PJAEE, 18(9) (2021)

PalArch's Journal of Archaeology of Egypt / Egyptology

A METHOD FOR THE APPLICATION OF PROJECT-BASED LEARNING IN PROFESSIONAL PEDAGOGY

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Libys Martha Zúñiga Igarza , Miguel Alejandro Cruz Cabeza , Ana Gabriela Vélez Santana , Telly Yarita Macías Zambrano , Carmen Liliana Mera Plaza , Yoan Pablo Rodríguez Monier , A Method For The Application Of Project-Based Learning In Professional Pedagogy , Palarch's Journal Of Archaeology Of Egypt/Egyptology 18(9), 1185-1197. ISSN 1567-214x.

Keyword: method, project-based learning, pedagogy, professional.

ABSTRACT

Project-based learning is linked to the way of carrying out learning and the development of projects, where both their procedural character converges, gradual development to build new qualities, products, or knowledge, has a specific purpose, and is participatory. For professional pedagogy, this convergence is valid because project learning can be used as a methodological option in a creative act through action research, which requires methodological development to optimize its potentialities. In the methodological construction they were used. For the development of the research, theoretical and empirical methods were used, including techniques and tools of professional pedagogy, and other related specialties. Among a group of scientific research methods, the analysis-synthesis, historical-logical, hypothetical-deductive stand out, in addition, empirical techniques were used such as the review of documents such as articles, undergraduate and postgraduate theses and web pages respectively, according to the different levels of teaching to analyze the information contained those results in a methodological process. From that perspective, this article aims to develop a method for project-based learning from

interdisciplinary perspectives and in singularized contexts, which allows it to contribute to the objectives demanded by the teacher to meet and increase their instruction, improve teaching skills and investigative, as well as shaping their values.

INTRODUCTION

The world increasingly tends to interdisciplinary approaches under interdependent and multiscale processes for the resolution of conflicts imposed by technological development and life in general, so that the world becomes a learning permanent in adaptation to own human development. From the previous notion, the learning process at any educational level is one of the most pressing problems in which pedagogy in general, and specifically professional pedagogy, is currently involved.

Professional pedagogy is oriented towards professionalized knowledge, that is, it is responsible for giving instruction in terms of professions, occupations and trades as part of an initial and (or) continuing education. That is why the professional training process is a conscious, planned and organized learning associated with the production of material goods and services, which gives it a strategic character in the socio-economic development of any region or country.

All these processes of change make it necessary for the current division between theory and practice; planning and realization; thinking and acting is replaced by a more comprehensive and comprehensive training. These aspects are reflected in the Sustainable Development Goals proposed by the 2030 Agenda, developed in 2015. It proposes a change in global thinking on cross-cutting issues, such as education. In this case of the 17 proposed objectives, the fourth is dedicated to the quality of education, so the demands of interdisciplinary and social competences must be oriented to action in accordance with the appropriate selection of teaching-learning methods used for the knowledge transmission.

In the very development of pedagogical sciences in general through history, there are multiple and diverse learning methods associated with the training process in students, among which are learning: receptive; by discovery; rote; significant; observational; repetitive; latent; emotional; cooperative; and those based on projects, among others. This last type of learning is also recognized as project learning (PBL).

Project-based learning is a learning method that was born between the Middle Ages and the contemporary, in a period between the 15th and 18th centuries. In 500 years of development, his contributions show a pedagogical notion that integrates two important processes: learning and projects.

It emerges from a vision of learning in which students take greater responsibility for their own learning, which helps them grow intellectually and as people, linked to a family and a society. From this perspective, this article makes theoretical methodological conceptions that help to carry out a method from interdisciplinary perspectives and in singularized contexts, which allows it to contribute to the objectives demanded by the teacher to fulfill and increase their instruction, improve teaching skills and investigative, as well as shaping their values.

PROJECT-BASED LEARNING FROM A METHODOLOGICAL EXPERIENCE

Project-based learning is an old tool, which is why a lot of literature is presented about it and it is conceptualized from different perspectives. They have found dissimilar concepts with differences

in the basic instrument of work in their objectives, the processes they develop, and in the purpose.

For a better understanding of the subject, 15 concepts by authors have been studied (Blank W., 1997; Harwell S., 1997; Jones, et. Al., 1997; Dickinson, et. Al., 1998; Reverte J. et al., 2007; Pérez G. et. Al, 2008; Muñoz M. and Díaz P., 2009; Moreno S. et. Al, 2010; Navarro, et. Al, 2011; Mújica R., 2011; Galeana L., 2015; Vergara J., 2015; Bergadá N., 2015; Library of the National Congress of Chile [BNCCH], 2015; Mercado M., et. Al, 2018) who have developed experiences in this field of work. Table 1 shows a summary of the conceptions developed by these authors. Each of the identified variables are also analyzed in order to contribute to the conceptual development of the topic that helps to develop an integrative and generalizable conception in a procedural way.

Table 1. Conceptual analysis for the development of a project-based learning method

Variables	Definitions of authors	Reference of authors
Basic work instruments	Model	Blank W., (1997); Mújica R., (2011); Galeana L., (2015); Bergadá, N. (2015)
	Group work	Harwell S., (1997)
	Group of activities	Jones N. et. al., (1997)
	Forming teams	Dickinson, et al, (1998)
	Methodology	Reverte J. et al., (2007); Muñoz M. and Díaz P., (2009); (BNCCH, 2015)
	Technique	Pérez G. et. al., (2008).
	Strategy	Navarro, et. al., (2011); Vergara J., (2015).
Objectives	Carry out projects to solve real problems, conflicts	Dickinson, et al, (1998); Pérez G. et. al., (2008); Moreno S. et. al.,(2010); Bergadá, N. (2015)
	Organize the curricular contents under a globalizing and meaningful approach, relating school knowledge with those of daily life.	Muñoz M. and Diaz P., (2009).
	Impact in real life.	Mújica R., (2011)
	Create cooperative educational experiences	Vergara J., (2015); Bergadá, N. (2015)
Processes that develop	Plan, implement and evaluate	Blank, (1997); Harwell S., (1997); Galeana L., (2015), Mercado M. et. al,, (2018).
	The problem is identified, and the necessary resources are determined; the question or topic is investigated, possible solutions are formulated and a product is created taking into account the most viable solution and the results of the investigation; and involves the presentation of the final product to the	Mújica R., (2011);

	corresponding evaluators.	
	We choose a topic; we investigate the prior knowledge of our students. What do we want to know about this topic? The students look for information, an index or a concept map is created, a content network is built, the project is concluded.	Bergadá, N. (2015):
	Presentation and comprehensive reading of the scene, definition of the problem, brainstorming, classification of ideas, formulation of learning objectives, research, presentation and discussion of the results	Matamoros W., (2018)
Purpose	Application in the real world beyond the classroom	Blank W., (1997); Market M. et. al,, ((2018).
	Student involvement in the design and planning of learning, decision-making, and research processes	Jones N. et. al., (1997)
	Learning through research on projects based on their future work as professionals	Reverte J. et al., (2007).
	Competences that the teacher has proposed for instruction	Pérez G. et. al., (2008).
	Development of interdisciplinary activities, medium to long term, focused in the student, and with the teacher as mediator	Mújica R., (2011); Bergadá N., (2015)
	Application in the real world beyond the classroom	Galeana L., (2015)
	Personal and group change in the confrontation of tasks	Vergara J., (2015).
	Protagonist of his own learning and where the learning of knowledge has the same importance as the acquisition of skills and attitudes	(BNCCH, 2015)

In the analysis of the aforementioned authors, the first variable was identified, the basic instruments of work defined by r the 15 authors analyzed and according to their conceptions it could be grouped into three large groups because some terms contain the others:

- Methodologies-method, (Blank W., 1997; Reverte J. et al., 2007; Muñoz M. and Díaz P., 2009; Mujica R., 2011; Galeana L., 2015; BNCCH, 2015; and Bergadá N., 2015);
- group of activities, (Jones N. et. al., 1997);
- the strategies, (Navarro, et. al.,2011; Vergara J., 2015); and
- the technique, (Pérez G. et. al., 2008).

In this case, the conception of the instrument for the treatment of project-based learning as a methodology is valid. This is based on the gradual processes that develop learning on the one hand and projects on the other.

According to the pedagogue Jerome S. Bruner, learning as a process is associated with the actions of: selection of information, generation of propositions, simplification, decision-making and construction and verification of hypotheses, which implies that several tools must be integrated that systemically help this idea. In their conceptions (Bruner J. and Goodman C., 1947), they also highlight the interaction of the learner with reality, in which they give way to the inputs according to their own mental models and schemes, creating new ones, or essentially modifying the pre-existing ones. in the characterization of new concepts and knowledge. This offers meaning and organization to their experiences and allows them to go beyond the given information, because to integrate it into their cognitive structure, they must contextualize and deepen said knowledge. In this experience, the student interprets its meaning and meaning throughout his life and achieves personal growth, through his comprehensive training (Alonso L., López &Dorrego, 2019)

It is precisely from this perspective that the projects of learnings. Etymologically "project" means directed towards; released for the benefit of; represented in perspective, design of a work or machinery; It is a tool for change to verify reality and lead it towards change; it is to make decisions, options, concrete actions with an institutional mission. The concepts vary according to the purpose or objectives that are determined, among them are scientific, political, institutional, labor, educational, constructive projects, among others, but all have a certain beginning and end.

The projects are of gradual elaboration where time and space are essential links since they all have a defined time, which is why they are recognized by the stages that determine their life cycle from its beginning and its completion. On the other hand, this materializes in a specific space or area of action, which gives it a procedural and participatory nature in its structuring and requires resources for its materialization, it is integrative, interdisciplinary, encourages research and research, requires control throughout the process and evaluation once it is concluded and must be contextualized. They also allow us to recognize the need to use the project as an alternative that helps to promote student learning based on the fact that they can apply the contents they learn in solving practical problems in social, work and professional life.

On the other hand, methodologies from a totality develop several phases, steps or activities concatenated with a common purpose, which uses specific techniques, strategies or other tools that allow it to carry out the proposed objectives for which it was conceived. In the case of group work (Harwell S., 1997; Dickinson, et al, 1998) it is a quality of project-based learning, and not as a working method.

Regarding the objectives proposed in table 1, it is considered that these will depend on the objectives that the teacher wishes to meet, so they can be as diverse as there are applications of the method. One of the greatest difficulties encountered in the processes that project-based learning develops is the lack of consent of the actions that must be developed in a systemic and concatenated way, and it is logical since there is no consensus on the instrument for its treatment. Although it is recognized that learning and projects converge in that they are active, association and construction processes. This aspect is highly important since it is the way in which the objectives are systematically achieved over the duration of the project.

From Table 1 developed previously, a group of phases are manifested only in seven authors who only coincide in the evaluation phase. Other authors are incorporated to analyze other possible phases and their concatenation to reveal how the processes unfold in project-based learning.

For this, the activities that are carried out are analyzed and based on (Pérez C., 2006,) in its conception to define processes, from the consultation of 62 concepts and through a statistical method of hierarchical clusters, whose results is a dendrogram defined and discriminated concepts, which allowed to conceptualize the processes for the development of methods such as:

> a type of action (classification of the action), with certain characteristics (characteristics of the action), consisting of (action) that is carried out on an object, by a subject, with certain means, to achieve an objective, taking into account a frame of reference, p.47

From that conception, it gives meaning and organization, it allows going beyond the given information because to integrate it into a structure Sequential procedural, a group of authors who identify steps or phases as a process in project-based learning are also analyzed, such as:

- Kilpatrick W., (1925): planning, execution, and evaluation, and clarifies that the ideal progression is when the four phases are started and finished by the students and not by Professor.
- Tippelt R., and Lindemann H., (2001): inform, plan, decide, carry out the project, control, value, reflect (evaluate)
- Muñoz M., and Díaz P., (2009): choice-motivation; planning; growth; evaluation
- Flores R., et.al., (2015). project design, development process, products generated.

From a global analysis of the 11 authors referred to in table 1, the problematic situation generated by the development of the project is not recognized as part of the process. This may be the result of the teacher demanding better conditions for the teaching-learning process, or other motivation, or by students who need to satisfy some research concerns.

Another phase that is recognized from a conceptual development through the meaning of words is an investigative phase. This is what creates, develops, and executes the research process itself. The product phase is also distinguished very clearly marked by (Flores R., et.al., 2015), since it is a way of giving results, which are possible to evaluate. In this way, the actions that determine the teaching-learning process for project-based learning are:

- Problem situation: it creates the basic conditions to successfully develop the remaining phases, for which both students and teachers and all those who the The project decides to include
- Research: establishes, characterizes, hierarchizes, plans, and executes the project
- Products: makes known the results of the research
- Evaluation: establishes the ways to evaluate both the learning process and the resulting product.

As for the last aspect to analyze related to why a project-based learning methodology is carried out, through a purpose; It is considered that the contributions of (Jones N. et. al., 1997) are consistent with the analysis that has been carried out so far. That is why it is taken as the purpose:

the involvement, which is replaced by commitment, of the student in the design and planning of learning, in decision-making and in research processes.

METHODOLOGICAL DEVELOPMENT OF A PROJECT-BASED LEARNING

In the previous section it was determined that project-based learning is a teaching method. According to the Great Dictionary of the Spanish Language, (1998), the word method comes from a Latin word methodus, which means the way to reach a result. In this same dictionary, in the specificity of teaching, it means "work in which something is explained or taught." From this the methodology is derived, as part of the logic that studies the methods. Therefore, a methodology is the totality of processes that are structured concatenately to meet a certain objective.

In this sense, Alonso B., Cruz C. and Ronquillo T., (2020) refer that “the method is made up of several procedures and depends on the intention to be achieved according to the objectives set”, p.139. It follows a sequence of phases, steps or tasks in its development through procedures. While the procedure, according to these same authors, they explain that it is a “particular, practical or intellectual operation of the activity of teachers and learners that is part of the method”, p.139.

It is from this perspective that the method leads to social practice a set of theoretical conceptions articulated to support a specific social purpose. That is why in the conceptual construction of project-based learning, this is considered as:

“a contextualized and interdisciplinary process that occurs between students and teachers from professionalized perspectives through group work with the school, the family, the world. work and the community, from a problem situation, which is investigated, produces a result and is evaluated in a set time, and with certain resources, which helps students to design and plan their learning, through commitment, decision making and research”.

This perspective is operationalized for its application in social practice through four phases: problem situation, research, product, evaluation, which materializes through various specific procedures in 18 steps (see figure 1), as support instruments. The methodological application establishes as a fundamental premise the recognition, by teachers, of the need to use the proposed method for project-based learning. This need may have as its purpose its utilitarian use in order to promote professionalized learning, which helps to encourage research, decision-making where the students themselves help to build their own knowledge to contribute in this way their own personal development and help with its heritage to the socioeconomic growth of society. It also considers some principles such as: guiding.

- Integrated Curriculum: different disciplines are addressed through a relevant topic and aaxis, including formal and non-formal learning.
- Shared protagonist: the teacher's main function is to create the learning scenarios that allow students to develop the project.
- Inclusive: it offers responses to different learning rates, interests and abilities.
- Part of a challenge: it starts with an attractive theme that connects the interests of the students with the expected learning to guarantee their motivation. Continuous
- evaluation and reflection: the students learn to evaluate themselves and to be evaluated to improve the quality of the processes and products in those who work.

- Socialization and dissemination: the experience of socialization occurs among the students, other teachers, the school-family-work world-community, in which the project ends with the public dissemination of the resulting products.

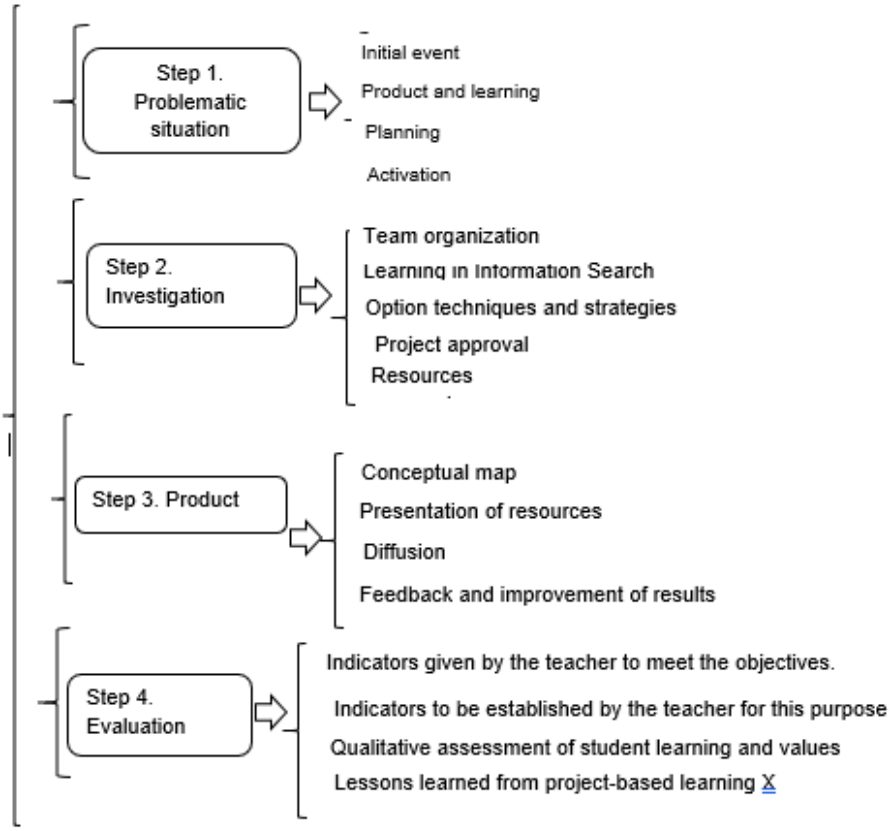

Figure 1. Methodology for the development of project-based learning.

The conditions on the basis of which its application is required, (Alonso B., Cruz C. and Ronquillo T., 2020), among others, the following:

- Mastery of the content to be taught by the teacher.
- Professional problem - objective - content relationship.
- Characteristics and structure of the technological work method (operations and technological steps).
- Teacher experiences.
- Level of appropriation of the content of the profession (if it will be at the reproductive, productive or applicative and creative level).
- Peculiarities and psychopedagogical characteristics of the personality of the students of the group.

- Group dynamics: number of students, previous group experiences, degree of integration, interpersonal communication.
- Material conditions and existing teaching aids in the institutional and labor (productive) context where the process takes place.
- Hygienic - environmental conditions of the context: desks, tables, available resources, existing ICTs, media, lighting, among others.
- Creativity and initiative of the teacher. Influences in the group, traits of their character.

In the same way, the didactic approach is manifested (Alonso B., Cruz C. and Ronquillo T., 2020) from the profession that bases the teaching process - professional learning is based, according to (Abreu R. and Soler J., 2014). in recognizing the integrating nature of the contents of each program to the essential logic of the profession, specialty or trade for which it responds according to its objectives (whether basic, specific basic or specific). This is possible to the extent that the principle of content professionalization is systematized.

The steps and objectives of each step in the proposed methodological development are described below:

-Step 1: Problematic situation

Objective:Create the basic conditions to successfully develop the steps of the proposed methodology.

It consists of establishing the need or opportunity from which it is possible to start the research process of the project. The project idea may be started due to any of the following reasons:

- Because there are current unmet needs, or it is anticipated that they will exist in the future if no action is taken.
- There are potentialities or under-exploited resources that can be optimized and improve current conditions.
- It is necessary to complement or reinforce other activities or projects that take place in the same place and with the same people involved.

-Step 2: Research

Objective: apply research actions through design, experimentation, and verification in an optimal way as a way of learning and social contribution through the knowledge that is acquired by students

This step consists of five tasks: organization of the equipment, learning in information searches, tactical and strategic options, approval of the research project, and necessary resources, as shown in figure 1.

-Step 3: Product

Objective: put into practice the previously planned research.

This result is a concrete product, often something tangible. During the elaboration of this product, the learning of the students takes place. It comprises five tasks: concept map, presentation of results, dissemination, feedback and improvement of results. The order of these tasks is reflected in figure 1. This is a decisive stage because it is the actual execution and presentation of the results.

The difficulties encountered must be resolved in a practical order and it is where the interdisciplinary nature of the process is materialized and made visible through forms of autonomous learning, assisted by means, whether computerized, contextual, work by processes, as well as the acquisition of competences. technical, social, and human from their individuality.

-Step 4: Evaluation

Objective: carry out the general evaluation of project-based learning, from two perspectives of the teacher and the student body that allows the taking of lessons for the realization of the next projects.

In this last stage, four tasks are recognized: indicators to be established regarding the objectives of the project, indicators to be established regarding the synergistic effect, qualitative evaluation of the students' learning and values; as well as the lessons learned in project X. as shown in figure 1. This process can be carried out in consensus with the students themselves at the end of the investigation, where the working groups show the rest of their colleagues what the results are obtained.

In this final stage of a project in which it is reviewed, and the pertinent evaluations are carried out on what is planned and executed, as well as its results, in consideration of the achievement of the objectives set. During the development of the project, the performance of the participants is evaluated, and for this the indicators are chosen based on the objectives and competencies achieved for such purposes.

The whole classroom comes together to share what they have learned and to reconsider what they know about the issue now and what they need to know now. An iterative process that turns the project into a kind of learning spiral that may have no end, since, throughout the investigation, new questions often arise and, therefore, the beginning of a new project.

On the part of the teacher, the qualitative and quantitative control-assessment-self-assessment process of professional growth (knowledge: knowing, skills: doing and professional values: being, being, living together) (Alonso B., Cruz C. and Ronquillo T., 2020), which is manifested in the personality of the student in initial or continuous training periodically, based on the degree to which the proposed training objectives are achieved (either at the level of topic, unit, subject, discipline or academic year) is evaluating your learning.

In the execution of project-based learning, the qualitative and quantitative indicators that will be evaluated at the end of its implementation must be specified, based on fulfilling the functions of the learning evaluation: innovative, pedagogical and established control (Álvarez Z. and Castro O., 2007). The control function reports on the degree to which the objectives are met, that is, it allows to measure, verify the state of professional growth achieved in line with the objective of the project according to its training structure and in turn assess the quality of the plans and study

programs, as well as the strategy used, which allows decision-making for continuous improvement. These indicators are specific for each project, so each teacher must build them.

The pedagogical function is the main function and essential nucleus of the evaluation of professional learning, since it allows to assess the professional growth of the student, that is, the transformations that occur in their way of feeling, thinking and acting during their professional performance in teaching, work practice or education at work and research, as a synergy that reveals the objective of the project (which integrates the cognitive and the affective) that is evaluated. This function has an instructive, educational and resonance effect.

The instructive effect is adequately achieved when the relationship is established with precision: objective-evaluation, when the learner is adequately guided from his formative structuring, he is clearly aware of what is expected of him, what path he has to follow and how he must check the degree of efficiency of their professional performance in carrying out the project.

The educational effect is aimed at being able to assess from the instructive effect, (Rodríguez Monier, Miguel Alejandro Cruz Cabezas, Luís Aníbal Alonso Betancourt, Verónica Del Pilar Zambrano Burgos, 2021), how, through the evaluation, the development of professional values is confirmed that, in an integrated way with the knowledge and skills, please the integrative nature of the evaluation. The conception of this effect is not limited to administrative regulations or the order of the theoretical foundation, but also to the affectation of ethical, moral, pedagogical, and social aspects. It is measured when the professional growth of the student or worker in initial or continuing training in their legal, environmental, economic, and energy education is evaluated, when entrepreneurship, teamwork, technological discipline, among other values are taken care of.

The resonance effect is the objective or distorted reflection of the instructive and educational effects in the different subjects and contexts (whether in teaching or job placement, education at work). It measures the impacts achieved on the worker in initial or continuous training in their professional growth (whether it was favorable or not) and how these impacts (transforms) the production process and the services in which it is inserted in terms of its efficiency, profitability, quality, technological innovation, productivity, quality of working life of workers and in society in general.

The innovative function will depend on the results achieved from the pedagogical function, the teacher will determine jointly with the students, the corrections that it is necessary to introduce in the components of the project (objective, content, methods, rhythms, consultations, etc.) to to bring the results closer and closer to the demands of the objectives in line with those with the socio-labor demands of a specialization in the profession.

CONCLUSIONS

The project learning method emerges from a vision of learning in which students take greater responsibility for their own learning through problem solving, so they undertake tasks with difficulty, which helps them grow intellectually and as a people, linked to a family and their society.

Project-based learning is considered as: a contextualized and interdisciplinary process that occurs between students and teachers from professionalized perspectives through group work with

school, family, the world of work and the community, based on a problem situation, which is investigated, produces a result and is evaluated in a set time, and with certain resources, which helps students to plan, design and evaluate their learning, through commitment, decision-making and research.

The theoretical methodological conceptions developed from interdisciplinary perspectives, and in singularized contexts, allow the development of a method for the treatment of project-based learning, based on the gradual processes that develop on the one hand the learning and on the other the projects, which uses techniques specific, strategies or other tools that allow you to carry out the proposed objectives.

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