RBECT
Revista Brasileira de Ensino de Ciência e Tecnologia

Revista Brasileira de Ensino de Ciência e Tecnologia
ISSN: 1982-873X

https://periodicos.utfpr.edu.br/rbect

Possibilities and challenges of Project-Based Learning in Professional and Technological Education from Teachers' Perspectives[1]

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ABSTRACT

This study presents the contributions of Project-Based Learning (PBL) in Professional and Technological Education (PTE) from the perspectives of teachers. To this end, a workshop on PBL was held, with eight participants active in PTE over three meetings, held on Saturday mornings, totaling ten hours, in which it was possible to Learn about and experience the stages of PBL. The methodology used is of an applied nature, with exploratory objective, qualitative approach and participant research method, with data collected through a questionnaire. As this is a qualitative research, the content analysis technique was chosen. The main results highlight the potential of PBL, evidenced through the participation and direct experience of this methodology, including collaboration, cooperation, engagement, autonomy and meaningful learning. It is concluded that the use of PBL in PTE privileges pedagogical practice, developing a guiding and mediating profile, giving new meaning to learning spaces. The teachers' perception was that the possibilities outweigh the existing challenges, especially when considering the value of more dynamic and attractive classes. In addition, it encourages students, enabling them to prepare proactive professionals with team spirit.

KEYWORDS: Active methodologies. Pedagogical practices. Student proactivity. Meaningful learning. Collaboration.

1 INTRODUCTION

In Professional and Technological Education (PTE), there is a lack of pedagogically qualified professionals for the the profession. (SANTOS, 2022, p. 18). Many are administrators, accountants, psychologists, however, there are bachelor's degree holders without pedagogical training, a degree or equivalent. According to Abreu (2009)

> Pedagogical training is still neglected by public policies and by many technical education teachers. Teachers who contribute to this thinking believe that they have mastered the practice for years when they repeat it when they enter the classroom (ABREU, 2009, p. 7).

Thus, it is essential for teachers to understand that constant Search for teaching strategies is indeed necessary to bridge the gap beteen education and work, establishing the necessary connections between contente and professional training while teaching.

The correlation between having specific knowledge and lacking pedagogical training may lead these teachers to seek teaching references in their previous school experience. For Tardif (2014, p. 20), "this fact is common to all teachers and, in our view, can also be thought of in relation to non-licensed teachers." In short, in initial training, their teaching experience refers to their experience as a student, because:

> Even before they start teaching officially, teachers already know, in many ways, what teaching is because of all their previous school history. In addition, many studies show that this knowledge inherited from previous school experience is very strong, that it persists over time, and that university education cannot transform it or even hake it (TARDIF, 2014, p. 20).

Teachers who work in the professional training systems "require consistent and coherent training in their internal organization, with regard to the curriculum, objectives, methodologies, and evaluation, that is, pedagogical competence" (JUNGES; SILVA; SCHENA, 2017, p. 167).

The change in mindset occurs through the professional development of teachers, since, due to the busy routine of the school environment, there is often a lack of familiarity and skill with new pedagogical approaches, resulting in hesitation when implementing innovative didactic strategies.

The authors Both and Wildner (2018) expose PTE as an excellent means of inserting active methodologies, considering the purpose of teaching focused on preparing professionals, specificity and practice of each profession. According to these authors, PBL includes information searching, calculations, graphing, inquiries, conversations, reading, data collection and other essential activities for professional practice, transforming content acquired in the classroom into concrete data for problem solving and project implementation.

Giving this, the issue that originated this study was: how to assist bachelor professionals who become PTE teachers in their teaching practice through PBL? Therefore, the general objective was outlined, which aimed to investigate the possibilities and challenges of PBL in PTE, with the specific objective of: To

implement a qualification course through a workshop for PTE teachers using an active teaching methodology focused on PBL.

The purpose was to support teachers in improving their knowledge, both licensed graduates and bachelor's degree holders, through a PBL workshop. This aimed to avoid the repetition of mechanical and disinterested teaching, characterized by predefined approaches that limit the exchange of knowledge and experiences between students and teachers, as well as among education professionals themselves. This approach is in line with the practices expected in PTE.

This study is the result of the dissertation entitled **Active Methodology: Project-Based Learning in Professional and Technological Education** (SANTOS, 2022) which aimed to investigate the contribution of Project-Based Learning (PBL) to teacher training.

2 PROJECT-BASED LEARNING IN VOCATIONAL AND TECHNOLOGICAL EDUCATION

PBL, derived from the English term *Project Based Learning* (PBL), is an active methodology that originated in the early twentieth century through the work of John Dewey, and has been studied by several authors (HERNÁNDEZ, 1998; BECKETT, 2002; VAN, 2006; FRANCO, 2008; BENDER, 2014).

Kilpatrick (1918), one of John Dewey's disciples, a professor at *Columbia Teachers College*, defended, through the book "The Project Method", the use of projects, emphasizing that such activity aroused interest, reinforcing his belief in learning that developed meaning and significance in students' construction and development.

Both highlight in their work that through this model of educational process, it is possible to provide an autonomous and consistent teaching to students, in which, through experience and development of a product, they attribute meaning to learning (BOUTINET, 2002).

PBL is an active teaching approach in which students engage in challenges, tasks, and activities with the goal of solving a project or producing a product. In addition, this methodology integrates diverse knowledge, thus promoting the development of skills. This is due to the fact that the new demands of the labor market demand professionals capable of communicating effectively, coordinating various tasks, making ethical decisions, and working collaboratively as a team (DIESEL; BALDEZ; MARTINS, 2017).

The pedagogical praxis through PBL lead to the construction of democratic, participatory and effective decision-making in the formation of the student as an integral human being. According to Bender, PBL is a technique that aims to:

> Promote the development of projects, centered on an issue, task or problem, to teach academic content to students in the context of cooperative work for problem solving and has been used in practically all subjects and school years, and in adult learning situations (BENDER, 2014, p. 15).

PBL begins with an open question, which the teacher/advisor uses to make the connection between content and current and relevant problems. The central

point of the entire process is a specific question or problem, called an anchor. This anchor is essential as it challenges thinking, encourages imagination and creativity. Soon after, deadlines, the job description, what is expected to be achieved, and the evaluation criteria are provided.

Students are organized into groups or teams, which must be of an appropriate size to deal with the challenges of both the project and the coordination team. These conditions are important for the development of transversal skills, such as teamwork, leadership, project management and communication (VAN; MESQUITA, 2011). PBL, whether in physical or virtual spaces, promotes interdisciplinary discussions, individual or group decisions, hands-on learning, development of critical thinking and problem solving, essential skills for organizational and social daily life.

The characteristics of this method, portrayed by Bender (2014), do not conceive step by step, but topics that deserve to be considered, as listed in Table 1.

Table 1 – Characteristics of PBL

Features	Description
ANCHOR	Introduction and basic information to prepare the ground and generate student interest.
TEAMWORK COOPERATIVE	It is crucial to PBL experiences, emphasized by all proponents to make learning more authentic.
DRIVING QUESTION	It should get the attention of the students, as well as focus their efforts.
FEEDBACK & REVIEW	Structured assistance should be routinely provided by the teacher or within the cooperative teaching process. The comment can be based on the evaluations of the teacher or colleagues.
RESEARCH AND INNOVATION	Within the overarching driving question, the group will need to generate additional questions focused more specifically on the project tasks.
OPPORTUNITIES AND REFLECTION	Creating opportunities for students' reflection within various projects is an aspect emphasized by all PBL proponents.
INVESTIGATION PROCESS	Guidelines can be used for project completion and artifact generation to structure the project. The group can also develop specific timelines and goals for completing aspects of the project.
RESULTS PRESENTED PUBLICLY	PBL projects are intended to be authentic examples of the problems students face in the real world, so some category of public presentation of project results is key within the project.
STUDENT VOICE AND CHOICE	Students should have a voice in some aspects of how the project can be carried out, as well as being encouraged to make choices throughout the execution.

Source: Bender (2014, p. 32).

This is an innovative and at the same time simple teaching modality, as it does not require high costs or significant changes in the physical space of the classroom. In the opposite direction of traditional teaching, it is established in the change of paradigms, from the old teaching focused on the teacher, to teaching centered on the student in the construction of their learning.

It is Based on teamwork, strengthening the personal and professional development of students. According to Vieira (2016):

> Articulating knowledge, experience, sustainability, school, community, environment, etc. has become, in recent years, the objective of innovative pedagogical projects, which translates, in practice, into a collective and solidary work in the organization of teaching and the educational institution, identified by a general vision of education, in a progressive and liberating sense (VIEIRA, 2016, p. 7).

During the execution of the projects, pauses are provided for reflections and discussions, constant feedback, self-evaluation and peer evaluation with other groups and the development of activities to improve ideas.

Unlike a didactic sequence, which transfers the concept and then engage in reinforcement activity, PBL is concerned with the elaboration, preparation and delivery of a product, which is not necessarily physical, and can be composed of a campaign, presentation, a theory, among other possibilities.

3 METHODOLOGY

The present investigative process is characterized as a qualitative research, according to Lüdke and André (2012, p. 12), in this category of research, the "researcher has direct contact [...] with the environment and the situation being investigated", and the naturalness of the environment "is its direct source of data and the researcher is its main instrument" (LÜDKE; ANDRÉ, 2012, p. 12).

The nature of this research is classified as applied because it seeks to generate knowledge with the objective of solving specific problems (ZAMBERLAN, 2014), as evidenced by the question: how to provide support to professionals with a bachelor's degree who start a teaching career in Professional and Technological Education (PTE) to develop their professional practices? According to Flick (2013, p. 20), applied research is understood as "the development or testing of theories in practical fields" considering that "it aims to generate knowledge, for practical application, aimed at solving specific problems".

From the perspective of objectives, it was an exploratory research providing familiarity, conviviality with the field of study, in this case, the EFA professors of the subsequent technical course in administration. Gil (2010, p. 41) clarifies that:

> These studies aim to provide greater familiarity with the problem, with a view to making it more explicit or building hypotheses [...]. In most cases, these researches involve: (a) bibliographic survey; (b) interviews with people who have had practical experience with the researched problem; and (c) analysis of examples that stimulate understanding.

Exploratory research involves a literature review and interviews with participants. It provides a certain degree of familiarity with the problem Giving this

fact, it is understood that this research has an exploratory bias, considering the intervention of the researcher in the diagnosis of the research problem, and the professors (collaborators) participated in this work.

According to Silva and Menezes (2005, p. 22), the participatory research method was chosen, which "develops from the interaction between researchers and members of the situations investigated", which aims to promote social participation for the benefit of the research participants.

After obtaining the approval of the ethics committee of the Federal Technological University of Paraná, according to CAAE: 46725021.3.0000.5547 of July 13, 2021, those involved received invitations via email and gave their consent online by signing a Free and Informed Consent Form (ICF).

In the PBL workshop for teachers, a group of eight participants, working in PTE , was designated as P1, P2, and so on to preserve their anonymity throughout the study. The workshop took place in three sessions on Saturday mornings, on August 21 and 28, and September 4, 2021, totaling 10 hours of duration via Google Meet. During these meetings, the participants, professors working in the technical course in administration at a state school in Curitiba, Paraná, had the opportunity to explore and experience the stages of PBL. These stages were experienced by the participating teachers, as shown in Table, and each meeting addressed two of the stages of the PBL project.

Table 2 – Structure of the PBL workshop

MEETINGS	DATE AND DURATION	STAGES OF PBL	WORKSHOP PLANNING	INTENDED OUTCOMES OF LEARNING
1st Meeting	Aug 21 4 hours	1st Introduction and Planning	• Application of the initial questionnaire • Introduction to Active Methodology • Principles of Project-Based Learning	• Know the proposal of the active methodology and the objectives of project-based learning;
		2nd Initial research and information gathering	• Sharing and exchange of ideas among teachers about their respective areas and possible common themes;	• Generate reflections on the current didactics used in the classroom, and the challenges of the teaching profession in EFA.
2nd Meeting	Aug 28 3 hours	3rd Creation, development, initial evaluation.	• Definition of teams;	• List the needs of the EFA teacher based on reflections on current demands.
		4th Second phase of the research	• Construction of the theme that will cover all disciplines (with planning of activities and	• To facilitate the use of PBL in an integrated way with the curricular proposal of the different subjects of the EFA

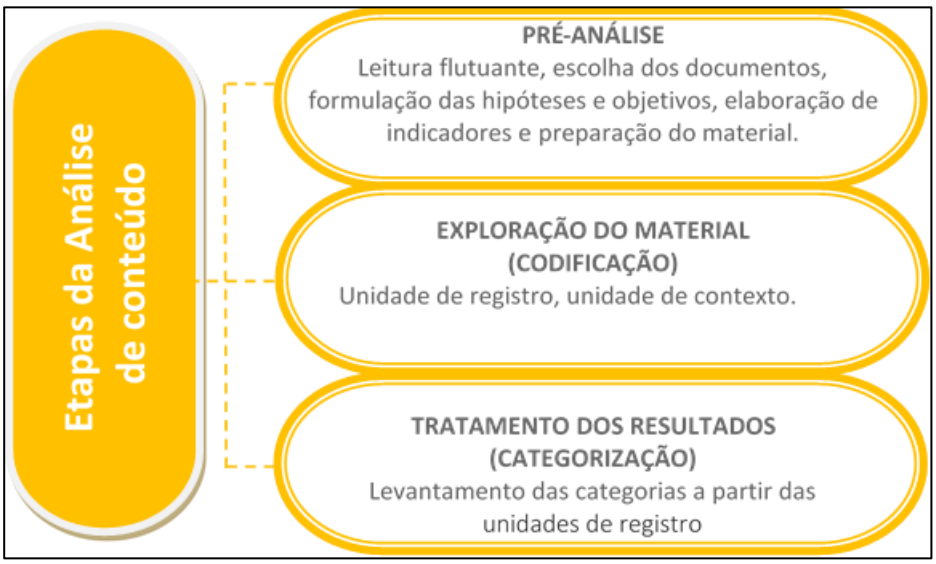
			execution of the project); • Definition of proposals.	curriculum, assisting in its teaching practice.
3rd Meeting	3 hours 04/Sep	5th Presentation: product publication	• Presentation of the final product;	• Understand the formative role of assessment, classroom organization and the influence of context.
		6th Assessment	• Closing: Explanation of each objective, sharing of the opinions of each participant. • Application of the perception questionnaire.	• To improve and qualify the teacher in the mold of PBL for the application of this pedagogical practice in the context of EFA. • Teacher satisfaction.

Source: Authors (2021).

After the conclusion of the workshop, an online questionnaire Focused on Teachers' Perspectives on the Possibilities and Challenges of PBL in PTE was administered. This questionnaire, structured according to predefined criteria, included two open-ended questions and was designed to be answered regardless of the presence of an interviewer (MARCONI; LAKATOS, 1999). This instrument aimed to collect data from a group of respondents to obtain specific information (GIL, 2010).

The data collected through the questionnaire were categorized and analyzed, using qualitative research, Bardin's (2016) content analysis was adopted, described as a set of refined methodological instruments applicable to various discourses. This analysis involves three phases: pre-analysis, exploration of the material, and treatment of the results, as illustrated in Figure 1.

Figure 1 - Content Analysis Steps



Source: Adapted from Bardin (2016).

Thus, after defining the categories, significant expressions were cut for the analysis, making it possible to verify the frequency of responses and expressions in a given field of meaning.

4 RESULTS, ANALYSIS AND DISCUSSIONS

In order to develop an understanding of the application of various methodologies and their potential impact on teaching practice, knowledge construction and professional training, all information was obtained by filling out the questionnaire by all participants. All responses were selected to integrate the analyses and discussions, which are presented in full.

4.1 Question 1: Report your perception of PBL after the workshop

The initial objective of the first question was to obtain an assessment of the participants' perspective in relation to PBL, as shown in table 3. This, in turn, aimed to help the participants improve their teaching practice and identify the perceptions acquired during the workshop.

Table 3 – Participants' perception of PBL

Participants	Answers
P1	Wonderful, this PBL methodology is excellent, fundamental in PTE, as it unites theory and practice.
P2	Efficient, active methodology, which puts students in front of challenges and solutions to problems they have experienced in companies.
P3	I found this methodology very rich in details and construction of knowledge on the part of the students.
P4	I loved it, the classes are much more attractive and interesting.
P5	A teaching method that works with interdisciplinarity effectively, it seeks to engage students in a creative way, making them autonomous.
P6	A perfect learning tool that brings challenges to students and teachers.
P7	Innovative method capable of solving real problems collaboratively.
P8	Methodology that provides learning in a practical way, contextualizing the challenges of the classroom and the job market.

Source: Santos (2022).

It is possible to notice in the reports in Table 3, the potentialities of the use of PBL, perceived through the participation and experience of this methodology, such as: collaboration, cooperation, engagement, autonomy, significant learning, among others. This method uses practical activity as a tool for learning and

knowledge construction. Correlating with the authors who define PBL, according to Bender (2014):

> [...] it is a teaching model that consists of allowing students to confront the Questions and problems of the real world that They consider significant, determining how to approach them, and then acting cooperatively in search of solutions (BENDER, 2014, p. 9).

Other authors argue that PBL incorporates collaborative methodologies because it "focuses on learning, presenting a greater democratization of decision-making and a teacher who assumes the role of collaborator in the procedures defined by the group" (SILVA; CASTRO; SALES; 2018, p. 2).

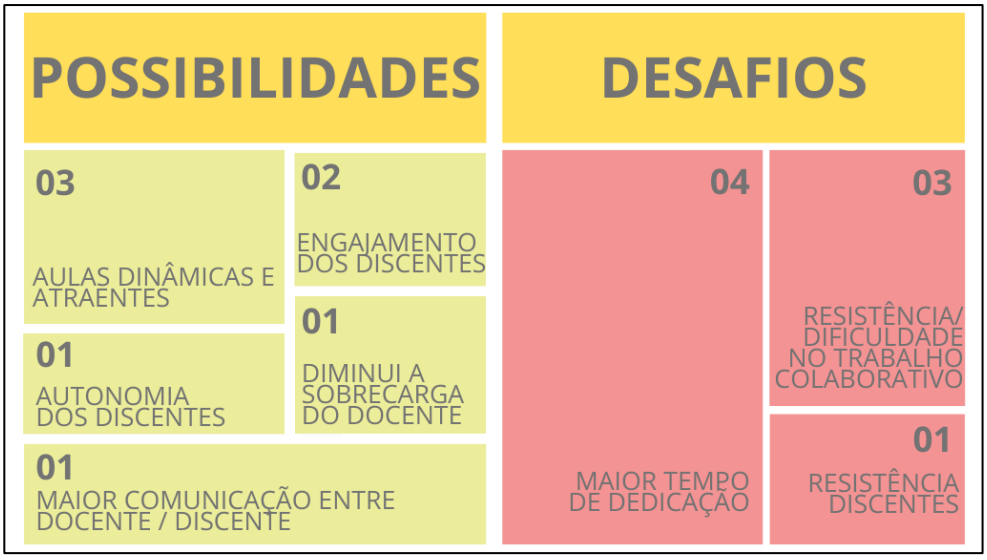
For Márquez and Jímenez (2014), PBL provides the opportunity for students to act collaboratively and actively plan, developing and evaluating projects of practical application. That is, it prepares them to solve problems and find complex solutions as the labor market demands.

For Barp (2016), this methodology contributes significantly to the learning process, as it internalizes concepts, develops critical thinking and autonomous work, acquired throughout the research process and group discussions. Following this line, Gemignani (2012) emphasizes that PBL requires teachers to consider the integration between theory and practice, taking into account Students' experiences and backgrounds.

4.2 Question 2: Opportunities and challenges related to the implementation of the PBL method in PTE.

When asked about the opportunities and challenges associated with the adoption of the PBL method in PTE, participants drew up a list of expressions, as shown in Figure 2. These expressions were later analyzed using Bardin's Content Analysis methodology.

Figure 2 – Possibilities and challenges of PBL from the perspective of the participants



Source: Santos (2022).

Faced with the open-ended question, participants were able to explore different points of view. Thus, it can be noted that there are higher rates of possibilities cited, in a total of 5 (five) indicators (dynamic and attractive classes, student autonomy, decreases teacher overload, student engagement and greater communication between teacher and student) than the number of totaling 3 (three) indicative (greater time of dedication, resistance/difficulty in collaborative work, student resistence).

The item that received the most attention in terms of possibilities was "Dynamic and attractive classes". In his research, Ribeiro (2016) discusses some of the possibilities of using PBL, highlighting that it develops skills and attitudes, such as oral communication, writing, and group work, which are essential for all professionals, regardless of their attributions and responsibilities.

Samford University (2016) highlights another possibility: learning to think, research, communicate and interact with the group, developing interpersonal skills and affective climates favorable to learning. Below, each of the possibilities mentioned is correlated based on the experience in the PBL workshop and in relation to the literature:

1. Dynamic and attractive classes: Bender (2014) points out that teaching projects promote rich didactic activities, the tasks proposed in a teaching project should, in addition to being pleasurable and dynamic, favor learning.
2. Students' autonomy: According to Diniz (2015, p. 13), PBL "as a research method, encourages students to acquire knowledge and skills, enabling the investigation of complex issues". Thus, students have the possibility of taking control of their own performance in the teaching-learning process (ALMEIDA, 2011).
3. Reduces teacher workload Collaborative learning is defined by Behrens (2014, p. 116) as "resulting from a consensus between members of a knowledge community, something that people build by dialoguing, working together directly or indirectly, and reaching an agreement". PBL reduces teacher overload by fostering collaborative learning, where members build knowledge through dialogue, teamwork and consensus, distributing responsibilities and facilitating the teacher's time management.
4. Student engagement: PBL has been advocated as an effective process that results in a high level of involvement and performance, increasing student motivation (BENDER, 2014).
5. Greater communication between teacher and student: The idea of group work with fluid openness of communication and *constant feedback*, as a driver of education, favors "the collaborative environment, allowing the use of connections for the joint resolution of problems and the production of new knowledge" (COLOSSI; CONSENTINO; QUEIROZ, 2017, p. 55), It enables students to identify the interrelationships between disciplines, thus promoting interaction between teachers and students.

Among the challenges mentioned (Greater dedication time, Resistance/difficulty in collaborative work, Students' resistance), the most cited according to Figure 2 refers to the answer: "greater dedication time".

Effective time management is crucial for planning and executing a lesson using PBL. This dedication, which requires more time to prepare the lesson plan, occurs as in any other activity planned by the teacher.

In contrast to traditional methods, PBL requires, according to Frezattie and Martins (2016), a greater investment in research and extracurricular studies, which can be considered a disadvantage. Fernandes (2010) reinforces the relevance of time management, resources and division of tasks for the success of PBL.

Below, each of the mentioned items is detailed based on the experience in the PBL workshop and in relation to the literature:

1. Greater dedication time: Teachers emphasize that, for the implementation of this methodology, it requires more time for lesson preparation and planning. Barbosa and Moura (2013) emphasize that in the PBL method "the teacher has broader and more complex functions than in conventional teaching methods" (BARBOSA; MOURA, 2013, p. 60). Ribeiro (2016) corroborates the assertion that PBL requires a greater administrative Work, reducing the time dedicated to institutional research. Therefore, within the scope of this study, an educational guide was developed to guide teachers in the implementation of the PBL methodology, aiming to simplify its application.[2]
2. Resistance/difficulty in collaborative work: In the PBL approach, students need to plan their work cooperatively, with their team as they advance in solving the problem, developing an action plan, and beginning to elaborate a description or guideline for the development of their products or artifacts (LARMER; MERGENDOLLER; BOSS, 2015). In this way, each member knows exactly what their role and responsibility within the group are. When each member's goal is clear, it is possible to increase team collaboration on a project, which allows for new ideas, increase efficiency and innovation, and improve relationships within the team.
3. Student resistance: Bender (2014) clarifies that due to the PBL approach resembling real-life problems, the structure to reach the intended solution must be created and debated, thus, there may be some resistance on the part of individualistic, introverted and competitive students to adapt to the participatory and collaborative nature. Another relevant factor is the resistance in the face of the difficulty in changing posture, transitioning from a passive to na active subject position.
4. The teachers' perceptions highlight that the participation in the PBL workshop resulted in the expansion of pedagogical knowledge in Professional and Technological Education (PTE), playing a significant role in the construction of knowledge. The incorporation of PBL in teaching practice stimulated reflections and promoted significant learning, contributing to the improvement and confidence of

teachers. These perspectives directly influence educational activities and pedagogical development in PTE.

FINAL THOUGHTS

Throughout this study, it became evident that professional education demands continuous discoveries and is In constant evolution, which requires the adoption of new approaches and methodologies. Therefore, it is essential that the educational process be prepared to incorporate technological innovations to enhance the performance of all those involved.

In addition to offering practical activities that stimulated reflection on daily pedagogical practice, both individually and collaboratively, PBL has a positive impact on the teaching-learning process, as observed and adopted by the teachers participating in this study.

The research obtained results through the use of references and participatory research, in which the active PBL methodology satisfactorily promotes contributions to teaching practice.

The evidence obtained through the questionnaire and the participation in the activities developed indicates that the teachers are capable to organize attractive and motivating classes for the students. They play the role of advisors, promoting autonomy, dialogue, and conducting continuous and diversified assessments in various areas of knowledge, while following the requirements of the PTE curriculum.

In the context of this study, participants realized that PBL offers more possibilities than challenges. Five indications of possibilities were identified: dynamic and attractive classes, student autonomy, reduced teacher workload, greater student engagement, and better communication between teachers and students. In contrast, only three indicators of challenges were mentioned: greater dedication time, resistance or difficulty in collaborative work, and student resistance.

Thus, PBL emerges as a valuable methodology for teachers and students, promoting centered and disciplined learning, while stimulating autonomy in solving everyday problems. In addition, this approach is based on real life issues and demands, and can be supported by theory or adapted to the context, with students guiding the process and teachers acting as mediators.

It is concluded that the use of PBL in PTE privileges pedagogical practice, developing a guiding and mediating profile, redefining the learning spaces and other significant situations provided to the didactic practice, in addition to providing support to the teacher to build security and confidence so that they can implement PBL in the classroom. Furthermore, it empowers students in technical course, making it possible to prepare professionals with initiative and teamwork spirit.

POSSIBILIDADES E DESAFIOS DA APRENDIZAGEM BASEADA EM PROJETOS NA EDUCAÇÃO PROFISSIONAL E TECNOLÓGICA A PARTIR DAS PERSPECTIVAS DOCENTES

RESUMO

Este estudo apresenta as contribuições da Aprendizagem Baseada em Projetos (ABP) na Educação Profissional e Tecnológica (EPT) a partir das perspectivas de docentes. Para isso, foi realizada uma oficina sobre AB com oito participantes atuantes na EPT ao longo de três encontros realizados aos sábados pela manhã, totalizando dez horas. Durante esses encontros, os participantes tiveram a oportunidade de conhecer e vivenciar as etapas da ABP. A metodologia utilizada é de natureza aplicada, com objetivo exploratório, abordagem qualitativa e método de pesquisa participante, os dados foram coletados por meio de um questionário. Tratando-se de uma pesquisa de abordagem qualitativa, optou-se pela técnica de análise de conteúdo. Os principais resultados destacam as potencialidades da ABP, evidenciadas pela participação e vivência direta dessa metodologia, incluindo colaboração, cooperação, engajamento, autonomia e aprendizado significativo. Conclui-se que a utilização da ABP na EPT privilegia a prática pedagógica, desenvolvendo um perfil orientador e mediador, ressignificando os espaços de aprendizagem. A percepção dos docentes foi de que as possibilidades superam os desafios existentes, especialmente ao considerar o valor das aulas mais dinâmicas e atraentes. Ademais, incentiva os discentes, possibilitando a preparação de profissionais proativos e com espírito de equipe.

PALAVRAS-CHAVES: Metodologias ativas. Práticas pedagógicas. Proatividade discente. Aprendizado significativo. Colaboração.

NOTES

1 The paper was submitted and presented during SINECT 2022.

2 Project-Based Learning - Resources and Discoveries for Teaching - Available at: https://repositorio.utfpr.edu.br/jspui/bitstream/1/29556/2/abpeducacaoprofissionaltecnologica_produto.pdf.

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Received: Apr. 18th, 2023.
Approved: Apr. 04th, 2024.
DOI: 10.3895/rbect.v17n2.16699
How to cite: SANTOS, S. S. R. F.; MATOS, E. A. S. A. Possibilities and challenges of Project-Based Learning in Professional and Technological Education from Teachers' Perspectives1. **Brazilian Journal of Science Teaching and Technology**, Ponta Grossa, v. 17, Special Edition, p. 1-19, 2024. Available at: <https://periodicos.utfpr.edu.br/rbect/article/view/16699>. Access on: XXX.
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