

# PEDAGOGICAL MODEL LEARNING BASED ON PROJECTS FOR A CONTEXTUALIZED TECHNICAL TRAINING

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Received for publication on 07.27.2018

Approved on 10.16.2018

## Abstract

The article unveils the experience of installing and implementing the Project-Based Methodology (PBL) in technical education professional centers in Chile. It has enabled the systematization of practices targeted at the improvement of quality education, thus building a pedagogical model that can be replicated. Furthermore, a few preconceived pedagogical actions were described, which were key in order to enable students to learn in diversity, working with others, encouraging their emotional, personal and intellectual growth.

**Keywords:** Project-Based Learning. Technical and vocational intermediate education. Active learning methods. General Training. Differentiated training.

## 1. Introduction

Diversity is an element which formal schooling training has delayed over time, and, as a result, it is unequal, although everyone has access to it (CUBERO, 2008). This structure is a reflection of certain cognitive and cultural patterns specific to their authors, leaving out a considerable number of culturally diverse people, causing a reverse desired effect, and increasing the distance within the educational system.

This requires teachers to modify their pedagogical practices, and steer them to the integration of each students' singularities (LÓPEZ, 1997), in order to create effective links between their cultural background, with the contents that must be addressed in the established programs, therefore creating a meaningful learning (ONTORIA, 1999).

This enhanced scenario for a global, interconnected world requires changes in the way teaching work is developed with students, making it necessary to include strategies and methodologies that enable the participation of children and young people into the teaching-learning processes, fully developing their capabilities. That is how the teaching-learning active methods, such as the Cooperative Work and Project-Based Learning (PBL) become a relevant and effective answer for the creation of lasting lifetime learning in larger diversity contexts.

These methodologies foster the ultimate educational goal: to ensure everyone lives up to their potential and talents, regardless of each one's personal, socio-economic and cultural situation, in order to develop their cognitive and affective abilities, so that they can think reflexively and solve their own problems, hence allowing them to improve their quality of life.

The Chilean schooling system is not detached to this diverse and global reality, and it is taking charge of it in all educational levels during the 12-year mandatory education,

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**The project approach makes possible to combine vocational education to the methodology applied by teachers**

where the last two years are the differentiated cycle that offers two possible schooling paths. In one side, the Scientific-Humanistic High School, and, in the other, the Technical-Professional High School.

The Technical-professional High School, in Chile, with a trajectory of over 100 years, presently comprises 39% of last year's school registration, whose purpose is to graduate young people in a specific work field, turning it into a initial preparation area to the workforce, and, largely, an alternative for a unified education to adult life.

This preparation is built as a curriculum that combines the control of technical competences or peculiar to the specialty (Differentiated Education) with transverse competences and the contents of Intermediate Education General Training. It requires a teaching-learning interdisciplinary process between the two types of education, aiming to develop competences, which will allow students who choose this category to properly integrate in society through work field or continuing education.

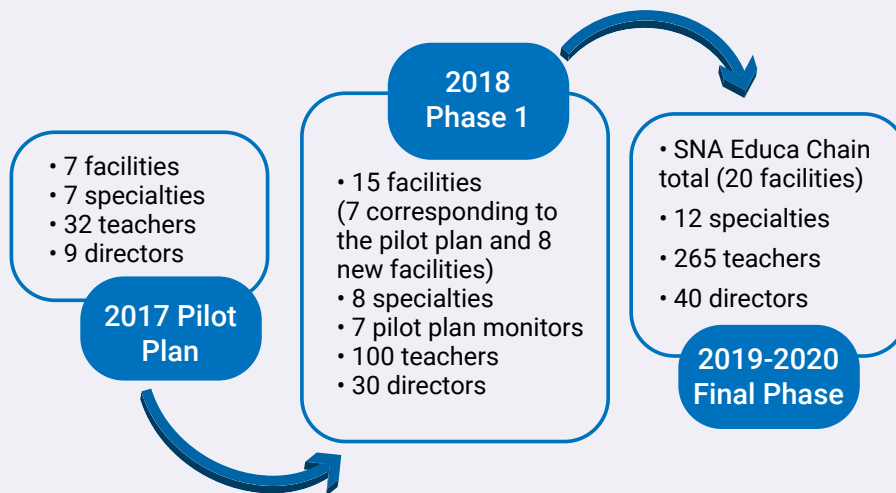
The project approach makes possible to combine vocational education to the methodology applied by teachers. This encompasses, among other topics, the definition of common objectives to different areas involved, and the building of a plan according to time, means and available resources to the development of each project.

The Agriculture National Society (SNA Educa) aspires to graduate whole people, with a clear, worthy education, defined entrepreneurial capability and competence to face new situations and solve problems, in both personal and professional fields. This agenda emphasizes the use of technology, global vision and proactivity as core competencies, achieved through the General and Differentiated training programs.

The SNA Educa Educational Corporation, with its 42 years of expertise in the Technical-Professional Intermediate Training, with emphasis in the rural sector and in vulnerability contexts, presently manages a Chain of 20 educational centers with ample coverage in the entire country, which shelters more than 11.000 young people trained in several specialties mainly related to the following sectors: Agricultural, Industrial, Food, and Mining.

The Pedagogical Model carried out at the SNA Educa facilities is based on the student's leadership, which entails a structure including different organization levels, beginning with the equipment, design and infrastructure distribution, up until the teacher-student interaction, and all the above items being focused in an effective, integral student development, therefore enabling their future work placement, the development of a company or a study search.

**Figure 1 - Progression system to the PBL methodology set up in the SNA Educa Chain**



Source: Own depiction.

Given that the PBL Methodology is an important answer to the education challenges faced by SNA Educa, it was decided, as an strategic guideline, to gradually set it up in the chain educational centers, as shown in the previous system.

Next is the two-year experience to set up and implement the PBL methodology in 15 SNA Educa technical-professional education centers in Chile.

## 2. PBL set up at SNA Educa centers

The new school context within a global world contrasts with the classic educational, standardized individual and simplified reality process (LÓPEZ, 1997), whereas, in the world, the exact opposite occurs, society becomes more complex, which requires new challenges to the teaching processes; as a consequence, people should be

more trained starting at their own capabilities and cultural features in connection with their reality to be actively encased in a dynamic and systemic world.

In this scenario, the active methodologies become more relevant, since they favor that the students assume a leading role in order to learn and develop themselves. This change in the teaching-learning process provides an opportunity so that young people can develop the skills required by society, becoming reflective, creative, technical knowledgeable, capable of learning throughout life, cooperatively working and effectively communicating.

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**The transverse competences contribute significantly to the personnel development**

These changes represent challenges to the educational system in the development of flexible skills or transverse competences, and, already in 2008, Wanger - co-director of the "Leadership changes" group at Harvard - has identified seven basic abilities in order to one's acclimation to the new work scene: critical thinking and problem solving; cooperation through networks and leadership by influence; agility and adaptability; initiative and entrepreneurial mind; effective verbal and written communication; access to and analysis of information, curiosity and imagination.

This opinion also finds support at Davos Forum, which identifies the 10 Best Skills for workers in 2020 as: complex problem solving, critical thinking, creativity, people management, coordinating with others, emotional intelligence, judgment and decision making, service orientation, negotiation and cognitive flexibility.

The capabilities to make decisions, stress management, flexibility, initiative or motivation are attributes that will enable students to develop in an organizational environment, beyond the technical knowledge. The transverse competences contribute significantly to the personnel development and directly influence employability, being one of the main central points in job interviews and selection processes.

In short, it is possible to combine these new demands in the training of technicians in:

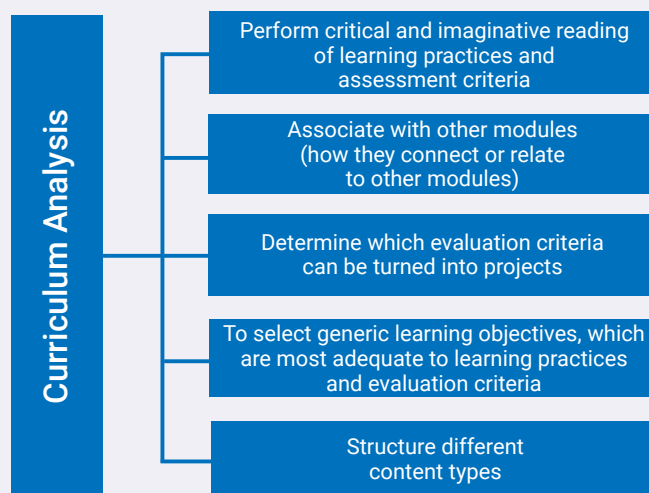
1. Learning to learn. It is the ability to independently train throughout the years.
2. Adjustment. It is the ability to develop oneself in different work environments, benefiting from all the capabilities in several contexts (of companies, sectors or countries).
3. Team work. Knowing how to adopt a positive role, putting knowledge and personal capabilities to work for a job in which several workers are involved and efforts are combined, leadership capability and other aspects are created.
4. Resolution. Applying logics and make decisions in different contexts, evaluating decisions and being able to troubleshoot errors. It includes project management with employees.

Project-Based Learning is not a recent methodology; on the contrary, one of the most well known milestones was in the early 20th century, with William Heart Kilpatrick in 1918, with the publishing of his work "The methodology of projects". However, it seems that their use today makes more sense in pedagogical practice, as it creates a more active participation of students and, consequently, their greater involvement (without often being aware that they are experiencing a significant teaching-learning process).

On the other hand, the PBL contributes and becomes an opportunity to recognize the subjects of General Training and Differentiated Training (Technical). This makes feasible to focus on pedagogical actions based on common and additional learning, benefiting a lasting learning acquisition, promoting a challenging education, attached to the needs and features of the students, connecting them with the real world through a project. This causes major motivation and autonomy of students, as well as essential skills such as research, cooperative work and problem solving, so necessary to properly approach their job placement or additional studies. Interdisciplinary work around a project also becomes a case of open and flexible collaboration among teachers, which provides learning spaces that enable the fullest development of each student's skills and work teams.

The implementation of the Project-Based Learning methodology at the center proposed that each facility would take a leading role in the process. In other words, it considered as focal point that the facilities had autonomy in each of its stages, from the analysis and curriculum review, training and updating of teachers and the preparation of teaching materials and evaluation instruments, among others.

**Figure 2 - Diagrama de análise curricular para implementar a ABP na Rede SNA**



Source: Own depiction.

Addressing the set up of Project-Based Learning in the institution facilities knowingly as pedagogical strategy answers to the fact that this approach, in addition to adapt particularly well to this training demand, since it enables the solely technical, combined development of transversal skills, promotes a positive attitude in students regarding learning and training.

Next, the actions that were determining in the PBL methodology implementation as a teaching learning approach in each of the educational centers:

- a. Building of a team of teachers and selection of learning objectives to work with. At each educational center or group of educational centers, teams include teachers who are teaching directly to students, both from General Education and Differentiated Education (or a specialty), as much as possible of the same educational level. It is crucial that the team also includes a pedagogical director who leads the faculty and enables the PBL implementation in each of the educational centers.
- b. Analysis of the technical skills or generic learning objectives expressed in the graduation profiles and integration of the general and differentiated (or specialty) curriculum, through the identification of focal points that will support the achievement of the competencies expressed in egress profiles.

On the other hand, teacher teams who apply interdisciplinary work through a project must have clear common and individual goals to be achieved, such as:

- A learning difficulty degree adequate to the study programs and educational level.
  - The learning coverage defined in the plans and study programs.
  - A learning approach, ability or transverse goal in more than one instructional area, achieving greater impact.
- c. The cooperative learning methodology set-up for the classroom work with students, as this is a key success factor for the subsequent PBL implementation. It is intended, at this stage, in order to guide the teacher job in the classroom, to implement a lesson plan explaining through different strategies and cooperative work techniques, that students work out most of the time as a team, in which they must play an active role and interact with others, taking on different roles. Although the classroom design or lesson plan simplifies the teaching work, it should be flexible in order to adapt to the reality of students and to the context of the center.
  - d. Setting up the PBL methodology, based on interdisciplinary work to determine the theme of the projects to be developed with the students, the preparation of teaching materials and assessment tools, in order to identify the earlier behaviors that the students must have to its resolution. This phase, regardless of the model with its different steps applied, requires a great ability of the teacher to flexibly adapt the model to the reality at the Center.

- e. Functionality of the PBL teaching staff. Regarding the coordinating and planning timing, it is important to maintain a schedule that allows the work of the teachers for planning and follow-up. In this respect, it is necessary to be flexible by adapting to the demands of the project (setting schedules, spaces, furniture that respond more to functions than papers etc.).

### 3. PBL methodology implementation in class

The active methodologies in the classroom, in particular the development of projects, provide the possibility for students to comprehensively learn, supported by their teachers. In this sense, the relevant aspects to its implementation in the classroom were the following:

- a. Using a template as a teaching resource. This allows students to take ownership of the project methodology and develop integrated technical skills, generic objectives and general training learning.

The model that guides the PBL implementation in SNA Educa considers the following phases:

**The occasion**, the moment when the teacher values the educational potential of a given theme, analyzing the goals that may arise, the acceptance it will get from the students and the impact on the educational community.

**The intention**, the stage at which the group of students, along with the teacher, decide whether the project will take place.

**The look**, the project design and its possible routes, from this moment the group starts to work on the project.

**The strategy**, research that identifies different routes to be followed by the group members in the development of the project.

**The action**, completion of a final product or service.

**The architecture** (transverse phase to the previous five stages), continuous account of the project development in all its phases.

**The evaluation** (transverse phase to the previous five stages), a process that combines the evaluation of the teacher with the self-assessment and the group co-evaluation.

Table 1 shows the intervention of the teacher and students in each phase of the model used.

**Table 1 - Material planning based on the PBL project**

PHASES	TEACHER ACTIONS	STUDENTS ACTIONS
<b>SURPRISE ONESELF</b>		
THE OCCASION	A project is born Feature-Oriented Domain Analysis (F.O.D.A.)	
<b>DECIDE</b>		
THE INTENTION	Look for detonator Summarize impressions	A project is born They express experiences in regards to the activities performed and commitments they made
<b>DRAWING THE PROJECT (ROUTES)</b>		
THE LOOK	Activates previous knowledge, what do students know? Problem formulation	Previous knowledge? What do we know?
<b>RESEARCH AND DO</b>		
THE STRATEGY	Research design, lines of work Research management Required resources	Proposals and research lines Research proposal formal writing Proposals defense
<b>ACT AND CHANGE</b>		
THE ACTION	Summarize action proposals introduced Estimates the impact	Project product Action Proposal
<b>TRANSVERSE TO THE ENTIRE PROCESS</b>		
THE ARCHITECTURE	Defines the architecture format	Proposes the project architecture: how to gather everything that happens during the project?
<b>TRANSVERSE TO THE ENTIRE PROCESS</b>		
THE EVALUATION	Continuing evaluation of learning processes, project, and relational dynamics	Continuous and final evaluation (co-evaluation and self-evaluation)

Source: VERGARA (2015).

Class planning. Its purpose is for the teachers to introduce the PBL model, which will become the script, and will make it easy for the students to develop and put into practice their several skills around a project development.

**Figure 3 - Lesson Planning**

SUBJECT/STUDY FIELD/MODULE			
COURSE/GROUP			
TIMING			
Total hours assigned to the project:			
Weekly hours assigned to the project:			
EXPECTED LEARNING AND EVALUATION CRITERIA			
Expected Learning	Evaluation Criteria EL		Generic Learning Objectives EL
	CL1		
	CL "n":		
EL Contents	Grades	Procedures	Professional Outlook

Source: Own depiction.

- b. Project general planning. It describes the modules or materials involved, the objectives covered (general and specific) and all the details displaying a process synopsis and the interdisciplinary work to be carried out by the teachers in different centers.



Figure 4 - General planning of a project

1. PROJECT TITLE/ PROJECT SLOGAN			
2. GENERAL OBJECTIVE			
3. AREAS/SUBJECTS/INCLUDED COURSES			
TEACHER	AREA	CONTENTS	COURSE
Subject/Area/Module	Included Course	How my area contributes to the project?	
4. PROJECT SPECIFIC OBJECTIVES			
AREA	SPECIFIC OBJECTIVES	COURSE	
5. SKILLS TO DEVELOP DURING THE PROJECT			
Cognitive skills (TO KNOW)			
Affective and social skills: (TO FEEL + SHARE):			
Metacognitive skills: (TO KNOW ONESELF)			
Problem solving skills: (TO SOLVE)			
Concepts and principles to apply: (TO DO/ACT):			
6. COMPETENCES FOR LIFE /TRANSVERSE COMPETENCES/ GENERIC LEARNING OBJECTIVES			
Learning as a process:			
Cooperation:			
Executives:			
Critical thinking:			
Creativity:			

Source: Own depiction.

- c. Implementation monitoring. Monitoring and follow-up of major milestones, through virtual or in-person meetings on the progress, follow-up visits to teams of teachers, additional reports on the progress, in order to assess compliance levels of different stages, which take into account the achievement of objectives in the implementation of the project.
- d. Contextualizing of projects. The projects developed by students are related to the social or professional context situation, which is particular to the facility. This helps students to get more involved, and, as a result, they occupy the center stage and are able to test their knowledge, skills and behaviors, in addition to being more receptive to new learning and solutions. Examples of projects developed by SNA Educa:

Figure 5 - Examples of PBL Projects developed by SNA Educa



Source: Own depiction.

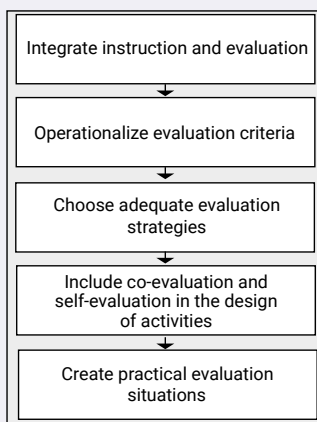
#### 4. Evaluation in the project creation process

It is important to mention that the “assessment” stage is performed transversely throughout the project process, as it provides continuity, motivation and engagement in young people’s learning.

The evaluation criteria specify the achievement level regarding learning outcomes and describe what is desired in all its dimensions (conceptual, procedural and attitudinal).

The synthesis of the evaluation process that teams of teachers from each center address is as follows:

Figure 6 - Stages of the evaluation process



Source: Own depiction.

A number of teacher and student evaluation cases are presented below:

**Table 2 - Evaluation function during the learning process**

The evaluation must assist with the observation of all participants about the learning. It must be an element that is present during the entire process and combine the educator evaluation with the self-evaluation and group co-evaluation.	
TEACHER	STUDENT
Continuous evaluation (tools, agents, timing). It functions as working guide to the weekly, biweekly, or other evaluation sessions	Continuous evaluation (it functions as basis the previous observation to the weekly, biweekly, etc. evaluation meeting)
Evaluation of the learning results (with demonstration of tools, agents, timing, if no headings are used)	Final evaluation (it functions as a guide to the final evaluation meeting)
Evaluation of project phases (of resources, timing, grouping, techniques and dynamics utilized)	
Evaluation of the relational dynamic (operation of teams, the teacher role, community agents, etc.)	

Source: Own depiction.

A variety of supporting tools, timings and participants involved in the evaluation coexist in the PBL:

- A few of the supporting tools are portfolios, learning journals, questionnaires, conceptual maps, cooperative team evaluation target, the Six Thinking Hats, data flow diagrams, role drama play, open questions, multiple choice questions, product evaluation headings, etc.
- As for the timing, the evaluation is performed with different frequency: daily, weekly, biweekly, monthly and up until the end of the project.
- Grouping levels are considered in regards to the subjects to be evaluated, that is, the student is individually evaluated, as well as the work group and the course group.

Finally, teachers evaluate their own teaching process to support or modify their pedagogical interventions, in order to reach the proposed learning objectives in the project planning.

The relevance of the work done would not make sense if we did not consider the impact it caused in students and teachers.

Next, a few opinions collected through interviews with students and teachers during the follow-up visits:

The cooperative work helped me to get to know myself (third-year High School student, with specialty in Automotive Mechanics, *Liceo Agrícola el Carmen de San Fernando*).

The teacher guides us and we find our own answers (third-year High School student, with specialty in Industrial Mechanics, *Liceo Industrial Guillermo Richard Cuevas de San Felipe*).

We all learn and realize that we are able to contribute to the work group (third-year High School student, specialty in Industrial Mechanics, *Liceo Industrial Guillermo Richard Cuevas de San Felipe*).

To take on a role within the work group help us to better organize ourselves, to save time and it compels everyone to work (4th-year High School Student, with specialty in Agriculture, *Liceo Agrícola de San Felipe*).

It takes longer to organize everything, however, better results and products are achieved, besides, students learn more (Science Teacher, *Liceo Agrícola de San Felipe*).

The cooperative work helped to integrate students who were apart from the course (English Teacher, *Liceo Agrícola el Carmen de San Fernando*).

It is amazing to see the findings and issues that arise from students being challenged by the teacher, learning by themselves, achieving significant progress (Specialty Teacher, *Liceo Industrial Guillermo Richard Cuevas de San Felipe*).

## 5. Final considerations

The Project-Based Learning is a conducive methodology to the 21st century education, because students take on a leadership role in the teaching-learning process.

In addition, it turns out to be a relevant methodology for technical training, since it enables the acquisition of technical and labor skills by young people, with the use of a balanced combination between theory and practice.

### The Project-Based Learning is a conducive methodology to the 21st century

In the context in which the PBL methodology is developed the acquisition and practice of social skills by the students are promoted while strengthening their integral education, raising the relevance and response to the demands of social and productive environment. On the other hand, it contributes significantly in the coordination of different subjects that make up the curriculum, both for the general education and the differentiated education; such integration is a basic tenet in order to obtain a quality technical education.

From the experience in the implementation of the ABP methodology, with regard to the installation and management aspects:

- The methodology requires a paradigm modification in the way some teachers think, that is why the socialization with them about the PBL benefits and its leadership role in the implementation is paramount, as well as the dissemination of its impact and results. The success of its implementation demands the willingness of teachers and administrators, as it requires to be updated in its practices and knowledge, is willing to investigate and have enough flexibility to work with other teachers.

- Curriculum analysis makes it possible to identify learning goals more compatible with the PBL methodology.
- It is essential to set up the cooperative learning methodology in advance.
- The implementation of the PBL methodology should be gradual, systematic and flexible, it is supplemental to other learning methodologies, and it is not for all contents or for all times.

In regards to the Management.

- It requires more time for preparation and implementation. Teachers who take on a new role as facilitators need more time to plan and evaluate the processes, which translates into teachers committed and cohesive as a PBL team. The majority of teaching teams required an adjustment period to decide on the theme and the project progress. The performance was smoother with the teams holding the same educational level courses.
- One of the main challenges is to keep a log of all phases. This evidence alone will make it possible to evaluate the project progress and the learning process level expected.
- The functionality of the project will depend on a detailed and accurate planning, as well as the leadership and management team support of each center.
- The follow-up is fundamental to the teams that are developing a project for the first time. There is a risk of focusing on the final product or service, leaving all planned learning objectives behind. One should always focus on the learning pursuit.

In regards to the benefits obtained with the methodology implementation:

- Students find meaning in learning, because, thanks to the PBL, they learn working in contexts that are meaningful to them, and it becomes a lifelong learning experience.
- It increases training times, avoiding content and learning repetition among the subjects.
- Critical thinking, autonomy and motivation development are maximized to the students.
- It causes teachers to seize education egress profiles.
- It strengthens the skills of students and teachers by means of interdisciplinary and cooperative work.

To ensure the methodology progresses in centers, three actions are suggested to improve it, to measure its impact and perfect it:

- To formalize and systematize its implementation in the study program.
- To strengthen, on a permanent basis, the competences of teachers.
- To build a bank or repository of projects.

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