

Chapter #19

CHALLENGE BASED LEARNING (CBL)

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ABSTRACT

A new education for the 21st century requires comprehensive training by students. An education focused on the development of cognitive skills, abilities, and attitudes that allow them to approach and design solutions for the main social challenges. This change in the educational paradigm demands the incorporation of new teaching and learning methodologies. In this chapter, Challenge-Based Learning (CBL) is presented as a pedagogical proposal to favor the development of transversal and disciplinary skills, collaborative work, leadership, research, critical and reflective thinking. CBL allows students to be involved in real teaching contexts so that through the design and implementation of projects, they generate proposals for solutions to the main social challenges. This paper describes the background, the characteristics, the teaching process, and the methodology, in its different stages for developing CBL, as well as its main differences with other active methodologies that are used to develop problem-solving skills. Finally, the CBL stages are exemplified within a university experience and its implementation through the project called Social Reconstruction. This project allowed the participation of students and teachers in a multidisciplinary and collaborative way for the social transformation of two Mexican communities affected by the earthquake of September 19, 2017.

Keywords: experiential learning, challenge based learning, social transformation.

1. INTRODUCTION

Within the framework of an education that is required in the 21st century, comprehensive training strategies for students, in higher-level educational institutions, are becoming more indispensable due to new demand for skills-based training for them to solve complex problems (Davidson, 2017). The New Education Agenda 2030 states that it is necessary to emphasize the development of high-level cognitive and non-cognitive skills, such as problem-solving, critical thinking, creativity, collaborative work, communication skills, and conflict resolution. These should apply to different professional contexts that allow students to face the challenges of local and global order (Martin & Jabonero, 2017).

The approach of a new education implies a restructuring of the curriculum and a revolution in the educational process. One of the most important competencies to develop in this new vision of education is problem-solving, understood as the ability to identify, analyze and define the significant elements that constitute a problem to develop proposals for its solution with defined criteria and in an effective way (Villa & Poblete, 2007).

This approach suggests the use of active methodologies in teaching and learning and that is focused on the student to favor the development of problem-solving competence in them and the analysis and design of proposals for solutions to the main social challenges. Among the methodologies, the following are proposed: Problem-Based Learning, Project-Based Learning, Challenge-Based Learning, Service Learning, Case Method, Research-Based Learning, Relationship-Based Learning, Simulation-Based Learning, Team Working and Action Research (Table 1).

Table 1.
Active methodologies.

METHODOLOGY	CHARACTERISTICS	COMPETENCES DEVELOPED
Problem-Based Learning (Sánchez, 2016).	Student-centered. Approach to real or simulated situations described in problematic scenarios. Open, structured, contextualized problems related to the purposes of the subjects.	<ul style="list-style-type: none"> • Analytical Thinking • Investigation • Self-directed learning • Social and communicative skills • Problem-solving
Project-Based Learning (Tobón, 2010).	Design of multidisciplinary projects based on context analysis. Dynamic learning environments, interactive and focused on problems and challenges of the context. Vision of learning as a useful, and relevant process.	<ul style="list-style-type: none"> • Project management • Self-reflection • Analytical thinking • Social and ethical commitment • Entrepreneurship
Challenge-Based Learning (Instituto Tecnológico de Estudios Superiores de Monterrey, 2015).	Collaborative approach to social challenges through immersion by students in real formative contexts. Based on the detection of the challenges, multidisciplinary projects are analyzed, designed, executed and evaluated.	<ul style="list-style-type: none"> • Design and project management • Investigation • Collaborative work • Social and solidarity commitment • Leadership • Creative thinking • Problem-solving • Self-reflection
Service Learning (Díaz-Barriga, 2006).	Community projects that favor service activities linked to the curriculum. Authentic on-site experience	<ul style="list-style-type: none"> • Collaborative work • Social responsibility • Thoughtful and critical thinking • Moral, social and civic awareness.
Case Method (Servicio de Innovación Educativa UPM, 2008).	Part of a real problem through which students analyze the context and the variables involved in the case. Consensus is reached through dialogue and discussion and informed decisions are made.	<ul style="list-style-type: none"> • Information management • Investigation • Decision making • Analytical thinking • Autonomous work • Collaborative work
Research-Based Learning (Karlsruhe Institute of Technology, 2018).	Link the teaching process with research. Research activities and projects become integral components of the learning process. Students apply investigative techniques and skills to solve context problems	<ul style="list-style-type: none"> • Self learning • Problem-solving • Scientific thought • Analytical thinking • Reflective thinking • Creative thinking

<p>Relationship-Based Learning (Robinson, 2017).</p>	<p>Educational proposal for teaching and learning and that puts relationships as the driving axis of the class and activities in the context. Human connections as the basis of personal, professional and social development. It is based on 3Cs: Connect, collaborate and cultivate.</p>	<ul style="list-style-type: none"> • Collaborative work • Reflective thinking • Social skills • Social commitment • Creativity
<p>Simulation-Based Learning (González, 2018).</p>	<p>Teaching with environments that mimic aspects of reality, through simulated or virtual contexts. It allows the reproduction of a certain procedure or technique and allows everyone to apply a standardized criterion. It can also be used for evaluation processes of skills and abilities.</p>	<ul style="list-style-type: none"> • Analytical thinking • Decision making • Digital skills • Autonomous learning • Collaborative work • Complex problem-solving
<p>Team Working (Parmelee, Michaelsen, Cook, & Hudes, 2012).</p>	<p>Methodology for active learning through work teams. It is based on the instructional design of sequential activities of individual, collaborative and feedback work.</p>	<ul style="list-style-type: none"> • Collaborative work • Collegial thinking • Social skills • Problem-solving
<p>Action Research (Peleteiro, 2007).</p>	<p>Methodology that contemplates in its basic principles the following postulates: it is oriented to the solution of problems, centered on the subject-person, it is a challenge of the status-quo and generator of experiences related to daily and professional life.</p>	<ul style="list-style-type: none"> • Reflective inquiry • Scientific thought • Deep and analytical thinking • Reflective thinking • Design and project management • Problem-solving • Social commitment

2. BACKGROUND

Challenge-Based Learning (CBL) was originated in 2008 within a project of the Apple company called Apple Classrooms of Tomorrow-Today. CBL, as a pedagogical proposal, is based on the experiential learning of John Dewey, Jean Piaget, William Kilpatrick, Carl Rogers, and David Kolb. This seeks to encourage students to propose solutions to problems related to their environment, through their immersion in real training contexts and the design of multidisciplinary intervention projects. In these contexts, students recognize some issues of their interest, which they become for them a challenge to address, analyze, discuss and solve methodologically and collaboratively. In addition to the above, CBL awakens in students' sensitivity towards local problems that most affect society. In such a way, the development of various competencies is favored, among which the following stand out problem-solving, communication skills, research, use of

technology, collegial thinking, emotional competencies, analytical thinking, reflective thinking and social commitment (Nichols, Cator, & Torres, 2016).

CBL creates a space where students can direct their research and think critically about how to apply what they learn. At the center of CBL is a call to action that inherently requires students to make something happen. This methodology was designed to promote creativity and risk-taking within a framework that assures the students have both a fertile topic to explore those skills, as well as the freedom to do so (Johnson & Adams, 2011).

In CBL, students have the opportunity to recognize the relevance of the contents they have learned in the classroom, through their active, intellectual, creative, social and emotional involvement. The above is done in projects of global significance with local actions to attend critically and positive some problems of its surroundings, they get involved directly in the context of the problem to solve. Indeed, the development of problem-solving competence is not typical of CBL since it resembles Problem-Based Learning (PBL) and Project-Based Learning (PL). CBL, unlike the first, uses real environments for the problematization of the contents, while in PBL the simulation of the problems is allowed (Sánchez, 2016). Concerning its relationship with PL, the design of integrating projects is one of the characteristics they share. However, in CBL the designed projects must be implemented, evaluated and disseminated.

3. DIDACTIC PROCESS IN CBL

The teaching process in CBL is characterized by having a common thread to the challenge itself. This thread is strengthened with the knowledge that is transmitted through the teaching of learning modules, intensive periods of approach to the challenge and an evaluation process through the generation of performance pieces of evidence that allow the individual and integral evaluation of the level of mastery of the skills that students develop (Torres & Ayala, 2019).

The teaching process of the CBL starts from the following premises:

- There is a profile of students' graduation skills.
- The challenge is chosen or designed with the clear intention of impacting the development of the competencies of the graduation profile.
- The challenge is divided into stages specific to its characteristics and needs.
- The knowledge, skills, and attitudes that the student wishes to develop are defined for the best possible performance at each stage of the challenge.
- A period of total immersion to the challenge is included, that allows students to experience.
- An evaluation process is designed that includes: a diagnostic evaluation, an evaluation of the level of mastery of competencies at each stage of the challenge, an integrative evaluation that allows determining the level of development of competencies at the end of the academic period.

Within each content module that accompanies the stages of the challenge, it is necessary to include active and consistent methodologies with the model of challenges among which are: Team Working, Case Method, Project-Based Learning and Problem- Based Learning.

4. CBL METHODOLOGY

CBL starts with the approach of the general theme to work, which is called in this method the Big idea, a concept with far-reaching significance, such as biodiversity, sustainability, pollution, poverty and migration. Indeed, in this phase, the teacher as a facilitator of the process, together with the students define the theme of global relevance and possibilities of local action to work. In this first stage, the essential question of the process is also established and characterized by being a general question which allows linking the issue to be addressed with the problem to be solved (Apple, 2011).

Afterward, students, once they have selected the challenge they want to address, they establish a series of guiding questions to work on their research process. The challenge is framed to bring the big idea and essential question home with a local call to action. When defining the challenge, students' approach to the problem environment is a key element; not only to sensitize them about the need for social transformation, but also allow them to measure the needs to be resolved, the actions to be established, and the possible scope of their intervention. Based on the research, they systematically plan the key activities to execute and define the resources necessary to address the challenge, through a dynamic group session of the students with the guidance of their teacher. The purpose of this phase is that through research, activities and collaborative work sessions, students have sufficient knowledge to generate innovative solution proposals for the selected challenge.

The next phase of the methodology is the construction of a proposal for a solution to the challenge, this proposal is described through the design of an intervention project. The project considers a multidisciplinary vision of the solution, as well as its realization of intangible deliverables. These deliverables must be prepared during the implementation of the project and they seek to demonstrate the lessons learned and the skills developed by the students, the above contributes greatly to their training process-oriented to social transformation. Finally, the learning evaluation mechanisms and the impact of the project are established, as well as the strategies for disseminating the results obtained.

The evaluation process requires the selection of the strategies and instruments necessary for the collection and recording of the information that is generated in the different planned phases. Concerning the dissemination, students with the support of their teacher, agree on the best way to share the experience, both with the recipients of the project and with the academic community. This last stage allows identifying the progress in the fulfillment of the expected objectives, achievements, and learning achieved by the students and the impact on the transformation of the attended reality (Table 2).

Reflection, formative evaluation, and feedback are an important part of the process at each stage, as they reinforce learning and prepare students for similar situations in their professional future.

Table 2.
CBL methodology.

Phase 1. BIG IDEA		
Essential question		
Phase 2. DEFINITION OF THE CHALLENGE		
Phase 3. PLANNING STAGE		
Guiding questions	Key activities	Necessary resources
Phase 4. SOLUTION		
Proposal, design and implementation		
Phase 5. EVALUATION		
Strategies and instruments		
Phase 6. DIVULGATION		

5. CBL EXPERIENCE: SOCIAL RECONSTRUCTION PROJECT

To exemplify the CBL process, the experience of UPAEP is described below, whose educational model poses an educational vision that mobilizes and transforms society from the person, through the generation of significant experiences. The educational model uses active methodologies in teaching and learning processes, achieving this way, the formation of leaders transforming social realities.

The purpose of this university experience with CBL was to involve students and professors in a collaborative and multidisciplinary way within a social intervention project, generated from the earthquake juncture of September 19, 2017, in Mexico, which brought with it the destruction of homes in rural communities. Next, the actions carried out in the project called Social Reconstruction are described, considering the stages of the methodology (Table 3).

Table 3.
University experience of the CBL employment.

Big idea	Social reconstruction
Essential question	How could the university help rebuild communities affected by the earthquake?
Challenge definition	Rebuild the communities of Tepapayeca, municipality of Tlapanalá and San Francisco Xochiteopan, municipality of Atzizihuacán, both in the State of Puebla.
UPAEP participants	Students and professors of the Faculties of Medicine, Nutrition, Architecture, Civil Engineering and Environmental Engineering UPAEP High School Students. University Life Area Humanist Training Area Entrepreneurs Area

Strategic allies	Puebla Community Foundation, Estrella Roja, Mapfre Foundation and Beck Foundation.
Activities performed	<p>Installation of a university collection center. Visit to the communities of Tepapayeca and Xochiteopan in order to dimension the problem and define the needs to be addressed. Brigades for the supply of food, demolition and debris removal. Health and nutritional diagnosis. Community integration activities with families, children and youth. Proposals of architectural designs. Establishment of strategies for educational, cultural, family and community strengthening. Advice on the economic recovery process. Design and construction of one house for each affected family.</p>
Evaluation	Preparation of evidence of the intervention through the capture of photographs and videos. Similarly, interviews and feedback sessions were conducted by students, teachers and community representatives through the focus group methodology.
Divuligation	<p>The progress and results obtained in the project were shared with the university community and with the inhabitants of the affected communities, through internal means of communication and follow-up visits. There is a portfolio of evidence prepared by students and a video was recorded. The video explains the experience of students in the construction of a house for a family in the community.</p>

6. CONCLUSION

The incorporation of innovative pedagogical strategies, in the educational process in response to the need for comprehensive training of university students, requires reengineering of the teaching, learning and evaluation processes. This should be oriented towards the establishment of systematized, collaborative and multidisciplinary educational actions that allow the linking of disciplinary content with the main social challenges.

UPAEP has incorporated CBL in its pedagogical model and thus has been able to realize its educational proposal through the generation of community intervention integrating projects. Therefore, UPAEP has carried out actions related to various agents of

change, such as government agencies, companies, organizations and foundations of civil society; influencing the transformation of social realities.

With the use of CBL in academic programs and from the perspective of social innovation, curricular content not only had meaning for students but, above all, made sense in their comprehensive training and the development of generic, disciplinary skills and professional skills such as teamwork, research, social sensitivity, problem-solving, community intervention project design, empathy, social commitment, reflective thinking, and analytical thinking.

The experience with the project of Social Reconstruction under the process of CBL methodology, allowed students and university professors, not only to become aware of the short-term problem of the communities affected by the earthquake but also allowed them to participate directly in the various activities derived from the project, promoting the development of social commitment and citizenship skills in students.

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