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Customer Information System for performance evaluation of three Public Utilities. Case study PBL

Sistema para evaluar tres servicios municipales de utilidad pública. Caso de estudio de ABP

LAGUNES-GÓMEZ, Isabel† & HERNÁNDEZ-Y ORDUÑA, María Graciela*

Instituto Tecnológico Superior de Alvarado, Tecnológico Nacional de México
Academia de Desarrollo Regional Sustentable, El Colegio de Veracruz

ID 1st Author: *Isabel, Lagunes-Gómez* / **ORC ID**: 0000-0002-4631-4385, **Researcher ID Thomson**: J-1920-2016, **CVU CONACYT ID**: 623176

ID 1st Coauthor: *María Graciela Hernández-y Orduña* / **ORC ID**: 0000-0003-2958-9907, **CVU CONACYT ID**: 102548

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Abstract

In the present work we show an extra academic activity (EAA) developed through a university innovation project: "Design and construction of a system to evaluate the quality of municipal public services" developed at the Instituto Tecnológico Superior de Alvarado by a group of teachers of Computer Systems and Basic Sciences, with student participation of Engineering in Computer Systems. Our objective is to analyze the contribution of the Project-Based Learning (PBL) methodology to university education and professional development of teachers. We use the qualitative research method Participatory Action Research (IAP), field experience log and portfolio of evidence for data collection and coding and scales for processing. As a result, we found that the educational experience created meaningful learning, as well as verifiable academic products, and verifiable competencies and professional experience for the mutual benefit of students and teachers. Therefore, we conclude that the ABP is an effective Strategy for Creating Meaningful Learning Experiences in technological higher education, because its results have a positive impact on university education and Professional Development of Teachers. To conclude from this experience we offer recommendations to obtain better results.

Project Based Learning (PBL), Case studies, Participatory Action Research (PAR)

Resumen

Se estudió la contribución del Aprendizaje Basado en Proyectos (ABP) al ejercicio de funciones universitarias en la experiencia educativa extracurricular «Diseño y construcción de un sistema para evaluar la calidad de los servicios públicos municipales», desarrollada en el Instituto Tecnológico Superior de Alvarado por un grupo de docentes de Sistemas Computacionales y de Ciencias Básicas, con participación estudiantil de la Ingeniería en Sistemas Computacionales. Se empleó el enfoque cualitativo y el método Investigación-Acción Participativa (IAP), para la toma de datos la bitácora de campo y el portafolio y para su procesamiento codificación y escalas. Como resultado, se observó que la experiencia desarrollada contribuyó a la formación de recursos humanos y al desarrollo profesional docente, a través de la generación de competencias, productos académicos, y experiencia profesional comprobables. Por lo cual, se concluye que el ABP se puede emplear en contextos de educación superior tecnológica con resultados efectivos e integradores, tanto en la formación de recursos humanos, como en el desarrollo profesional docente. Para finalizar, basados en esta experiencia, se ofrecen recomendaciones para obtener mejores resultados.

Aprendizaje Basado en Proyectos (ABP), Estudio de caso, Investigación-Acción Participativa (IAP)

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* Correspondence to Author (email: autorcorresponsal@gmail.com)
† Researcher contributing as first author.

Introduction

From the institutional vision of the current Mexican government, quality in education consists of achieving excellence, relevance and relevance of education at all levels and modalities. In higher education, the concept of quality is associated with the exercise of central functions (Tobón, Rial, Carreto, and García, 2006), which for this case are defined as: strengthening the commitment of educational institutions with their community (local, regional and national) and its cooperation and link with the productive sector; promote the training of students through the development of projects that improve their practical, theoretical and methodological capacities; and revalue teacher professional development and its continuous improvement (Presidencia de la República, 2020).

Specifically speaking of the technological higher education developed within the framework of the National Technological Institute of Mexico (TecNM) 1, the excellence, relevance and relevance of education is pursued through instruments such as: the Program for Teacher Professional Development, for the Higher Type (PRODEP) coordinated by the Secretary of Public Education, through the Directorate of Academic Improvement; the National System of Researchers of the National Council of Science and Technology; and the Program of Incentives for the Performance of Teaching Personnel, the Dual Education Model for the undergraduate level and the Manual of Academic-Administrative Guidelines, the latter three exclusive to TecNM.

These actions and programs establish priority functions of the educational task, among which are: the teaching of classes, tutoring, research, technological development and innovation, and academic management activities and links with the environment. However, in practice its exercise is conditioned by contextual restrictions specific to each educational institution (Montes, 2020), whether these are organizational, budgetary, by management styles, and / or by the disposition, preferences or abilities of the students themselves. teachers or students;

Therefore, in this work it is in our interest to present an experience of strategic integration of teaching substantive functions, developed using as a technique learning based on the project "Design and construction of a system to evaluate the quality of municipal public services". its objectives, the methodology used, as well as its results, scope and possible applications. This experience was developed, between December 2017 and March 2020, at the Alvarado Higher Technological Institute (ITSAV) 2 by a group of teachers from the Computer Systems Academy, under the coordination of the Academy of Basic Humanistic Sciences, with the purpose of paying for the social function of the university as a transformer and creator of changes (Samour, 2015).

State of the question

Studies show that the efficiency with which citizens perceive government results influences public trust and their willingness to align with it (Díaz, 2017; Scartascini, 2019); Despite this, in Mexico the measurement of the quality of procedures and public services is limited (INEGI, 2016, 2018) and this deficiency mainly affects municipal public administrations, for which since 2011 there are 2 official projects, aimed at monitoring the quality of the procedures and services they provide: the National Survey of Government Quality and Impact (ENCIG) and the National Census of Municipal and Delegation Governments (CNGMD), both coordinated by the National Institute of Statistics and Geography (INEGI). Unfortunately, the information that these projects manage presents attributes that make it little useless to generate diagnoses focused by municipality and by locality, since its coverage does not include all Mexican municipalities and delegations of Mexico City.

Therefore, and since the main objective of the ITSAV is to positively impact its environment and train professionals and researchers capable of applying and generating scientific and technological knowledge, in accordance with the requirements of the economic and social development of the region, of the State and the country; The purpose of the working group was to develop a contribution that, combining their profiles, would seek to address the deficiency in access to systematized information and by locality of the quality with which municipal public services are provided.

ISSN-On line: 2539-1372

Theoretical framework

In this study we use a qualitative approach because we consider that it is compatible with educational practice and enriches it, while, returning to Taylor and Bogdan (cited in Alvarez-Gayou, 2016), for this type of study all scenarios are worthy study, allows the use of flexible research designs, its perspective is holistic, researchers are sensitive to the effects they cause on the people under study, it tries to understand people within the same frame of reference, and it is interested by all the perspectives of the participants.

The methodological foundation of the design is congruent with the methodological position of Alvarez-Gayou (2016) who, in opposition to the positivist approach, chooses: authenticity versus validity and structural corroboration (Eisner cited in Alvarez-Gayou, 2016) versus reliability. The research design is based on triangulation of data and methods (Denzin and Lincon cited in Alvarez-Gayou, 2016). In our case, the methods used are Participatory Action Research (PAR) and Project-Based Learning (PBL).

We selected Participatory Action Research (PAR) since, according to Reis-Jorge, Ferreira and Olcina-Sempere, (2020) it is the research model most frequently associated with systematic reflection and critical analysis of teachers as researchers of their practices. In addition, knowing reality aims to transform it (Colmenares, 2012; Hernández and Mendoza, 2018; Ballester, 2004), and by focusing on one's own practice, it allows developing the critical reflective capacity of teachers and improving their capacity for intervention in their daily work (Ballester , 2004) when they plan and explore educational situations, they check the limits and effects of their practice, and reformulate or reorient it to avoid the unwanted.

For its part, Project-Based Learning (PBL) can be defined as a methodology (Ausín, Abella, Delgado and Hortigüela, 2016; Cobo and Valdivia, 2017; Serna and Melgar, 2020) or as a technique or strategy (Maldonado, 2008 ; Martí, Heydrich, Rojas, & Hernández, 2010) of student-centered learning that has demonstrated positive impacts on learning motivation and learning autonomy (Maldonado, 2008) as it confronts the student with real-world situations (Cobo and Valdivia, 2017).

That is to say, with practical application problems (Martí et al., 2010), thus promoting socioformative teaching (Tobón cited in Hernández-Mosqueda, Tobón-Tobón, and Vázquez-Antonio, 2014). Although the extracurricular educational experience has been addressed in the literature in an ambiguous and unclear way in the literature, there is consensus that it provides relevant benefits for the professional development of students and therefore it is considered an important aspect in educational practice (Bartkus, Nemelka, Nemelka and Gardner 2012), since it promotes the creation of knowledge through experiential learning in the meaning that Gleason and Rubio (2020) give to this term.

Methodological procedures

The focus of this study is qualitative, oriented towards change, and the method used to study the Project Based Learning (PBL) experience (Maldonado, 2008; Martí et al., 2010) is Participatory Action Research (PAR). The research design is of the single case type N = 1 (Ato, López, and Benavente, 2013; Meza-Mejía and Flores-Alanís, 2014). Returning to the common approach of the qualitative methodological process proposed by Ballester (2004), the intervention was developed in 4 phases and 8 steps (see table 1).

Phase	Steps
High school	1. Definition of the problem
	2. Selection of design methodology
Field work	3. Negotiation and access to the research field
	4. Systematic collection of data and information
Analysis	5. Data transformation and reduction
	6. Preparation of analysis schemes
	7. Interpretations and discussion of results
Informative	8. Preparation and presentation of results

Table 1 Common approach to the qualitative methodological process
Source: elaborated from (Ballester, 2004, p. 241)

A non-probability type of sampling was used to select the participants, based on available subjects. For data collection, the field log and the portfolio and for its processing, coding and scales, defining 10 categories of analysis with the competencies that were considered key for the development of the activities entrusted to the student: documentation, validation tests and dissemination of results.

ISSN-On line: 2539-1372

Analysis and discussion of results

Preparatory phase-Definition of the problem

As a result of the recognition by the National Institute of Statistics, Geography and Informatics (INEGI, 2016, 2018) of the limitations in measuring the quality of procedures and public services in Mexico, we carried out a diagnosis to know the scope and limitations of official projects in charge of your care.

Based on the result, we define as a problem the deficiency in access (of municipal authorities, citizens and civil society) to systematized information (by municipality and by locality) on the quality with which municipal public services are provided, which hinders the evidence-based decision making at this level of government. It was identified as causes that the ENCIG and the CNGMD present attributes that make them little useless to generate focused diagnoses (see Table 2), such as:

– Partial geographic coverage that does not include the 2,456 Mexican municipalities and the 16 delegations of Mexico City;

– Level of disaggregation of the data that does not include the locality;

– Although the collection or capture and recording of data is direct through an electronic system, the consultation is not immediate since there is a waiting period (17 months for the Census and 4 months for the Survey) for it to be carried out. The registration, identification, classification, grouping, processing and storage of data, and finally, the information is legible and useful for its recipients; as well as what

– In both cases, data collection requires the training and deployment of interviewers and the expenditure of expenses to finance the operation.

Attributes	CNGMD	ENCIG
Data disaggregation level: national	Yes	Yes
Level of disaggregation of the data: by state	Yes	Yes
Level of disaggregation of data by municipality	Yes	NO
Level of disaggregation of data by locality	No	No
Dynamic update of data	No	No
Periodicity	Biannual	Biannual
It includes the public service of Public Security	Yes	Yes
It includes the public service of Public Lighting	Yes	Yes
It includes the public service of Parks and Gardens	NO	Yes
Duration of the survey period	5 months	1 month
Processing the results	12 months	3 months
Results presentation	17 months	3 months
Provides quality management indicators for public services	NO	Yes

Table 2 Attributes of the CNGMD and ENCIG
Source: Self Made

In such a way that the reasons why it was decided to carry out this intervention are its potential contributions to teaching, its social relevance to solve an unmet need that is also linked to Sustainable Development Goal 16 Peace, justice and solid institutions, and the National Development Plan 2019-202, general axis of Justice and the Rule of Law, and transversal axis Combating corruption and improving public management.

Preparatory phase-Selection of design methodology

To address the problem, we conducted a documentary review in scientific and technical search engines and repositories, concluding that the use of Information Technology Systems (STI) is an effective strategy to manage information, identify areas of opportunity to improve local government management , and develop evidence-based public policies. Therefore, we decided to present as a proposal for the modernization and improvement of municipal public management an ITS that would include in its knowledge base a meso-level analysis of the expected and perceived quality (Mora, 2011) of municipal public services from the client's perspective external, through satisfaction surveys, and the agile Extreme Programming (XP) methodology (Letelier and Penadés, 2006) was chosen for its development.

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In this first phase, it was decided to develop a demo version for the municipality of Alvarado, considering public safety services, lighting, streets, parks and gardens, on a web platform using technologies: MVC pattern, PHP and JavaScript languages, leaf framework Bootstrap style, and standard for JSon and HTML5 data exchange.

Since this project was developed in an educational context, the PBL was also used.

Fieldwork phase-Negotiation and access to the research field.

With the operational support of the ITSAV and the City Council of the Municipality of Alvarado, Veracruz, the working group, made up of specialists in the area of Computer Systems and Management and Public Policies, formulated the proposal «Design and construction of a system to evaluate the quality of municipal public services "that was presented to the Call for support for scientific research, technological development and innovation of the TecNM, in which it was benefited with financial support for its implementation.

In this phase, the SIT was developed, which at this time was functional and had been validated in a simulated operating environment. In addition to recording, storing and processing the responses provided to the public services evaluation instrument (see figure 1), this system allows us to know how well or how acceptable the performance of public services is perceived. To achieve this, it translates the frequencies of the responses into points, stores them in the database and accesses them using an SQL query. With this information, and with the support of a programmed logic algorithm, the system reasons the answers consulted and offers an expert interpretation (see figure 2) to calculate the average per question and the general average per public service, as shown in the figure 3.

Assessment of public services

Using a scale from 1 (one) to 10 (ten), where 1 is in complete disagreement and 10 in complete agreement, evaluate your position regarding the following statements about the public services provided by the Municipality in which you reside:

	Completely Disagree									Completely Agree
Item	1	2	3	4	5	6	7	8	9	10
1.- The provision of the public lighting service is constant, that is, without interruptions for any cause attributable to the service provider.	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎
2.- The lighting is adequate and there are no dim places on public roads.	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎
3.- The response time of the authority to make repairs to flaws or failures in the public lighting service is acceptable.	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎
4.- The maintenance and equipment and cleaning in general of the streets, is adequate, that is to say without imperfects that hinder their transit.	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎
5.- The maintenance and equipment and cleaning in general of the parks and gardens is adequate, that is to say, without imperfects that hinder their use.	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎
6.- In general, the response time of the authority to make repairs to damages or failures in the service of streets, parks and gardens is acceptable.	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎
7.- The municipal preventive police are adequately trained and equipped to provide the public security service.	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎
8.- The response time of the municipal preventive police in the event of a call from the public is adequate.	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎
9.- The municipal preventive police performs with legality and ethics in the provision of the service.	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎
10.- Municipal transit personnel are adequately trained to provide public safety services.	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎
11.- The response time of municipal transit personnel in the event of a call from citizens is adequate.	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎
12.- The municipal transit personnel act with legality and ethics in the provision of the service.	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎

Figure 1 Response interface to the public services evaluation questionnaire
Source: Municipal services evaluation system of Alvarado, Veracruz

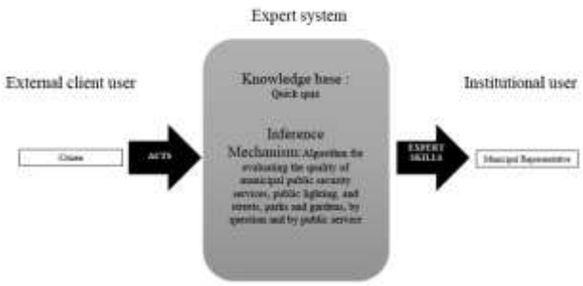

Figure 2 Problem domain scheme
Source: Self Made

Street lighting

Items	Frequencies										Average per Item
	1	2	3	4	5	6	7	8	9	10	
1.- The provision of the public lighting service is constant, that is, without interruptions for any cause attributable to the service provider.	1	◎	◎	1	◎	◎	◎	◎	◎	◎	**2.50**
2.- The lighting is adequate and there are no dim places on public roads.	1	◎	◎	1	◎	◎	◎	◎	◎	◎	**2.50**
3.- The response time of the authority to make repairs to flaws or failures in the public lighting service is acceptable.	1	◎	◎	◎	◎	1	◎	◎	◎	◎	**3.50**

Figure 3 Public lighting results interface
Source: Municipal services evaluation system of Alvarado, Veracruz

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Once the STI was developed, the support of the Academic area of the Institute was requested for 3 students to join professional residencies (2 industrial engineering students, and 1 computer systems engineering student); receiving a response from a computer systems engineering candidate, who joined the work team to support documentation, dissemination and validation tests (Blanco-Llano and Rodríguez-Hernández, 2011) of product quality in an environment real by peer category review (Zamora, 2011) based on user acceptance (Jústiz-Núñez, Gómez-Suárez, and Delgado-Dapena, 2014; Sánchez, 2015; Zamora, 2011) and with which the methodology of job under which your professional residency would be developed (see tables 3 and 4).

Principles of the work methodology
1. Joint, well-founded, critical and purposeful participation in the construction of knowledge
2. Permanent and direct communication
3. Goal orientation
4. Mutually beneficial relationship
5. Accuracy over speed
6. Socialization of knowledge and information
7. Under identical conditions, the simplest option is preferred to the more complex one
8. Translation of effort into experience and products

Table 3 Work methodology
Source: Self Made

Student	Teacher
– Protagonist in the construction of knowledge – Co-responsible for the achievement of objectives – Beneficiary of curricular experience	– Guide, tutor and advisor in the extracurricular experience – Generator of an environment of trust so that the student can express their views and doubts. – Student empowerment catalyst

Table 4 Roles of the participants
Source: Self Made

With the incorporation of the student, the PBL experience began according to the 5 phases suggested by García and Tobón (cited in García, 2010) for competency-based training schemes: 1) Study of the context, 2) Understanding of the problem, 3) Search for alternatives, 4) Selection of the best alternative, and 5) Execution scenario.

Field work phase-Systematic collection of data and information.

For data collection in the process of implementing the educational experience, we used the observation technique, the field log and the portfolio. The behavior of the 10 previously established categories of analysis was observed and recorded throughout the 5 phases of the PBL experience, at the beginning (I) and at the end (F) (see Figure 4).


Field log
Project Based Learning experience log
Draft:
Student participant
Name: Profile: Role: Responsibility in the project
Observation record
Phases
Analysis Categories | Context study | Understanding the problems | Search for alternatives | Selection of the best alternative | Execution scenario | Devolution | Settings
Domain of the subject | I | F
Problem and situation resolution | I | F
Information integration structure | I | F
Kinesthetic expression | I | F
Interaction with the audience | I | F
Support materials | I | F
Security | I | F
Drafting | I | F
Argumentation | I | F
Autonomous Learning | I | F

Figure 4 Field log
Source: Self Made

Analysis phase-Data transformation and reduction

To record the observations of each category of analysis, a coding system was defined by level and by color (see Figure 5).

Level	Coding
Deficient	Deficient
Good to	Good to
Regular	Regular
Outstanding	Outstanding

Figure 5 Coding
Source: Self Made

We use coding since "The codes provide a focus to think about the text and its interpretation" (Gibbs, 2012, p. 79); which makes the information easier to understand.

Analysis phase-Preparation of analysis schemes.

The observations were coded with the support of a matrix to simplify the processing and understanding of the information (see Figure 6). In addition, an electronic folder was integrated to house the portfolio of evidences of the project's products.

ISSN-On line: 2539-1372

Analysis Categories		Phases				
		Context study	Understanding the problema	Search for alternatives	Selection of the best alternative	Execution scenario
Domain of the subject	I	Deficient	Good	Good	Good	Outstanding
	F	Good	Good	Good	Good	Outstanding
Problem and situation resolution	I	Regular	Regular	Regular	Regular	Good
	F	Regular	Regular	Regular	Good	Good
Information integration structure	I	Regular	Regular	Good	Good	Good
	F	Regular	Regular	Good	Good	Good
Kinesthetic expression	I	Deficient	Deficient	Deficient	Regular	Regular
	F	Deficient	Deficient	Deficient	Regular	Regular
Interaction with the audience	I	Deficient	Deficient	Deficient	Deficient	Regular
	F	Deficient	Deficient	Deficient	Regular	Good
Support materials	I	Deficient	Deficient	Deficient	Regular	Good
	F	Deficient	Deficient	Deficient	Regular	Good
Security	I	Deficient	Deficient	Deficient	Deficient	Regular
	F	Deficient	Deficient	Deficient	Regular	Good
Drafting	I	Regular	Regular	Regular	Good	Good
	F	Regular	Regular	Good	Good	Good
Argumentation	I	Regular	Regular	Regular	Regular	Good
	F	Regular	Regular	Regular	Good	Good
Autonomous Learning	I	Regular	Regular	Good	Good	Outstanding
	F	Regular	Good	Good	Outstanding	Outstanding

Figure 6 Coding matrix
Source: Self Made

Analysis-Interpretations phase and discussion of results

At the starting point of the PBL, practical skills were observed with a fair and poor level. As I agreed, progress was made in the phases, a general growth was observed in the competencies studied, but with a differentiated level. The main growths were observed in the domain of the subject, the creation and use of support materials, safety and autonomous learning (see Table 5).

Competences	Evolution	
Domain of the subject	+++	Poor to Excellent
Resolution of problems and situations	+	Fair to Good
Information integration structure	+	Fair to Good
Kinesthetic expression	+	Poor to Fair
Interaction with the audience	+	Poor to Fair
Support materials	++	Poor to Good
Security	++	Poor to Good
Drafting	+	Fair to Good
Argumentation	+	Fair to Good
Autonomous Learning	++	Fair to Outstanding

Table 5 Evolution of the competences evaluated
Source: Self Made

When starting their participation in the project, the student was unaware of the problem that the project seeks to address. At the time of his incorporation, he received an induction in which he was provided general and material information on the problematization, development methodology and access to the SIT with administrator and citizen user level. The activities and responsibilities entrusted to him, together with the constant teaching support and feedback, allowed him to know the project in depth, apply the knowledge acquired during his career and obtain practical experience, both in the execution of the project and in its dissemination, also allowed to deepen its foundations and scope, and to a lesser extent develop greater security and improve their kinesthetic expression and interaction with the audience, their writing and argumentation skills.

This growth materialized in outstanding participations in 2 academic events with state and international recognition, achievements that were of curricular relevance for the student, who for the first time in his school career participated in events recognized for their academic quality.

As a result of these participations, the following were obtained: recognition as one of the 20 finalists, out of 180 projects nominated for the Sixth Meeting of Young Talent Veracruz 2019, organized by the highest authority of National Science and Technology and the State of Veracruz; a gold medal and an accreditation to the continental final as a representative of the Gulf South Mexico delegation in the XIV Latin American Contest of Student Projects in Science and Technology; recognition for participation in the continental final in which the project was presented to an international audience.

In these meetings, by exposing the project and answering questions formulated by national and international experts, in addition to exchanging experiences with peers, the student was able to exercise, evaluate and strengthen their argumentation, autonomous learning, linguistic, paralinguistic and sociolinguistic communication skills,.

As can be seen in Table 6, the goals programmed in productivity associated with the intervention were met, with the exception of the participation of residents in the project.

ISSN-On line: 2539-1372

The main limitation for the incorporation of residents was the preference of students to carry out their professional residency in a company with the expectation of being hired; therefore, in future occasions an adjustment in this goal will be considered.

Programmed	Programmed	Obtained	Compliance
Book	1	1	100%
Indexed article	1	1	100%
Refereed article	1	1	100%
Participation in academic event	1	2	200%
Prize in academic event	1	1	100%
Funded project	1	1	100%
Participating residents	3	1	33%
Thesis	2	2	100%
Prototype	1	1	100%

Table 6 Productivity associated with the project
Source: Self Made

Regarding the thesis development goal, difficulties were observed to meet it at the undergraduate / engineering level since the academic-administrative guidelines of the TecNM establish options for comprehensive degree or performance in the General Bachelor's Exit Exam (EGEL) , which are more agile than the thesis degree, therefore we do not consider it advisable to set it as a commitment to verify financing.

Regarding scientific articles, whether refereed or indexed, due to the waiting times between the moment they are submitted and the moment they are approved for publication and published, we recommend committing them as only sent, like patents, packages technological and other products.

Informative phase-Preparation and presentation of the results.

This phase included the preparation of the technical report of the project in which a balance of compliance with the objectives and committed products is presented.

We believe that the main results of the PAR include:

- Impact on the training of human resources.
- Academic products of curricular value for both students and teachers.
- Recognition of the quality of the project and dissemination at the state, regional and international level.
- A functional prototype of an application category SIT to evaluate the performance of 3 municipal public services (public security, public lighting, and streets, parks and gardens) in real time, which, compared to the ENCIG and CNGMD, has attributes that characterize an expansion more than a competitor (see Table 7).

Attributes	National Census of Municipal and Delegation Governments (CNGMD)	National Quality and Government Impact Survey (ENCIG)	Municipal services evaluation system of Alvarado, Veracruz
Data disaggregation level: national	And it is	Yes	And it is
Level of disaggregation of the data: by state	And it is	And it is	And it is
Level of disaggregation of data by municipality	And it is	NO	And it is
Level of disaggregation of data by locality	NO	NO	And it is
Dynamic update of data	NO	NO	And it is
Periodicity	Biannual	Biannual	Permanent
It includes the public service of Public Security	And it is	And it is	And it is
It includes the public service of Public Lighting	And it is	And it is	And it is
It includes the public service of Parks and Gardens	NO	And it is	And it is
Duration of the survey period	5 months	1 month	And it is
Processing the results	12 months	3 months	Instant
Results presentation	17 months	3 months	Instant
Provides quality management indicators for public services	NO	Yes	And it is

Table 7 Comparison of the SIT developed with the CNGMD and the ENCIG
Source: Own Elaboration based on INEGI (2016, 2018)

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Conclusions

Based on the results obtained, we consider that the IAP implemented constituted a successful experience, since despite being an ambitious project, the expected objectives were met and significant learning was obtained for the participants that will serve to guide the management of future projects. Among these learnings are:

– For the teacher, the experience allowed the integration of activities considered substantive in the educational policy instruments and that govern teacher professional development, as well as maximizing the impact on productivity associated with the project. His participation as a tutor, motivator and detonator of student talent contributed to the academic benefit of the student body, in which growth was observed as feedback and teacher support and interaction with external expert evaluators increased.

– For the student, the experience of participating in the project was enriching on a theoretical-practical level, since it allowed him to practice, evaluate, develop and perfect his knowledge and skills; giving rise to a reflective and growth process that served to improve their self-knowledge and personal commitment to take advantage of their areas of opportunity. This exercise represented a first academic experience in a broader context than the classroom and a first encounter with reality, under the guidance and individual and personalized advice of a teaching team. Thanks to this exercise, he was able to exercise, evaluate and strengthen his argumentation, autonomous learning, linguistic, paralinguistic and sociolinguistic communication skills.

Among other benefits of the project-based extracurricular learning experience, we found that it promotes the relevance of educational practice in the environment.

Transforms the traditional teacher-student relationship and stimulates their interaction in the construction of knowledge and technological development; it promotes the contextualized and practical exercise of the professional competences of teachers to know areas of opportunity in the attention of problems and participate in their solution; and requires updating of teaching knowledge, which allows them to guide their courses effectively to develop learning environments that promote practical skills in students; and in students it promotes the development of skills of knowing, knowing how to do and knowing how to be.

For the aforementioned reasons, we conclude that PBL can be used in contexts of technological higher education as a method of teaching work with effective and inclusive results, both in the training of human resources, and in the professional development of teachers, and based on our experience For best results we recommend: planning teamwork to achieve common goals; clearly establish the scope and goals of the project; designate responsible for task; constantly assess progress to identify deviations and make adjustments; stimulate motivation and enthusiasm in participants; maintain permanent and direct communication channels; socialize knowledge and information; and ensure that the effort is translated into experience and products of mutual benefit.

Notes:

1. Deconcentrated administrative body of the Ministry of Public Education, with technical, academic and management autonomy in charge of providing, developing, coordinating and guiding technological higher education services, through the Institutes, Units and Centers attached to it (Presidency of the Republic , 2014)

2. Decentralized public body of the Government of the State of Veracruz, with its own legal personality and assets, created by decree published in the Official Gazette on April 12, 2004 (Executive Power, 2004).

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