Problem-based learning

A proposal for structuring PBL and its implications for learning among students in an undergraduate management degree program

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Abstract

Purpose – The purpose of this paper is to present a proposal for structuring the use of problem-based learning (PBL) as an active teaching strategy and assess PBL's implications for student learning in the undergraduate management degree program of a federal university in Northeastern Brazil. PBL can turn students into active subjects in their own learning and promote the development of decision-making abilities through the identification and analysis of real problems.

Design/methodology/approach – The study follows the assumptions of qualitative research and uses the action research approach. The data were collected through reflective reports (texts freely written by students describing their experiences in a course) and through interviews. The collected material formed the basis for analysis and discussion of the results using content analysis.

Findings – The results indicate that the PBL teaching strategy has positive implications for student learning in that it promotes the integration of theory and practice, which enhances the motivation to learn. The students perceived the practical aspect, teamwork and presence of an entrepreneur/manager in the PBL classes as factors facilitating learning. By contrast, teamwork and the time involved were seen as factors limiting learning.

Practical implications – The use of PBL demonstrates its potential for learning through the integration of students' cognitive, behavioral and social dimensions, fostering closer integration with the context of professional activity. The presence of entrepreneurs/managers who present real problems to be analyzed by the students in the classroom can contribute significantly to the promotion of learning and reflection by undergraduate management students.

Originality/value – The results of this study reveals its originality and value to management education in Brazil because it defines a framework for the implementation of PBL as an active learning strategy in a management program, it indicates the potential of PBL for the development of students' competencies, it increases the potential for integrating theory with professional practice and it can aid the process of training teachers as they assess the implications of PBL for student learning.

Keywords Problem-based learning, Management degree programme, Active learning strategy

Paper type Research paper

1. Introduction

Problem-based learning (PBL) is an active teaching strategy that allows the student to take the lead and become responsible for his or her learning process (Egido Gálvez *et al.*, 2007); it also provides learners the opportunity to work collaboratively and develop the ability to learn under their own direction (Hmelo-Silver, 2004; Gwee, 2009) as well as, over the course of their lives (Woods, 2006), solve problems through an investigative process, analyze data

and propose solutions (de Souza and Verdinelli, 2014). In the PBL context, the teacher acts as a facilitator of collaborative learning (Graaff and Kolmos, 2003). PBL aims to encourage students to use their prior knowledge to make decisions with a focus on problem solving (Egido Gálvez *et al.*, 2007), which helps make them more reflective and responsible for their own learning (Hmelo-Silver, 2004).

Silva (2016) proposes a system of learning through action for management education in Brazil and suggests five dimensions that should be considered in teaching and developing leadership: the learning environment, the experience of the teacher and students, learning styles, reflective practice and active teaching strategies.

PBL is one of the active teaching strategies proposed by Silva (2016) to make management students' learning more meaningful, as it helps students reflect on their own needs (Egido Gálvez *et al.*, 2007) and enhances their ability to develop independence as learners (Hmelo-Silver, 2004; Gwee, 2009).

This paper came out of the research agenda of a project under the Universal Call for Proposals by the Brazilian National Council for Scientific and Technological Development (*Conselho Nacional de Desenvolvimento Científico e Tecnológico* – CNPq). This project aims to develop and disseminate innovative teaching strategies in the management program of a federal university in Northeastern Brazil, in the context of the Center for Research and Practice in Management (*Observatório de Pesquisa e Prática em Administração* – OPPA), which was established in 2014 to create a learning environment for undergraduate and graduate students through "teaching-based research" or "research-based teaching." The OPPA has a 100 m² physical space that can be characterized as a hub for dynamic and innovative learning, as it fosters the creation of a learning environment that values the physical, behavioral, social and technological aspects that bring teachers and students closer together, as well as facilitates the learning process, as shown in the study by Silva and Santos (2015).

This study is motivated by the need to assess how the adoption of an active teaching methodology enhances the learning process among management students. Thus, this paper aims to present a proposal for structuring the use of PBL as an active teaching strategy and to assess PBL's implications for student learning in two classes of an elective course in a management degree program. The study can help instructors to use PBL as a teaching strategy in a more structured manner. It achieves this by presenting the perceptions of students who experienced PBL in classes that combined theory with practice (Freitas, 2012) and reflection with action through a more experience-based approach. According to Gosling and Mintzberg (2003), the management field needs to break with more technically oriented education approaches so that students can develop the ability to adapt under contexts marked by uncertainty (Vasconcelos *et al.*, 2013).

In addition to this introduction, the paper is structured into five parts. Section 2 covers the theoretical framework, presenting some specific details about PBL and indicating the elements that make up its structure. The next section addresses the methodology used to understand the phenomenon being studied. Section 4 presents the proposal for structuring PBL in the context of the OPPA, which can aid its dissemination in other programs and institutions. Section 5 assesses the implications of PBL for student learning and identifies the factors that facilitate and limit its adoption as a teaching strategy. The last section includes some final reflections on the study.

2. Theoretical framework

PBL is considered to be an active teaching strategy, as PBL students are encouraged to take the lead in their own professional training and education. Its use in a teaching context allows the student to move beyond a passive role, to be exposed to a problem and to develop a sense of self-direction in search of the knowledge required to solve it (de Souza and Verdinelli, 2014). It is an educational strategy that takes into account the

complex nature of learning (Savin-Baden and Major, 2004) and values the practical experience of learning because, as noted by Hmelo-Silver (2004), it is based on the educational approaches of William Heard Kilpatrick and John Dewey.

PBL was disseminated in the medical school of McMaster University, Canada, in 1969, under the coordination of Howard S. Barrows (Gwee, 2009; Borges *et al.*, 2014), as an innovative, radical strategy that ultimately became an educational trend. Gwee (2009) emphasizes that PBL aims to improve and optimize educational outcomes because it is student centered, collaborative, contextual, integrated and self-directed, and it promotes more reflective learning. According to Savin-Baden and Major (2004), the use of PBL can be affected by the structural and pedagogical environment in which it occurs, as it involves factors such as the subject matter, students, teachers and organizations.

In their analysis of the definitions of PBL, Graaff and Kolmos (2003) distinguish among three levels: the central theoretical principles of learning, specific models based on PBL and various practices that follow the guidelines of traditional educational models but incorporate elements of PBL in their theories, models and practices. In terms of theoretical perspectives, PBL can be associated with an educational approach that takes a problem as the starting point for the learning process, which is based on perspectives such as student-centered learning, experience-based learning, activity-based learning, interdisciplinary learning, a focus on practical examples, and collaborative group learning.

As a model, PBL includes the following components: the structure of the program curriculum, group-based learning and evaluation. Other models are based on project-based learning and whether the projects are associated with a task, a subject matter or a problem. The discussion of PBL as a practice involves the manner in which the strategy is implemented, with an emphasis on its goals, motivation, student engagement, the relationship between teaching strategy and the depth and complexity of learning, and the manner in which a student develops a more complex level of analytical understanding through a problem-based assignment. There are several paths to the practice of PBL, and teachers can empower students to develop more inductive or more deductive thought by relating their goals to a project on three levels: general structure, themes and types of problems or the formulation of proposals (Graaff and Kolmos, 2003).

By understanding these levels of distinction within PBL, one perceives that they are integrated rather than unrelated, and therefore, teachers must understand the theoretical bases of PBL and how the strategy can be implemented in the context of teaching, as well as be clear about the roles of the participants. Some of these points are highlighted in Section 2.1.

In their discussion on the basic principles of PBL grounded in an analysis of studies on the subject, Savin-Baden and Major (2004) indicate that PBL can be understood as a general educational strategy, as a philosophy or as an approach to teaching. The authors present the following parameters to aid in understanding, which they describe as broad areas of differentiation:

(1) PBL's essential characteristics include the organization of integrated curricula and classes around problems, in addition to an emphasis on cognitive skills;

(2) certain conditions facilitate PBL, such as small groups, tutorial instruction and active learning; and

(3) PBL emphasizes results, such as the development of skills and the motivation to continue being a life-long learner.

PBL requires the student to integrate various areas of knowledge, and it seeks to present real problems (Araújo and Sastre, 2009) to promote the development of skills for self-directed learning (de Souza and Verdinelli, 2014). According to Egido Gálvez *et al.* (2007), the method allows the student to be the center of learning, facilitates the development of self-awareness,

makes use of motivation, requires the curriculum to be organized around holistic problems, promotes professional training in small group relationships and encourages learning skills.

The use of PBL in management education is a way to allow the student to experience the context of professional life by solving problems related to the issues that arise in the course of a manager's professional activity. Hmelo-Silver (2004) believes that educators are interested in PBL because of its potential to motivate students, as well as its emphasis on active and collaborative learning (Escrivão Filho and Ribeiro, 2008) and the development of lifelong learning skills, management changes, teamwork, conflict resolution and problem solving (Woods, 2006). Identifying which skills or competencies are to be developed must be part of planning PBL activities, that is, the teacher should explain to the students what they can learn by using the PBL strategy. Thus, it is important to discuss the elements involved in the use of PBL.

2.1 The elements that constitute the use of PBL

There are several ways to use PBL in teaching, and this paper will describe the implementation of one way that can be employed in undergraduate and graduate programs in management. Table I shows various types of PBL based on Woods (2006), emphasizing that although it is an extremely effective environment for learning specific knowledge, it is not well known, which affects decisions about which PBL type best fits a learning objective.

Although they indicate different paths for teachers to plan for their use, these variations of PBL describe the strategy's basic elements in terms of guidelines for learning. In this paper, we develop a structured PBL approach drawing on prior knowledge as a point of reference, but focusing on the creation of an action-oriented learning environment that encourages the development of collective learning. The following are some aspects considered central to the PBL strategy and that facilitate the understanding of its use in management education, given the specific needs of that field.

Type	Description	Challenge
PBL	It is a learning environment in which the problem is presented before the students obtain new knowledge	To provide students a more effective opportunity to develop problem-solving skills
	Helps students create knowledge structures that will help them apply what was learned to future situations	To facilitate the development of suggestions or clues and a more appropriate knowledge structure
Self-directed PBL	Empowers students through learning tasks. They choose the topics, create the learning objectives and criteria, contact members of the group to learn and teach parts of an unknown activity, teach others, develop and self-assess their learning progress	To make students more responsible
	Empowers students by allowing them to share in the assessment process	To develop students' self-assessment skills and provide an opportunity for the teacher to monitor and conduct the assessment
Small-group PBL	Uses a learning environment in which students are active and cooperative. There is a clearly defined deadline for tasks, with rapid feedback, as well as catalysis of the student's learning style	To create a small-group learning environment that actually incorporates the elements that describe it
	Incorporates principles of self-directed PBL and a process of self-assessment to create an environment for more in-depth learning	To explicitly develop lifelong learning skills such as teamwork, self-direction, teaching skills, self-assessment and communication

Source: Prepared by the authors based on Woods (2006)

2.1.1 *The studied problem*. Discussing a problem is the central focus of PBL, given that the search for possible solutions to a problem can contribute to the development of students' skills. Macdonald and Savin-Baden (2004) reflect on the use of the term "problem" because, in addition to its meaning being associated with the search for a solution, the word can also have a negative connotation; for this reason, many use alternative terms such as "concept-based," "investigation-based," "topic-based" or "context-based" learning; however, they recognize that a problem is at the center of the curriculum and offers the student a sharper focus and stimulus to learn.

In the context of management education, problems consist of a description of a real situation (or a close approximation of reality) that requires a solution. According to Egido Gálvez *et al.* (2007), the student takes an inventory of his or her knowledge about the subject, analyzes it, reflects upon it and exchanges information with classmates, teachers and tutors to brainstorm ideas, form hypotheses and obtain solutions.

The main goal is to generate productive discussions (de Souza and Verdinelli, 2014). To this end, the studied problem should have the following characteristics (Hotchkiss, 2002; Sakai and Lima, 1996): it should be simple and objective to avoid confusion in identifying the main goal; it should be motivational for the student; it should include a neutral description of the case; it should be capable of elucidating the information required for its resolution; it should not include procedures for its resolution; it should allow students to make unique decisions; it should focus on a few learning items; it should contain elements about which the students have prior knowledge; and it should set a limit of approximately 16 hours for independent study.

2.1.2 *Curriculum*. The curriculum for PBL can be structured in a way that integrates with other disciplines, grouped by thematic blocks (Mamede, 2001). Graaff and Kolmos (2003) underscore that such thematic blocks involve a semester of approximately six weeks that focuses on a specific topic. Planning the cases is crucial to a learning process geared toward professional practice.

In the context of management programs, PBL can be implemented in an interdisciplinary manner in various courses during the same period or semester; however, it can also be used in a specific course, as is the case with the proposal presented in this paper.

The professor or instructor of a certain course that employs the PBL strategy can collaborate with teachers from other courses to enrich the problem with information drawn from true-to-life professional situations (Borochovicius and Tortella, 2014).

2.1.3 *Students and teachers*. Unlike conventional teaching strategies, in which the student is a passive recipient of information that emanates from the teacher, PBL involves a change in these roles. The strategy requires the student to take an active role in his or her education. The teacher assumes the role of tutor and moderator, facilitating the group's work and communication among its members (Graaff and Kolmos, 2003).

de Souza and Verdinelli (2014) believe that the tutor should take an active role in stimulating students, encouraging them to reflect on the problem and to connect their prior knowledge to new concepts. In addition, the teacher should help students develop their communication skills, critical thinking, professional behavior and ability to assess themselves and their colleagues (Mennin *et al.*, 2003; Woods, 2006).

With regard to the students, creativity and reflection outside the classroom, as well as critical thinking, are crucial to solving the studied problems (de Souza and Verdinelli, 2014; San Tan and Frank Ng, 2006). Within the student groups, there are two main roles (Iochida, 2001): the discussion leader and the secretary who records the discussions and prepares the report. These group members should work cooperatively so that no single person monopolizes the assignments and discussion.

A third role can be integrated into the process – the ambassador, a tutor who is active in the business world and involved in the studied activity. Such tutors are generally employees

who work directly in areas related to the proposed problem and can provide useful
information about the topic (Pinto *et al.*, 2015).

2.1.4 Process. Although there may be several ways of implementing the PBL strategy,
the philosophical foundations of the strategy consider it a student-centered approach that
encourages students to develop their independent research skills and draw a direct
connection between what they learn and their needs as learners (Macdonald and
Savin-Baden, 2004). With the goal of aiding the process of implementing PBL and drawing
on various authors who have studied the PBL strategy (Woods, 2006; Schimidt, 2001;
Moust *et al.*, 2005), the following main phases are proposed:

- describing the problem and its terms, considering the steps discussed above;

- forming groups of students with, on average, six members;

- researching the problem, proposing hypotheses, creating questions to guide the
learning and laying out the goals expected from this case-study;

- perceiving gaps in the existing knowledge, which are noticeable as the difference
between the students' current knowledge and potential future knowledge that may
be needed;

- identifying the sources that contain the theoretical or practical information needed;

- setting goals and allocating resources within each group;

- describing each team member's duties and role within the group;

- sharing knowledge to facilitate the development of the learning process and the
resolution of the problem;

- applying new knowledge to the problem in an attempt to solve it; and

- presentation, assessment and reflection on the process and solution.

2.1.5 Assessment. For a program that uses PBL to train students or in specific courses that
employ PBL as an active learning strategy, assessment should be planned as part of the
curriculum structure, and the assessment process should reflect the goals and skills to be
developed, as suggested by Silva (2016).

In PBL, assessment "gives students a responsible role in analyzing their own progress
and that of classmates in their group, rather than focusing only on the teacher's assessment"
(Pinto *et al.*, 2015, p. 15). Moreover, it is crucial to tailor the assessment process to the type of
learning desired, which requires great care and attention to the relationship between
teaching and learning (Macdonald, 2005). When using this strategy, the teacher should
define a system of teaching focused on professional practice, considering broader principles,
based on student performance according to well-defined criteria and relevant evidence
(Macdonald and Savin-Baden, 2004; Macdonald, 2005; Woods, 2006).

According to Macdonald and Savin-Baden (2004), the purpose of assessment is to
support students in their learning by engaging them in activities through feedback, to
measure learning progress and to set the standards by which those who are being assessed
can be distinguished. PBL aims to help students develop skills that are applicable in the
workplace and identify their own learning needs for the acquisition of knowledge and skills,
with the understanding that learning is a holistic process.

These reflections reveal the complexity of the PBL assessment process, which is closely
connected to its potential for competency development. To minimize ambiguity in the
assessment process, Woods (2006) suggests that clear definitions be established for the following
aspects: goals (what will be assessed?); criteria (what are they, and how will they be assessed?);

types of evidence (is the evidence supported by the assessment criteria?); resources (how are the goals and evidence observed over time using available resources?); assessment process (how are students assessed? what is the purpose of the assessment? how will feedback be given to the students, and who is responsible for such consideration?); and training for assessment (has any prior training been given in how to conduct the assessment process?).

There are several assessment methods in PBL, including group or individual presentations, multiple assessments among group members and the group, an individual report on the case being studied, the resolution of a real-life situation, development of a portfolio, triple-jump exercise (presenting the issue, gathering information and posing hypotheses, and writing a report on one's findings), self-assessment, peer assessment, open group assessment, online reflections written weekly and assessed at the end of the semester, assessment by the tutor/facilitator, written assessments and patchwork assessment in which group members work together to submit a shared written report containing their observations and remarks.

More specifically, Woods (2006) highlights certain forms or resources for assessment, including a student-written synthesis of the quality of the knowledge acquired; the group's solution to the problem; concept maps of the knowledge acquired; individual tests or examinations about the knowledge, which may be developed by the teacher, peers, groups, people or the students themselves; individual teaching grades and learning contract; and peer evaluations of the quality of knowledge acquired during the teaching activity.

One can see a close relationship between the methods proposed by Macdonald and Savin-Baden (2004) and the forms and resources proposed by Woods (2006), which show that the assessment process in the PBL strategy has several alternatives, and it is up to the teacher to define the most appropriate one for the nature of the program and the course. The next section describes the methods used in the study.

3. Methods

This study's methodology was guided by the assumptions of qualitative research (Merriam, 2009) and used the strategy of action research proposed by Cousin (2009) that is associated with the teacher-as-researcher movement. Action research can be used to investigate changes in daily routine in natural settings as well as in controlled environments such as the Center for Research and Practice in Management (OPPA), where the study was conducted and which promotes the practice of "teaching with research" or "research with teaching."

The processes of action research proposed by Cousin (2009) involve the following steps: recognition of the problem, planning, action, observation and reflection. Section 4 describes the teaching strategy institutionalized in the management program in an elective course for students in their final year of study at a federal university in Northeastern Brazil in morning and evening classes. The participants included 90 regularly enrolled students in the decision making and managerial development course (35 in the morning section and 55 in the evening section), in which a PBL format is being introduced with the presence of a business leader or manager who describes a problem to the students and later returns to the Center to review the proposed solutions that the students have developed under the guidance of their teachers, which fosters a process of reflection about the applicability of the proposed solutions.

Two teachers, a master's degree student and a research assistant were involved in the implementation of the strategy, and they are also considered subjects of this action research, in addition to the 90 students involved. The teachers planned the implementation of the strategy and assumed the role of moderators throughout the process. The graduate student and the research assistant supported the implementation of the PBL strategy through direct observations of the entire process and by assisting and guiding the students with the preparation of their reports.

After the activity concluded, the students were invited to participate in individual interviews to assess the implications of the PBL teaching strategy for their learning. As participation was voluntary, only six students from the two classes volunteered to participate in the interview, which was conducted in a suitable setting, and the interviews were recorded with the students' consent. The interviews followed a semi-structured script with 13 questions. The questions ranged from the understanding of the PBL implementation process and its implications for student learning to perceptions of how the strategy contributes to the integration of theory and practice and the ways in which PBL facilitated and limited students' learning. The interviews were transcribed in their entirety for analysis.

As a complement to the data analysis, some of the reflective reports written by the 90 students at the end of the course were considered. The purpose for using these reports was to study PBL's effects on the students' learning.

The reflective report is an activity that was developed based on Jennifer Moon's (2004) reflections in a book about the development of reflection. Based on a reading of the book and the proposed activities, a framework was developed to encourage students to assess the implications of using active teaching strategies incorporated into a course for learning through a process of reflection. Writing is understood as a mental process of reflection that involves a systematic first-person account of an experience involving ideas and feelings, going beyond a description of facts and points of view to promote a deeper and more critical examination of the writer's ideas. As this activity was new to the students, a description was developed that entailed a brief presentation about the report's purpose and broader reflective questions to spark the students' reflective thought, as well as specific standards for the format of the activity.

This activity was conducted at the conclusion of the course and served as a source of data on which the teachers were able to base their assessments of the learning process. In the course, The Decision-Making Process and Managerial Development, several reports assessed the implications of the student's experience with PBL as an active teaching strategy and the most positive aspect of their learning. The most significant aspects have been included in this paper. Thus, the qualitative data were collected not only from interviews but also from the students' reflective reports, adding consistency to the analytical process.

The analysis of the data collected from the interviews followed the three stages of content analysis proposed by Bardin (2007), specifically, pre-analysis, exploration of the material and treatment of the results and, finally, inference and interpretation.

Pre-analysis consisted of organizing the material collected, which was carried out in an intuitive manner but aimed to systematize the initial ideas. In this first stage of content analysis, it is important that the researcher undertake a free-floating reading (Bardin, 2007) of all the material collected in the field. Thus, following the author's recommendations, the transcripts of the interviews and the reflective reports were read. Next, the passages most relevant to this study's aims were chosen from the interviews and written reflections to make up the body of material necessary for the researchers to obtain a general overview of the data. In the study's findings, spoken passages from the interviews are designated by the letter "I," while passages from the reflective reports are designated with the letter "R." The number following the letter identifies the student.

The second stage, again following Bardin's (2007) recommendations, consisted of exploring the material in light of the researchers' decision to focus on two categories considered relevant to demonstrating the implications of applying the PBL strategy with undergraduate management students. The analytical categories and subcategories were identified in this phase.

The final stage of content analysis involved the treatment and interpretation of the results. This stage consisted of codifying the corpus of the study through data processing,

grouping it into units (categories and subcategories) in a way that made it possible to represent the content of the corpus of analysis.

Finally, Bardin (2007) emphasizes that when the analyst finds significant results, he or she can make inferences and advance interpretations with regard to the objectives established or to other unexpected discoveries. The results of the analysis are presented in the next sections.

4. Structuring PBL as an active teaching strategy

Several modes of PBL are mentioned in the literature; however, in the context of the Center for Research and Practice in Management, it was decided that a form of PBL would be developed in which students interact with an entrepreneur or professional manager to make the process more realistic, leading students to experience professional practice through the use of theoretical concepts.

The strategy was implemented in the morning class with the participation of a small-business entrepreneur who sells gourmet sandwiches from a food truck, and the problem to be solved by the students was as follows: "How can public awareness of the company's product be improved in the city of João Pessoa, Paraíba state?"

The students in the evening class worked on a problem presented by an executive of a private college in the capital of another northeastern state, located approximately 140 km from the university where the study was conducted. The executive presented two problems, and the groups of students chose to solve one of the two problems: "How does the college attract potential clients who ride public transportation to a campus that is located one kilometer from the closest bus stop on a steep slope?" or "Since the college's current facility accommodates only 2,500 students and is surrounded by a six-kilometer radius of land traditionally used for public purposes, how can the institution plan for its intended future growth, given that legislation does not permit expansion or remodeling of the current building?"

The fact that the business that was to be the object of the PBL exercise was located in another state worried the teachers, as the students were far from the company; however, the students used Google Earth and other technology to take virtual tours of the site, examine the surrounding economic environment and gather information on buildings that might be leased by the business.

The proposed PBL process involves four stages, and its application occurs in four phases. The first consists of the definition of the problem by the teacher/tutor and the choice of an entrepreneur/manager who will attend the first PBL class meeting to present the problem to the students. The second phase also occurs in the classroom and involves choosing the groups of students who will share the initial reflections following the manager's presentation of the problem. The third phase occurs outside the classroom and involves a process of research to gather academic and non-academic information that will aid the groups in solving the problem. The fourth and final phase involves shared understanding and occurs during the second PBL class meeting when the solutions to the problem are presented, with the participation of the manager. Figure 1 shows the stages of PBL in the context of the Center for Research and Practice in Management.

Each stage is described below for the purpose of sharing the process and helping disseminate the active teaching strategy in the context of management education, as most studies of PBL do not describe its implementation in detail.

4.1 First stage: definition of the problem
Considering the PBL approach chosen for the course, after the entrepreneur/company manager is chosen, the teacher/tutor should discuss the problem to be presented to the students with him or her. The initial conversation should explain the strategy and request
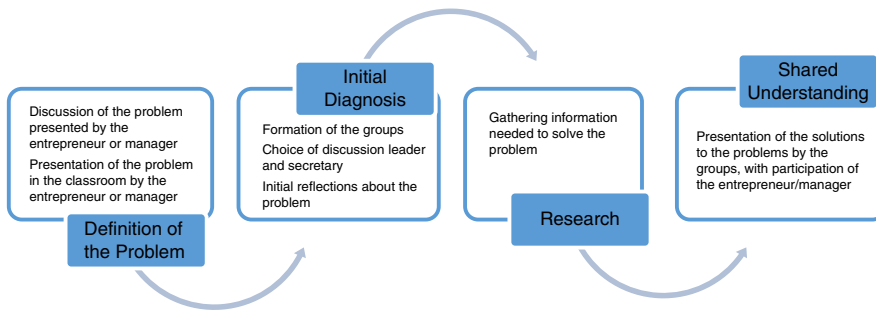
Source: Prepared by the authors based on Wurdinger and Carlson (2010)

the entrepreneur/manager's cooperation because it is hoped that the results of the PBL exercise will also benefit companies in the area. The planning stage also requires the teacher/tutor to prepare informative material for the students, especially in programs and courses where the strategy is not yet well known.

During this stage, the entrepreneur/manager presents a real problem that requires a solution and is able to generate a productive discussion. The problem should be objective and specific and, in the case of the course in which this PBL was implemented, can involve topics related to any area of the organization, as the students are enrolled in the final year of the undergraduate management program.

It is recommended that in describing the problem, the entrepreneur/manager contextualize the company, the sector in which it operates and its products and/or services or other points considered relevant, culminating with the presentation of the problem.

4.2 Second stage: initial diagnosis
The initial diagnosis occurs during the first PBL class meeting and should be carried out after the student groups are formed and the discussion leader and secretary of each group have been chosen. The discussion leader's role is to facilitate the process of solving the problem posed by the entrepreneur/manager and to act as the group leader. The secretary's role is to organize the information and take notes on the discussion. It is also the secretary's job to organize the final PBL report with the support of the group.

At this stage, discussion of the problem posed by the entrepreneur/manager begins. At this time, the students are expected to begin the search for information through casual conversation, and it is believed that the active and reflective attitude of the group with respect to the problem posed by the entrepreneur/manager will be crucial to the search for a solution to the problem. In this stage, the teacher/tutor can also help the class by posing reflective questions to the entrepreneur/manager and to the students.

4.3 Third stage: research
The process of conducting research to solve the problem is one of the most important steps in PBL. This stage is usually conducted by groups outside of the classroom and consists of a more detailed analysis of the problem posed by the entrepreneur/manager.

At this stage, the groups of students should connect theory to practice, drawing on academic sources (books and journals) to help them understand the problem. They should also seek information in the business community that can help the group make decisions. If the entrepreneur/manager is amenable to the idea, a visit to the company may be organized, or information can be exchanged using technological resources (telephone, e-mail, text messaging, Facebook and Instagram).

Based on the research process, information should be organized to prepare the group's report, which should contain information on the following aspects:

- Description of the problem.

- Definition of the problem's causes and hypotheses to help understand the problem's causes.

- Definition of a plan to solve the problem (a number of techniques can be used for the definition of the plan, such as the 5W2H or CANVAS method).

- Reflections of the group about the proposed solutions. In this section, the group can mention the difficulties encountered in the course of solving the problem. The reflection should discuss the factors that facilitated and hindered the group activity and answer the question "What did the group members learn from the activity?"

4.4 Fourth stage: shared understanding
The stage of shared understanding occurs in the second PBL class meeting in the classroom, and it includes the participation of the entrepreneur/manager who presented the problem in the first stage. Each group presents its report to reflect on the solutions proposed, with the participation of the business representative, which makes it possible to consider the connections between theory and practice, reflection and action.

Although the groups may present different solutions, the exchange of experiences through the discussions can help them reflect on the implications of decision making in managerial activity.

The teacher/tutor is responsible for coordinating the session and can contribute with questions and comments to the groups about their proposed solutions.

5. Implications of PBL for student learning in a management program
To identify the implications of PBL for learning, six students from an undergraduate course in management, including both morning and evening classes, were interviewed. All the interviewees were male. At the time of the interview, all were in their final or penultimate semesters of the program. In addition to the interviews, the reflective reports written by students as the final project and described in the methods section were analyzed. The activity counted for two points in the third unit of the course. However, the teacher promised top marks to all who submitted the assignment, which would only be read after the conclusion of the course so that students would feel free to express their thoughts regarding the experience during the course, The Decision-Making Process and Managerial Development.

Analysis of the interviews revealed two categories that stood out as the most significant for presenting the implications of PBL in the learning of the students interviewed, which are presented in this section. They are integrating theory and practice and the factors that facilitated and limited learning through PBL. What stands out from analysis of the reports are students' comments that the use of PBL in that course allowed them to bring together organizational practice with the theory learned not only in that course but also in previous courses.

5.1 Integration of theory with practice
The students described the importance of PBL as it is used in the OPPA, that is, with the participation of a manager and a small-business entrepreneur who presented real problems to be solved by the students, reporting that this allowed them to integrate the theory studied during the program with organizational practice. Not only was this combination mentioned

by the students in their interviews, it was also noted by the teachers in the reports about possible solutions that students submitted both to the entrepreneur/manager and to the teacher for assessment. This was especially true because the students were encouraged to integrate theory with practice in stage 3, the research component, by using academic sources (books and journals) to help them understand the problem and propose viable solutions grounded in theory:

> It's like this, it's crucial because **the problem is a practical one but it requires theory to be solved, so PBL provided a way to connect theory and practice,** because we took that practice there and had to resort to theory, […]. (I2.9)

> […] through PBL, starting with the possible solutions and the challenges facing the businessman, **we were able to reconcile it with the theory** that we had been seeing in various classes over the course of the program, […]. (I3.9)

> I liked the participation of company managers sharing what they experience in their organizations, bringing their problems to the classroom. From there, students try to understand the problems posed, figure out and analyze their causes […] The students act sort of like consultants, **putting the wealth of knowledge into practice**. (R1)

> […] I strongly believe that the debate about real-world problems experienced by managers of companies was the most productive activity, and also the one I most enjoyed getting involved with. **Recounting experiences allows students to see all the theory they have been studying in the classroom applied to practice**. (R6)

The link between theory and practice is still taboo for management programs at both the undergraduate and graduate levels. The use of an active learning approach such as PBL can help enhance student learning, as the students reported, based on the integration of theory with practice, that they are able to acquire or expand their ability to understand reality of the field and come up with innovative solutions to transform it.

Assessing their first six years of experience with the International Master's Program in Practicing Management, Gosling and Mintzberg (2003) state that management classes should be taught in settings where students can reflect deeply on their experiences. Moreover, there is an obvious need for changes in the way students are currently trained, as noted by Vasconcelos *et al.* (2013) in their study of a Brazilian Business School. According to these authors, there is a transition underway, and the role of management today goes beyond the typical administrative duties such as planning, organization, leadership and control to enter the realms of influence, adaptation to different contexts and unpredictability.

The respondents also reported that the PBL strategy made them see that theory is not divorced from practice, as teachers of undergraduate management courses usually hear from their students, who are always eager to see organizational practice ahead of the range of theoretical content that goes into the training of a bachelor in management, as can be observed in the comments of I4 and the report of R14:

> […] **the main thing we learned is to try to think about how theory applies to a specific practice**, because it's like we talked a lot about in class, there's theory and there's practice, sometimes people make a distinction, "uh, it's different and all", but it's not that theory is different from practice, it's just that theory has to be adapted to different realities. So, with this activity that we just did […], it has its target audience, so we have to adapt the logic of marketing, for example, to that reality […]. (I4.1)

> […] **it made several concepts we had studied more applicable, the PBL practice allowed us to make use of a lot that we had seen in several other classes** […]. This was very valuable, not only for developing skills in problem solving, conflict management, etc. but also to understand some concepts that were taught in other classes, but before, without a real-life

case or practical experience, just didn't make the connections needed to consolidate the knowledge. (R14)

The fact that students highlighted the relationship between theory and practice corroborates the observation by Freitas (2012, p. 407) that PBL "helps overcome the much-criticized separation between academic training and concrete reality, between theory and practice." In a study by de Souza and Verdinelli (2014, p. 45) that assessed the use of PBL, the students stated that "it is much better to learn by combining theory with practice."

In their work, Escrivão Filho and Ribeiro (2008) claim that students learn how to learn collaboratively and autonomously by working on the problems presented in the PBL method. According to these authors, the main point is learning to solve the problems by researching management concepts.

An analysis of report R14 also confirms the opinion of Hmelo-Silver (2004) and Woods (2006) regarding PBL's potential for developing conflict resolution and problem-solving skills, in addition to its potential for interdisciplinary learning (Graaff and Kolmos, 2003).

Regarding the relationship between theory and practice, interviewee I1 stated that the PBL strategy used at the OPPA should be applied in other courses of the program, even starting with introductory courses. His comments indicate a certain eagerness for practical applications of the theories studied:

[…] Yeah, **there should be more of that during the entire program** starting from the beginning, because we see lots of theory, a whole lot of theory, and sometimes forget to combine it with practice, and **in my opinion, out of this whole program, I think this activity did the best job of giving us some practice**, because we didn't just watch the practice, we practically became part of the company to find the solution for it. (I1.9)

It was also possible to observe that the implementation of PBL increased student motivation, as noted by I5. This finding corroborates the conclusions of Graaff and Kolmos (2003), Savin-Baden and Major (2004) and Egido Gálvez *et al.* (2007). The student's motivation for learning can come from the implementation of a conventional PBL exercise that consists of real or fictitious problems; however, the opportunity to present the solutions directly to the entrepreneur/manager also seems to arouse greater interest in contributing to the business being studied. Moreover, I6 states that the implementation of PBL allowed students to experience reality, drawing together the various concepts that had been studied during the program and unifying them in a single activity, which he considered important to the training of a competitive, capable and competent professional. In report R30, the student states that PBL provides an opportunity to encounter real-life situations that until then he had only heard about, saying that the activity was engaging precisely because it allowed him to experience reality:

The application of theory to a problem, you know it's real, you know that the person will take it to his company and possibly really apply it, that this will help, makes us more motivated to contribute. […] so **this alignment between the theory that we see and practice that will really go to market**, because it's one thing for us to do a case study where we make suggestions and give opinions and know that it might help us in our learning but won't be implemented because it's a made-up study, but it's a very different thing to know that you're really helping a business, you're affecting somebody's business, and this could really help someone, that's very rewarding. (I5.9)

During the program, we rarely had the experience of putting something into practice, of **applying what we see in the classroom**, I think PBL is all about this issue of reality, about the world out there and it is important to train a competitive, capable, competent professional […]. **For me, theory turned out to be really applicable to practice** when you get started, you see some concepts, you see how you can apply finance here, you see concepts of marketing where you have to keep some visual issues in mind, and such, you can do this, you can't do that, you have concepts

of logistics […] different courses come together there on the spot, and this is extremely important to a professional who's being trained […]. (I6.9)

PBL put me into situations I had only heard about, just in theory, so thinking of a way to act in the face of a challenge to a real company, that helped me see and think differently about aspects that were covered, you know, it was really real, I experienced it and I kept wondering if I were that manager, what would I do, what's the solution, is there a solution? […] **I think that was the most reflective part of the course for me and the most engaging because it was real**. (R30)

These findings corroborate the observations of several authors covered in the theoretical framework, such as Graaff and Kolmos (2003), Hmelo-Silver (2004), Savin-Baden and Major (2004); Woods (2006); Egido Gálvez *et al.* (2007) and Freitas (2012), by indicating that problem-based teaching can situate the subject matter in meaningful contexts of action (or professional work), motivating students and cultivating in them a sense of responsibility for solving problems, managing conflicts and thinking in broader and more interdisciplinary terms. The study participants also cited the factors that facilitate and limit the use of the PBL strategy.

5.2 Factors that facilitate and limit learning in the adoption of PBL
The students were asked to describe the factors that facilitated and limited their learning through the use of the PBL strategy. The reports showed that the use of this strategy was viewed positively by the interviewees with regard to three facilitating factors: the practical aspect, the presence of an entrepreneur/manager and teamwork. The research conducted by de Souza and Verdinelli (2014) involving the application of questionnaires to 107 students who had participated in a PBL learning experience revealed that 77 percent of the respondents approved of the method, of whom 25 percent considered the method very effective and 52 percent considered it moderately effective.

Consistent with what had already been indicated by the students with regard to the importance of integrating theory and practice in the adoption of the strategy, the practical aspect was one of the main factors that facilitated learning cited by the students, as seen in the remarks of I2 and I3:

What I think was **most effective for me was the practical aspect,** I always get very involved with what I learn through practice, so **the fact that we were right there experiencing a real problem of a real person who was right there in front of us,** we could talk with him, have him answer our questions, that we had the opportunity to visit the company that was having the problem, for me, that was one of the factors that helped me learn better. (I2.3)

I think because of my own learning style, **it was the practical aspect, you know, the practice itself brought me more** […] made me more, how can I say it, **more interested** in discussing it in more detail. In the case of PBL what I could […] it's not something very theoretical, it's more **practical** and I was more interested in participating. (I3.3)

Another facilitating factor mentioned by the students was the presence of the entrepreneur and/or manager in class to present the problem and later to hear the solutions proposed by the teams of students:

"[…] **I think the fact that the businessman came and provided a context for the company, a context for the whole problem**, that got us involved with the company and with the issue, so I think that made it a lot easier for us to make suggestions to improve the problem. (I1.3)

[…] the first thing **is to have the person present** whose problem I'm solving, you know, listening and arguing back, or building on the face-to-face discussion […]. **And so the fact that he's there and he's considering your ideas, that makes the learning happen** […]. (I4.3)

Teamwork was the third facilitating factor that emerged from the analysis of the corpus of the interviews. The statement by I5 confirms Woods' (2006) opinion that PBL contributes to the development of the skills needed for working as a team:

> It was **the teamwork** that made it a lot easier and also the **presentation of the problem**, how the problem was presented to us, **the participation of the entrepreneur** helped a lot during the reflection and the description of the problem. (I5.3)

Escrivão Filho and Ribeiro (2008) report that when they used PBL with engineering students, the students rotated their roles within the groups, acting alternately as group leader, secretary, spokesperson and participating member. Thus, they were able to experience realistic, though simulated, situations from professional life. The authors used two strategies to form the groups: during the first part of the course, the students were allowed free choice in forming their groups, which were based on friendship and affinity; however, during the second part of the course, they were encouraged to form groups that would achieve the best possible performance.

Students also mentioned some of the limiting factors of PBL. Teamwork emerged as both a facilitating factor and a limiting factor. Its most significant limiting aspects were said to be the passive role taken by some students and the difficulty of arriving at consensus on the solutions to be presented, as is evident in the remarks of I1 and I3:

> Yeah, I don't know if the learning process, but **the main difficulty with forming the groups is that not everyone participates,** there are people who come just to criticize the others who are trying, but they don't contribute anything, that's the only thing […]. (I1.4)

> I think in the case of PBL, I don't think I had much difficulty. I was really interested in the case, I think **the only difficulty was getting the team to agree on an idea,** just because of this divergence of thought, but after we reached a consensus, everything went smoothly. (I3.4)

Teamwork was also identified as a challenging factor in a study on the use of PBL by Pinto *et al.* (2015). The authors found that some groups had problems with leadership, as some members were resistant to respecting the established hierarchy, including the roles and responsibilities of each member, which overburdened the members who were more responsible and committed to the course.

Time was another limiting factor cited by interviewees, as observed in I2 and I5:

> Look, for me, **the only difficulty I had was the issue of time**, that I didn't have much time to go visit the company, to get to know it in more depth, but **just the fact that he came here made up a little for the problem I had**. (I2.4)

> Yeah! **The time factor**, as a student, to dedicate myself to this activity made it a little difficult, and the fact that I still haven't gone to visit the company; Wagner presented the problem well, but to give more relevant suggestions, it would be better if we knew it in more depth, since I didn't have time to go visit his business, my assessment was kind of superficial. (I5.4)

de Souza and Verdinelli (2014) also cited time as a limiting factor. According to these authors, students do not have sufficient time for PBL. The implementation of PBL by de Souza and Verdinelli (2014) had some features in common with this study, especially the implementation of the strategy at the end of the semester. One difference is that in the case of this study, the problem was presented by the entrepreneur/manager, while in their study, the problem was written up and presented to the students. The authors even suggest that PBL activity be implemented at the beginning of the semester. This suggestion was supported by the teachers who had been involved in implementing of the learning strategy, especially because the course had been one of the last ones in the program, and the students were involved with writing their final projects.

6. Final considerations

The use of PBL as an active teaching strategy demonstrates its potential for learning through the integration of students' cognitive, behavioral and social dimensions, fostering closer integration with the context of professional activity.

The development of a framework for the dissemination of the PBL strategy reinforces the uniqueness and contribution of this paper as an innovative teaching strategy, as well as an opportunity to reflect on the implications of using PBL in the education of students in a management program.

The dissemination of student-centered learning strategies promotes interdisciplinary learning and the integration of theory and practice, as well as provides added motivation for learning and teamwork through practical experience with professional activity, which can make learning more meaningful. The results of this study confirm PBL's contribution to the students who experienced it in the context of the Center for Research and Practice in Management.

The study's results showed that teamwork is considered both a facilitating factor and a limiting factor. This indicates the complexity of student relationships in the educational context, which involves both behavioral and social aspects and should be taken into consideration by the teacher responsible for applying the strategy in the classroom. Factors such as passivity, lack of commitment from some group members and the difficulty of arriving at a consensus on the proposed solutions may hinder a group's ability to solve the problem, and it is the duty of the teacher or tutor who sees evidence of these factors to suggest ways to minimize them.

In addition to teamwork, the time factor was identified as another challenge to learning. In a content-focused curriculum, in which the teacher is seen as the central figure and transmitter of knowledge, it is more difficult to introduce strategies that give the student an active role in learning. Moreover, the culture of self-directed learning is not yet incorporated into the behavior of many students in higher education. Thus, one of PBL's contributions is to encourage the student to become familiar with a more experience-based learning process, through action, with emphasis on the development of a sense of self-directed development.

The use of active teaching strategies in management programs has increased in recent years; however, it is still in its infancy. Similarly, the use of the PBL strategy, especially as proposed in this work, with the presence of entrepreneurs/managers who bring real problems to the classroom, can contribute significantly to the promotion of learning and reflection among undergraduate management students. It is hoped that the presented structured process of implementing PBL in an undergraduate management program may help and motivate teachers to introduce this strategy to an ever greater number of students enrolled in higher education in Brazil.

An analysis of the results of this study reveals its potential contribution to management education in Brazil because it defines a framework for the implementation of PBL as an active learning strategy in a management program, it indicates the potential of PBL for the development of students' competencies, it increases the potential for integrating theory with professional practice and it can aid the process of training teachers as they assess the implications of PBL for student learning.

Future studies can address themes related to PBL's contribution to the development of professional skills and its relationship to interdisciplinary learning and students' academic performance.

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