Class dissatisfaction and intelligibility of PBL

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Abstract

In the context of changing strategies, many teachers are challenged to leave their teaching models and switch to others that bring concepts and principles that often do not meet the previous model in teaching. This change is not trivial, because at the slightest sign of weakness in the new model, there is a tendency to return to the previous model experienced for a long time and even if it proves unsatisfactory, it is a safe haven for the teacher. In this work, data regarding satisfaction with previous teaching models and the intelligibility of teachers about new teaching models that provide for the use of projects will be presented. This is a complement to the work previously presented at PAEE. The teachers' previous conception of a model to structure the PBL will be raised based on data obtained in two stages from a questionnaire conducted with different groups of teachers. The results indicate that the basic principles of PBL are known and understood by teachers, though the same give it a peculiar structure, changing the order of the steps in relation to the standard models of PBL. Teachers also realize the advantage of using PBL, that is, there is the belief that the use of this strategy can contribute to learning. At the same time, there is resistance to the use of these strategies, which may be associated with the doubt that new models can be positive to promote learning.

Keywords: PBL; Teachers conceptions; Active learning; Conceptual change.

1 Introduction

Project Based Learning - PBL - has been offered as an encouraging strategy for training engineers, and many schools have incorporated this strategy into their curricula. The success of this proposal depends on the engagement of teachers, without which the best performance that this strategy offers may not be achieved. This engagement is important, because in a process of moving to PBL, the more efficient the process of implementing the higher the teacher engagement will be.

The PBL presupposes the student to be the main responsible for his learning, and the teacher the one who assists in the construction of learning, having a role of "tutor", and evaluating the student's learning. In this strategy, teachers propose projects, but the responsibility for execution lies with the student (KOLMOS, 1996; ALVES et al, 2012) with the assistance of the teacher.

A basis for this work is the conceptual change model (POSSNER et al, 1982). Interpretation is the process of changing teachers that involves a first stage of dissatisfaction with the teaching-learning process, and a later stage of PBL intelligibility, which allows for their participation and eventual adherence to this teaching strategy. Installed a dissatisfaction, the model of conceptual change envisage a second stage until a change to a new strategy is consolidated. Intelligibility, the second stage, refers to understanding the principals of PBL, which determines the construction of coherent representations of the model used, whether as propositions or representations that are internal of the individual.

The work of Ribeiro was used as the PBL model, which indicates the steps of PBL: Step 1. Identification of one or more problem(s); Step 2. Survey of the possible solutions by the students; Step 3. Attempt of an initial resolution of the problem with the basic knowledge of the students; Step 4. Analysis of which would be the learning points in the project; Step 5. Planning of the teamwork; Step 6. Independent study by the students (individually or in teams); Step 7. Meeting and sharing of information from the students in the team; Step 8. Application of the knowledge acquired in the project; Step 9. Final presentation of the project of the students; Step 10. Final assessments and feedback (Ribeiro, 2008).

The aim of this work is to assess dissatisfaction with the teaching models used and the intelligibility about the PBL. It is worth clarifying that in order to obtain good results in this process of conceptual change, teachers must be motivated and engaged for a good performance.

This work presents the combination of two stages of a larger research on the changing conditions for the incorporation of PBL in the teaching of Engineering. These two steps were reported in previous works and are aligned in this work, to clarify the path of change.

2 Methodology

2.1 Study context

The change has been studied with teachers at an engineering school that implemented projects to complement engineering courses. Teachers were responsible for the design and implementation of these projects, which have no direct link with the course subjects but intend to develop technical or transversal skills that can contribute to the education of the student.

2.2 Data collection and analysis

The focus of the work is the professors of the engineering course, and because it is the synthesis of two stages of a larger research work, it presents the data collection in two different moments and with two different groups of professors. It is an exploratory case study with quantitative and qualitative data (Lüdke & André, 1986). In both stages, data were collected from questionnaires sent to teachers in order to obtain information that characterized the sample, data about satisfaction with the teaching methods used and the intelligibility about the use of PBL. The questionnaire was essentially composed of multiple choice questions and questions with five points in the Likert scale.

For the distribution of the questionnaires, google forms was used and the link was sent to teachers by email. Out of approximately 200 teachers at the Institution, 80 answered the questionnaires in the 1st stage. In the 2nd stage, the questionnaire was sent to 80 teachers and 27 questionnaires were answered. The lower number in the 2nd stage is because only three programs were considered among the nine offered by the institution.

An Excel spreadsheet were used to analyze the data. For data related to beliefs, it was used the mean and standard deviation of the responses obtained. For data related to intelligibility, graphs were constructed with the absolute frequency of responses.

To analyze the sequence of steps perceived by teachers in their projects, a table of the sequence suggested by Ribeiro (2008) was given and placed in a random order, then respondents were asked to indicate the order of these steps in the projects they proposed to students. For the analysis of how far each step performed differed from the order proposed by Ribeiro (2008), the average of difference between the order practiced by the teacher and that indicated by the author was weighted, which guaranteed the possibility of comparison in the deviation of each step.

3 Results and Discussion

3.1 Analysis of (dis)satisfaction with teaching strategies

Using a Likert scale in which "1" is strongly disagree and "5" strongly agree, the following results were obtained.

3.1.1 Belief in usual active learning strategies

The results in **Table** indicate that teachers believe on active learning strategies (Average 3.96). It is interesting to note that the possibility of using active strategies soon is low (Average 2.06), which may indicate a reluctance to change.

Table 1 – Belief in the use of active learning strategies

Item	Average	Standard deviation
I believe that the use of active strategies is more effective for learning, than the traditional / expository model.	3,96	0,89
I have doubts about the effectiveness of using active learning strategies.	2,38	0,97
I do not use active learning strategies but I want to use them soon	2,06	1,07

3.1.2 Difficulty in using active learning strategies

Regarding the difficulty in using active strategies, that is, putting the use of these strategies into practice in the classroom, the results presented in Table 2 indicate that teachers feel safe in the use of active learning strategies (Average 3.80), however, also indicate that the use of these strategies is laborious and requires time for their preparation.

Table 2 – Results on the difficulty in using active learning strategies

Item	Average	Standard deviation
I believe that the use of active strategies is very laborious as it requires time to prepare them	3,36	1,01
I feel safe to use active strategies	3,80	0,89

3.2 Conceptions on the PBL

Approximately half of the interviewed (47%) admit to having knowledge on the PBL. Other 41% do not agree or disagree with this affirmation. Regarding to the affirmation that the seeking of knowledge in the PBL by the students is more important than the transmission of the knowledge by teacher (Fig. 1), the majority recognizing the importance of the students acting as protagonists in researching and seeking their own knowledge. In PBL, the students is the responsible for their learning, while the teacher assumes the posture of a tutor, motivating the students, facilitating the learning and stimulating the students (Silveira, 2008). This function of motivator meets the affirmation of some authors (Lima et, al, 2012, Terrón-López, 2016) that indicates that the PBL stimulates the teaching through questioning, connecting specific contents with the transversal skills that, on their turn, will be developed by the students.

Regarding the possibility for the students to have their own approaches to solving problems, 64% agree with it, as the same way, with the possibility for the students to bring their own solutions teachers also recognize the virtues of the PBL (Fig. 2). Data indicate a positive perception regarding the promotion of the student's autonomy in proposing approaches and solutions for the problems by the principles of the PBL.

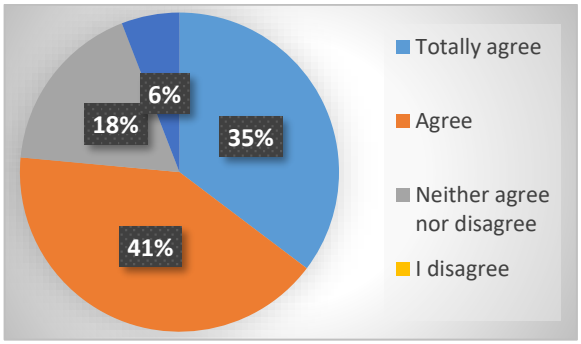

Fig. 1. In the PBL the search for knowledge is more important them transmitted by the teacher

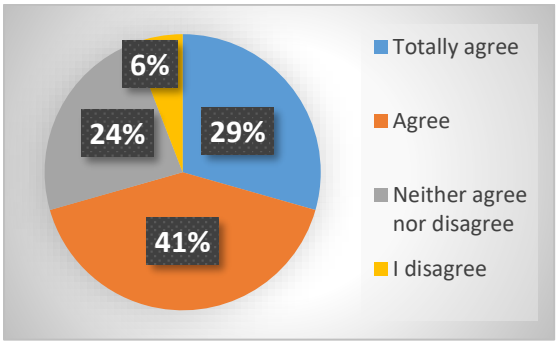

Fig. 2. The students bring solutions that are different from those proposed by teacher

3.3 The assessment of the learning in the PBL

About the steps "final presentation of the project" and "final assessments and feedbacks" in the model of Ribeiro (2008) these elements correspond respectively to the steps nine and ten. It was observed that to the respondents it happens in different steps, Fig. 3 and Fig. 4. There are no agreement that the final presentation should happen in the ninth step, but in the sixth or seventh step and a small percentage chose the eighth step. Regarding "final assessments and feedbacks", only 9% agree that this is the final step of the PBL. These indicate that the respondents perform these steps before those of the theoretical model, maintaining it, but shortening the process

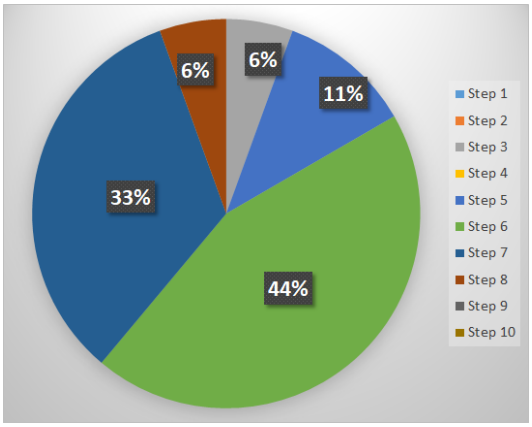

Fig. 3. Final presentation of the project by the students

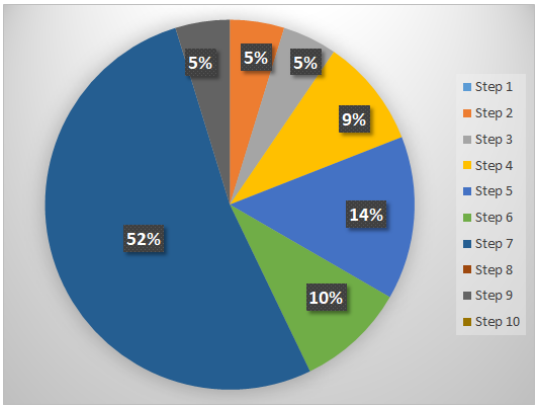

Fig. 4.Final assessments and feedback to the students

The data from Fig. 5 and Fig. 6 indicate that the respondents follow up the work and provide feedback to the students, contributing for the progress of the work and the student's learning, avoiding repetition of mistakes and highlighting positive points. The answers show that the 94% agree concerning the fact that they provide feedback to their students. The concordance rate is 70% in case of holding periodical meetings in order to discuss the project.

The respondents reveals the use of elements of the PBL to structure their projects, but changing some steps of the classic model, leading to different models of PBL of their own. However, elements as final assessment and follow-up are present in these models, even if in different steps of the model of Ribeiro (2008).

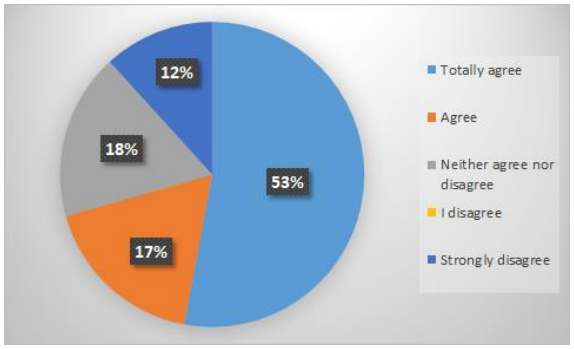

Fig. 5. Performs periodical meetings with the students in order to discuss the project

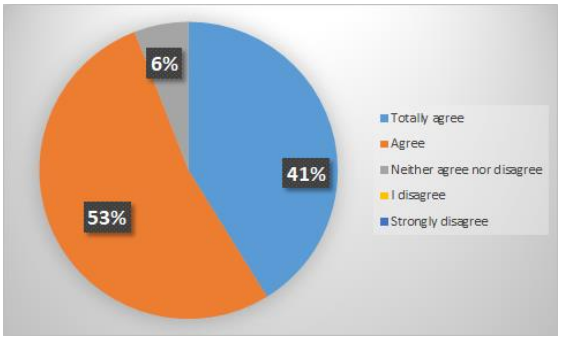

Fig. 6. Provides full feedback for the teams

Instruments of assessment in the projects

A question regarding the instruments for the assessment was used. From the options offered, all of them were pointed out as answers, except the "Written test". The data indicates that several assessments instruments are used, which go to meet of the PBL nature to develop other soft skills and assess them, besides the ones that

can be observed in written tests and examinations. The teachers perceive the need of a multiplicity of assessment instruments in order to observe what the students are reaching. The respondents revel that use mainly seminar (21%), oral presentation (35%) and project report (28%).

A list with 13 soft skills was presented to teachers to freely point, those, which were developed by the students in the projects carried out. These data are presented in Fig. 7, and it indicates that teachers perceive that the students in the projects develop soft skills.

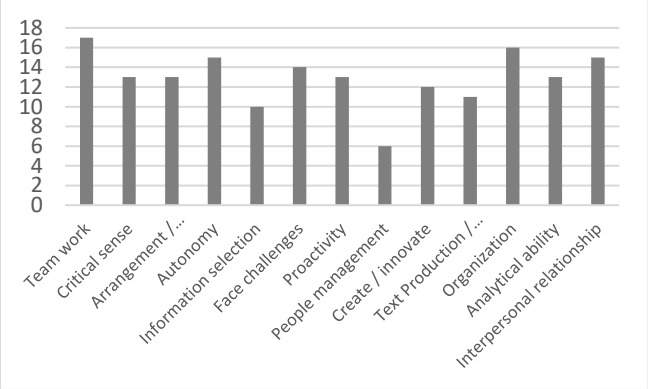

Fig. 7. Competencies developed in the PAEs using PBL

3.4 The structuring of the PBL

Based on the comparison table between the model that Ribeiro structured and the order practiced by the respondents, it is possible to obtain a weighted average considering the order of the steps. In this weighing, it was considered if the respondent would indicate as step 1 the step 1 from the theoretical model, the weight would be 10 and then regressively until reaching the weight 1, if the respondent indicated that the step 1 of the theoretical model would correspond to the tenth step in their application model of the PBL. This analysis was carried out for each of the 10 steps of the theoretical model. Fig. 13 presents the averages, in a scale from 1 through 5. These same pieces of data are indicated in Table II, in order to facilitate the reading of this article.

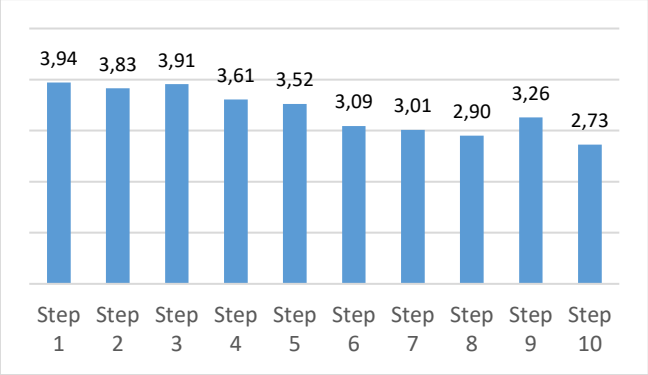

Fig. 8. Affinity between the theoretical model and the one applied in the PBL used by teachers

The steps 9 and 10 appear as the final steps for the teachers, going against the structure adapted from Ribeiro (2008). However, these steps are not carried out following the order of the theoretical model.

Fig. 9 provides more details regarding steps 1, 2, 5, 9 and 10 of the model (Axis of the abscissas) and the frequency with which the respondents indicated these steps in the questionnaire (Legends in the graphic).

In order to illustrate that, it is worthy of mentioning that step 1 "Identification of one or more problem(s)" is even associated with the 6th step of the work in the project. That is, for some respondents, the identification of the problem can happen at any of the 6 initial steps of the project. Steps 9 and 10, as already discussed in the data contained in Fig. 9, are displaced and appear more strongly until the eighth and ninth steps of the project, but more strongly until the sixth step of the project. In the specific case of the feedback, step 10 of the theoretical model, which is an important step for the students to know how their performances were, it has not worked on the moment indicated in the theoretical model. "Planning of teamwork", which corresponds to the fifth step in the theoretical model is, according to the respondents, more frequently used until the 4th step of the project.

These results indicate that teachers create their own steps when conducting the PBL, which can be associated with the need for an adaptation either for a model of conducting a project or for the needs they face when carrying out work with students.

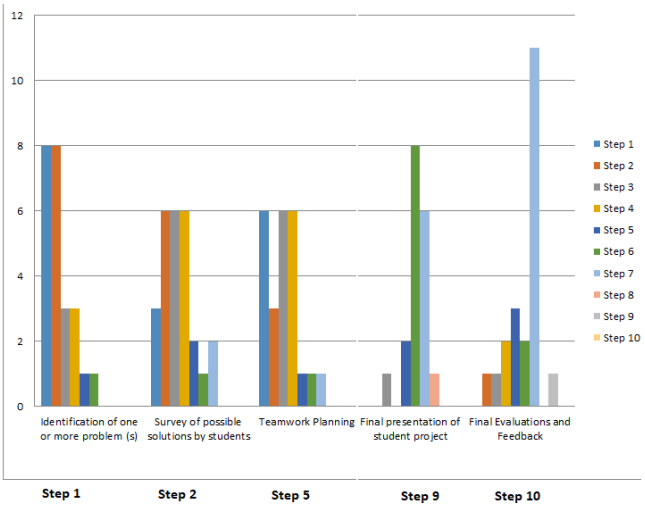

Fig. 9. Steps according to the theoretical model and respondent options

Not following the structure of the PBL as indicated by Ribeiro (2008) might be an indication of the unawareness regarding this structure of the PBL, an adaptation of other models [13] (With 7 or 8 steps), or even of a model created by the teachers themselves.

4 Conclusion

The central issue of the work is about the dissatisfaction with traditional classroom and intelligibility of the PBL by teachers working in projects and workshops offered in parallel of the subjects of an engineering course. Half of the respondents know and have alignment with the principles of the PBL as students as protagonist of the process, making research, seeking knowledge without dependence of the teacher.

The teachers also recognized the advantages from the PBL, perceiving that the students create their strategies for approaching and to seek solutions for the problems, which are competencies associated with autonomy and desired in the engineering professionals.

In line with the belief that the use of active strategies can contribute to learning, there is still resistance to the use of these strategies, which is indicate by the high rate of use of traditional classes. In turn, teachers recognize the elements of PBL but build their own models, indicating a spontaneous conception in the construction of this teaching strategy. Related to the assessment of learning and competences development teachers make use of instruments that allow assessing such as oral presentations, seminars and reports. Thus, the evaluation,

the feedback, the follow-up meeting with the students happen differently from the model indicated by Ribeiro (2008) used as a standard in this research.

Acknowledgments

To the teachers that kindly responded to the research. This work was partially supported by CNPq - National Council for Scientific and Technological Development - as scientific initiation sponsorship, and partially supported by FCT – Fundação para a Ciência e Tecnologia - within the R&D Units Project Scope: UIDB/00319/2020.

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