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Pedagogical practice and problem-based learning: an analysis from action research

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Abstract.

This research article aimed to understand pedagogical practices and their relationship with problem-based learning from the perspective of research, and pedagogical action, where the teacher preconfigures, applies and evaluates his practice. The methodological approach was oriented from the qualitative paradigm with a method of pedagogical action research. Seventy-five students, one teacher and one external observer participated in the study. The findings of the study show that the pedagogical practices, through the design and implementation of a guide based on Problem Based Learning (PBL), stimulate the active and responsible participation of the student in their learning process.

Keywords: problem-based learning, pedagogical practice, secondary education, action research, action research.

1. INTRODUCTION

It is important to begin by ratifying the definition of Problem-Based Learning as "a learning method based on the principle of using problems as a starting point for the acquisition and integration of new knowledge" Barrows (cited in Servicio de Innovación Educativa de la Universidad Politécnica de Madrid [UMP], 2008, p. 4).

Regarding the historical point where PBL is established, it is possible to ratify what Guevara (2010) mentions when determining that:

it had its first applications and development in medical school at Case Western Reserve University in the United States and McMaster University in Canada in the 1960s. This methodology was developed to improve the quality of secondary education by changing the orientation of a curriculum that was based on a collection of topics and presentations by the teacher, to one that is more integrated and organized in real life problems and where the different areas of knowledge come together and are brought into play to solve the problem (p. 144).

For its part, in methodological terms, the Educational Innovation Service-UPM (2008) mentions that PBL is "a methodology focused on learning, research and reflection that students follow to solve a problem posed by the teacher" (p. 4).

On the other hand, Barrows (cited in Morales & Landa, 2004) presents PBL from the following topics:

(a) Learning is learner-centered; (b) Learning occurs in small groups of students; (c) Teachers are facilitators or guides; (d) Problems form the focus of organization and stimulus for learning; (e) Problems are a vehicle for the development of clinical problem-solving skills; (f) New information is acquired through self-directed learning (p. 147-149).

Within this horizon, Guevara (2010) addresses his own topics for the PBL:

* It is an active work method where students participate constantly in the acquisition of their knowledge.
* The method is oriented to the solution of problems that are selected or designed to achieve the learning of certain knowledge objectives.
* The learning is centered on the student and not on the teacher or only on the contents.
* It is a method that stimulates collaborative work in different disciplines, working in small groups.
* The courses with this work model are open to different disciplines of knowledge.
* The teacher becomes a facilitator or tutor of learning (p. 146).

Exley & Dennick (cited in Hernández-Huaripaucar & Yallico, 2020) present their position when they state that "PBL implies active, cooperative, student-centered learning, associated with highly motivated independent learning" (p. 168).

For the Servicio de Innovación Educativa-UMP (2008), the role of the teacher in this strategy entails giving students a leading role in the construction of their learning, being aware of their students' achievements, being a guide and facilitator of learning, offering students various learning opportunities, helping students to think critically by guiding their reflections, and conducting tutoring sessions. For the student, his role implies assuming his responsibility for learning, being autonomous, knowing how to ask for help and guidance when needed, working in groups, having a receptive attitude towards the exchange of ideas, sharing information and learning with others, to have the necessary strategies to plan, control and evaluate the steps he carries out in his learning (p. 12).

PBL is possible to observe from what is proposed by Hidalgo et al. (2008), where it can be conceived from three pillars: PBL as a system of philosophical thinking of the educational process, the second in the key of a curricular paradigm, and the third from the delimitation of an educational strategy. It is important to recognize how this last one is ratified under the understanding that it is a process that, from the problem approach, allows to create or recreate knowledge and develop skills, abilities, attitudes and ethical values, concerning the significant learning of a subject, in particular, or a group of study areas, integrating its objectives and contents in an interdisciplinary way (p. 48).

2. METHODOLOGY

It is important to delimit the methodological approach pursued in this work, which is framed within the Pedagogical Action proposed by Restrepo (2004), which was initially proposed by Stenhouse (1998). It should be noted that this methodological approach was completed with elements of the hermeneutic and phenomenological approach. In its practical and real scenario, this methodology allows improving the teacher's exercise from the configuration of critical criteria that go hand in hand with self-observation in practice, self-questioning, the recognition of problem cases, the consolidation of action routes and the constant review of processes (Martínez, 2007).

Thus, the knowledge and how pedagogical practices are built and their qualification were approached from three moments: the critical and structural analysis of the practice, the consolidation of the design and implementation of the proposal and the observation of the results of the intervention process. All of this maintains its procedural consequence from the support of hermeneutics and phenomenology (Vanegas et al., 2021).

It is important to highlight that, within the methodological route sponsored within this work, the context was approached from the application of interviews, accompanied by a constant study that was strengthened from the direct observation of the context, ratified in a diary of notes, during and after the educational processes of the seventh-grade course of the third academic period of the school year 2022, where some elements of Chemistry were approached. The data obtained were transcribed and a matrix called field diary was filled out, thus allowing categorization of the information. Also, an audiovisual record was made since it is presented as the most diligent technique for self-questioning, allowing the teacher to observe each of the moments of his practice (Martínez, 2007), thus allowing to have important information that was crossed with what was recorded in the field diaries. The sample included the participation of 30 seventh-grade students, 45 eighth-grade students and one teacher manager.

3. FINDINGS AND DISCUSSION

3.1 Critical and structural analysis of the practice

In phase 1, known as critical and structural analysis, the following categories were analyzed: pedagogical strategy, curriculum and competency-based training. Within the process, it was possible to observe the appearance of 4 important subcategories: pre-knowledge, contents, didactic resources and school environment, which allow determining the scenario of practices in which teachers develop their activities.

Within the process, the category of preknowledge was externalized within the formative process of natural sciences, which allows taking stock of the components that students have upon arrival in a new course. Because of this, the sessions have as a starting point a series of problem questions that serve as a diagnosis of the topics already seen. There it is possible to see how Ausubel (cited in Moreira 2012), postulated the significant learning theory, where the subject relates new knowledge with the previous knowledge he already has, restructuring it and giving it a meaning (p. 2).

If this path is lost, the questions offered by the teacher have a direct emphasis on bringing together the pre-knowledge and the context of the learners, which seen by Freire (cited in Zuleta 2005), is supported by the fact that "questions help to initiate interactive learning and problem-solving processes, as well as to maintain them until the objectives are achieved and new problems and new learning situations are posed in this continuous journey that is life" (p. 116).

It is necessary to emphasize, on the other hand, that despite the moments of the class, a methodological route according to the scholastic restlessness of the students was not found; they were flat classes lacking in didactics given their preponderance on the use of guides that eliminated the motivation within the student body, given their monotony.

There, it is possible to situate what is stated within the magazine N°6 Estrategias de Aula en Los Centros de Fe y Alegría (Classroom strategies in the Fe y Alegría centers.), where Benjumea (2013) points out that:

Classroom strategies are a set of educational actions, methods and procedures that teachers use daily in the classroom to organize and improve teaching and learning processes, to better deal with conflicts, explain and make students understand, motivate them, stimulate them and make them produce better results (p. 30).

Likewise, Benjumea (2013) states that:

A well-chosen teaching strategy helps students to develop learning strategies that enable them to face and solve diverse situations autonomously. The aim is not only that they learn knowledge, but also that they know how to use it to solve problems, explain phenomena and raise new questions (p. 30).

It is necessary, in short, to determine that it is imperative to modify the classroom processes that affect how students feel close to their classroom formative process. In this sense, the formative processes developed within the natural sciences course have as an articulating entity the memory and the realization of activities that do not guarantee the competitiveness of students, given its broad component located in memory and monotony (Gómez, 2020), which can be analyzed from Kenley (1999, cited in Escribano & Del Valle, 2015), where he emphasizes that in conventional learning, teaching materials are always prepared and presented by the teacher, and the responsibility for learning is centered on the teacher; in the face of the lack of motivation and low academic performance of the students (Duarte et al., 2018).

For their part, Pozo & Gómez (2009) state that "students do not learn because they are not interested... Possibly they are not motivated because they do not learn either" (p. 26), which translates into the way the educational process has historically been thought without a direct correlation with the context, being the school processes an epistemic and competent response to the reality of schoolchildren.

In addition, within the pedagogical practices, the use of different tools that allow the development of competencies is only placed in the classroom scenario in an isolated and poorly organized manner according to the curriculum that the teacher manages (Acevedo-Jaimes & González-García, 2017), which was possible to ratify in the interview and the field diary. It is important to highlight that the Ministry of National Education (Mineducación) through Article 45 of Decree 1860contreras (1994), said tools as "educational material or equipment for legal and regulatory purposes, didactic aids or means that facilitate the pedagogical process", in a more current concept is defined as "REDA", open digital resource, "all types of material that have an intentionality and purpose framed in an educational action..." (Mineducación, 2012, p. 50).

3.2 Assessment and analysis of the intervention

It is necessary to determine that the classroom strategy is a wide range of actions, processes, methods and innovation that has an impact on the teacher's self-training, the constant planning of the subject and the understanding of the organization of the wing process from the teaching-learning process and the resolution of daily problems of the context of the students. This allows obtaining results in students who manage to solve the problems of their daily lives and are motivated to take education as an integral process that contributes to their quality of life. There, Benjumea (2013) established the possibility of designing a strategy based on that has an impact on the qualification of the formative processes of the natural sciences sample.

Within the process of critical and structural analysis of the practice, the critical view of the processes that do not contribute to the educational quality of the students remained, given their low motivation, which was expressed above. It is necessary to review the questionnaire applied to the students. In it, it was found from question No. 22: What do you like least about the class?

That there are no visits to the laboratory (E1).

That they only work with the notebook and the guide (E2).

That the topics are not understood and the classes are tedious (E20).

That there is no fun or practice in class (E21).

That there is only copying and copying (E23).

That there are no actions that allow us to create (E26).

In this sense, and coinciding with Benjumea, which is taken as an educational process based on the problem approach that forges skills within the educational process (Hidalgo et al., 2008). Likewise, criticism, participation, and didactic actions are preponderant (Mozo-Ayuso, 2013).

3.3 Innovation

Problem-based learning is an innovative classroom process, as it integrates didactics and student competencies. It is possible to affirm that students are at the center (Dirección de Investigación y Desarrollo Educativo, 2004). For his part, Restrepo (2005) states that PBL is seen as a regenerative process of methodological and curricular devices, from how teaching and the educational environment are approached (Roca et al., 2015). It is necessary, in short, to review the interview conducted with the students, where the feeling of comfort is evidenced, from the question How did you find the methodology of the Problem-Based Learning strategy? (PBL)?

It was very good because it allowed me to learn a lot (E2).

It was cool to review the context of drugs and the problems of the human body (E3).

I liked it because it was a different activity (E5).

It was good because I learned a lot (E6).

It was good because we had not worked like this before (E9).

Accordingly, PBL is a scenario where the strengthening of competencies and not memory is a priority, leaving aside the actions from the guide to the design of activities that conform to the learning rhythm of the students. There is satisfaction within the classroom, which can be seen from the statements made by González et al. (2014) and Méndez (2015) when mentioning that PBL satisfies the students' concerns and innovative methodological designs.

In sum, the findings of this research define that PBL can be considered a methodological innovation because of the aforementioned. Abadías (2014) and Roca et al. (2015) ratify PBL by emphasizing that a juxtaposition can be made between traditional and meaningful learning.

3.4 Collaborative work

To reorient the formative process within the classroom and in the key of PBL, collaborative learning spaces were sponsored, which were ratified in the consolidation of work groups that will dynamize spaces for critical discussion, role-playing and the definition and achievement of detailed goals. According to Barrows (cited in Morales & Landa, 2004), PBL educational processes allow the creation of small groups of students, or what is the same and according to Guevara (2010) “it is a method that stimulates collaborative work in different disciplines” (p. 146).

The influence of PBL on collaborative work stimulates discussion and role-playing. There, Espinoza & Sánchez (2014) conclude that it stimulates the autonomy of the student who assumes a role within the group where pedagogical actions are carried out. Likewise, Henao & Tamayo (2015) conclude that with PBL there is a role-playing game, which forges criteria, the dissertation of ideas and self-directed learning.

This category allowed identification from the perspective of Del Valle et al. (2011) and in coincidence with Amo et al. (2014), it is possible to affirm that PBL is consolidated with Cooperative Learning, where students forge critical thinking and strengthen competencies.

The findings from the above-mentioned establish that PBL, from collaborative work, debate and how autonomy is assumed within the educational process, affects the reconfiguration of the pedagogical process as such by placing the student at the heart of the formative space. Nevertheless, within the sample, it was possible to see the disagreement of some students with other members of the group, as

can be observed from the question "What difficulties did you find in the development of this methodology?"

The team did not help me and I did everything by myself (E4).

A partner was not able to contribute anything to the process (E5).

The problem is that not everyone helps in the group work that was assigned to us (E6).

It was very difficult to work as a team because we did not manage to disagree on the activities (E10).

In spite of the scarce literature on this category, it was found that the students were unable to identify the way in which they work as a team and did not understand the dynamics to carry out this activity. In the interview and response to the question "How have you felt working in a team with your classmates?"

Teacher, I like to work alone (E1).

Carlos Esteban didn't help the teacher at all, and the one who helped was Constanza. But we had to beg him a lot so that he would contribute to the work. That's not possible (E10).

It is possible to see the noticeable discomfort of students within the group formative process. In this sense, Escribano and Del Valle (2015) mention that there may be some stumbling blocks of PBL from the practical scenario, which can translate into greater slowness in the learning process, causing the more advanced students to be affected. Likewise, the authors point out that "the greatest difficulty stems from the possibility that the group does not work, that there are those within it who feel inactive, not responsible or who systematically escape from the work" (p. 144).

3.5 The student as the axis of learning

The dynamic of PBL is based on the autonomy and educational capabilities of the learners, that is, the processes are centered if and only if in the student. According to Barrows (cited in Morales & Landa, 2004), Problem-Based Learning is a scenario focused in detail on learning and is key to educational innovation in the epistemological and academic processes developed by students. In addition, it is innovative because it allows the student active learning, in which inquiry is relevant for the development of skills and appropriation of knowledge (Prada et al., 2021).

For the Educational Innovation Service-UPM (2008), the student is the one who determines his/her formative process, requests accompaniment and strengthens the bonds of collaborative work within the classroom, maintains optimism, can refuse to learn, is the one who raises criticism and provides important data so that, in the contextual analysis of teachers, the educational experience can be qualified. Abadías (2014), in his study, concludes that combining traditional methodology with PBL leads to the student not being a figure of reception of content. Likewise, Roca et al. (2015) state that the complementation with PBL breaks the teaching and teacher-centered perspective.

3.6 The role of the teacher

The formative process was designed from the role of the teacher, who gives more preponderance to the student's learning process, since now she is only a mediator, accompanies and serves as a bridge in the learning process. For the Direction of Educational Research and Development (2004), in PBL, the destinies of education are anchored in the student as the epicenter and it is not the role of the teacher. For the Educational Innovation Service-UPM (2008), the teacher leads the student to be the protagonist of the study scenario, from the provision of opportunities, guiding the thought processes, accompanying the epistemic reflections and being a facilitator for the consolidation of the formative process from the constant accompaniment. In the words of Escribano & Del Valle (2015), the teacher "...has to become a "learning professional" and do everything possible to facilitate the intellectual access of students to the contents..." (p. 25). In this sense, for the implementation of PBL, elements that facilitate its execution in the classroom are needed, such as the understanding of the theoretical foundations and its pedagogical use (Prada et al., 2022; Contreras et al., 2019).

3.7 The role of the student

The change in the student's role within the learning process is essential in terms of the qualification of autonomy, school sense and learning rhythms. In this order of ideas, Escribano & Del Valle (2015) consider that in PBL learning is constantly autonomous on the part of the student, who assumes responsibility for learning, and requests guidance in their needs; in addition, it manages to detonate collaborative work that affects having a receptive attitude towards the exchange of ideas, sharing information and learning with others.

3.8 Motivation

Using PBL as a strategy in the re-elaboration of the teacher's work, it was evidenced that students are in good spirits, they want to study and their interest in natural sciences resurfaces. Studies such as Mozo-Ayuso (2013) agrees that PBL determines the active participation of students, García et al. (2013) conclude that PBL improves the learning process; likewise, Pantoja & Covarrubias (2013) agree that PBL achieves meaningful and active learning, and internalizes theory and practice.

Motivation becomes the key element to forging meaningful learning, it is the driving force that energizes it, and it is the one that generates the work of students. Escribano & Del Valle, (2015) and Pozo & Gómez (2009) state "students do not learn because they are not interested... Possibly they are not motivated because they do not learn either" (p. 26). In this research, it was found that students like to participate in the work done and feel motivated to improve their educational process.

Among the findings of this research, we found the following statistical analyses that allow us to establish PBL as a strategy that generates motivation and interest in learning:

In Item N°15, Has the PBL methodology increased my interest in scientific subjects? 30.0% of the students surveyed expressed ALWAYS and 42.5% of the students surveyed expressed ALMOST ALWAYS.

In Item N°16, Have the activities carried out in these subjects allowed me to increase my critical spirit towards the contents, my creativity, and my curiosity? 42.5% of the students surveyed expressed ALMOST ALWAYS and 30.0% of the students surveyed expressed ALWAYS.

In Item N°17, Do I think that with the PBL methodology I participate more in class and I feel motivated to look for information and contribute with the group in the solution of the problem? 45.0 % of the students surveyed consider that ALWAYS, 32.5 % of the students surveyed consider that ALMOST ALWAYS and 32.5 % of the students surveyed consider that ALMOST ALWAYS.

Benjumea (2013) defines the classroom strategy as the set of educational actions, methods and procedures that teachers use daily in the classroom to organize and improve the teaching-learning processes, to better handle coexistence conflicts, to explain and make students understand, to motivate them, to stimulate them and make them produce better results (p. 45).

3.9 Inquiry

With the implementation of PBL, it was determined that students develop inquiry competence, the interpretation of information, as well as the search for solutions to formative processes. The Educational Innovation Service-UMP (2008), points out that PBL improves the search for and handling of information and allows students' research in the learning process.

The Colombian Institute for the Promotion of Higher Education [ICFES], 2007), the reconstruction of the teacher's pedagogical practices through the implementation of PBL allowed students to use inquiry as a classroom element; the search for information in different sources, the exploration of the school environment, the recording of data and the search for a solution to the problem posed were strengthened.

5. CONCLUSIONS

According to the results of the structural analysis of the teachers' pedagogical practices, a triangulation of the information was developed based on the data from the field diaries, the observation guideline and the survey in which researchers, academic peers and students were the main actors. This triangulation allowed evidencing the lack of pedagogical strategies on the part of the teacher that would allow the motivation and participation of students in the teaching and learning process; this is evidenced by the fact that the strategy implemented by the teacher lacks pedagogical actions in which practice and theory are articulated, offering monotonous and not very didactic meetings in which there is no student participation, there is no implementation of learning material or resources and, at the same time, the learning context is unknown.

Now, among the findings, the use of a learning sequence as the methodology of the meetings is evident; in this sense, at the moment of deconstruction of the pedagogical practice, it is evident that the teacher under a constructivist model starts her meeting with the inquiry of previous ideas using as a strategy didactic sequence and thinking routines implemented from popular education, strengthening at the same time the formation in values and the development of hard and soft skills.

To continue, at the moment of reconstructing the pedagogical practice from the implementation of the PBL methodology, it was found that through teaching methodologies focused on the active participation of the student, the role of the teacher changes, generating dynamics of support, cooperation, teamwork and co-responsibility, in which the student is a main actor of the process, increasing, in turn, the motivation and commitment of himself on his learning; that is, the PBL allows the classroom to be transformed from the real need and interest of the group and the consolidation of meaningful learning experiences.

Finally, to evaluate the progress and transformations of the pedagogical practice, the results of the observation before the intervention were contrasted with the results and evidence after the pedagogical intervention, allowing inferring that the PBL methodology strengthens the teaching-learning process because the students are connected with the object of learning, they are interested in the process and evaluate their progress and setbacks, consolidating in turn critical and reflective thinking.

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