DPH: Validation and implementation of quantum physics: the Fano solving plan of Dantesque Rhetoric

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Abstract: Many education professionals have realized that the traditional expository method and dogmatic type of teaching methodologies are an obsolete trend that prevent them from introducing new teaching styles to work on new contents, develop objectives, acquire competences, and achieve learning assessment, which are related, for example, to human cognition ability, skills, or capacity to solving problems, leadership, or strategic management. Instead, from the end of the 19th century and the beginning of the 20th century to nowadays, teachers introduce new teaching styles, as is the case of active methodologies, where students become the center of the educational process; the rote learning is completely rejected, thereby fostering their critical thinking based on the rationale behind scientific methods, while influencing their leadership development, communicative, and collaboration skills. Like this manner, knowledge could be reformulated and disciplines would acquire new specialized connotations in scientific fields such as scientific and distributed computing regarding blending learning. This paper, then, aims to explore the theme of a scientific and technological transformation that invests in communication modalities and semantics by assessing the effectiveness of Problem-Based Learning (PBL) strategy instruction on students' mathematical ability to solve the Fano Plane. To this end, we will conceive a set of phenomena that need to be explored and a puzzle-like problem that needs to be solved.

Keywords: Teaching styles, active methodologies, Problem-Based Learning (PBL), the Fano Plane, critical thinking, leadership development, collaboration skills, blending learning.

INTRODUCTION

This article's main objective is to set out the reasons for the application of Problem-Based Learning (PBL) as a methodology to develop on the one hand the student's critical and analytical skills, and one the other, to analyze the instruments for assessing teacher motivation so important for the mathematical instruction setting. Particularly, it does aim to bring out an approach, which would allow math teachers to have the adequate information to develop students' own knowledge as well as acquire their technical-mathematical and scientific-humanist competences for their future careers: a) to solve numerical problems in everyday life, b) to improve cognitive skills, and c) to develop realistic mathematics learning strategies (García Vigil *et al*., 2000). To this end, the analysis and study of the Fano plane to unravel the problem of Dante's rhetoric constitutes the key approach to accomplish this goal. For this to be achieved, we will draw on a recreation of original approaches from existing materials and actual data from teachers, who have analyzed this topic. Accordingly, this approach is aimed at underscoring PBL pedagogical methods in such a context of education, since as an active learning methodology, it is focused on students so that they will actively participate, observe, study, and discuss the key raised problem. This is, therefore, an inductive approach in which students learn contents while trying to solve a real life

problem: firstly, the teacher presents the problem-solving to students, next, he/she identifies the learning needs, then, students find the necessary information, and finally they return to the task. Thus, this dynamic process encourages their critical thinking and the ability to solve problems while purposefully learning the theoretical foundations of the subject matter (Labrador Piquer and Andreu-Andrés, 2008).

Subsequently, Hung *et al*. (2008) the PBL learning process normally involves the following steps:

• Students in groups of five to eight encounter and reason through the problem. They attempt to define and bound the problem and set learning goals by identifying what they know already, what hypotheses or conjectures they can think of, what they need to learn to better understand the dimensions of the problem, and what learning activities are required and who will perform them.

• During self-directed study, individual students complete their learning assignments. They collect and study resources and prepare reports to the group.

• Students share their learning with the group and revisit the problem, generating additional hypotheses and rejecting others based on their learning.

• At the end of the leaning period (usually one week), students summarize and integrate their learning.

BACKGROUND
THE FANO PLANE: SOLVING THE DANTE'S RHETORIC PROBLEM

According to Planat (2014, 2016), if we want to connect contextual clues of quantum and linguistic meaning before trying to introduce a simple geometric model as the smallest finite projective plane (PG (3, 2): Fano plane), one must identify in a text which ones are 1) the points, 2) the lines. A line corresponds to at least three points that have a common property. If teacher and students wanted to face the Dantesque poem by examining the rhetoric and the style and architecture of the three songs of the Divine Comedy, such as Hell, Purgatory, Paradise, we could define that the text metaphorically desires a journey of redemption and for, subsequently, the author has two particular techniques to describe emotionality as the symbolism of the number "3" and the phonological technique, which are in Dante's triplets. They do constitute minimal isobaric and chained joints, therefore as detectable, they are characterized by Phonic morphs alternated with dysmorphia, and the second technique is the positional displacement of foreign elements. In fact, when the two techniques meet, the emotional level is very high. A careful examination of the two factors has led us to ..: Dante Alighieri, master of style and rhetoric, knew how to transmit ideologies, values of transcendence, as well as significant semantic content, to give glory to himself and to God and then used, in particular, two techniques such as repetition, to graduate in infinitesimal emotion and the driving effect of the extra-nuclear positional elements of pre-verbal and post-verbal deictic constituents. If we desire to scientifically validate what has already been stated according to Renzi *et al*. (1988), (chapter 11), is based on the fact that the verb is the nuclear element of the sentence and that it determines in the sentence and captures the nuclear and extra-nuclear elements, specifically in the pronominal series such as: pronominal and clitic series, which due to their syntactic properties give different and effective interpretations. In doing so, the question to the problem is: How can we quantitatively solve the detection of the emotion expressed by Dante Alighieri with the awakened techniques? The response is instantaneous and that is with the Fano Plane. It is the projective plane that actually contains 7 points (each of

which is contained in three lines) In linguistics the verbal operator is the nuclear one of the sentence, the points 7 are the verbal operators and the sentence operators are 7, each of which is contained in 3 lines. The lines are the triplets of the phrase operators that when found produce a phonological repetition and deictic manipulation effect replacing the concatenating morphemic effect.
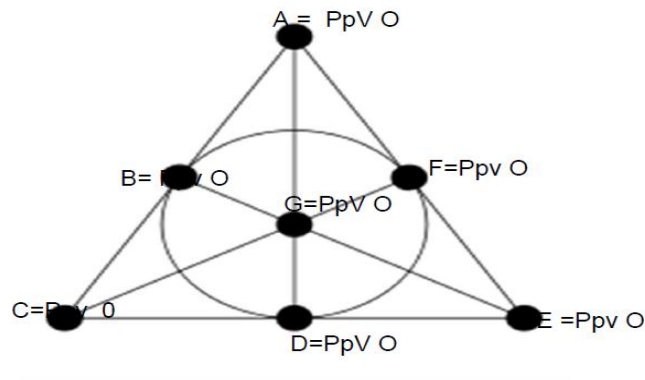

Figure 1. Analysis of Dantesque triplets in Canto XXXIII and Canto III based on the Fano plane

Paradise Singing XXXIII
Prayer to the Virgin

In you (is) mercy, in you (is) godliness,
in you (is) the magnificence, in you (s'aduna)
although in the creature it is of goodness.

Canto III of Hell: The anti-inferno and the encounter with the Ignatians

"For me you go to the painful city,
for me it goes into eternal pain,
for me it goes among the lost people

METHOD

Research Design

The type of research used in this study is the experimental blended learning mode, online and face-to-face instruction, in a group of twenty-five fifth-year college math students. The teacher give learners a list of online resources they can use to broaden their understanding of the target topic and asks them to complete an online group project that centers on the subject they will discuss. Like this manner, the teacher presents students the Fano plane's problem, they question what they know and what they need to learn in order to solve it; they decide to work in a collaborative way by using the "zoom" computer tool, and establish how to carry out the learning plan. The sampling technique in this research is based on both quantitative and qualitative statistics. They will, then, constitute the blueprint for the collection and analysis of data to work out, on the one hand, if blended learning gives an opportunity via the computer/online instruction to tailor the course to the needs, abilities, and pace of the individual student; and on the other, if the face-to-face contact with the teacher offers the opportunity to convey to each student that they have integrated their learning.

Procedure and population

The first day in a face-to-face instruction setting, the teacher gives support materials and presents the target problem and specific objectives to students so that they will work individually. The second and third day via online by using "zoom" as computer tool, both teacher and the twenty-five students work collaboratively, add each other's individual responses, and in a brainstorming session they summarize their work. The fourth and fifth day, teacher and students return to a face-to-face instruction setting in which learning assessment and teacher's formative feedback take place, with the main aim of promoting students' critical thinking, mathematical, and cognitive skills. The total allotted time in these five days does not exceed more than fifteen hours.

Instrument

The research instrument used in this research is as follows:

In the first day in a face-to-face instruction with three hours of allotted time and the twenty-five students working individually, the teacher gives the needed materials to them for the task based on different types of supports and formats and a great variety of activities in which students pass from receivers to makers: computer media, screen, bibliographic resources, books, articles, and online materials. A first evaluation is performed by the teacher with the aim to know the initial knowledge of students as a reference for the formation of the required learning.

In the second and third day, via online with five hours of allotted time, "zoom" is used as computer tool, in which teacher and all the students work collaboratively and summarize each other's previous work in the first session. A second evaluation is carried out by the teacher with the aim to assess their capacity of summarization as a cognitive skill.

In the fourth and fifth day with seven hours of allotted time, teacher and students eventually return to a face-to-face instruction. In this last phase, the teacher's role is to give formative feedback as a key of learning assessment. Likewise, students evaluate the teacher's educational practice.

Data Analysis Techniques

In order to explore student acquisition learning, a thorough evaluation and survey was conducted by both the teacher and students.

On the one hand, the teacher carries out quantitative data analysis by assessing students' performance and gives formative feedback to them as a key tool of evaluation to improve their target skills. And on the other, the twenty-five students individually also conducted a survey through Google Drive underpinned by qualitative data analysis to assess the teacher's educational practice.

RESULTS AND DISCUSSION

In the first day in a face-to-face instruction, as the teacher presents the problem-solving to students, the Fano Plane: solving the Dante's rhetoric problem, the results of the quantitative analysis show the following results:

Table 1. Score of Students' Ability to develop mathematical learning strategies in solving numerical problems

No. of student	Aspect	Score percentage
1	mathematical learning strategies	82%
2		
3		
...		

During a self-directed study, individual students completed their learning assignments, collected, studied resources, and prepared reports to the group. In view of that, according to teacher's evaluation, the twenty-five students were able to find out the *Fano Plane and its curve* and learned that *a finite projective plane is a point-line incidence geometry*, with a percentage average of 82% as shown in table 1.

In the second and third day, via online with "zoom" as the computer tool, both teacher and all the students work collaboratively and summarize each other's individual previous work, whose quantitative analysis show the following results:

Table 2. Score of Students' Ability to improve cognitive skills in solving numerical problems

No. of student	Aspect	Score percentage
1	Cognitive skills	10%
2		
3		
...		

Students in a collaborative atmosphere encounter and reason through the problem. Consequently, according to teacher's evaluation, the twenty-five students were not able to summarize the fact that to *connect contextual clues of quantum and linguistic meaning before trying to introduce a simple geometric model as the smallest finite projective plane (PG (3, 2): Fano plane), one must identify in a text which ones are 1) the points, 2) the lines*, with a percentage average of 10% as shown in table 2.

In the fourth and fifth day in a face-to-face instruction, teacher gives students formative feedback as the key of learning assessment to integrate students' knowledge. Based on very good criteria-referenced tools, this type of evaluation, as a continuing tool for teaching, has a guiding function; that is to say, to introduce the modifications that, from the practice, will be considered convenient. Namely, it does allow making the necessary decisions to correct, support, modify, or improve the procedures of the

completely teaching-learning process, thus improving the results. The main objective is to let know students what to improve and how to do so. It also serves for teachers to correct what is not working or to increase the activities that do work. Hence, it has a regulatory and corrective nature of the process itself; it is implemented primarily to know the possible deficiencies and achievements by looking for the way to enhance them. In this sense, the assessment provides both the possibility of feedback and of verification of the obtained learning. Hence, we, as teachers, must know and assess the teaching and learning process to take action on that procedure, to try to improve it, thereby correcting the negative aspects and develop the positive ones. In this way, this accomplishment on the teaching and learning process must be reflected in either specific aspects, which refer to each of the aspects or teaching elements that have been planned, or to the work dynamics with which the educational task is carried out.

In doing so, the teacher attempts to define, bound the problem and set learning goals by identifying what students know already, what hypotheses they were not able to think of, what they need to learn to better understand the dimensions of the problem, that is, the acquisition of cognitive skills regarding summarizing. Like so, the teacher requires the twenty-five students to perform individually some learning activities and for them to carry such tasks he or she also asks them to pay attention to some *contextual clues of quantum and linguistic meaning* to solve the Dante's rhetoric problem through the Fano Plane:

- *The relevance of two particular techniques to describe emotionality as the symbolism of the number "3" and the phonological technique, which are in Dante's triplets. They do constitute minimal isobaric and chained joints, therefore as detectable, they are characterized by Phonic morphs alternated with dysmorphia, and the second technique is the positional displacement of foreign elements.*
- *The transmission of ideologies, values of transcendence, significant semantic content, in particular, two techniques such as repetition, to graduate in infinitesimal emotion and the driving effect of the extra-nuclear positional elements of pre-verbal and post-verbal deictic constituents.*
- *The significance of sentence, whose operators are 7, each of which is contained in 3 lines. These lines are the triplets of the phrase operators that when found produce a phonological repetition and deictic manipulation effect replacing the concatenating morphemic effect.*

At the end of the leaning period, with the teacher's assessment, students summarize and integrate their learning in a brainstorming atmosphere. (Please, take a look at 2 and 3 pages).

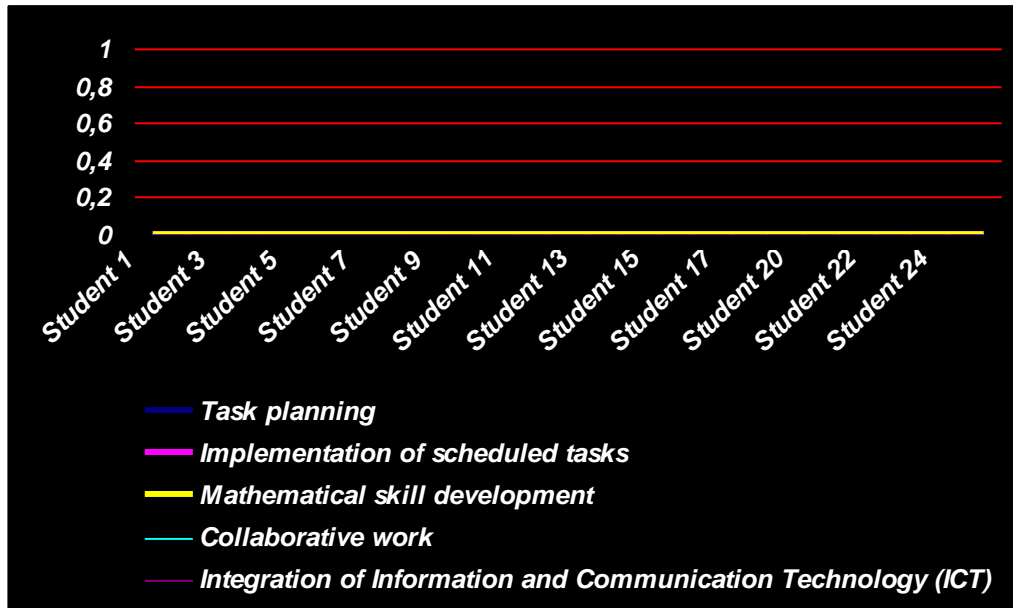In the end, students evaluate the teacher's performance.

Figure 2. The teacher's performance

As can be seen, the assigned activities by the teacher involve all students in the comprehension, production and interaction during the task process. The attention, then, focuses mainly on assessing the effectiveness of Problem-Based Learning (PBL) strategy instruction by the teacher on students' mathematical ability to solve the Fano Plane; how it is structured with a beginning, an end and a clear work procedure, an objective, a content and concrete results.
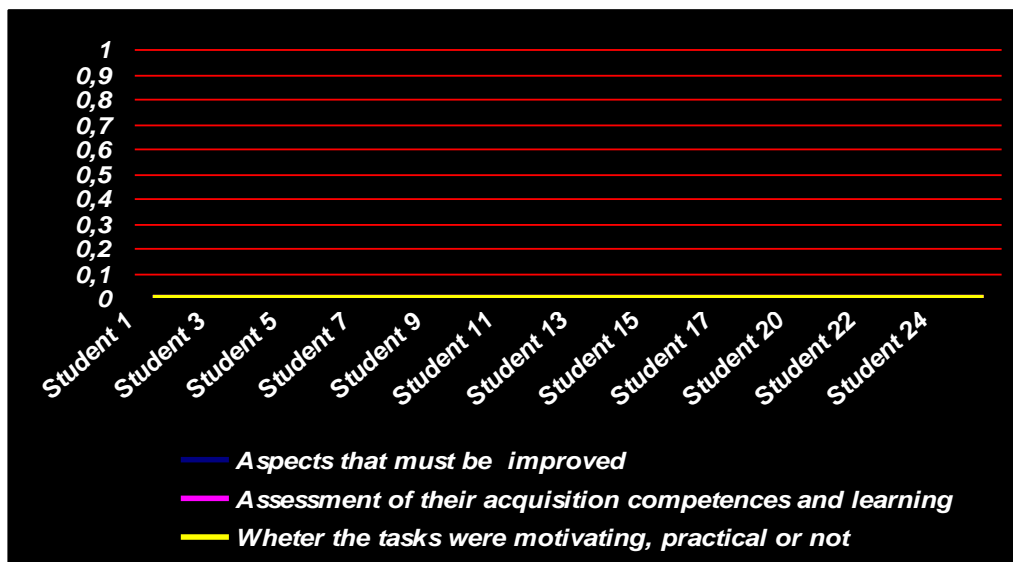

Figure 3. Students' opinion and assessment

The different aspects the teacher must taken into account to evaluate the activities are reflected in the image that we offer above. We consider it essential to know the students' perception, both in terms of what has been learned and in terms of the suggestions for future actions.

Subsequently, the data collected has allowed us to state clearly that all the students found it correct the active methodology of Problem-Based Learning (PBL) strategy instruction by the teacher to solve the Fano Plane, thereby developing the target mathematical learning strategies in solving numerical problems. However, despite the cognitive complexity to summarize and a lack of literary knowledge about Dante, they consider that the tasks were appropriate for their level and underline that they found it to be interesting and motivating; it is unanimously highlighted that the input information and formative feedback by the teacher was sufficient to make it possible for the teaching process development. Particularly, as regards their ability to improve cognitive skills in solving numerical problems; one aspect students consider that must be improved for the proposed objectives.

CONCLUDING REMARKS

Throughout this paper our primary aim was largely to bring out the application of an eclectic approach underpinned by Blended Learning and Problem-Based Learning (PBL). We then presented a rationale in Blended Learning, which gave an opportunity via the computer/online instruction to tailor the course to the needs, abilities, and pace of the individual student, in addition to face-to-face contact with the teacher, thus offering the opportunity to convey to each student that they were valuable contributors to their learning process. In this procedure, we highlighted the active methodology of Problem-Based Learning (PBL) as a dynamic practice that encouraged students' critical thinking and ability to solve problems while purposefully learning the theoretical foundations of the subject matter. Thus, the analysis and study of the Fano plane to unravel the problem of Dante's rhetoric constituted the key method, which did allow the math teacher to have the adequate information to develop students' own knowledge about mathematical learning strategies and cognitive skills in solving numerical problems.

In this research, we also focused on learning assessment criteria as a key tool in instruction, which responded to "how" teachers should have taught to students so that they would have been able to learn "what."

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