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Project-based Learning: A Case Studying the Catholic Monarchs in Elementary Education

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Abstract

This study aimed to assess the use of Project-Based Learning (PBL) in classroom practice with 121 primary school students in five different schools in Spain, analyzing the advantages and effectiveness of practicing PBL in social sciences, in the topic of the history of the Catholic Monarchs. In this pedagogical design, students interact and create their history-related content. The first dimension, PBL in the Catholic Kings unit comprises a quasi-experimental approach through a student t-test, which showed significant improvement regarding curriculum concepts and academic results. The second dimension, Assessment of elements and implementation of PBL, details data from 46 teachers and professors who evaluate the implementation and characteristics of PBL in the proposal and practice. From the results, the methodological approach using PBL improves academic results and encourages students to have a bigger role in the learning process, with active participation where students seek information, interact with classmates in groups, try to solve problems and create final products for subsequent presentations.

Keywords: *active learning; K-12; team teaching; project-based learning.*

Abstrak

Penelitian ini bertujuan untuk menilai penggunaan Pembelajaran Berbasis Proyek (PBL) dalam praktik kelas dengan 121 siswa sekolah dasar di lima sekolah berbeda di Spanyol, menganalisis keuntungan dan efektivitas praktik PBL dalam ilmu sosial, dalam topik sejarah Monarki Katolik. Dalam desain pedagogis ini, siswa berinteraksi dan membuat konten mereka sendiri yang berkaitan dengan sejarah. Dimensi pertama, PBL dalam Kerajaan Katolik terdiri dari pendekatan kuasi-eksperimental melalui uji-t siswa, yang menunjukkan peningkatan signifikan terkait konsep kurikulum dan hasil akademik. Dimensi kedua, Penilaian elemen dan implementasi PBL, merinci data dari 46 guru dan profesor yang mengevaluasi implementasi dan karakteristik PBL dalam proposal dan praktik. Dari hasil penelitian disimpulkan bahwa pendekatan metodologis menggunakan PBL meningkatkan hasil akademik dan mendorong siswa untuk memiliki peran yang lebih besar dalam proses pembelajaran, dengan partisipasi aktif di mana siswa mencari informasi, berinteraksi dengan teman sekelasnya dalam kelompok, mencoba memecahkan masalah dan membuat produk akhir untuk presentasi selanjutnya.

Kata kunci: *pembelajaran aktif, K 12, pengajaran kelompok, pembelajaran berbasis proyek.*

INTRODUCTION

Kilpatrick (1918) coined the project method approach, which has evolved today in project-based learning. According to Kilpatrick (1918), the project must represent a wholehearted activity in a democratic society, and therefore the intentional act is considered as preparation for life itself. It emphasizes the importance of the term “purposeful act” for the intentionality of the student in these processes, related to the approaches of learning by doing. The greatest strength of the project method is the potential to develop a moral character, with students pursuing a wide variety of purposes, individually or collectively, under the supervision of a qualified teacher to help guide them to increasingly discriminate correct and adequate ideas and judgments. Kilpatrick broke tradition by redefining the project from "independent constructive activity" to "intentionally wholehearted activity." According to the Buck Institute for Education (BIE) in Markham, Larmer, & Ravitz (2003), PBL is "a systematic method of teaching that involves students in learning knowledge and skills through an expanded consultation process, structured around complex and authentic questions, with products and tasks carefully designed”.

PBL is a methodology focused on students working and implementing interdisciplinary projects with objectives, real applications, and products. It is based on the constructivist approach, which means that people construct knowledge through interactions with their environment and that the knowledge construction of each individual is different (Bruner, 1996; Vygotsky, 1978) and especially on the contributions by Dewey (1959) and his active school approach, which in his laboratory in Chicago was based on the search and inquiry process. Dewey ensured that students commit to real, meaningful problems and tasks that emulate real situations. Some essential concepts are: (1) Active construction: Comprehension occurs when the student actively constructs the meaning based on his or her experiences and interaction with the world; (2) Located learning: The most effective learning occurs when it is placed in an authentic context; (3) Social interaction: Importance of working together in an activity to build shared understanding.

PBL is a constructivist pedagogy that aims to generate deep learning by allowing students to use a research-based approach to address questions and questions that are rich, real, and relevant to the topic being studied. It is designed to be used in complex issues requiring students to investigate to understand (Barron et al., 1998). PBL is more than just a web search or a research task online. The students find it fun, motivating, and challenging because they play an active role in the choice of the project and in the entire planning, execution, and evaluation process. The essential characteristics of PBL include 1) a central project; 2) a constructivist approach to important knowledge and skills; 3) a management activity in the form of a complex question, problem, or challenge; 4) an investigation directed by the teacher and guided by the student; 5) a real-world project that is authentic to the learner (Barron & Darling-Hammond, 2008).

The elaboration and presentation of a product is related to constructionism, which takes the notion that individuals construct knowledge one step further (Harel & Papert, 1991) and postulates that individuals learn best when building an artifact that can be shared with others and reflect on it. From the perspective of the Horizon K 12 report (Adams, Freeman,

Giesinger, Cummins & Yuhnke, 2016), there is a growing emphasis in K-12 education on deeper learning approaches, such as PBL and similar methods that encourage more active learning experiences. To stay motivated, students must understand how new knowledge and skills will affect the world around them. These approaches focus on the students, which allow them to control how they relate to a topic.

Recently, PBL has become an important educational focus because it includes components that promote learning. Generally, it has an interdisciplinary character, in different areas or subjects, and a collaborative approach, in which several students work together to achieve a common goal. Projects often require collaboration between the student and the teacher or the student and their classmates. The PBL promotes inquiry, critical thinking, the search for knowledge and self-directed learning in which students can perform tasks independently, enhancing motivation and creativity.

Several research results show that project-based learning can improve student learning achievement. The research results of Bani-Hamad and Abdullah (2019); Almazroui (2023) shows that PBL can improve 21st-century skills. The research results of Oh, Chan, & Kim (2020) revealed that PBL was able to increase students' learning motivation. The research results of Guo, Saab, Wu, & Admiraal (2021) also revealed that PBL improved students' cognitive abilities, social skills, and academic performance. The research results by Aksela & Haatainen (2019); Farida & Rasyid (2019) also stated that PBL is useful in promoting the students' learning and motivation, collaboration, and student-centered learning.

However, learning history in elementary schools does not place students at the center of learning, so students are less active. Therefore, PBL with the characteristics of having students become the center of learning and collaboration, a process that provides opportunities for students to study so that their critical thinking skills increase, can improve students' academic results in history, especially in the history of the Catholic monarchy.

Previous research related to project-based learning has been studied by researchers. Kaldi, Filippatou, & Govaris (2011) researched the effectiveness of project-based learning in elementary school students regarding content knowledge and their attitudes towards self-efficacy, applied learning methods, group work, task values, and peers from different ethnic backgrounds. The results of the research show that their knowledge and attitudes towards self-efficacy and assignments have increased at a moderate level, and students prefer project-based learning methods compared to traditional learning. Karaçalli & Korur (2014) researched the effect of project-based learning on students' academic achievement in elementary schools. The research results show that students who receive project-based learning achieve better academic achievements than students who receive traditional learning. Febriana (2017) researched the effectiveness of project-based learning on social attitudes and student learning outcomes. The results of his research show that project-based learning can improve students' cognitive, affective, and psychomotor aspects. Aksela & Haatainen (2019) have researched the advantages of project-based learning. The results of his research show that project-based learning has the advantage of being able to increase student learning motivation, being able to increase student collaboration and togetherness and being student-centered.

In contrast to previous studies, this research focuses on the application of project-based learning in social science disciplines, especially on the history of the Catholic monarchy in Spain. The objectives of this study were: (1) To compare the results of PBL with traditional

approaches; (2) To Check the activity that students maintain with PBL; and (3) To assess the benefits of the PBL approach in the learning process in elementary schools.

METHODS

This research focused on an intervention that uses complementary methods, implementing a design-based research (DBR) (Anderson & Shattuck, 2012; Dede, Ketelhut, Whitehouse, Breit, & McCloskey, 2009). In this significant intervention, DBR provides a sense of validity to the research and ensures that the results can be used effectively to improve practice. The DBR approach is implemented in this particular environment in a manner consistent with this methodology. This case study, applied with a naturalistic perspective (Guba & Lincoln, 1981), is approached from mixed research methods in two different dimensions, and it involves multiple iterations, collaborative association between researchers and teachers, and practical impact in educational contexts. This methodology incorporates both evaluation and empirical analysis. Based on the detailed research framework based on design, the research uses mixed and complementary methods based on quantitative and qualitative data and instruments (Table 1).

Table 1: Dimensions, indicators and instruments

Dimensions	**Indicators**	**Instruments**
1.-Learning of the unity of the Catholic Monarchs	Academic results Content development Evaluation	Exam short questions Test exam
2.-Assessment of the implementation and elements of PBL	Search for information Active Approach Collaboration Problem Product	Measurement of time (student/teacher) Questionnaire Observation

From the table 1, dimension 1 "Learning the unity of the Catholic Monarchs" focuses on a quasi-experimental design, analyzing data through a student t-test. There are five sessions of 45 minutes each. There are five groups working with a PBL methodology, as an experimental group; and there are two classroom groups working using traditional practices as a control group. The control and experimental groups work with the same competencies, objectives, content and evaluation in the five sessions, both groups only differing in the methodology. The control group is limited to transmitting the content and carrying out the activities of the textbook. On the other hand, the experimental group details the project (PBL), trying to make the students work in groups, seeking information from the time of the Catholic Monarchs, trying to motivate the students with the important facts of this historical period and working on a final product as a goal. In the experimental group, the students search historical facts and work in groups to collect and analyze the information, developing a multimedia product to present to the audience. Eventually, the students take two tests (SQ1 and MC1) that receive a qualitative validity of the content provided by 12 expert judges providing a value of Aiken V (V = S / [n (c-1)]) greater than 0.75 in all items. The pre- / post-test design measures the academic results related to the unit. In addition, Cronbach's reliability values are more than 8; therefore, it is acceptable (Cronbach, 1951; Hair, Anderson, Tatham, & Black, 1998).

Dimension 2 − "Assessment of the implementation and elements of the PBL" − a questionnaire is applied to 46 educators: 23 of elementary education and 23 of higher education (in pairs), once they have viewed the 28 recorded sessions (5 sessions per 7 groups) and have studied the pedagogical design documents of the present implementation. These teachers evaluate to what extent the pedagogical practice of the present study responds to the characteristics and elements of the PBL. In addition, the time in which the student's activity predominates is measured to compare and correlate with the results obtained in Dimension 1. The degree to which these two categorizations coincide represents inter-rater reliability (Gwet, 2014). The reliability among evaluators (or concordance) is the degree of agreement among the qualifiers. The statistics used for this measurement is Cohen's kappa, with the professor and the researcher as evaluators, considering the amount of agreement that could be expected. Cohen's kappa is one of the most widely used statistics to test inter-rater reliability; like most correlation statistics, kappa can vary from -1 to +1. We obtain a value concerning the relative agreement observed between qualifiers. In this investigation, only Cohen's kappa values greater than 0.60 are accepted; all the items below this value were eliminated. Cohen (1960); Cohen, Manion, & Morrison (2000) suggested values ≤ 0 as indicative without agreement and 0.01−0.20 as none to mild, 0.21−0.40 as regular, 0.41−0.60 as moderate, 0.61−0.80 as substantial, and 0.81−1.00 as almost perfect agreement (McHugh, 2012).

The methodological and data triangulation is consistent with a DBR design that provides data from different sources, techniques and instruments to increase validity. It is recommended to use more than one method to improve the validation process. Inter-method and multi-method and independent measures reach the same conclusions, providing validity and reliability.

The non-probabilistic sample in this study consists of 121 fifth-grade primary school students in five different schools and classrooms in the Castilla-La Mancha in Spain; in each classroom the number of students is as follows: 21, 24, 26, 26, and 24. Regarding gender, 52.1% are girls and 47.9% are boys. We also have a control group of two groups with 48 primary school students in two classrooms of 25 and 23 students respectively, of whom 50% are girls and 50% are boys. The contingency analysis (chi-square) is not detailed because there are no significant differences with regard to gender or school. The sample is not random; therefore, Dimension 1 poses a quasi-experimental design. On the other hand, Dimension 2 highlights the evaluations of 46 teachers who evaluate the practice carried out in the different groups and assess the elements related to the PBL in the aforementioned educational design, highlighting the following factors: Information search; active approach; collaboration; problem and product.

RESULTS AND DISCUSSION

Implementation of the Project

The same implementation was carried out in three groups in the 2016−17 academic year and during 2017−18 in two other groups. From a unit in Social Sciences for the 5th year of primary education, "Spain at the Beginning of the Modern Age," we focused on five sessions related to the enormous impact of the discovery of America and the most important events that occurred during the reign of the Catholic Monarchs. The content is the war of Castilian succession that took to the crown to Isabel I “de Castilla”, the conquest of Granada´s reign

and the discovery of America. The competencies in these sessions are: Digital competence, learning to learn and cultural competence (Figel, 2007).

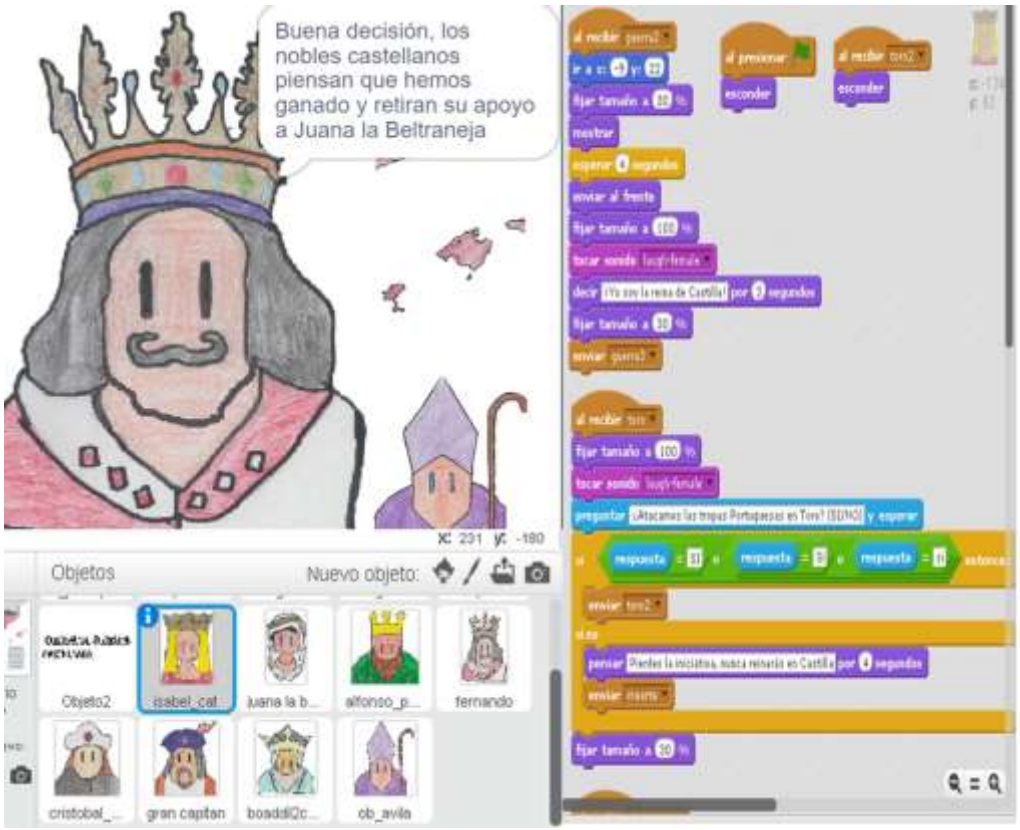

Figure 1: Video game with the contents of the 3 groups. Product of the project: https://scratch.mit.edu/projects/224787914/

They study the circumstances in which Isabel de Castilla came to the throne after a war with Portugal, which supported Juana "la Beltraneja"; the unification of Castile and Aragon with the marriage of Isabel and Fernando; the conquest of Granada, with episodes in Zahara, Alhama, Málaga and Granada; and the expedition to America. In the experimental group, the students work on the knowledge and skills for a viable solution, with a clear task of information search, with a group approach based on the puzzle technique (Aronson & Bridgeman, 1979) in all sessions (See Table 2 and Figure 1).

Table 2: Applied sessions

Sessions 45’	Experimental Group (EG)	Control Group (CG)
Session 1	Pretest SQ1 Pretest MC1 Groups are organized. Jigsaw tech (Aronson & Bridgeman, 1979). G1 Castilian war of succession G2 Conquest of Granada reign G3 Discovery of America	Pretest SQ1 Pretest MC1 Context Historical facts are explained The exercises in the book (pp.117) and tabs are copied and answered

Session 2	G1 Discovery of America G2 Castilian war of succession G3 Conquest of Granada reign	Castilian war of succession Historical facts are explained. The exercises in the book (pp..120, 121) and cards are copied and answered
Session 3	G1 Conquest of Granada reign G2 Discovery of America G3 Castilian war of succession	Conquest of Granada reign Historical facts are explained. The exercises in the book (pp. 121, 122) and files are copied and answered
Session 4	G1, G2, G3 they summarize content. Expose product and work in audience.	Discovery of America Historical facts are explained. The exercises in the book are copied and answered (pp.122, 123, 124) work with cards
Session 5	Test of short questions (SQ1POSTT) Multiple-choice test (MC1POSTT)	Test of short questions (SQ1POSTT) Multiple-choice test (MC1POSTT)

Dimension 1: Learning of the Unity of the Catholic Monarchs

Dimension 1 focuses on the application of a quasi-experimental design, analyzing the data of the short question test (SQ1) and the multiple-choice test (MC1) through the student t-test with related samples (pretest and post-test), and also comparing the means with a student t-test of independent samples, comparing the means of the control group and the experimental group. We have applied a short questions test and a multiple-choice test, with a pretest and post-test design and also compared with a control group. In both tests, normality is assumed due to the size of the sample and the Kolmogorov−Smirnov test. The level of significance (α) is 0.01.

First, we analyzed the short questions exam (SQ1), comparing the values of the pre-test and the post-test in the experimental group. The pretest values obtain an average of 2.07, while the values obtained in the subsequent test show an average of 7.06. The t-test of related samples details statistically significant differences (0.000) at a significance level of 99% between paired samples (Table 3). The values in the SQ1 test emphasize that students learned with the application of this unit.

Table 3: SQ1 Paired differences. Student t-test. Short questions test. Experimental group

	Mean	**Std. Deviation**	**Std. Error Mean**	**Upper α =99%**	**Lower α =99%**	**t**	**Df**	**Sig**
SQ1PRETT-SQ1POSTT	-4.992	1.676	.152	-5.390	-4.593	-32.766	120	.000

In addition, we compared the independent samples after the test. The experimental group obtained a mean of 7.06 and the control group obtained a mean of 6.25. We apply the Levene test for equality of variances and obtain a value of 0.45, so we do not assume equality of variances at a significance level (α = 0.01). The test details that there are statistically

significant differences (p = 0.003) at a level of significance of 99% between the control group and the experimental group (Table 4 and Figure 2).

Table 4: SQ1 independent samples. Experimental group and control group. Student t-test

	Levene's Test for Equality of Variances		**t-test for Equality of Means**				
	F	**Sig.**	**T**	**Df**	**Sig. (2-tailed)**	**Mean difference**	**Std. Error Difference**
SQ1POSTT							
Equal variances not assumed	.572	.450	3.082	79,218	0.003	.808	.262

From the results of the administered SQ1 test, it can be affirmed that there are statistically significant improvements and clear learning in both methodological approaches. But it is especially appreciated that the implementation of PBL in the experimental group highlights statistically significant improvements when checking the data of the tests (Table 4 and Figure 2).

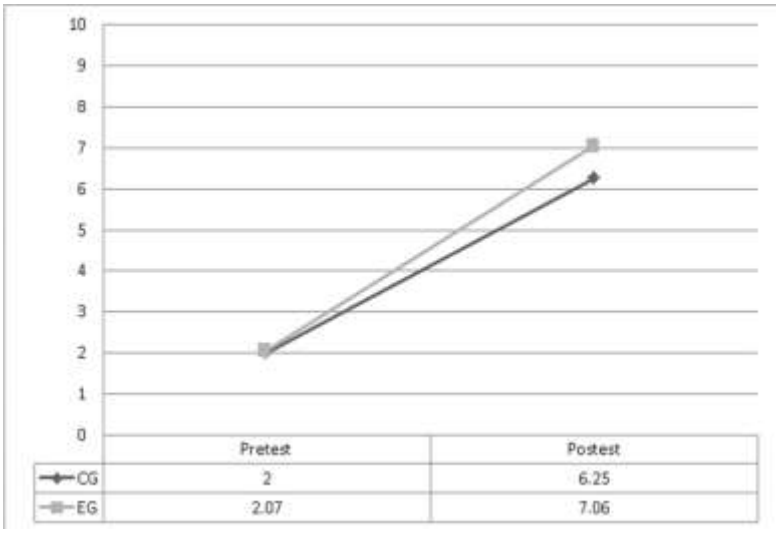

Figure 2: SQ1 results of the control group and the experimental group.

As for the multiple response test (MC1) comparing the values of the pretest and the post-test in the experimental group, the mean in the pretest is 2.24, while the mean in the post-test is 7.34. A p = 0.000 value is obtained, so there are statistically significant differences, at a significance level of 99% between paired samples (Table 5). It is clear, therefore, that the unit promotes learning.

Table 5: MC1 Paired differences. Student t-test. Multiple-choice test.

	Mean	**Std. Deviation**	**Std. Error Mean**	**Upper α =99%**	**Lower α =99%**	**t**	**Df**	**Sig**
SQ1PRETT-SQ1POSTT	-5.099	1.828	.166	-5.534	-4.664	-30.691	120	.000

Moreover, we apply the Levene test for equality of variances in SQ1 test and obtain a value of .942, so we do not assume equal variances in a significance level ($\alpha = 0.01$). The independent samples after the test are compared; the experimental group (mean is 7.34) and the control group (mean is 6.00) have different values. In the MC1 test we obtained statistically significant differences ($p = 0.000$) at a level of significance of 99% between the control group and the experimental group (Table 6 and Figure 3).

Table 6: MC1 independent samples. Experimental group and control group. Student t-test.

	Levene's Test for Equality of Variances		**t-test for Equality of Means**				
	F	**Sig.**	**T**	**Df**	**Sig. (2-tailed)**	**Mean difference**	**Std. Error Difference**
MC1POSTT Equal variances not assumed	.005	.942	5.517	85.086	0.000	1.339	.243

Again, from the results of the administered MC1 test, we obtained statistically significant improvements and clear learning in both methodological approaches, but the experimental group, with the implementation of PBL, achieved statistically significant improvements (Figure 3).

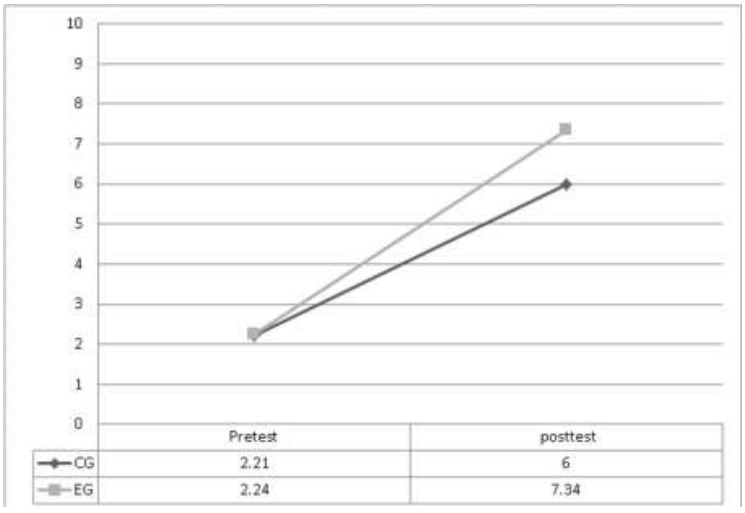

Figure 3: MC1 results of the control group and the experimental group.

Dimension 2: Assessment of the implementation and elements of the PBL

In this dimension, a questionnaire is applied to 46 educators who have previously viewed the 28 recorded sessions of the present implementation, so we applied an observation technique. These teachers value to what extent, the pedagogical practice of the present study

responds to the characteristics and elements of the PBL. In addition, the time in which the student's activity predominates is measured to make a comparison and correlation with the results obtained in Dimension 1. The items that are valued mainly are: Information search; active approach; collaboration; problem; and product.

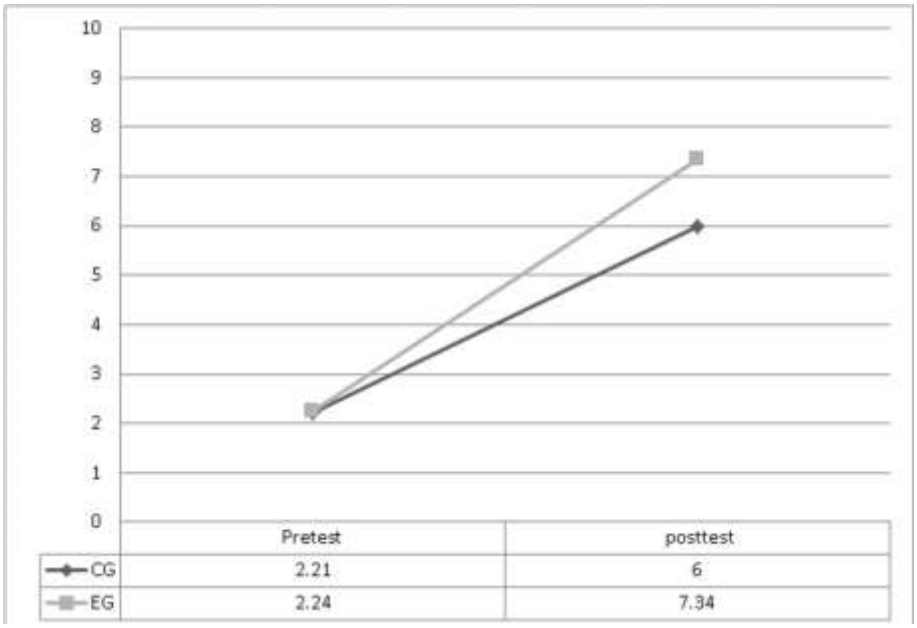

Figure 4: Elements of PBL observed in sessions.

When comparing the ranges with the nonparametric Mann−Whitney U test, we did not find significant differences between the control group and the experimental group regarding the search for information and the solution to a problem. However, statistically significant differences are highlighted in the active approach, collaboration and the realization of a product, so the PBL as a methodology improves these three elements in pedagogical practice (Table 7 Figure 4).

Table 7. Grouping variable: GC_GE. Contrast statistics. Mann−Whitney U test.

	Information	**Active**	**Collaboration**	**Problem**	**Product**
Mann−Whitney U	986.500	17.500	17.500	989.500	.000
Wilcoxon W	2067.500	1098.500	1098.500	2070.500	1081.000
Z	-.639	-8.346	-8.360	-.583	-8.668
Sig. asym. (two-sided)	.523	.000	.000	.560	.000

The time in which teachers (explanations, lecture) and students (activities, collaboration and information search) participate is measured. Of the 225 minutes total time of the sessions, in the control group the teacher occupies 128 minutes, just over 25 minutes per session, while the students occupy 97 minutes, about 20 minutes per session. On the other hand, in the experimental group the students occupy about 155 of the 225 of the total minutes (about 31 minutes per session); and teachers use about 70 minutes in the 5 sessions (about 14 minutes per session). A measure of association is carried out to see the agreement between the pairs of evaluators and a value of 0.63 is obtained from Cohen's Kappa, so there is agreement between the expert evaluators in higher education and basic education.

Although in the control group it is recognized that students seek information, it is appreciated that this search is limited to solving the activities in the textbook; it is focused on solving the tasks of the text using that search. The same thing happens with the resolution of the problem: the students look for a solution to the expositions and activities of the textbook. The difference between both groups is more evident in the active participation of the students, while in the control group a traditional dynamic is maintained with more explanations by the teacher and the presence of the textbook, the work with PBL promotes greater activity on the part of the student, which is reflected in the result of item 2 of Dimension 2, and in the students' active time, which has been measured in that dimension. The approach through PBL allows the realization of a final product presented to the audience and detailed in this article. There is also a collaborative learning practice with the jigsaw technique applied, and some interactions that are beneficial in the learning process.

In short, the methodological approach with PBL, with more profound approaches to learning, has shown in this study that it improves the academic results of the two administered tests: a short-question test and a multiple-choice test. Although the control group obtains acceptable results, the experimental group that applies PBL obtains statistically better results. Therefore, this study does not agree with the pessimistic conclusions of Colliver (2000) and is more consistent with the results of other researchers (Dochy et al., 2003, Strobel & Van Barneveld, 2009), who showed that an adequate application of the PBL promotes a deeper teaching−learning process and makes it possible to obtain better academic results.

The time students participate is objectively measured in both practices and it is appreciated how students with PBL have a greater role in the learning process, promoting an active learning in which the student seeks information, interacts with his/her classmates in groups, tries to solve the problem and makes the final product and its presentation. From the traditional approach of the control group, the teacher gives much longer oral explanations. Active construction emphasizes that understanding occurs when the student actively constructs meaning based on his/her experiences and interaction with the world.

The advantages of collaborative learning detailed in this intervention highlight the possibilities of interaction and cooperation in the search for information and the implementation of activities, which leads to organized and totally dynamic work, which is different from a traditional approach. This active work allows us to understand the concepts and provide a product (Figure 1) that is subsequently exposed to the audience; this makes it possible to improve oral expression skills and it allows the work to be shared with other students. In this sense, the researchers recommend practices that reflect professional practice, such as public exhibitions and presentations, which point to the social value and relevance of students' work (Barron & Darling-Hammond, 2008). The final or summative evaluation must use many different criteria that reflect the various skills involved in the task, and these criteria must be openly communicated to the students (Barron & Darling-Hammond, 2008).

Compared to traditional methods, students who participate in small groups achieve higher grades, retain information for longer and reduce drop-out rates; they improve communication and collaboration skills, and they understand better the professional environment (Johnson, Johnson, & Stanne, 2000; Terenzini, Cabrera, Colbeck, Parente, & Bjorklund, 2001). The present study highlights these advantages in both dimensions, especially in item 4.

The application of the jigsaw technique in this study reaffirms the contributions of different authors: Collaborative learning promotes time in the task in diverse groups (Johnson & Johnson, 2009). Collaborative learning benefits students through grade levels and academic subjects (Slavin, 1996). The present study agrees on the benefits of the development of collaborative and participatory skills provided by the PBL according to several studies (Belland, Ertmer, & Simons, 2006; Bradley-Levine et al., 2010; Brush & Saye, 2008; Ravitz & Mergendoller, 2005; Weng-yi Cheng, Shui-fong, & Chung-yan Chan, 2008).

Public presentations in the classroom also encourage full participation and they help to promote accountability (Barron & Darling-Hammond, 2008); presenting a product to the audience has very positive advantages for students. The product presented in this paper is very visual and entertaining, but the most important thing is that it encourages students to prepare their presentation, synthesize their work and explain their achievements to others; these tasks are very present in the workplace. Based on modern best practices, Kilpatrick (1918) was optimistic that a project method approach would result in student development in terms of citizenship, critical thinking, intelligent actions and adaptability to new social conditions. Many years later, research on PBL provides a degree of affirmation for Kilpatrick's optimism. From the present study, we highlighted the advantages of active learning, collaboration and the creation of a product, which provide added value compared to traditional practices and also improve academic performance by delivering more dynamic, active and profound teaching and learning practices.

CONCLUSION

In the present case study with 121 students from five schools working through project-based learning, statistically significant benefits and improvements are obtained compared to a control group that uses conventional methods. From different techniques and instruments, through a triangulation of data in two dimensions, evidence is described and results are provided. There are positive values that are obtained mainly from factors such as active learning, collaboration and creation of a product; in addition, there is an improvement in the academic results of two administered tests. From the data analysis, this research concludes: 1. By comparing the results of the short questions test (SQ1) and the multiple choice test (MC1) it is known that the experimental group that applied PBL obtained much better results than the control group; 2. There is no significant difference between the two approaches regarding working with information and solving problems; these factors worked well in both groups; 3. Increased academic achievement which is much better because PBL allows students to be more active, collaborative, and work on a product that is different from the traditional perspective; 4. The time used by students who work with PBL is much longer, because they do intensive activities for 155 minutes out of a total of 255 minutes. In contrast, in the group that uses traditional practices, control students maintain dominant activities for 70 minutes out of 255 minutes out of five sessions.

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