

Project-Based Learning: An Innovative Experience in Training Pharmaceutical Services of Villa Clara, Cuba

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Abstract: The teaching-learning process is greatly enriched when the motivation of students is achieved, so that they show greater interest in learning and are allowed to interact with others in being, knowing and doing, where they constantly ask questions, are amazed and can seek solutions to increasingly complex problems of their school and professional environment. To this end, it is necessary to propose a Project Based Learning methodology based on an optional program for the initial training of the Short Cycle Higher Technician in Pharmaceutical Services, during the 2022 course that contributes to the achievement of professional competences and knowledge management of the future graduate of Pharmaceutical Services of the Faculty of Nursing and Health Technology. University of Medical Sciences of Villa Clara, Cuba, which will be oriented to action, interdisciplinarity and use of Information and Communication Technologies. The Project Based Learning methodology proposed in the elective program constitutes an innovative experience in the undergraduate course, with the purpose of developing skills in self-management of knowledge in students and development of professional competences.

Keywords: Project-based learning, Competencies, Teaching-Learning Process.

1. Introduction

Graduates of initial training in Pharmaceutical Service show deficiencies in self-management of learning, which prevents them from successfully performing various tasks and responding to complex demands. This hinders the development of their competencies and affects their care work.

The development of independent work in the training of the Higher Technician in Pharmaceutical Services reveals a lack of quality in the deepening of knowledge in the different forms of teaching, the revision of the bibliography made by the students is insufficient and what they learn from it does not satisfy the proposed objectives.

In addition to dispensing medicines, graduates must perform other functions that allow them to join the health team and interact with patients, as stipulated in the Model for the Training of the Professional at the Short Cycle Higher Education Level. Pharmaceutical Services ([Ministry of Public Health of Cuba, 2018](#)); this requires continuing to improve independently for which they have computer media connected to the internet, but they do not feel prepared to manage their own learning.

The way in which the students' self-learning development process is planned and organized during their training is fundamental in the achievement of the referred objective ([Fernández-Cabezas, 2017](#)). Hence, the requirements to be met by the didactic conceptions used by the teacher, to stimulate an active participation of the learners in the process of autonomous appropriation of the contents object of learning, must be a space that awakens motivation and participation of students, so it is necessary to rethink the predominant educational models today (focused on the transmission and reception of fractioned

knowledge), to readapt them to contemporary training requirements (Fernández-Cabezas, 2017; Medina-Nicolalde and Tapia-Calvopiña, 2017).

Thus, educational praxis must leave aside the usual methods and venture into new active didactic strategies, which stimulate the development of competencies in terms of improving the educational process (Silva-Alache, 2018).

Taking into account this consideration, implies a change of pedagogical paradigm in front of the traditional teaching-learning models (Cáscales-Martínez and Carrillo-García, 2018).

Project Based Learning (PBL) is a way to solve the declared need for self-learning on the part of students, by actively intervening in the teaching-learning process and bringing the educational system closer to the context in which it operates after graduation.

PBL has its roots in the constructivist model (Dewey, 1997; Ginsburg and Oppen, 1987), which evolved from research conducted later and considered learning as the result of mental constructions, with new ideas, which are based on current and previous knowledge (Dole *et al.*, 2016).

PBL is understood by some pedagogues as a comprehensive educational strategy (Blank, 1997; Dickinson *et al.*, 1998; Harwell, 1997), as an instructional strategy (Katz and Chard, 1989), as a learning strategy (Edwards *et al.*, 1993). In contrast with other pedagogues (Greenleaf, 1997; Kilpatrick, 1918; Knoll, 1997; Maldonado, 2008) assume it as a teaching method. Rekalde and García (2015) present it as a didactic methodology. Other authors, such as García-Varcácel Muñoz-Repiso and Gómez-Pablos. (2017); Fernández-Cabezas (2017) and Cáscales-Martínez and Carrillo-García (2018) consider that project-based learning provokes a pedagogical and social change, standing as an option to transform traditional teaching strategies.

Regardless of the fact that the implementation of project-based learning constitutes a necessity, due to the opportunities it provides in terms of learning a discipline or several subjects, the author, from her critical position, has detected that there are in the literature, very varied proposals and linked to specific contexts. Consequently, it is necessary to investigate how to implement project-based learning in the initial training in Pharmaceutical Services, Faculty of Nursing and Health Technology. University of Medical Sciences of Villa Clara, based on the particularities of this process. Therefore, it is presented as a scientific problem:

There is no form of implementation of project-based learning that contributes to the achievement of self-management of learning of the future graduate in the initial training in Pharmaceutical Services of the Faculty of Nursing and Health Technology of the University of Medical Sciences of Villa Clara.

Therefore, the objective of the research is: to propose a Project Based Learning methodology based on an optional program for the initial training of the Short Cycle Higher Technician in Pharmaceutical Services, which contributes to the achievement of professional competences and knowledge management of the future graduate of the Faculty of Nursing and Health Technology. University of Medical Sciences of Villa Clara.

2. Materials and Methods

The design of the Short Cycle Higher Technician in Pharmaceutical Services has a systemic approach, and responds to the social needs existing in the country, the scientific-technical advances and the particularities of the profession. The contents of the classroom hours are distributed on the basis of the basic curriculum: 2476 hours and the optional curriculum: 192 hours presented in the Model for the Formation of the Professional of the Short Cycle Higher Education Level. Pharmaceutical Services (Ministry of Public Health of Cuba, 2018).

It was organized in three academic years and 21 subjects, including pre-professional practice. In the study plan appear a time fund of 200 hours destined to the own - optional curriculum.

The general organization of the career responds to the level of complexity of knowledge, where from the first year onwards, subjects are taught where theory is linked to practice preparing students from the labor point of view in the same scenarios where they later perform as senior health technicians (Ministry of Public Health of Cuba, 2018).

The training in Pharmaceutical Services at the Faculty of Nursing and Health Technology, University of Medical Sciences of Villa Clara, has a total enrollment of 28 students, distributed 15 in the first year, one student in the second year and 12 students in the third year. Based on the experiences of an approximation of the ABP Implementation in the group that is in the third year of training, the optional program proposed will be taught for the second period of the 2022 course.

2.1. Description of the Didactic Proposal Project Based Learning

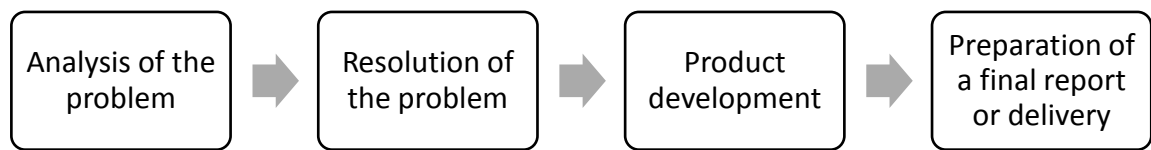
PBL aims not only to learn about something, but to do something with the knowledge learned, i.e., it leads students to transfer their knowledge and skills into a specific, real product that transcends the classroom (Cáscales-Martínez and Carrillo-García, 2018).

This is one of the great challenges of technical and technological education in the face of the processes of change and is to prepare their students from interactive and self-managed learning that require flexible teaching strategies to promote the acquisition of skills that allow them to evolve at the pace of change and readjust to the workplace (Pérez Muñoz and Carballosa González, 2018).

According to Hernández (1998) and Zúñiga Igarza *et al.* (2021) this type of strategy is located within teaching for understanding, since it implies participation in a participatory research process of their interest, which allows them to recognize the other and understand their own personal and cultural environment, i.e. it favors the self-knowledge of students, teachers and the world in which they live.

In general terms, PBL comprises the development of four stages that are represented in Figure 1 (Toledo and Sánchez, 2018).

Figure 1. Stages for the implementation of PBL



Each of these stages involves specific activities for both the teacher and the students. Below are the activities to be considered in each of these stages as described in the document of the Instituto Tecnológico y de Estudios Superiores de Monterrey (2000).

2.1.1. Problem Analysis

In this stage, a discussion should be generated to contextualize the problem to be solved and possible solutions are discussed to encourage students to look for readings related to the topic or to seek interviews with experts who can guide them.

The role of the teacher as a guide and facilitator at this stage emphasizes socializing the students about the project methodology and collaborating in the identification of key issues from the point of view of relevance, for its development.

2.1.2. Problem Solving

In the second phase, the different methods that can be used to solve the selected problem must be evaluated and based on the choice of the solution method, the depth of knowledge required to solve the problem must be determined, generally divided into several sections to increase the level of detail.

2.1.3. Product Development

For the next stage, the roles within the project, the work plan and the development of the product or service are established. Students will put previous knowledge into practice in a contextualized way and will have to acquire new knowledge on their own, thus generating complex thought processes.

2.1.4. Reporting

In this final stage, students must prepare a report documenting the development of the project. In addition to the product or service generated, through an oral and written report, students can demonstrate the knowledge acquired, as well as oral and written communication skills and teamwork skills.

Regarding the teacher in this last stage, its main function is to facilitate among all participants, including him a feedback of: The final product, what was planned with what was done: the process, includes experiences, mistakes, best practices, achievements, how was the work carried out by the group and recommendations for improvement to take into account in future projects to be developed.

It can be affirmed then that, from the teacher's point of view, it is necessary to generate working conditions, adjust the level of demand and define evaluation according to the different projects proposed by the students.

In the case of the students, they should choose a topic that is interesting for them to develop throughout the semester, define the roles that each one will have in the execution of the project and draft a document at the beginning of the project in which the scope of the students' commitments is written and according to which they will be evaluated.

2.1.5. Role of the Teacher and Student in Project Based Learning (PBL)

Teacher's role

- Know the necessary steps to promote PBL, as well as the roles played in the dynamics.
- To know the subject matter and clearly state the objectives of the problem-situation, the expected learning and the skills and competencies to be developed.
- To master the group work technique.
- To conceive the small learning group as an effective space to develop critical thinking skills.
- Play the role of tutor, providing individual counseling when required by the students.

Student's role

- To know the objectives of the PBL.
- To be committed, within the group, to the achievement of effective learning. At the same time, demonstrate receptivity to learn from others and to share knowledge.
- Seek, with responsibility, the information deemed necessary, so as to take advantage of the available resources.
- Work collaboratively to develop communication skills.
- Apply the skills of analysis and synthesis of information, with critical vision.

Regarding the roles of students in the development of the project, it is assumed to take to educational plans what is stipulated in the document of the Madrid Spain chapter of the PMI (Project Management Institute) in which the following roles are defined in a project: Program Manager, Project Manager, Project Manager and Participant (Aldana *et al.*, 2016).

According to PMI, the Program Manager is the one who verifies the strategic feasibility of projects, negotiates bids and contracts and in general who is in charge of relations with groups external to the organization. The Project Manager is the one who validates the technological and economic feasibility of the projects, is in charge of leading large-scale teamwork, participates in the commercial negotiation and is in charge of relations with external groups.

Table 1. Competencies acquired by a technologist according to the role in the project.

	Project Leader	Participants
Competencies	Cognitive Estimate costs and efforts Validate the technological feasibility of the project Validate the fulfillment of the objectives of your work team Procedural Coordinate the work team according to the established work plan Make technical and technological decisions Submit compliance reports Attitudinal Being responsible for the fulfillment of the team's objectives Resilience and negotiation skills in the face of difficulties Working in a team Listening to different opinions Reading skills Oral and written fluency Learning how to Learn	Cognitive Define activities for the achievement of the objectives identifying risks Procedural Execute your work plan Submit compliance reports Attitudinal Be responsible for the fulfillment of your objectives Work in a team Listen to different opinions. Independence in decision making and specific functions.

2.2. Steps to Get Started With Project-Based Learning

1. Choose a project topic. This can come from the students or from the teacher, the important thing is that it is close and attractive to them.
2. Identify objectives and content. If teachers of different subjects participate in the project, the first step is to identify the curricular contents to be worked on and put them in common.

3. Create an activity, a problem situation that motivates students to investigate the chosen topic. It should generate questions, doubts, concerns, etc. It is the moment to ignite the spark of curiosity!
4. Create a wish list. It is very important to identify the contents to be learned, as well as the final product. We can elaborate a list with the students where their "desires" and learning needs are reflected.
5. We must also decide what the final product will be. It is necessary to choose with which product we are going to expose the learning to others. It is the final product that will determine what competencies the learner will acquire.
6. Choice of competencies. The choice of the competencies to be acquired by the learner can be made before the choice of the final product, and both steps are mutually conditional. For example, if the final product is to elaborate a multimedia resource in a group, learners will acquire different competences than if the final product is an oral presentation in pairs.
7. Respect the deadlines and phases of the project. It is necessary to make clear the deadlines for each phase of the project. The projects are divided into three clear phases, a first stage of research and planning, a second stage of development of the final product, and finally a third stage of exhibition and evaluation.
8. Establish learning goals. A fundamental part of the procedure for students to evaluate their own process. It should include the levels of achievement of competencies and curricular content.
9. Constructive criticism. Students can make temporary group exchanges to contribute ideas to other classmates. In these exchanges they should help by saying what is good and what they think they need to improve.
10. Finally, the public presentation. Students will present their work in front of others, which will motivate them to get a positive result and show the best of themselves and the work they have done.

2.3. Proposed Activity for the Implementation of the ABP

Elective Program: Pharmacovigilance of Narcotic Drugs and Psychotropic Substances in Primary Health Care

First step: Choosing a project topic

The following problematic situation arises: there is no single reference material in pharmaceutical practice that regulates the control of each of the links that make up the critical route for the use of narcotic and psychotropic drugs in Primary Health Care, which makes it difficult to manage knowledge and carry out proper pharmacovigilance, since the information is very scattered.

By means of brainstorming, a consensus was reached as to what could be the solution to the difficulty presented.

From this, the following is derived as a possible solution: (it can be proposed by the students or by the teacher)

- Support material or reference manual in printed or digital format.
- Interactive multimedia

The design of an interactive multimedia that favors self-evaluation and learning about Pharmacovigilance of Narcotics and Psychotropic Drugs in Primary Health Care is agreed upon. The teams are formed and the roles to be performed are defined. In the case of Short Cycle Technicians in the first year of Pharmaceutical Services with an enrollment of 15 students, five teams of three students are formed to focus their project on the different elements that will make up the final product.

Second step: Identify objectives and contents: It is intended to develop interdisciplinarity, so from the year group through discussion and involvement of teachers who are part of the academic training, as is the case of the subject Research Methodology, Informatics, pharmacology, toxicology, Pharmaceutical Services and language training, i.e. English, the curricular contents to be worked on are identified and pooled.

Review of the state of the art: Readings suggested by the teacher to focus the information search process in an autonomous way by the students.

Third step: Making a "Surprising Event".

A Workshop on addictions in young people will be given, making clear the link with the profession, movies, musicals, effects on health in general of the use of these substances by man and if possible the consequences of the lack of control in the field of pharmaceutical services, legal responsibility and examples will be presented.

It should be an activity that motivates students to research on the chosen topic. It should generate questions, doubts and concerns.

Fourth step: wish list: It is very important to identify the contents to be learned, as well as the final product.

The Elective Program: Pharmacovigilance of Narcotic Drugs and Psychotropics in Primary Health Care. It has the following Topics (those that correspond to the content to be learned)

Topic I Evolution of the pharmacovigilance system in the world and in Cuba, reasons that justify its implementation.

Topic II International and national legal instruments on the use of narcotic drugs and psychotropic substances.

Topic III Pharmacology of narcotic and psychotropic drugs.

Topic IV Toxicology of narcotic and psychotropic drugs.

Topic V Mechanisms for the control of the critical path in the use of narcotic and psychotropic drugs in primary health care.

A "Wish List" is elaborated together with the students where their learning needs are reflected, taking into account the professional, cognitive, procedural and attitudinal competencies. This will be taken into account to reelaborate the strategy in such a way that it meets the learning needs stated by the students. On the other hand, they will constitute the indicators that will make it possible to evaluate the fulfillment of the objectives proposed in the program of the subject taught.

The following steps are directed to the preparation of the final product, the rules on which the students are governed for the preparation of research reports and the information to be contained in the Multimedia.

The competencies are related to those stated in the appropriate training model in such a way that they are developed according to the Role that corresponds to each student.

Step seven: deadlines and phases

Research and planning stage will be carried out in the period between September - October 2022.

Final product development stage, during the month of November 2022.

For the presentation, exhibition and evaluation of the final research project reports will be conducted in the month of December 2022.

Step eight: Establish learning goals

Indicators for evaluation and to be able to measure the achievement of the objectives, as well as the competencies described in Table 1. Which are effectively checked in the education at Work, with the fulfillment of the skills of the training.

Step nine: Conduct constructive criticism

At this level of PBL implementation, the exchange of experiences is encouraged and a partial presentation of the final report is made. (Pre-defense), with the aim of facilitating group exchanges to provide ideas to other colleagues. In these exchanges, they should help by saying what is good and what they think needs to be improved.

Step ten: Finally, the public presentation

It can be in the classroom, with the presence of courts of the specialty, but another space could be to make it coincide with basic student scientific conferences or other events related to the specialty.

The product obtained should be generalized and taken to the solution of real problems of the Pharmaceutical practice. If possible, the results should be published.

Teachers should develop their didactic strategies, based on constructivism, taking into account learning by doing, previous knowledge, significant learning and personal and group responsibility, in order to carry out from the classroom, transformations to the environment that lead to the improvement of the quality of life of people and the community in general from giving solutions to complex tasks that allow acquiring a deeper and lasting learning (Dewey, 1997; Ginsburg and Oppen, 1987).

Within the group of strategies that should be privileged are Project Based Learning, since this largely involves the five dimensions of learning: positive thinking attitude, thinking activities related to the search and integration of knowledge, thinking attitudes related to the refinement and expansion of knowledge, meaningful use of acquired knowledge and productive mental habits for the generation of

knowledge (Cáscales-Martínez and Carrillo-García, 2018; Fernández-Cabezas, 2017; García-Varcácel Muñoz-Repiso and Gómez-Pablos., 2017).

In addition to placing the student at the center of learning, it facilitates the teacher the integration of theory with practice from everyday events, i.e., putting into practice what has been learned based on real-life cases and situations, which contributes to the achievement of personal competencies such as critical thinking, autonomy, information search and selection, innovation and criticism. As interrelational competencies, these are present in group work and are related to decision-making, communication, dialogue and consensus (Gudiño León *et al.*, 2021).

The role of the teacher is to support the students, as a guide and facilitator of the whole process, and it is highlighted in the evaluation, related to the feedback that can come from various sources (themselves, peers, the teacher and experts). This feedback facilitates both the student and the teacher the elaboration of meta-cognition processes, ensuring lifelong learning and the realization of solutions and products facing the context, i.e., of quality against the relevance of the environment (Dole *et al.*, 2016).

The topicality of this research is determined by its inclusion in the range of interests of science in terms of expanding the areas of application of project-based learning. Taking into account the continuous and accelerated technological development of the pharmaceutical and health care industry in the world, it is necessary to constantly update the pharmacist in order to provide adequate information to patients about the rational, effective and safe use of medicines.

The proposal intends to reelaborate students' ways of learning, giving them the leading role that will allow them to integrate into the health team and interact with patients, from pharmaceutical care, being this the area of knowledge and professional practice that encompasses the whole process of drug supply, This is the area of knowledge and professional practice that encompasses the entire process of supplying medicines, medical devices and the care process, with the aim of ensuring good patient care, with equity, efficiency, effectiveness, cost control, measurable results and impact on health and quality of life, which leads to the pharmacist's participation in activities that promote health and prevent diseases. This could be achieved by adjusting project-based learning to the Cuban reality.

The results obtained can be extended to the rest of the Faculties of Nursing and Health Technology in the country due to the analogy that these processes have in all Cuban universities, as an educational experience their future performance, according to the professional training model in the solution of problems and modes of action.

3. Conclusion

With the study carried out, a Project Based Learning methodology adjusted to the conditions of the academic environment of the Pharmaceutical Services is proposed. This will allow students to experience in the classroom the roles and challenges they may encounter in the work environment. At the same time, it dynamizes the learning process by promoting the internalization of concepts and positively stimulating the emotional aspect of the learning dimensions.

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