the PBL method. The research was applied to students who were part of postgraduate project management courses in Denmark between 2009 and 2011. The results show a slight difference in learning performance in favor of students with more introvert characteristics. Also, women performed better than men. However, as statistically the results did not show significant differences at the psychological level, the main conclusion of the work was that PBL is an appropriate method for all students' individual styles of study and personality.

Silva et al. (2017) conducted a PBL learning-based study with seven students enrolled in the second half of 2015 in the Technology and Society discipline of a postgraduate program in Mathematical Education at a public university in Recife, Pernambuco, Brazil. As a result, the authors state that there was collaborative work, motivation, participation and student engagement.

Heaviside, Manley and Hudson (2018) conducted research with postgraduate students in Sport and Exercise Psychology at UK universities. The purpose of the case study was to explore students' experiences with PBL and their role in developing their employability skills. PBL was found to be instrumental in developing key employability skills: teamwork, communication, and interpersonal sensitivity; think critically, creatively and flexibly; to help students translate academic knowledge for application in future employment contexts and to raise awareness that learning is a lifelong developmental process.

The potential application of the PBL method in postgraduate studies can also be identified through its own objectives, as highlighted by Wilkerson and Gijselaers (1996) and Ribeiro and Mizukami (2005): (a) acquire an integrated knowledge base; b) acquire a knowledge base structured around real problems found in the professional's field of action; c) acquire a knowledge base linked to processes for solving these problems; d) develop autonomous learning and group work skills.

While, from a legal point of view, the PBL would contribute to the fulfillment of two goals of the graduate courses present in Law 5.540: the training of researchers and teachers for higher education.

Thus, it is understood that the linking of the PBL method with postgraduate courses is facilitated by the similarity with the scientific method. Since both go through the phases of definition and analysis of the problem, survey of hypotheses, search and use of theoretical grounding in the elaboration of the solution, exchange of information, presentation of results, and synthesis of the acquired knowledge. These phases can contribute to the mastery of the concepts of the researcher's area, as well as to the improvement of skills necessary for their performance (Schwartz et al., 2001; Gomes et al., 2009).

5. Method and procedures

The study is characterized as qualitative, aiming to describe the perception of postgraduate students when experiencing the PBL method in the formative process, in a masters *Strictu Sensu* in Sustainability, at a private university in the State of São Paulo, Brazil. The qualitative approach seeks to "understand the process logic and social structures, from deep analysis of one or few particular cases" (Abdal et al., 2016, p. 8). This approach is appropriate when seeking to study subjectivity, beliefs, attitudes, social relationships and practices, management models, and changes in organizational contexts (Gil, 2019).

The sample choice is non-probabilistic, taking into consideration the ease access of researchers, as instructed by Oliveira (2001). The study involved eight students that took the "Public and Private Strategies of Local and Metropolitan Development" class using the PBL method, during the first semester of 2018. The study sought to study students' perceptions of the PBL method compared to the traditional method, since the same teacher gave to the same students a class in the second semester of 2017, called "Ethics, Education and Sustainability Management", using the traditional method.

Data were collected through a semi-structured questionnaire containing multiple-choice and essay questions that aimed to extract, as presented by Erapuro-Piila et al. (2014) the students' psychological

perception and feelings about the use of a new teaching method, such as the expectation, reaction and difficulties at the beginning and during the use of the PBL method. Also, as presented by Heaviside, Manley e Hudson (2018), questions were proposed to evaluate students' perceptions regarding the impact of the PBL method on the activities inherent to the postgraduate student's formative process, which for the mentioned authors are understood as employability skills, such as: critical reading, peer debate, teamwork, documentary and bibliographic research, and communication of results. Finally, questions based on Silva's study et al. (2017) were also used, focused on identifying advantages and disadvantages of using the PBL method when compared with the traditional method.

It is important to highlight that the questionnaire was applied after the end of the activities of both disciplines, in order to avoid any bias caused by the extemporaneous comparison between the traditional method and the PBL. Prior to data collection, the teacher responsible for the classes talked with the students about the research objectives and the possibility of their participation.

After data collection, the analysis of the perceptions expressed by the students was made from four categories: i) previous knowledge of the PBL method; ii) feeling at the beginning and during the learning process using the PBL; iii) comparison between the PBL and the traditional method; and iv) specific skills developed with the PBL. The analytical process of the answers given by the students was made from the content analysis suggested by Mozzato and Grzybovski (2011).

5.1 Classes taken by students

5.1.1 Activities involved in the traditional method

The “Ethics, Education and Sustainability Management” class, offered in the second semester of 2017, was developed according to the standards of the traditional teaching method and served as a comparison for the eight enrolled students to evaluate the PBL method in the discipline. The weekly workload of the course was 3 hours/class, with 50 minutes of duration of each class. In total, there were 21 school days.

This discipline involved the following activities: (i) lectures of theoretical foundation; (ii) presentation of seminars and debates on the topics covered in the seminars, and; (iii) elaboration of scientific article.

The distribution of activities and their measures were:

a) Seminar presentations and debates took place throughout the semester, under the supervision of the teacher (25% of the total grade).

b) Preparation and delivery of an individual critical review on each seminar theme. The student did not need to prepare and deliver the review when responsible for present the seminar and conduct the debates (25% of the total grade).

c) Preparation of a scientific article in pairs, related to the contents of the discipline and aiming a future publication (50% of the total grade).

The activities of the course had the following sequence: The teacher conducted the activities during five school days throughout the semester. The other days were conducted by the students. On the first day of class, the course syllabus, the method to be used and the evaluation criteria were presented. Also, the activities that would be carried out individually and in pairs were distributed. On the second day of class, general aspects of the course contents were presented. In the middle of the semester, the professor presented a thematic seminar and led the respective debate. On the last two days of class, the teacher presented the

final considerations of the course, from the contents developed throughout the semester. The orientation activities on the elaboration of the scientific article were carried out in off class periods.

Throughout the semester, each student presented two seminars and coordinated two debates. In addition to these activities, each one of them presented 14 critical reviews on the topics discussed in the seminars.

5.1.2 Activities involved in the PBL method

The discipline "Public and Private Strategies of Local and Metropolitan Development", offered in the first semester of 2018, was developed according to the PBL method standards, as instructed by Ribeiro (2010). The weekly workload of the course was 3 hours/class, with 50 minutes of each class. In total there were 20 school days. The students enrolled in this class were the same as in the previous class. Three working groups were formed, two groups with three students each and one group with two students.

Over the semester, this class involved the following activities: (i) problem analysis; (ii) research on the problem theme; (iii) report elaboration, and; (iv) elaboration of scientific paper.

Each cycle worked on the PBL method followed the subsequent activities: (i) problem presentation; (ii) preparation of the partial report; (iii) research; (iv) preparation of final report; (v) presentation and debate; (v) theoretical complementation class.

The learning of the discipline contents was evaluated through collective activities held in the classroom, along with the elaboration of a scientific paper. The teacher formulated and presented to the students five problems during the semester.

On the first day of class the students started with the PBL cycle: the teacher presented the problem; each group read and later discussed the problem; finally, the students filled out a partial report pointing out the main problem, its causes and what should be researched to elaborate and substantiate a solution.

On the second day of class, the groups performed bibliographic and documentary research activities in the library. Subsequently, they began with the preparation of the final report (it would be finished overtime), which would present the theoretical framework studied and the proposed solutions in the short, medium and long term to the proposed problem.

On the third day of class, each group presented the synthesis of the final report. Subsequently, a debate was coordinated between the groups. On the fourth day of the lecture, the teacher conducted an exposition on the theory involved in the proposed problem, emphasizing the subjects not, or less, addressed and discussed by the students. Each theoretical exposition lasted 1.5 hour / class and allowed to close the PBL cycle. For the rest of the time (1.5 hour / class) the following PBL cycle was opened. Also, at the end of each PBL cycle the leader of each group completed a report on the participation and involvement of colleagues in the activities.

The measures of the collective activities were as follows: PBL activities = 50% (5 partial reports = 10% each; 5 final reports = 10% each; 5 presentations = 10% each; 5 debates = 10% each); elaboration of scientific article = 50%.

6. Results

Table 1 presents the results of the analysis of the responses obtained from the students.

Table 1. Students' perception on the PBL method in the learning process in a postgraduate discipline.

Analysis categories	Subcategories	Result analysis
Prior knowledge of the PBL method		Although some students heard about PBL, almost all but one student had their first contact with the method in the classroom.
Feeling at the beginning and during the learning process using the PBL method	Beginning of the process	Students expressed motivation for the innovation, but also anxiety and concern for the lack of specific information received about the PBL method.
	During the process	The students manifested difficulties in adapting to the proposed transfer of responsibility for the learning process, especially in the phases of problem identification and preparation of the proposed solution.
Comparison between PBL and the traditional method	PBL advantages	Opportunity to develop practical skills related to academic research activities; greater interaction between students and teacher; sense of responsibility and organizational skills; and the possibility to evaluate a problem from different perspectives and knowledge; besides the perception of having learned or developed more knowledge using the PBL.
	PBL disadvantages	Little time available to go through all stages of PBL between each problem proposed by the teacher; the relationship between time and density and quantity of theoretical content presented by the teacher at the end of each PBL cycle; the high number of problems or PBL cycles proposed during the semester, making it difficult to deepen the elaboration of each step.
Specific skills developed with PBL		More critical reading than the proposed in the traditional method; organization and teamwork; ability to communicate and discuss knowledge; ability to do documentary and bibliographic research; elaboration, communication and defense of proposals for solution to real problems; academic writing development and synthesis skills

Source: Prepared by the authors.

The perception of the master's students who participated in the research reinforces the statements of Gomes et al. (2009), Schwartz et al. (2001) and Souza and Dourado (2015) regarding the advantages that the PBL method can offer in the formative process of a postgraduate student. Advantages that go beyond the specific

subjects of a discipline and reach the student's activities as a researcher and communicator.

From the students' point of view, the interdisciplinary characteristic of the Sustainability Masters Course allowed the understand that the PBL is a method that contributes to the exposure, interaction and integration of the plurality of theoretical and practical knowledge present in a classroom. Fomenting the quality of the process of elaboration of solutions of the problems analyzed and, also, the construction of new knowledge. Consequently, all students approved the use of PBL in the disciplines and its potential to contribute to the construction of knowledge.

The disadvantages reported by the interviewed students allow to say that the available time and the density of theoretical / thematic content needed to be studied will require careful planning for the application of the PBL method, also including the evaluation of the possibility of combining PBL with other methods, even the traditional method, also suggested by Podges and Kommers (2016) and Godinho, Oleniki and Baroneza (2017). Or the possibility of combining PBL with tools to improve its efficiency throughout the process. For example, Luanrattana et al. (2010) evaluated the possibility of using individual mobile technology in the various stages of the PBL in a medical course at Wollongon University, Australia. In another example, Paliktzoglou and Suhonen (2014) evaluated the potential of social media as a supporting tool in the PBL process for an E-Marketing undergraduate course at Bahrain Polytechnic Institute in Bahrain.

The advantages of PBL perceived by the interviewed students are in line with Ribeiro and Mizukami (2005), that emphasize the importance of using PBL in postgraduate programs, keeping in mind the fact that the PBL includes mechanisms for self-assessment and contrasting the acquired knowledge, making it possible to make future teachers more reflective about the possibilities of teaching and learning processes.

The perceptions reported in this study from students of a *Stricto Sensu* Masters course indicate the positive effects on the use of PBL as a teaching method, which were also identified at other levels, as presented by Azer (2009) and Ribeiro (2010): (i) PBL facilitates learning in depth rather than content memorization; ii) students reflect on what they have learned and how this knowledge can be applied to new situations; iii) the student is more likely to retain and remember what he/she has learned; iv) problem-solving skills are developed; v) increased critical thinking of the student; vi) students are more intrinsically motivated to achieve their goal; vii) students value tasks where they can see their benefits; the student takes control of his own learning (self-regulation); viii) PBL encourages students to reflect on which strategies to apply to solve a problem (metacognition).

In this research, as also manifested by Silva et al. (2017) the application of the PBL method provided students with a process of building active, investigative, cooperative and reflective knowledge. The search for solutions to the problems occurred with engagement, motivation and participation of students and teacher.

At the end of the survey, suggestions were asked to improve the use of PBL. Students suggested the possibility of applying a hybrid model (PBL and other teaching methods) to overcome the limitations pointed out in the research; another suggestion is that the teacher could give an inaugural class introducing the PBL method prior to its application in the subject; it was also suggested to use a smaller number of problems (remembering that in the case evaluated five problems or five PBL cycles were used), so that there could be more time to deepen the study and develop better solutions for each proposed problem.

7. Final considerations

As the purpose of this study was to collect and analyze the perception of a group of students of the *Stricto Sensu* postgraduate course after experiencing the active PBL teaching method, the results show positive signs regarding the potential of PBL in the process of knowledge construction and developing specific and desired skills in postgraduate level courses. In the object of study of this research, it was revealed that the PBL allowed to develop skills such as: problem solving, teamwork, listening, disagreeing with others and defending points of view, acting under pressure, acquiring leadership and creativity, processes of documentary and bibliographic research and integration of diverse knowledge between students and teachers.

Despite the results are not statistically relevant to be generalized, there are several similarities with the results obtained in other studies conducted at different educational levels, both for the advantages and disadvantages observed.

On the other hand, the perception of disadvantages was also identified, although not from the comparative analytical perception between the PBL and the traditional method, but within the assertive choice of PBL itself and its respective cycles. This scenario requires the teacher to constantly search for greater efficiency of planning and implementing the teaching method, including, as shown in other studies and recommendations given by the target population of this research, the possibility of complementing the PBL with other teaching methods should be evaluated.

Finally, further research is recommended to show the advantages and disadvantages of PBL as a teaching method in larger populations and at various educational levels. It is even considered necessary to test the efficiency of PBL when used respectively with other teaching methods.

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