

SECTION: PAPERS

PROBLEM-BASED LEARNING AS A TEACHING METHOD IN MEDICAL TRAINING¹

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ABSTRACT

Active learning methodologies, such as Problem Based Learning (PBL), represent one of the main innovative teaching methods. However, although several institutions usually guide their courses through PBL, studies on the student's perception about the importance and contribution of the method are still relatively recent. The present study aims to report the student experience in the tutorial sessions of the PBL and their contributions to academic training in Medicine. The tutorial sessions foster the training of critical, autonomous and participatory students, making them take responsibility for their learning. On the other hand, pressure and fear of failure can hinder and/or compromise all the teaching-learning process. It is important to highlight that the success of the method is not just the student's function, but rather depends on other factors that include: acceptance of the method by the student; proactivity of the tutor; infrastructure; a well-developed problem situation, and other elements that must be considered in its implementation.

Keywords: Problem-Based Learning. Teaching-learning. Active methodologies. Higher education. Medical education. Medicine student.

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APRENDIZAJE BASADO EN PROBLEMAS COMO MÉTODO DE ENSEÑANZA EN LA FORMACIÓN MÉDICA

RESUMEN

Las metodologías de aprendizaje activo, entre ellas el aprendizaje basado en problemas (ABP), representan uno de los principales métodos de enseñanza innovadores. Sin embargo, aunque varias instituciones guían sus cursos por ABP, la literatura aún es relativamente reciente sobre la percepción del alumno en relación con las contribuciones y la importancia del método. El presente estudio tiene como objetivo informar la experiencia del estudiante en las sesiones de tutoría de ABP y sus contribuciones a la formación académica de la medicina. Las sesiones de tutoría fomentan la formación de estudiantes críticos, autónomos y participativos, asumiendo la responsabilidad de su aprendizaje. Por otro lado, la presión y el miedo al fracaso pueden obstaculizar y/o comprometer el proceso de enseñanza-aprendizaje. Es importante destacar que el éxito del método no es solo responsabilidad del alumno, sino otros factores que incluyen la aceptación del método por parte del alumno, la proactividad del tutor, la infraestructura, la situación problemática bien desarrollada y otros elementos que deben considerarse en su implementación.

Palabras clave: Aprendizaje Basado en Problemas. Enseñanza-aprendizaje. Metodologías activas. Enseñanza superior. Educación médica. Estudiante de Medicina.

APRENDIZAGEM BASEADA EM PROBLEMAS COMO MÉTODO DE ENSINO NA FORMAÇÃO MÉDICA

RESUMO

As metodologias ativas de aprendizagem, dentre elas a Aprendizagem Baseada em Problemas (ABP), representam um dos principais métodos inovadores de ensino. No entanto, embora diversas Instituições orientem seus cursos pela ABP, a literatura ainda é relativamente recente sobre a percepção do estudante em relação às contribuições e à importância do método. O presente estudo tem por objetivo relatar a experiência discente nas sessões tutoriais da ABP e suas contribuições na formação acadêmica em Medicina. As sessões tutoriais fomentam a formação de alunos críticos, autônomos e participativos, fazendo com que eles assumam a responsabilidade pelo seu aprendizado. Por outro lado, a pressão e o medo de fracassar podem atrapalhar e/ou comprometer o processo de ensino-aprendizagem. É importante destacar que o sucesso do método não é apenas função do educando, mas depende de outros fatores que incluem aceitação do método pelo discente, proatividade do tutor, infraestrutura, situação-problema bem elaborada e outros elementos que devem ser considerados na sua implementação.

Palavras-chave: Aprendizagem Baseada em Problemas. Ensino-aprendizagem. Metodologias ativas. Ensino superior. Educação médica. Estudante de Medicina.

INTRODUCTION

Information and Communication Technologies (ICT) are largely responsible for the economic, political and cultural transformations of contemporary society. They directly influence the way individuals interact, learn and perceive the world, opening up new perspectives regarding access and knowledge acquisition (PIMENTEL, 2016). Nevertheless, in parallel to these transformations, the reciprocal relations between education and society are no longer sustained and, consequently, there has been a rupture in pedagogical practices in public and private Higher Education Institutions (HEIs) in recent years. (CEZAR *et al.*, 2010).

The facility of access to information, provided by digital culture and technological tools, offers students the opportunity to learn anywhere and anytime. In this context, the traditional method of education, based on lectures, is no longer sufficient to provide long-lasting and solid learning among students (FARIAS; MARTIN; CRISTO, 2015). Thus, the search for new models of knowledge production and organization, consistent with the demands and needs of today's society, coincides with the new curriculum proposed by the National Curricular Guidelines (DCN) of the undergraduate medical course (BRASIL, 2014).

The new DCNs, revised and reformulated in 2014, emphasize the concern to train general practitioners with the development of skills and abilities that allow a greater aptitude in working with the real needs of the population, especially with an emphasis on adapting to the demands of the Unified Health System (SUS/Brazil). Considering this situation, the use of these new methodologies supports the idea that, in today's society, the role of the holder of knowledge and understanding is not only up to the teacher and that, therefore, promoting student autonomy in solving problem situations must be a priority in the teaching method (BERBEL, 2011).

Among the active learning methodologies recommended by the DCN, the Problem Based Learning (PBL) stands out. This method allows the student to investigate, analyze, debate and propose solutions relevant to medical practice, through collaborative work. Currently, PBL functions as an inseparable axis of theoretical learning, promoting interdisciplinarity and integrality in the training of students (CEZAR *et al.*, 2010; DIESEL; BALDEZ; MARTINS, 2017).

The precursor to the PBL model was McMaster University, Canada, in the late 1960s. Since then, the method has been redesigned and instituted at Harvard Medical School in 1985. It was only in the 1990s that the idea was developed, got strength and arrived in Brazil through the Faculty of Medicine of Marília (FAMEMA) and the State University of Londrina (UEL) (MILLAN *et al.*, 2012). At present time, many medical schools already use PBL as a central teaching method in the medical curriculum. In the Northeast, approximately 78% of medical institutions employ some type of active methodology (TAKENAMI *et al.*, 2018), including PBL. One of the HEIs that use PBL as a teaching method is the Federal University of Vale do São

Francisco (UNIVASF), Paulo Afonso campus, Bahia. The undergraduate medical course on this campus emerged from the Federal Government's initiative to expand the supply of medical education (OLIVEIRA *et al.*, 2019). Since its opening in 2014, approximately 40 vacancies have been offered full-time in an annual academic regime. At that institution, two *campi* offer the medical course. However, seeking to meet the new DCN, the Paulo Afonso campus uses PBL as a central pedagogical practice in the curricular organization from the 1st to the 8th semester (FEDERAL UNIVERSITY OF VALE DO SÃO FRANCISCO, 2017). In addition, this is the first course of the institution to use active learning methodologies as a teaching method and, therefore, represents a practical and theoretical laboratory of professor and student's knowledge.

Six years after the update of the DCN, many studies have already been published in order to understand the importance of PBL in the training of medical students (MORAES; MANZINI, 2006; GOMES *et al.*, 2009). However, in Brazil, the literature is still relatively recent and few studies that emphasize and highlight the perception and level of satisfaction of these students (GOMES; REGO, 2011; IGARASHI; HAMAMOTO; SANTOS 2018). The study published by Smolka, Gomes and Siqueira-Batista (2014) revealed good receptivity and adaptation to the method, including greater autonomy and active participation of the student. From this perspective, it is understood that the student's view of the teaching method is of fundamental importance, as it allows to offer more qualified guidance and better use of educational resources, ensuring a more expressive result in the teaching-learning process. Thus, the objective of this study is to report the experience of two students in the tutorial sessions of the PBL and their consequences in the academic training of Medicine.

METHODOLOGY

It is a descriptive study, an experience report lived by two undergraduate medical students (D1, D2) at the Federal University of Vale do São Francisco (UNIVASF), Paulo Afonso campus. The report covers the period from September 2016 (1st semester) to August 2019 (6th semester), totalizing three years of experience with the application of PBL. The campus honors the city with the same name and is located in the interior of the state of Bahia, on an artificial island bathed by the São Francisco River, bordering the states of Pernambuco, Alagoas, and Sergipe. This privileged location allows a plurality of students from different states.

The PBL applied at this institution consisted of a strongly systematized approach to solving problems, by applying pre-established steps and sequences in a script adapted from the work published by Mamede and Penaforte (2001). The method was used in two presential moments (opening and closing), which were entitled tutorial sessions and occurred weekly over a semester. The sessions were composed of a maximum of 12 students and a tutor teacher. At each tutorial session, a coordinating student and a secretary student were defined, as

indicated by the tutor teacher or through the student's free choice. So, during the semester, the roles of coordinator and secretary were reversed among the group of students.

After these definitions, the tutor teacher delivered the problem-situation to everyone. The students analyzed, discussed, and proposed a resolution for each of the problem-situations addressed in each period of the course. Approximately 13 problem-situations relevant to the theoretical and practical knowledge of medical training were worked on each semester. The elements, participants, and step by step of the tutorial session are described in Figure 1 and Table 1, respectively.

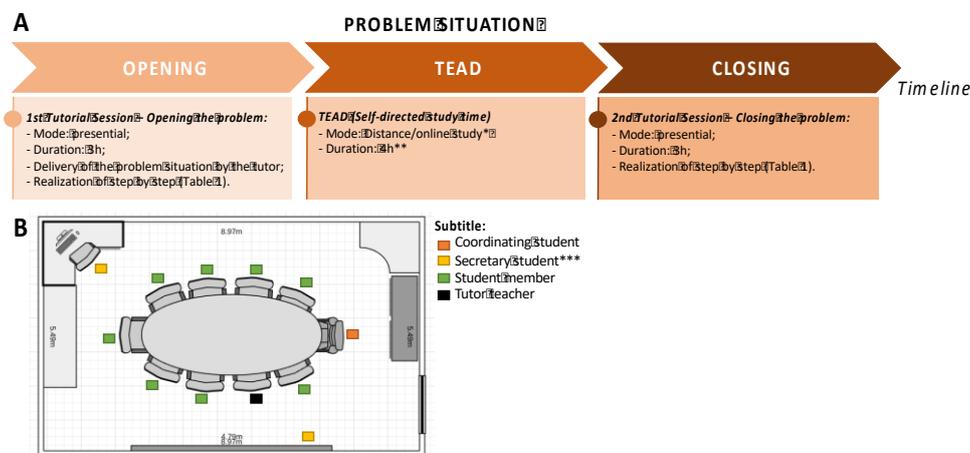


Figure 1 – Timeline of application (A) and participants (B) of the Problem-based Learning (PBL)

*TEAD⁷ can be performed in any space of the university and / or in the student's own home.

**TEAD depends on the particularities of each student. However, the curriculum includes a period of 4 hours per week for the TEAD.

*** The secretary student can participate using the computer with the datashow, whiteboard or digital whiteboard.

Source: created by the authors, 2019.

The problem-situations worked represented authentic or applicable situations, created from professional practice and/or diseases prevalent in SUS. Texts, pictures, and videos were used as support resources in the student's performance. The problems were carefully elaborated and/or revised by the tutors, in such a way that the themes present in them, guided and directed the students in the construction of the objectives and, therefore, in the content to be studied. In this way, the questions presented in the tutorial sessions were inherent to the contents of the curricular matrix from the 1st to the 3rd year of the undergraduate medical course at UNIVASF (FEDERAL UNIVERSITY OF VALE DO SÃO FRANCISCO, 2017).

⁷ Self-directed Study Time

Tutorial session	Steps	Meaning
1st Tutorial Session – Opening the problem	1st Step	Read the problem carefully (individually and in groups); identify and clarify unknown terms.
	2nd Step	Identify the themes proposed by the problem.
	3rd Step	Raise previous knowledge about the identified themes, promoting a brainstorm
	4th Step	Develop the synthesis of the brainstorming (1 to 3 sentences).
	5th Step	Establish learning goals.
	6th Step	Feedback: individual evaluation and peer evaluation (coordinator, secretary, other students and the tutor - teacher).
	7th Step	Individual study respecting the established objectives: Self-Directed Study Time (TEAD).
2nd Tutorial Session – Closing the problem	1st Step	Read the problem again (group reading).
	2nd Step	Define the order of discussion of the objectives, if necessary.
	3rd Step	Provide bibliographic references for each learning objective. *
	4th Step	Discuss the objectives studied.
	5th Step	Reading of the objectives proposed by the tutor.
	6th Step	Identify unreached goals and define a pending plan.
	7th Step	Feedback: individual evaluation and peer evaluation (coordinator, secretary, other students and the tutor - teacher).

Table 1 – Steps of the PBL tutorial session applied to the undergraduate medical course, UNIVASF, Paulo Afonso campus

* References can be presented before discussing each objective, so that students can list a specific reference to their respective objective.

Source: created by the authors, 2019.

RESULTS AND DISCUSSION

This report presents the experience and perceptions, based on the on-site observations, of two students (D1, D2) of the undergraduate medical course. each semester a new tutor with training in the health area was assigned to the group. this allowed contact with different professionals with backgrounds in biology, biomedicine, nursing, medicine, and dentistry. The tutors had a higher level of education with a doctorate (62.5%) or post-doctorate (12.5%). Of the 12 tutors (one per semester) involved in the training of the two students, only one (12.5%) was graduated in medicine, whose maximum degree was a specialist. The distribution of students followed a rotation, which allowed them to get to know each other and get closer to the class during these three years of course. The minimum and the maximum number of students who composed the tutorial sessions were 8 and 12 subjects, respectively.

The arrival: immersion in active learning methodologies

Active learning methodologies were integrated into the Medicine course as of the 2014 DCN (BRASIL, 2014), however, few students know the method and/or were trained through it in basic education. After entering the HEI, the main expectation of the student refers to the

adjustment in the university environment. Most of the time, this adjustment involves multidimensional aspects, which include: change of municipality, distancing from the family members and the group of friends, among others (SOUZA; FRANCO, 2018). Due to these factors, it is common for students not to be interested and/or research on the teaching method of HEI, which can represent a great challenge or even impose a limitation on students in their cognitive development, since they are unable to adapt quickly turns to active learning methodologies. Corroborating these findings, a study published by Igarashi, Hamamoto and Santos (2018) demonstrated that, at the Faculty of Medicine of Marília (FAMEMA), students, when comparing the method used in the Systematized Educational Unit (UES) with the traditional teaching method, showed a greater weakness in the understanding of PBL, the basis for UES.

These difficulties also show reflexes of the mastery of traditional teaching methods in the pre-academic training of the student, which is linked to passive learning, centered on the teacher and the transmission of knowledge (MAMEDE; PENAFORTE, 2001). Thus, many times, the subject arrives at the HEI without prior knowledge of the methodology covered in the medical course, which intensifies the strangeness in face of PBL and the delay in relation to an adaptation. The difficulties encountered are clear in a statement by a medical student at a private college in Minas Gerais: “We also come from a culture of not having studies of this type. We are used to people giving classes and we are only receiving information” (TEIXEIRA; ALMEIDA; AGUILAR-DA-SILVA, 2018, p. 23). Furthermore, a study published by Torres, Sampaio and Caldeira (2019) also suggests that the immaturity inherent at young age may also contribute to the difficulty of adapting to the new teaching method.

Against this thought, entry into UNIVASF, through a transfer of course between federal universities, was the object of choice for student D1, precisely because of the innovation in the teaching method, when employing active methodologies in the Medicine curriculum. This choice was fostered by information collected from other HEIs, websites, experience reports from teachers, students, among others. On the other hand, student D2 was unaware of the active methodologies and this was a surprise and a great challenge since until then no previous contact had occurred with this form of teaching-learning. Although there was resistance, during the first weeks of class the questions and doubts gained strength and voice, ceasing to be just uncertainties. To remedy them, the institution promoted Freshman Week which, among other activities, held a dialogue between veterans, teachers, and coordination to present the curriculum structure and the learning method worked on in the medical course.

PBL being integrated into the formation of university students

Although in theory, PBL is easy to understand, in practice it was not simple to understand and/or get used to it, especially for students who were already used to the traditional lecture,

a reality that permeates the vast majority of centers of high school (SOUZA; DOURADO, 2015). The first practical contact with PBL took place through a simulation of the tutorial session, held in the first week of class, whose title was “Problem 0: Problem-Based Learning, what now?”. This simulation followed the steps of the PBL applied at the institution and, as a way of making the student more familiar with the method, two veterans were invited to participate in the simulation as coordinator and secretary. Furthermore, the teaching tutor also participated as a facilitator of the learning process. Although the simulation was important to glimpse the method, the step by step of the tutorial session and its importance was only really understood with the repetition of PBL throughout the 1st semester.

PBL is a methodology that breaks paradigms and concepts, as it deconstructs the idea that the teacher is the center of the teaching-learning process and transfers this position to the student (MACEDO et al., 2018). In this type of methodology, the teacher positions himself as a mediator between knowledge and students and, therefore, they are guided to actively build their knowledge, together with their partners in this process (DIESEL; BALDEZ; MARTINS, 2017). Thus, it is likely to consider that PBL is a formative method, and not merely informative like traditional pedagogical practices, as it stimulates an active attitude of the student in search of knowledge (SAKAI; LIMA, 1996). According to Berbel (1998), several medical schools in Brazil were studying adopting PBL as a teaching method in their curriculum even before the publication of the DCN of the undergraduate medical course in 2001 (BRASIL, 2001), which demonstrates that the search for brand new models of production and organization of knowledge has been a present demand ever since.

In the 1st semester, PBL was one of the major obstacles for students in the academic experience, once there were many questions about the depth of the appropriate level in relation to the content. Also, as it is a heterogeneous group, students had difficulties in entering the discussions and, consequently, there was polarization in the discussion by two or three students. Nevertheless, with the passing of the semesters, the built relationships and familiarization with the method allowed more active and equal participation among them. The same could be observed by Torres, Sampaio and Caldeira (2019), who perceived a high degree of difficulties, uncertainties and anguishes, brought by students who enter the active methodologies. Doubts about the source and / or database that should be used in the search for knowledge ar added to these obstacles. I summary, these conclusions confirm that, when entering the HEI, students are not fully prepared to exercise the autonomy required by the method.

PBL impacts on student and professional training

According to Gomes and Rego (2011), there are a few experiences of checking the results of curricular changes in Brazil specifically focused on the impacts of PBL according to the

student's perspective, and international works that deal with this theme are more easily found. However, some studies that evaluated PBL and the conceptions of both teachers and students about it were carried out at the Faculty of Medicine of Marília (FAMEMA), which since 1997 started a process of implementing PBL in its curriculum. The first study confirms that the teaching-learning and professional practice context is dynamic and full of contradictions and different opinions, and that:

These students showed, with such feelings, the lack of understanding of the roles of teachers in this curriculum and teaching-learning method, which could still reveal the need for greater training of teachers in new roles (MORAES; MANZINI, 2006, p. 129).⁸

The second study reported the experience of the Educational Unit of the Endocrinological System (UESE), which took place during the second semester of the medical course at FAMEMA. The comments made in the unit's evaluations demonstrated the need for greater reflections on the steps of the tutorial process by students and tutors, pointing out that PBL has both achievements and weaknesses, but that the biological paradigm of Medicine must be broken every day (TSUJI; AGUILAR-DA-SILVA, 2004).

The study of Costa et al. (2011) showed that the incorporation of active methodologies in the medical curriculum stimulated learning and promoted good acceptance among students at the Serra dos Órgãos University Center (UNIFESO - RJ). According to the authors, the students chose to study at the institution, mainly because good references in medical education were given. Even though this choice was not based on changing the curriculum, the study showed positive results in relation to the students' perception of PBL, but it also indicated that improvements in methodologies were still necessary. On the other hand, a study made by Millan *et al.* (2012) showed that students in the traditional curriculum evaluated themselves as better prepared in the social aspects of the disease, medical skills and ethical concepts than those submitted to PBL.

Regarding the Medicine course at UNIVASF, Paulo Afonso campus, for each problem-situation, a coordinator and a secretary were chosen from each tutorial session, both with pre-defined functions. According to Mamede and Penaforte (2001), it is the coordinator's role to guide colleagues in discussing the problem, under the steps of the tutorial session, favoring everyone's participation and keeping the focus on the discussions; discourage the monopolization or polarization of discussions; support the activities of the secretary and respect individual positions, ensuring that they are discussed by the group seriously; demand that the learning objectives are presented by the group in a clear, objective and

⁸ "Esses estudantes mostraram, com tais sentimentos, a não compreensão dos papéis dos docentes neste currículo e método de ensino-aprendizagem, o que ainda poderia revelar a necessidade de maior capacitação dos docentes nos novos papéis" (Translated by the authors).

understandable way and request assistance from the tutor, when necessary. On the other hand, it is a significant function of the secretary to record the discussions and events that took place in each tutorial session, to facilitate the later reading that will be made by the group members; accurately note the learning objectives, and respect the opinions of the group.

All members of the tutorial session took turns as coordinator and secretary, so that, throughout the semester, each student was coordinator and secretary, at least once. This allowed everyone to understand in practice the role and importance of each of them in the teaching-learning process. Besides, at each beginning of the semester, a new rotation of students was accomplished. During the formation of groups, it was sought to balance the number of students regarding possible conflicts of interest and repetitions. The objective was to structure the group in a way to increase equity and productivity since the students' experiences and familiarity could benefit and/or harm some tutoring group. The diversity in the formation of the groups contributed to the development of collaborative and cooperative work, as well as to the training of students in facing adversity, mainly because people have unique personalities and can carry different prior knowledge related to the problem. This heterogeneity encourages the ability to listen, respect the opinion of others and express their ideas in a friendly manner. In professional practice, this strategy aims at training professionals capable of acting and communicating properly with co-workers, multi-professional team, patients, and family members, in order to provide better health care (GOMES *et al.*, 2009; SOUZA; DOURADO, 2015).

The PBL tutorial sessions took place on Tuesdays (opening of the problem situation) and Mondays of the following week (closing of the problem situation), regardless of the semester. This one-week interval between opening and closing provided the student with sufficient time to plan and organize his study schedule, always preserving the minimum time necessary for individual study - Self-Directed Study Time (TEAD).

After defining the coordinator and the secretary, the problems were distributed and the tutorial session got started. Among the steps pertinent to the 1st session, the brainstorming stands out, the 3rd step of the opening problem (TABLE 1). Although all stages are important, the brainstorming was an essential stage for the teaching-learning process of the respective students. The different experiences and familiarity allowed students to reframe the problem situations, establishing connections and increasing their understanding of the complexity of the world around them. Therefore, at that moment, they were motivated to make connections, express and/or find assumptions related to the problem, it was the moment for the "unintentional error" and the "guessing" related to the variety of contents covered.

During this stage, the tutor's sked by the teachers stimulated the critical-reflective process consistent with the proposed method (BOROCHOVICIUS; TORTELLA, 2014). In each semester, the tutors listened carefully to the rain of ideas, asked questions directed to explore and/or

stimulate the students' thinking. Then, the objectives were synthesized and constructed. Between opening and closing, the TEAD was performed. At this point, the subject was able to identify his study needs and, therefore, created his method to absorb the content. It was very common for the student to remember the "unintentional error" and replace it with knowledge based on good arguments, with solid and scientifically proven bases. This tutorial organization (opening - TEAD - closing) has significant importance in the preparation of the medical professional, since, to act in different situations in the health network, whether public or private, the professional needs to develop autonomy and management capacity.

The growing autonomy, granted to the student by the tutor teacher, allowed the student to stimulate critical-reflective thinking, create the learning objectives to be achieved and to search for updated and appropriate bibliographic references concerning the problem-situation. In summary, these actions contribute to the acquisition of knowledge and the strengthening of the interdependence process. Concerning the medical professional, this autonomy affects the identification, analysis and interpretation of the problems of medical practice and their resolution, as well as the proper use of diagnostic and therapeutic procedures, scientifically validated and proven. This result only occurs because discussions about medical training have been rethinking teaching methodologies to adapt them and make them favorable to the profile of the professional who wants to undergraduate (GOMES et al., 2009). Moreover, the administration and management promoted by the work of the secretary and, individually, by the organization of TEAD, fosters the formation of professionals capable of managing and administering both the workforce, physical resources and materials, and that intellectual and scientific production.

During the closing tutorial sessions, all students were encouraged to discuss and recall the information discussed in the brainstorming and, when necessary, to make the needed corrections. At the end of this process, the tutors read the official objectives and, if any objective was not contemplated, it entered as a pending item for the next tutorial session. The complexity of the problems increased each semester, as well as allowing the student to review topics at different levels of depth. According to Moran (2018, p. 2), "learning is active and meaningful when we move in a spiral, from simpler levels to more complex knowledge and competence in all dimensions of life". Summarizing, students perceive themselves as builders of their learning, capable of learning to learn. That is, they identify previous knowledge, develop curiosity, formulate questions to search for scientifically consolidated answers and critically evaluate the information obtained from different types of sources.

Although the level of difficulty of problem-situations, over the semesters, was increasingly complex, comprehension and understanding were factors that influenced the absence of pending issues. The construction of the problem-situations was accomplished by the tutors, based on the problems relevant to the Brazilian and/or local population. In this way, the

problems promoted integration and interdisciplinarity in coherence with the curriculum development axis, seeking to integrate the biological, social, psychological and environmental dimensions. Moreover, we sought to use different teaching-learning scenarios allowing the student to know and experience different life situations, the organization of practice and multi-professional teamwork. Moran also agrees that:

active learning increases our cognitive flexibility, which is the ability to alternate and perform different tasks, mental operations or goals and to adapt to unexpected situations, overcoming rigid mental models and inefficient automatisms (MORAN, 2018, p. 3).⁹

Finally, the importance of providing feedback at the end of the opening and closing of the tutorial sessions is emphasized. Initially, the feedback was seen as a programmed element, which did not need much attention from the students. However, throughout the semesters, it came to be considered an important element in the construction of knowledge. It is through him that the tutor teacher, coordinating student, student secretary and other members of the tutorial session express feedback on the problem and their role as a tutor, coordinator, secretary and member of the tutorial session. This constructive criticism was a primary instrument for growth and improvements in the student's teaching-learning process. Currently, this return is seen as essential in the application of PBL, as it allows individual and collective maturation through the assessment of skills and performance, identifying strengths and those that need improvement. This ability to receive and make constructive self-criticisms allows the professional to perform in a more qualified way health care and attention service. In this sense, he is more prepared to identify deficiencies and, consequently, to enable reformulations and improvement in his work and in the development of future actions.

PBL Infrastructure

The infrastructure of a tutoring room is very different from that of a traditional classroom but adequate for students to be more participatory. The tutoring room is basically composed of a circular table and a maximum of 13 chairs arranged around of it. This configuration allows for comfort and horizontality in the speech, especially with the tutor, who matches the figure of the student. In addition, it awakens responsibility, security, autonomy and satisfaction for sharing the findings with colleagues. It is an alternative to chairs in a row, stimulating critical thinking and a sense of collectivity. Not having the teacher as the "center of attention" at all times is also something new; it is as if everyone (students and teacher) deserves attention from the moment they start articulating, and this encourages the search for their space of speech during the discussions. The tutoring room can also include differentiated audiovisual

⁹ "a aprendizagem ativa aumenta a nossa flexibilidade cognitiva, que é a capacidade de alternar e realizar diferentes tarefas, operações mentais ou objetivos e de adaptar-nos a situações inesperadas, superando modelos mentais rígidos e automatismos pouco eficientes" (Translated by the authors).

technology, such as anatomy artifacts, digital whiteboard or whiteboard, computer and a projector. The availability of these elements offers greater possibilities for learning, because as described by Moran:

A deeper learning requires frequent practice spaces (learning by doing) and environments rich in opportunities. For this reason, it is important to stimulate multisensory and enhance the students' prior knowledge to 'anchor' new knowledge (MORAN, 2018, p. 3).¹⁰

The role of the tutor

The role of the tutor teacher in the development of the tutorial session is quite different from the role of the teacher in traditional lectures (ALMEIDA; BATISTA, 2013). Their participation has a direct influence on the operability of the tutorial session and, therefore, on the construction of learning objectives by students. Over these three years, all tutors have participated adequately in opening and closing problem situations. In general, the student's self-learning was stimulated by the teachers' performance. Regardless of the original training and/or training in active learning methodologies, the proactiveness of the tutor teacher was the factor that most contributed to the development of critical thinking, the rescue and articulation of concepts/ideas and the encouragement of reasoning. In addition, the autonomy promoted by them, especially about the formation of learning objectives, strengthened confidence and promoted a more pleasant and satisfying environment for students' learning. This support allowed students to think for themselves, without fear of making mistakes, since "unintentional error" is part of the teaching-learning process (BERBEL, 2011).

On contrary to what happens in traditional classes, the teacher is no longer responsible for the transmission of knowledge and becomes a learning facilitator (MARTINS; FALBO NETO; SILVA, 2018). This represents an important step towards the construction of new learning by the student since the tutor/teacher is the main responsible for challenging and encouraging the student to seek information to solve the problem situations. In other words, the student is encouraged by the tutor teacher to "think outside the box" and take responsibility for his learning.

However, it was possible to identify that those with specific training in the thematic area of the problem situation induced in the students greater resourcefulness in the opening and closing of the tutorial sessions. This domain of content allowed the tutor teacher to elaborate questions and list knowledge with greater ease and, therefore, collaborate so that learning would happen with greater fluidity. Together, these results suggest that the educator's

¹⁰ "a aprendizagem mais profunda requer espaços de prática frequentes (aprender fazendo) e de ambientes ricos em oportunidades. Por isso, é importante o estímulo multissensorial e a valorização dos conhecimentos prévios dos estudantes para 'ancorar' os novos conhecimentos" (Translated by the authors).

performance is not linked to his original training or training in the application of methodologies, but with the tutor's affinity with the content addressed in problem situations. PBL contributions to the training of students are briefly described in Table 2.

PBL elements	Features
Chairs arranged around the circular table	It optimizes the environment, increases fluidity and allows everyone to socialize.
Approach of everyday themes in the problem-situation	It allows us to know problems that are pertinent to the Brazilian and / or local population.
Integrality and interdisciplinarity of the problem-situation	It allows a comprehensive approach to the patient, listing biopsychosocial aspects, the integration of content with other areas of knowledge, as well as the inseparability between theory and practice.
Coordinator's role	It allows the development of leadership skills, which are exercised in the horizontality of relationships and involves compromise, commitment, responsibility, empathy, ability to make decisions, interaction, participation and dialogue, seeking the well-being of the group.
Secretary's role	It allows the development of the capability of organization and management, registration, regularity and authenticity of the sessions.
PBL Operationality	It allows the development of skills and competences related to autonomy, learning to learn, communication, cooperative and collaborative work and feedbacks: <ul style="list-style-type: none"> • Autonomy: allows the student to participate in decision making, in order to formulate his own ideas, search for knowledge, formulate learning objectives, etc. • Learning to learn: allows students to identify previous knowledge, develop curiosity, formulate questions to search for scientifically consolidated answers and critically evaluate the information obtained from different types of sources. • Cooperative and collaborative work: allows the exchange of knowledge between group members to discuss problems, stimulates the improvement of collaboration and quality in solving problem-situations. • Communication: allows the development of human relationships in a clear, objective way and that the ideas are understandable despite the diversity of the students involved. • Feedbacks: allow to identify the strengths and the points that need to be improved, being a primordial instrument for the growth and improvements in the student's teaching-learning process.

Table 2 – Correlation of the elements that make up PBL and their contributions to medical formation and practice

Source: created by the authors, 2019.

FINAL CONSIDERATIONS

The experiences provided by the application of PBL resulted in a more autonomous, collaborative and cooperative learning. This has repercussions on the students' self-confidence and, consequently, makes them more prepared to mobilize knowledge and develop the capacity to manage information relevant to the resolution of real problems. Also, the development of skills and competences related to communication provided greater security concerning its positioning in other environments, such as the student's contact with the community in which he is inserted and the exchange of knowledge with professionals in the Health area - and other areas - working in Family Health Units, hospitals and the university itself. Therefore, the PBL adds a satisfactory experience, since the set of elements that participate in the method (operational, structural and pedagogical) stimulate the student to prepare more adequately to face the challenges proposed by the job market, which requires the ability to articulation, creativity, leadership profile, group work and empathy, regardless of the audience involved. Finally, the limited number of students who reported their experience with the ABP method in the UNIVASF Medicine course, Paulo Afonso campus stands out as a limitation of the article. However, this type of study offers possibilities to know and understand a certain reality, and how it has influenced the teaching-learning process of these students. Therefore, it provokes the need for more in-depth research, which can contribute to the production of knowledge in the areas of Education and Teaching in Health.

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REFERENCES

ALMEIDA, Enedina Gonçalves; BATISTA, Nildo Alves. Desempenho docente no contexto PBL: essência para aprendizagem e formação médica. *Revista Brasileira de Educação Médica*, Rio de Janeiro, v. 37, n. 2, p. 192-201, jun. 2013. Disponível em: <https://www.scielo.br/pdf/rbem/v37n2/06.pdf>. Acesso em: 2 fev. 2020.

BERBEL, Neusi Aparecida Navas. A problematização e a aprendizagem baseada em problemas: diferentes termos ou diferentes caminhos?. *Interface (Botucatu)*, Botucatu, v. 2, n. 2, p. 139-154, fev. 1998. Disponível em:

https://www.scielo.br/scielo.php?script=sci_arttext&pid=S1414-32831998000100008.
Acesso em: 14 jun. 2020. DOI: <https://doi.org/10.1590/S1414-32831998000100008>.

BERBEL, Neusi Aparecida Navas. As metodologias ativas e a promoção da autonomia de estudantes. *Semina: Ciências Sociais e Humanas*, Londrina, v. 32, n. 1, p. 25-40, jan./jun. 2011. Disponível em:

<http://www.uel.br/revistas/uel/index.php/seminasoc/article/view/10326/10999>. Acesso em: 15 ago. 2019. DOI: <http://dx.doi.org/10.5433/1679-0383.2011v32n1p25>.

BOROCHOVICIUS, Eli; TORTELLA, Jussara Cristina Barboza. Aprendizagem Baseada em Problemas: um método de ensino-aprendizagem e suas práticas educativas. *Ensaio: Avaliação e Políticas Públicas em Educação*, Rio de Janeiro, v. 22, n. 83, p. 263-294, jun. 2014. Disponível em: <https://www.scielo.br/pdf/ensaio/v22n83/a02v22n83.pdf>. Acesso em: 15 jun. 2020. DOI: <http://dx.doi.org/10.1590/S0104-40362014000200002>.

BRASIL. Ministério da Educação. Conselho Nacional de Educação. Câmara de Educação Superior. Resolução CNE/CES nº 4, de 7 de novembro de 2001. Diretrizes Curriculares Nacionais do Curso de Graduação em Medicina. *Diário Oficial da União*: seção 1, Brasília, p. 38, 9 nov. 2001.

BRASIL. Ministério da Educação. Conselho Nacional de Educação. Câmara de Educação Superior. Resolução CNE/CES nº 3, de 20 de junho de 2014. Diretrizes Curriculares Nacionais do Curso de Graduação em Medicina. *Diário Oficial da União*: seção 1, Brasília, p. 8-11, 2014.

CEZAR, Pedro Henrique Netto; GUIMARÃES, Francisco Tavares; GOMES, Andréia Patrícia; ROÇAS, Giselle; SIQUEIRA-BATISTA, Rodrigo. Transição paradigmática na educação médica: um olhar construtivista dirigido à aprendizagem baseada em problemas. *Revista Brasileira de Educação Médica*, Rio de Janeiro, v. 34, n. 2, p. 298-303, jun. 2010. Disponível em: <https://www.scielo.br/pdf/rbem/v34n2/a15v34n2.pdf>. Acesso em: 26 ago. 2019. DOI: <https://doi.org/10.1590/S0100-55022010000200015>.

COSTA, José Roberto Bittencourt; ROMANO, Valéria Ferreira; COSTA, Rosane Rodrigues; GOMES, Andréia Patrícia; SIQUEIRA-BATISTA, Rodrigo. Active teaching-learning methodologies: medical students' views of problem-based learning. *Revista Brasileira de Educação Médica*, Rio de Janeiro, v. 35, n. 1, p. 13-19, mar. 2011. Disponível em: https://www.scielo.br/scielo.php?script=sci_arttext&pid=S0100-55022011000100003. Acesso em: 15 jun. 2020. DOI: <https://doi.org/10.1590/S0100-55022011000100003>.

DIESEL, Aline; BALDEZ, Alda Leila Santos; MARTINS, Silvana Neumann. Os princípios das metodologias ativas de ensino: uma abordagem teórica. *Revista Thema*, Pelotas, v. 14, n. 1, p. 268-288, 2017. Disponível em: <http://periodicos.ifsul.edu.br/index.php/thema/article/view/404/295>. Acesso em: 05 set. 2019. DOI: <http://dx.doi.org/10.15536/thema.14.2017.268-288.404>.

FARIAS, Pablo Antonio Maria de; MARTIN, Ana Luiza de Aguiar Rocha; CRISTO, Cinthia Sampaio. Aprendizagem ativa na Educação em Saúde: percurso histórico e aplicações. *Revista Brasileira de Educação Médica*, Rio de Janeiro, v. 39, n. 1, p. 143-150, mar. 2015.

Disponível em: <https://www.scielo.br/pdf/rbem/v39n1/1981-5271-rbem-39-1-0143.pdf>.
Acesso em: 20 ago. 2019. DOI: <https://doi.org/10.1590/1981-52712015v39n1e00602014>.

GOMES, Romeu; BRINO, Rachel de Faria; AQUILANTE, Aline Guerra; AVÓ, Lucimar Retto da Silva de. Aprendizagem Baseada em Problemas na formação médica e o currículo tradicional de Medicina: uma revisão bibliográfica. *Revista Brasileira de Educação Médica*, Rio de Janeiro, v. 33, n. 3, p. 444-451, set. 2009. Disponível em: https://www.scielo.br/scielo.php?script=sci_arttext&pid=S0100-55022009000300014&lng=en&nrm=iso. Acesso em: 15 jun. 2020. DOI: <https://doi.org/10.1590/S0100-55022009000300014>.

GOMES, Andréia Patrícia; REGO, Sergio. Transformação da educação médica: é possível formar um novo médico a partir de mudanças no método de ensino-aprendizagem?. *Revista Brasileira de Educação Médica*, Rio de Janeiro, v. 35, n. 4, p. 557-566, dez. 2011. Disponível em: https://www.scielo.br/scielo.php?pid=S0100-55022011000400016&script=sci_abstract&tlng=pt. Acesso em: 10 jun. 2020. DOI: <https://doi.org/10.1590/S0100-55022011000400016>.

IGARASHI, Fernanda de Oliveira; HAMAMOTO, Cássia Galli; SANTOS, Ione Ferreira. Processo ensino-aprendizagem: compreensão de estudantes de um curso de Medicina sobre a Aprendizagem Baseada em Problemas. *Ciaiq - Investigação Qualitativa em Educação*, São Paulo, v. 1, n. 1, p. 772-781, 2018. Trabalho apresentado no 7º Congresso Ibero-Americano em Investigação Qualitativa (CIAIQ), 2018, Fortaleza. Disponível em: <https://proceedings.ciaiq.org/index.php/ciaiq2018/article/view/1706>. Acesso em: 27 ago. 2019.

MACEDO, Kelly Dandara da Silva; ACOSTA, Beatriz Suffer; SILVA, Ethel Bastos da; SOUZA, Neila Santini de; BECK, Carmem Lúcia Colomé; SILVA, Karla Kristiane Dames da. Active learning methodologies: possible paths to innovation in health teaching. *Escola Anna Nery*, Rio de Janeiro, v. 22, n. 3, 2018. Disponível em: https://www.scielo.br/scielo.php?script=sci_arttext&pid=S1414-81452018000300704. Acesso em: 8 dez. 2019. DOI: <https://doi.org/10.1590/2177-9465-ean-2017-0435>.

MAMEDE, S.; PENAFORTE, J. C. *Aprendizagem baseada em problemas: anatomia de uma nova abordagem educacional*. Fortaleza: Hucitec, 2001.

MARTINS, Antonio Carlos; FALBO NETO, Gilliatt; SILVA, Fernando Antonio Menezes da. Características do tutor efetivo em ABP: uma revisão de literatura. *Revista Brasileira de Educação Médica*, Brasília, v. 42, n. 1, p. 105-114, jan. 2018. Disponível em: <https://www.scielo.br/pdf/rbem/v42n1/0100-5502-rbem-42-01-0105.pdf>. Acesso em: 2 fev. 2020. DOI: <https://doi.org/10.1590/1981-52712018v42n1rb20160100>.

MILLAN, Laís Pereira Bueno; SEMER, Beatriz; RODRIGUES, José Mauro da Silva; GIANINI, Reinaldo José. Traditional learning and problem-based learning: self-perception of preparedness for internship. *Revista da Associação Médica Brasileira*, São Paulo, v. 58, n. 5, p. 594-599, out. 2012. Disponível em: <https://www.scielo.br/scielo.php?pid=S0104->

42302012000500018&script=sci_arttext&tlng=en. Acesso em: 15 jun. 2020. DOI:
<https://doi.org/10.1590/S0104-42302012000500018>.

MORAES, Magali Aparecida Alves de; MANZINI, Eduardo José. Concepções sobre a aprendizagem baseada em problemas: um estudo de caso na Famema. *Revista Brasileira de Educação Médica*, Rio de Janeiro, v. 30, n. 3, p. 125-135, dez. 2006. Disponível em: https://www.scielo.br/scielo.php?pid=S0100-55022006000300003&script=sci_abstract&tlng=pt. Acesso em: 10 jun. 2020. DOI: <https://doi.org/10.1590/S0100-55022006000300003>.

MORAN, José. Metodologias ativas para uma aprendizagem profunda. In: BACICHI, Lilian; MORAN, José (org.). *Metodologias ativas para uma educação inovadora: uma abordagem teórico-prática*. Porto Alegre: Penso, 2018.

OLIVEIRA, Bruno Luciano Carneiro Alves de; LIMA, Sara Fiterman; PEREIRA, Marina Uchoa Lopes; PEREIRA JÚNIOR, Gerson Alves. Evolução, distribuição e expansão dos cursos de Medicina no Brasil (1808-2018). *Trabalho, Educação e Saúde*, Rio de Janeiro, v. 17, n. 1, p. 1-20, 2019. Disponível em: <https://www.scielo.br/pdf/tes/v17n1/0102-6909-tes-17-1-e0018317.pdf>. Acesso em: 22 ago. 2019. DOI: <https://doi.org/10.1590/1981-7746-sol00183>.

PIMENTEL, Nara. As Tecnologias de Informação e Comunicação (TIC) no ensino superior: a utopia da inovação pedagógica e da modernização. *Revista de Educação Pública*, Cuiabá, v. 25, n. 59/2, p. 476-501, maio/ago. 2016. Disponível em: <https://periodicoscientificos.ufmt.br/ojs/index.php/educacaopublica/article/view/3831>. Acesso em: 14 ago. 2019. DOI: <https://dx.doi.org/10.29286/rep.v25i59/2.3831>.

SAKAI, Marcia Hiromi; LIMA, Gerson Zanetta de. PBL: uma visão geral do método. *Olho Mágico*, Londrina, v. 2, n. 5/6, p. 24-30, nov. 1996.

SMOLKA, Maria Lúcia Rebello Marra; GOMES, Andréia Patrícia; SIQUEIRA-BATISTA, Rodrigo. Autonomia no Contexto Pedagógico: Percepção de Estudantes de Medicina acerca da Aprendizagem Baseada em Problemas. *Revista Brasileira de Educação Médica*, Rio de Janeiro, v. 38, n. 1, p. 5-14, mar. 2014. Disponível em: https://www.scielo.br/scielo.php?pid=S0100-55022014000100002&script=sci_abstract&tlng=pt. Acesso em: 27 ago. 2019. DOI: <https://doi.org/10.1590/S0100-55022014000100002>.

SOUZA, Laura Augusto de; FRANCO, Sergio Roberto Kieling. Adaptação do jovem à universidade e o impacto no bem-estar psicológico do estudante de Licenciatura em Pedagogia. *Saúde em Redes*, Porto Alegre, v. 4, n. 2, p. 59-69, 2018. Disponível em: <http://revista.redeunida.org.br/ojs/index.php/rede-unida/article/view/883>. Acesso em: 8 nov. 2019.

SOUZA, S. C.; DOURADO, L. Aprendizagem Baseada em Problemas (ABP): um método de aprendizagem inovador para o ensino educativo. *HOLOS*, v. 5, p. 182-200, out. 2015. Disponível em: <http://www2.ifrn.edu.br/ojs/index.php/HOLOS/article/viewFile/2880/1143>. Acesso em: 14 jun. 2020. DOI: <https://doi.org/10.15628/holos.2015.2880>.

TAKENAMI, Iukary Oliveira; PALÁCIO, Maria Augusta Vasconcelos; ANDRADE, Wellen Zane Nunes; CANSANÇÃO, Isaac Farias. Uso das metodologias ativas de aprendizagem em instituições de ensino médico no Nordeste brasileiro. *Revasf*, Petrolina v. 8, n. 17, p. 22-38, dez. 2018. Disponível em:

<https://www.periodicos.univasf.edu.br/index.php/revasf/article/view/239>. Acesso em: 12 set. 2019.

TEIXEIRA, Luciana Scapin; ALMEIDA, Leandro; AGUILAR-DA-SILVA, Rinaldo. Mudança curricular e de métodos pedagógicos: impacto vivenciado por estudantes de Medicina. *Revista de Estudios e Investigación En Psicología y Educación*, v. 5, n. 1, p. 19-28, 2018. Disponível em:

http://repositorium.sdum.uminho.pt/bitstream/1822/56996/1/Mudan%C3%A7a%20curricular%20e%20de%20m%C3%A9todos%20pedag%C3%B3gicos_Impacto%20vivenciado%20por%20estudantes%20de%20Medicina.pdf. Acesso em: 20 nov. 2019. DOI:

<https://doi.org/10.17979/reipe.2018.5.1.3349>.

TORRES, Vânia; SAMPAIO, Cristina Andrade; CALDEIRA, Antônio Prates. Ingressantes de cursos médicos e a percepção sobre a transição para uma aprendizagem ativa. *Interface (Botucatu)*, Botucatu v. 23, p. 1-16, 2019. Disponível em:

https://www.scielo.br/scielo.php?pid=S1414-32832019000100203&script=sci_arttext&tlng=pt. Acesso em: 20 nov. 2019. DOI:
<http://dx.doi.org/10.1590/interface.170471>.

TSUJI, Hissach; AGUILAR-DA-SILVA, Rinaldo. Relato de Experiência de Um Novo Modelo Curricular: Aprendizagem Baseada em Problemas, Implantada na Unidade Educacional do Sistema Endocrinológico na 2ª Série do Curso Médico da Faculdade de Medicina de Marília - FAMEMA. *Arquivos Brasileiros de Endocrinologia & Metabologia*, São Paulo, v. 48, n. 4, p. 535-543, ago. 2004. Disponível em: https://www.scielo.br/scielo.php?pid=S0004-27302004000400015&script=sci_abstract&tlng=pt. Acesso em: 15 jun. 2020. DOI:
<https://doi.org/10.1590/S0004-27302004000400015>.

UNIVERSIDADE FEDERAL DO VALE DO SÃO FRANCISCO. *Projeto Político Pedagógico do Curso de Graduação em Medicina*. Paulo Afonso, BA: UNIVASF, 2017. Disponível em:

<http://portais.univasf.edu.br/medicina-pa/medicina-pa/documentos-e-normas/ppc-medicina-univasf-campus-paulo-afonso-ba.pdf>. Acesso em: 20 jun. 2019.

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