

PBL problem-based learning for critical thinking in university students

Aprendizaje basado en problemas ABP para el pensamiento crítico en estudiantes universitarios

Kony Luby Duran-Llaro kduran@ucv.edu.pe Universidad Cesar Vallejo, Trujillo, Perú. https://orcid.org/0000-0003-4825-3683

ABSTRACT

The objective is to analyze PBL problem-based learning for critical thinking in university students. The methodological perspective of the work focused on a systematic review of bibliographic information, working with a population of 30 scientific articles, located in databases: PubMed, Scopus, WOS, Scielo. Redalyc. It is agreed that PBL is a model of learning through active work following processes such as planning, implementation and evaluation; it can be understood as a strategy where teachers previously elaborate the challenges or products that will later be developed by students. Likewise, in order for critical thinking to be developed in students, procedures, strategies and activities aimed at expanding the use of the mind are needed.

Descriptors: critical thinking; activity learning; learning methods. (Source: UNESCO Thesaurus).

RESUMEN

Se tiene por objetivo analizar el aprendizaje basado en problemas ABP para el pensamiento crítico en estudiantes universitarios. La perspectiva metodológica del trabajo se focalizó en una revisión sistemática de información bibliográfica, se trabajó con una población de 30 articulos científicos, ubicados en base de datos: PubMed, Scopus, WOS, Scielo. Redalyc. Se concuerda en que el ABP es un modelo de aprender mediante el trabajo activo siguiendo procesos como la planificación, implementación y la evaluación; puede comprenderse como una estrategia donde los docentes elaboran previamente lo retos o productos que luego serán desarrollados por los estudiantes. Así mismo, para que el pensamiento crítico para ser desarrollado en los estudiantes, se necesita de procedimientos, estrategias y actividades dirigidas a ampliar el uso de la mente.

Descriptores: pensamiento crítico; aprendizaje activo; método de aprendizaje. (Fuente: Tesauro UNESCO).

Received: 19/8/2023. Revised: 20/8/2023. Approved: 09/23/2023. Published: 01/10/2023. Review articles section



INTRODUCTION

Problem-based learning (PBL), has its philosophical foundation in empiricism where learning from experience is promoted, this implies from a didactic point of view to implement projects to respond to concerns in students in reference to a particular topic, This requires the application of pedagogical resources including ICT, in order to generate an effective process of apprehension of knowledge, but this is not only achieved individually, but also in community, generating the action of constructivism as pedagogy (Luy-Montejo, 2019).

In this order, PBL is suitable for university students, since they are at a stage of life where they can be autonomous and critical in the search for information with the intention of articulating critical and innovative thinking (Luy-Montejo, 2019). Therefore, it is taken into consideration that:

PBL is a learner-centered approach, who is the one who determines what he or she needs to learn. It is up to learners to identify the key aspects of the problems they face, define their knowledge needs, and undertake the search for the missing knowledge (Morales-Bueno, 2018, p. 94).

From the above, it is proposed that PBL is in the pedagogical order of active learning centered on the student, being this a contrast to the mechanistic model where the central axis was the teacher who transmitted knowledge. In this postulate, it is related to the fact that "the didactics of critical thinking requires active learning for the construction of good knowledge" (Núñez-López, *et al.*, 2017, p. 86). It is in that way, that PBL is constituted as an affective learning method for the promotion of critical thinking competencies in university students (Suárez-Cretton, & Castro-Méndez, 2022).

Therefore; it can be summarized that the PBL method not only helps students to understand in depth, but also promotes independent learning in students because they have to formulate their own learning objectives after understanding the PBL scenarios, solve their problems through literature and the Internet, compare scenarios with theories from various sources (Manuaba & Wu, 2022). This contributes to a more effective pedagogical interaction between students and teachers by forming cooperative work teams (Torralba & Doo, 2020).

In addition, (Schaller, *et al.*, 2023), state from their research experience that active learning approaches are effective. Several facets of active learning are components of problem-based learning (PBL), which is a teaching modality in which students' learning is self-directed towards problem solving in a relevant context. This approach is supported by (Hierrezuelo-Osorio, *et al.* 2022), who applied a training program in critical thinking, being favorable for problem solving from the application of reasoned arguments to the various educational scenarios presented in their professional training.

Based on the above, the objective is to analyze PBL problem-based learning for critical thinking in university students.

METHOD

The methodological perspective of the work focused on a systematic review of bibliographic information on PBL problem-based learning and critical thinking, in works focused primarily on providing information on how both variables are developed in university students.

We worked with a population of 30 scientific articles, located in databases: PubMed, Scopus, WOS, Scielo. Redalyc, the criterion was the studies located in the last five (05) years of publication; however, due to the epistemological contribution, six (6) investigations prior to this date were included, since they contributed to the scientific contribution of the theoretical synthesis presented throughout the present work.

Once the works to be scrutinized were selected, we proceeded to use the technique of content analysis and underlining of the main ideas with the intention of organizing an information base, applying the analytical-synthetic method with the intention of processing it and building a referential theoretical framework as an output product as a contribution to the state of scientific knowledge.



ANALYSIS OF RESULTS

The results of the research are presented from an analytical-synthetic connotation:

Problem-based learning (PBL)

The application of strategies and teaching-learning methods in the world is nothing new, we all have different ways of learning and teaching. One of the methods that nowadays is promoted in contemporary pedagogy is the so-called active pedagogy, a current that proposes action as the main part of the educational process (Villacís *et al.*, 2022). PBL is a methodology proposed during the first decades of the twentieth century, although its beginnings are attributed to (Kilpatrick, 1918), who proposes the idea of educating through projects and making students take care of their learning, the truth is that this methodology and the way of approaching reality to the student, has its origins in antiquity when it was proposed to learn by trying to solve the problems of the environment (Botella-Nicolás, & Ramos-Ramos, 2020). The aforementioned implies being part of the classic questions we ask ourselves: What is education for? One of the answers is to achieve improvements in society, solve its problems, coexist better and create the conditions to achieve individual and collective goals.

The idea of involving students with their environment awakens their interest, is motivating and challenging, which is why constructivist pedagogues incorporated it as a method that takes learning as a sociocultural process, considering students as active entities (Feeney *et al.*, 2022). Over time, the PBL method will be nurtured by theories and studies that will give it the necessary consistency, such as the contribution of Dewey, Piaget with cognitive pedagogy, Ausubel with his theory of the meaningfulness of learning, Vygotsky with the contribution of sociocultural relevance, Freire, among others.

Involving the schoolchild in their learning process is part of the principles of current methodologies that move away from the old traditional, rote, repetitive, expository training where the teacher occupied a leading role and considers the student as a recipient of information, now "doing" becomes a necessity, a practical way to learn and develop skills that will be useful for life (Balsalobre-Aguilar, & Herrada-Valverde, 2018).

Learning taking into account the challenge of facing the problems of the environment is significant, already with the pandemic in the years 2020 - 2022, has shown us that there is an urgent need to train students with autonomous capabilities, able to build their learning and develop skills in difficult environments that require the mobilization of knowledge for life (Ribosa, 2020). The PBL methodology arises with the purpose of obtaining knowledge and developing competencies through the elaboration of projects that are oriented to respond to real-life problematic situations.

Studies that have been conducted in different realities demonstrate the effectiveness of the methodology, for example, (Torres-Gordillo, 2014), points out that PBL improves autonomous learning (Flores-Rivera, Luis, & Meléndez-Tamayo, 2017), increases confidence and awakens the interest of students; the finding is supported by (Molina-Torres, 2019), (Stentoft, 2019), also the study of (Trullàs, *et al.* 2022), point out that this methodology encourages student involvement in their own learning and promotes team and collaborative work; in addition to developing skills cataloged as superior such as those related to critical thinking (Albarrán-Torres, & Díaz-Larenas, 2021).

There are several attempts to define PBL, most agree that it is an active methodology that through projects promotes the search for solutions to real problems, however, several scholars have been interested in its study and have raised various concepts according to their experience or their field of research, thus García and Basilota, cited by (Villanueva-Morales, *et al.* 2022), define it as a teaching modality that is expressed through collaborative and participatory processes among learners with the aim of developing a product; for (Sáiz-Manzanares, *et al.*, 2022), PBL is a teaching-learning method that focuses on activities or processes shared among students whose final purpose is to obtain a product.

PBL is a model of learning through active work following processes such as planning, implementation and evaluation; it can be understood as a strategy where teachers previously elaborate the challenges or products that will then be developed by students, these products



respond to a certain reality that is shown as problematic (Tiwari, *et al.* 2017) this statement is supported by (Malik, & Zhu, 2023), who comment that in PBL students put into practice various competencies such as investigative, social and communicative, as well as skills such as decision making and critical thinking. The theories that support the research are cognitive theory, constructivism, socio-constructivism and the theory of liberating pedagogy proposed by the pedagogue Paulo Freire, all of which promote action as the purpose of learning and take into account the environment as a key or determining factor.

When we speak of critical thinking, we recall the ability to think and make judgments. As previously mentioned, the challenge in education in the present century is to teach how to think, an action that has been proposed since ancient times. Thus, we have (Ennis (1989), who proposes a series of studies to define critical thinking, who catalogs it as a cognitive process that involves three dimensions: logical, criterial and pragmatic, adding that the ability to think critically is associated with finding ourselves in a problematic situation that requires us to adopt a certain position.

Critical thinking

In this order, (Zuluaga-Marín, *et al.*, 2022), indicate that critical thinking, in order to be developed in students, requires procedures, strategies and activities aimed at expanding the use of the mind. Emphasizing and implementing it in the educational sector requires a series of steps ranging from providing resources to enhancing teaching skills. Thus, from the educational practice and in the work of teachers, different and varied didactic strategies should be implemented that lead students to form a critical thinking forceful enough to make decisions and solve the diversity of problems they face in everyday life (Cangalaya-Sevillano, 2020). At this point it is necessary to highlight the consistency of reasoning, since this can only be achieved by having an assertive reading of reality, having the necessary knowledge and the ability to communicate judgments.

The competencies developed in the area of social sciences are oriented under the approach of active citizenship, they pursue the formation of students with the capacity to influence their environment, students who assume an active role, capable of making decisions, critical, questioning and making judgments; For this, it is essential that they process information, assimilate and adopt a position (Gonzales-Llontop, & Otero-Gonzales, 2021); that is, critical thinking allows analyzing and evaluating texts, for which the individual will make use of intelligence, reasoning and knowledge (Bani-Issa, & Khataibeh, 2021).

Regarding the dimensions of the research we rely on the studies of (Ennis,1989), who considers the logical, criterial and pragmatic aspect (Bezanilla *et al.*, 2018). The logical dimension is related to the way we examine our own thinking, students in this dimension clearly express their ideas, the meaning of the statements, formulate valid thoughts taking into account coherence, clarity and different perspectives. In the criterion dimension, students make value judgments, examine their own thinking, question and argue logically, and analyze and judge the credibility of information considering other opinions or points of view. As for the pragmatic dimension, students are capable of recognizing the application of their own thinking, questions such as "What is it for? What use do you give to what you have learned?" become important to determine how they relate what they have learned to their environment.

CONCLUSION

There are several attempts to define PBL, most agree that it is an active methodology that through projects promotes the search for solutions to real problems; however, it is agreed that PBL is a model of learning through active work following processes such as planning, implementation and evaluation; it can be understood as a strategy where teachers previously elaborate the challenges or products that will then be developed by students, these products respond to a certain reality that is shown as problematic. Likewise, in order for critical thinking to be developed in students, procedures, strategies and activities aimed at expanding the use of the mind are needed. Emphasizing and implementing it in the educational sector requires a series of steps ranging from facilitating resources to enhancing teaching skills, which highlights the implementation of PBL for an effective enhancement of critical thinking in students.



FINANCING

Non-monetary

CONFLICT OF INTEREST

There is no conflict of interest with persons or institutions related to the research.

ACKNOWLEDGMENTS

To Universidad Cesar Vallejo, Trujillo, Peru.

REFERENCES

- Albarrán-Torres, Felipe, & Díaz-Larenas, Claudio. (2021). Metodologías de aprendizaje basado en problemas, proyectos y estudio de casos en el pensamiento crítico de estudiantes universitarios [Teaching-learning methodologies based on problems, projects and casestudy for the development of critical thinking in university students]. *Revista de Ciencias Médicas de Pinar del Río*, *25*(3), e5116.
- Balsalobre-Aguilar, Laura, & Herrada-Valverde, Rosario. (2018). Aprendizaje basado en proyectos en educación secundaria: el orientador como agente de cambio [Project-based learning in secondary education: the guidance counselor as an agent of change]. REOP
 Revista Española De Orientación Y Psicopedagogía, 29(3), 45–60. https://doi.org/10.5944/reop.vol.29.num.3.2018.23320
- Bani-Issa, Heba, & Khataibeh, Abdullah. (2021). The effect of using project based learning on improving the critical thinking among upper basic students from teachers' perspectives. *Pegem Journal of Education and Instruction*. 11, 2 (Apr. 2021), 52–57. https://doi.org/10.14527/pegegog.2021.06.
- Bezanilla, María, Galindo-Domínguez, Héctor, Campo, Lucía, Fernández-Nogueira, Donna, & Poblete-Ruiz, Manuel. (2023). Understanding critical thinking: A comparative analysis between university students' and teachers' conception. *Tuning Journal for Higher Education*, 10(2), 223-244. https://doi.org/10.18543/tjhe.2515
- Botella-Nicolás, Ana, & Ramos-Ramos, Pablo. (2020). Motivación y aprendizaje basado en proyectos: una investigación-acción en educación secundaria [Motivation and projectbased learning: an action research in secondary education]. *Multidisciplinary Journal of Educational Research*, 10(3), 295–320. https://doi.org/10.17583/remie.2020.4493
- Cangalaya-Sevillano, Luis. (2020). Habilidades del pensamiento crítico en estudiantes universitarios a través de la investigación [Critical thinking skills in university students, acquired through research]. *Desde el Sur, 12*(1), 141-153. https://dx.doi.org/10.21142/des-1201-2020-0009
- Ennis, Robert. (1989). Critical Thinking and Subject Specificity: Clarification and Needed Research. *Educational Researcher, 18*(3), 4-10. https://doi.org/10.3102/0013189X018003004
- Feeney, Silvina, Machicado, Gimena, & Larrosa, Luana. (2022). El Aprendizaje Basado en Proyectos como política de enseñanza: algunos interrogantes [Project-Based Learning as a teaching policy: some questions]. *Praxis educativa*, 26(3), 136-
- Flores-Rivera, Luis, & Meléndez-Tamayo, Carlos. (2017). Variation of the autonomy in the learning, in function of the knowledge management, to diminish in the students the effects of the isolation. *Distance Education Journal*, *17*(54).
- Gonzales-Llontop, Rosa, & Otero-Gonzales, Carlos. (2021). Perspectivas y retos del pensamiento crítico: nivel de desarrollo en estudiantes de pregrado [Perspectives and challenges of critical thinking: level of development in undergraduate students]. *Revista Universidad y Sociedad*, *13*(5), 124-133.



- Hierrezuelo-Osorio, José, Franco-Mariscal, Antonio, & Blanco-López, Ángel. (2022). Use of socio-scientific dilemmas for the development of critical thinking skills in pre-service teachers. Teachers' perceptions. *Revista Interuniversitaria De Formación Del Profesorado. Continuación De La Antigua Revista De Escuelas Normales*, 97(36.1). https://doi.org/10.47553/rifop.v97i36.1.92435
- Kilpatrick, William. (1918). The Project Method. *Teachers College Record*, 19(4), 1-5. https://doi.org/10.1177/016146811801900404
- Luy-Montejo, Carlos. (2019). El Aprendizaje Basado en Problemas (ABP) en el desarrollo de la inteligencia emocional de estudiantes universitarios [Problem Based Learning (PBL) in the Development of Emotional Intelligence of University Students]. *Propósitos y Representaciones*, 7(2), 353-383. https://dx.doi.org/10.20511/pyr2019.v7n2.288
- Malik, Khalid, & Zhu, Meina. (2023). Do project-based learning, hands-on activities, and flipped teaching enhance student's learning of introductory theoretical computing classes? *Education and information technologies*, *28*(3), 3581–3604. https://doi.org/10.1007/s10639-022-11350-8
- Manuaba, Ida, & Wu, Chien. (2022). The effectiveness of problem based learning in improving critical thinking, problem-solving and self-directed learning in first-year medical students: A meta-analysis. *PloS one, 17*(11), e0277339. https://doi.org/10.1371/journal.pone.0277339
- Molina-Torres, María. (2019). El Aprendizaje Basado en Proyectos (ABP) en la formación metodológica del profesorado del Grado de Educación Primaria [Project Based Learning (PBL) in the methodological training of Primary Education teachers]. *Enseñanza & Teaching: Revista Interuniversitaria De Didáctica, 37*(1), 123–137. https://doi.org/10.14201/et2019371123137
- Morales-Bueno, Patricia. (2018). Problem-based learning (PBL) and critical thinking skills a binding relationship? *Interuniversity Electronic Journal of Teacher Formation*, 21(2), 91–108. https://doi.org/10.6018/reifop.21.2.323371
- Núñez-López, Susana, Ávila-Palet, José-Enrique, & Olivares-Olivares, Silvia-Lizett. (2017). El desarrollo del pensamiento crítico en estudiantes universitarios por medio del Aprendizaje Basado en Problemas [The development of critical thinking in university students through Problem-Based Learning]. *Revista iberoamericana de educación superior*, 8(23), 84-103.
- Ribosa, Jesús. (2020). El docente socio constructivista héroe sin capa [The social-constructivist teacher: a hero without a cape]. *Redi/UAB,56*(1). https://doi.org/10.5565/rev/educar.1072
- Sáiz-Manzanares, María, Alonso-Martínez, Laura, Calvo-Rodríguez, Alberto, & Martin, Caroline. (2022). Project-Based Learning Guidelines for Health Sciences Students: An Analysis with Data Mining and Qualitative Techniques. *Journal of visualized experiments: JoVE*, (190), 10.3791/63601. https://doi.org/10.3791/63601
- Schaller, Michael, Gencheva, Marieta, Gunther, Michael, & Weed, Scott. (2023). Training doctoral students in critical thinking and experimental design using problem-based learning. BMC medical education, 23(1), 579. https://doi.org/10.1186/s12909-023-04569-7
- Stentoft, Diana. (2019). Problem-based projects in medical education: extending PBL practices and broadening learning perspectives. Advances in health sciences education : theory and practice, 24(5), 959–969. https://doi.org/10.1007/s10459-019-09917-1
- Suárez-Cretton, Ximena, & Castro-Méndez, Nelsón. (2022). Contribución del aprendizaje basado en problemas en el Pensamiento Crítico [Contribution of problem-based learning to critical thinking]. *Revista Interuniversitaria De Formación Del Profesorado. Continuación De La Antigua Revista De Escuelas Normales*, 97(36.3). https://doi.org/10.47553/rifop.v97i36.3.96182



- Tiwari, Ranjana, Arya, Raj, & Bansal, Manoj. (2017). Motivating Students for Project-based Learning for Application of Research Methodology Skills. *International journal of applied* & basic medical research, 7(Suppl 1), S4–S7. https://doi.org/10.4103/ijabmr.IJABMR 123 17
- Torralba, Karina, & Doo, Loomee. (2020). Active Learning Strategies to Improve Progression from Knowledge to Action. *Rheumatic diseases clinics of North America*, *46*(1), 1–19. https://doi.org/10.1016/j.rdc.2019.09.001
- Torres-Gordillo, Juan. (2014). Construcción del conocimiento en Educación Superior a través del aprendizaje por proyectos [Knowledge construction in Higher Education through project-based learning]. *REOP Revista Española De Orientación Y Psicopedagogía*, 21(1), 137–142. https://doi.org/10.5944/reop.vol.21.num.1.2010.11518
- Trullàs, Joan, Blay, Carles, Sarri, Elisabet, & Pujol, Ramon. (2022). Effectiveness of problembased learning methodology in undergraduate medical education: a scoping review. *BMC medical education*, 22(1), 104. https://doi.org/10.1186/s12909-022-03154-8
- Villacís-Macías, Carolina, Zea-Silva, Cecilia., Campuzano-Rodríguez, Sandra, & Chifla-Villón, Mario. (2022). Project-based learning and gamification to generate active learning in students. *Science Magazine Unemi*, 15(39), 35-43. https://doi.org/10.29076/issn.2528-7737vol15iss39.2022pp35-43p
- Villanueva-Morales, Camila, Ortega-Sánchez, Gustavo, & Díaz-Sepúlveda, Lesly. (2022). Aprendizaje Basado en Proyectos: metodología para fortalecer tres habilidades transversales [Project Based Learning: a methodology to enhance transversals skills]. *Revista de estudios y experiencias en educación*, 21(45), 433-445. https://dx.doi.org/10.21703/0718-5162.v21.n45.2022.022
- Zuluaga-Marín, Marisol, Botero, José, Martínez-Romero, Ana, & Lopera-Ortega, Yanelis. (2022). Neurodidactics and Critical Thinking: Perspectives for Today's Education. *Educación y Educadores*, 25(2), e2522. https://doi.org/10.5294/edu.2022.25.2.2

Bajo la Licencia Creative Commons 4.0 de Reconocimiento-NoComercial-Compartirlgual 4.0