A survey on the synergy between teaching and learning approaches in Brazilian Engineering Schools

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Abstract

Presently, most engineering programs throughout the world still practice a banking education, treating their students as nothing more than depositories for information, which must be passively assimilated, and, in this process, become inefficient and ineffective, under the economic, social and environmental perspectives. However, experiences with the PBL have shown better results than other educational methodologies in use, and given birth to the PLE, a variation that seems to increase its potential to raise the future engineers' technical and collaborative skills to solve problems, develop technology and generate innovation. Through a descriptive field research of the reality of the engineering programs of three Brazilian universities whose advertisements mention an investment in modern educational methodologies, this study investigates how the PBL and the PLE are being implemented in their engineering programs, aiming to contribute to the consolidation of a scientific basis, both in its theoretical foundation and practical application.

Keywords: engineering education; PBL; PLE; engineering teaching and learning

1 Introduction

As global economy is increasingly driven by technology and innovation, human action is less and less related to doings – i.e. memorization and reproduction – and more and more connected to interventions – i.e. prediction and facing of the unknown – especially in engineering, where the mere recollection of solved problems and direct transfer of previously implemented procedures and solutions are not enough to cope with an ever more challenging world, which requires the ability to creatively adapt old knowledge to new contexts.

1.1 General context

As a general rule, the university as a whole and the engineering programs in particular still do not enable students to look for solutions to existing and emerging problems by means of the dynamic and critical relationship between theory and practice, as they usually favor the unidirectional and linear transmission of fragmented content, which adds up to college evasion rates and poor educational quality, causing academic, economic and social damage to the world and to Brazil.

1.2 Specific context

As if withdrawing from this debate, teachers, in their classrooms, show little interest or competence in helping build a university whose educational activities foster knowledge sharing and creation, and instigate critical thinking among its students: amid the causes for lack of interest, it is to be underscored that prestige in higher education teaching comes from researches, publications, participation in debates and examining boards, attendance to conferences and seminars, supervision of dissertations and theses, academic management and consulting, stimulating these teachers, mostly magistro-centric, to limit themselves to conveying information and experiences, basically through expository lectures, complemented by practical lessons, which ultimately seek to demonstrate what had been said; amidst the causes for lack of competence, it is worth notice that graduate programs, which enable university-level teaching, prioritize technical not pedagogical expertise, offering little or nothing in terms of teaching proficiency skills to the teachers to be – mostly physicians, managers, engineers and lawyers who are experts in their fields but not in education – and whose entry into the academic career is generally not a first option. So, either through negligence or inability, teachers in higher education institutions have not been able in most cases to align science, technology, culture and society while establishing and maintaining an effective dialogue with their students. These, on their turn, as they leave the paper world – in which linear, restricted and slow knowledge survives in paper and is transmitted by teachers in schools – and enter the paperless society – in which hypertexts, images and sounds socialize individual and collective knowledge in a multilinear, broad and immediate way on the Web – reject the notion of education as a

product – i.e. teacher-centered – rather than a process – i.e. student-centered – and highlight the inadequacy of current teaching practices in higher education: today´s students of cyberculture demand teachers who, abandoning decontextualized and one-way teaching, strive to promote integrated and collaborative learning in schools where technology is fully used to critically develop skills and tools for occupations and daily lives. In this plot, teachers complain that students are less and less interested in studies and more and more disrespectful of their authority; students, in their turn, find themselves insulted by teachers, whose classes they deem to be boring and meaningless.

1.3 Research context

Since the 60s, the PBL (Problem-Based Learning) methodology has been adopted by universities as an educational approach, strategy, technique and method by teachers who, rejecting the post theory exercises, began using topics from students' everyday life to start, focus and motivate meaningful learning (RIBEIRO; MIZUKAMI, 2005), in an attempt to help learners adapt underlying theories to their individual cognitive structures through contextualized questions carefully designed to stimulate the students' critical and committed participation in finding explanations to authentic situations of the real world (BARRETT; MOORE, 2010): in this methodology, inductive (i.e. from practice to theory) non-linear (i.e. simultaneous access to multiple knowledge) teaching and active (i.e. doing more than just seeing and repeating) learning have reportedly allowed students to tap into interdisciplinary knowledge and to build a broader and more cohesive base of competencies and abilities more suitable to their needs (AMADOR et al., 2006). Specifically in engineering programs, experiences with the PBL methodology, besides showing better results than other educational methodologies in use, have given birth to a variation that seems to increase its potential to raise the future engineers' technical and collaborative skills to solve problems, develop technology and generate innovation: the PLE (Project-Led Education) methodology, which, going beyond the case problems, with small tasks and known answers to known difficulties, that characterize the PBL methodology, focuses on creating products, with big tasks and multiple innovative solutions to challenging unknown questions (WEENK, W.; VAN DER BLIJ,), and adopts an even more hands-on educational approach, where students, while creating materials, artifacts, processes and systems, closely related to future professional situations, identify, analyze and apply the most suitable theories to develop and manage their projects (POWELL; WEENK, 2003).

Although the difficulty in differentiating the PBL and the PLE methodologies is recognized in the literature, Bloom's Taxonomy (BLOOM, 1994) and Kolb's Learning Cycle (KOLB, 1984) can help show some light (Figure 1) on the matter.

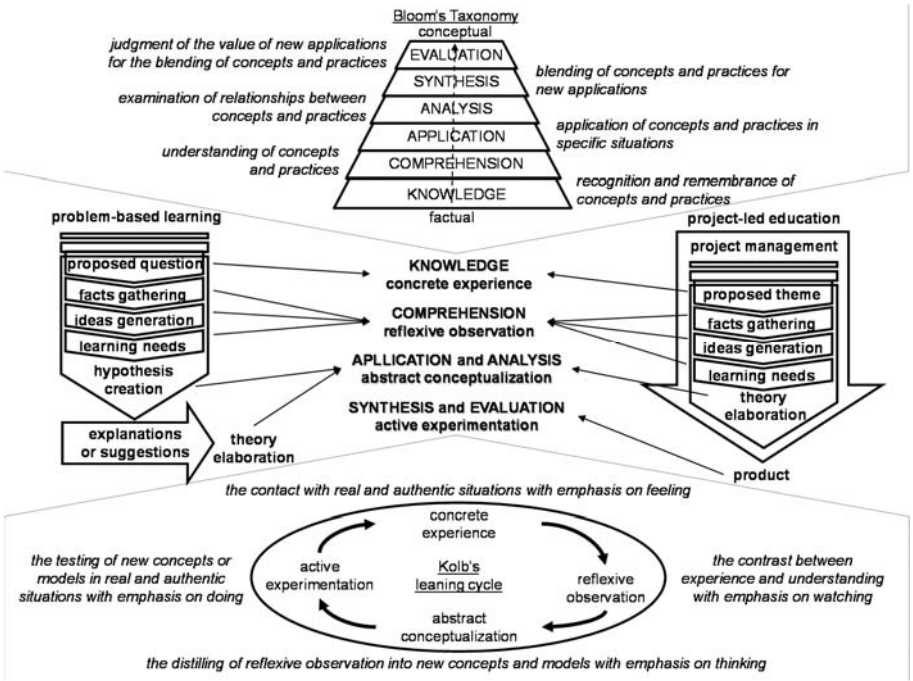

Figure 1: the difference between the PBL and PLE methodologies – Source: based on BLOOM, 1994 and on KOLB, 1984

Bloom's Taxonomy (Figure 1) refers to a classification of the different learning objectives educators can set, targeting a more holistic form of education, which allows learners to acquire specific competences from simpler (factual) to

higher (conceptual) abilities: its cognitive domain is a model that classifies thinking according to six levels of complexity, depicted as a stairway, whose lowest three levels are knowledge, comprehension, and application, and whose highest levels are analysis, synthesis, and evaluation.

Kolb's Learning Cycle (Figure 1) is based on the idea that learning involves the acquisition of abstract concepts in a process whereby knowledge is created through the transformation of experience in a four stage learning sequence: 1) concrete experience, (the contact with real and authentic situations with emphasis on feeling); 2) reflective observation (the contrast between experience and understanding with emphasis on watching); 3) abstract conceptualization (the distilling of reflexive observation into new concepts and models with emphasis on thinking); and 4) active experimentation (the testing of new concepts/models in real and authentic situations with emphasis on doing).

It could be argued (Figure 1) that, 1) since explanations or suggestions constitute the expected deliverables of the PBL methodology, it encompasses the first four objectives of Bloom's taxonomy and the first three stages of Kolb's Learning Cycle; and that, 2) once the development of a new product is the PLE methodology expected deliverable, it covers all six objectives of Bloom's taxonomy and all four stages of Kolb's Learning Cycle.

However, although very promising, the theoretical foundations and practical applications of the PBL and the PLE methodologies are still incipient and require much discussion about how and with what results they have been being used, especially in engineering programs.

1.4 Research purpose

More often than not, engineering programs practice a "banking education" (FREIRE, 1972, p. 53), treating their students as nothing more than depositories for information, which must be passively assimilated, without discussion (LUECHTEFELD; WATKINS, 2009), and, in this process, become inefficient (since they do not stimulate learning, by flaws in content, teaching and evaluation) and ineffective (as they send unprepared engineers to the job market), under the economic, social and environmental perspectives. Thus, in face of demands from Technique and Ethics for effective ways of teaching and learning engineering, it is necessary to invest in research aimed at discovering and implementing new educational methodologies that exceed the mere transmission and accumulation of data, and that facilitate information sharing and knowledge development, by combining theory and practice to graduate pragmatic – i.e. able to identify, model and solve problems – and cooperative – i.e. able to work in multidisciplinary teams – engineers.

1.4.1 Research objectives

This paper sought to investigate how the PBL and the PLE methodologies are being adopted by engineering programs, aiming to contribute to the consolidation of a scientific basis, both in its theoretical foundation and practical application. Therefore, this research examined the reality of the engineering programs of three Brazilian universities located in São Paulo, whose advertisements mention an investment in modern educational methodologies. To this end, two intermediate objectives were established: intermediate objective 1 – to identify the underlying concepts in the educational methodologies adopted by the studied universities; and intermediate objective 2 – to examine the perceptions of teachers and students on the educational methodologies adopted by the studied universities.

1.4.2 Research question

The main question in this research was "How are the PBL and the PLE methodologies being adopted by the engineering programs of three Brazilian universities located in São Paulo, whose advertisements mention an investment in modern educational methodologies?"

2 Methods

Research methods encompass the rationale and the philosophical assumptions that underlie a particular study, and which define its research methodology (approach, procedure and investigation methods), research design (data collection and data analysis techniques) and research strategy (research aims, means and orientation toward knowledge) (DAINTY, 2008).

2.1 Research methodology

As method of approach, e.g., the more abstract and broader methodological behavior for investigating events (MARCONI; LAKATOS, 2006) – this study used the inductive method, which constructs or evaluates general propositions that are derived from specific examples (FACHIN, 2005). As method of procedure – i.e. the

methodological behavior adopted in the more concrete phases of a study (MARCONI; LAKATOS, 2004) – this research was based on the observational method, which seeks to accurately capture the essential and accidental aspects of phenomena in the empirical context (FACHIN, 2005). As method of investigation, e.g., the methodological behavior regarding the way the researcher intervenes in reality (VERGARA, 2005) – this investigation made use of field research, an empirical research where a phenomenon is occurring or has occurred (FACHIN, 2005).

2.2 Research design

From among the different techniques for data collection, this study used questionnaires with closed and open questions (Likert scale), MARCONI; LAKATOS (1990): in the closed questionnaires, respondents agreed or disagreed with given statements (Likert scale) regarding traditional teaching, the PBL methodology and the PLE methodology; in the open questionnaires, follow-up questions allowed respondents to freely express what they meant and to explain why they thought that way.

With regard to the techniques for data analysis, both the quantitative – i.e. the objective analysis of facts which can be measured and expressed numerically (GIL, 2006) – and the qualitative – the subjective detailed description of observed phenomena (GIL, 2006) – treatments were applied.

2.3 Research strategy

As this research aimed at uncovering the features of teaching and learning in engineering programs, defining their nature and establishing relationships between the variables that constitute and/or influence them, it characterized a descriptive study (VERGARA, 1998).

Since the way of gaining knowledge in this research was by means of an empirical investigation, in which primary data is collected where the studied phenomena are likely to occur – outside of a laboratory, library or the workplace setting – it constituted a field research (FACHIN, 2005). Once this study endeavored to stimulate the development of educational models that bring less domination and exclusion, and because it rejected unilateral views and oppressive actions, perceived as useless in today's world, it adopted a critical orientation to teaching and learning (BAPTISA-DOS-SANTOS et al., 2010).

2.4 Population and sample

The studied universities, whose advertisements mention an investment in modern educational methodologies, were three of the largest in São Paulo, offering from five up to eleven engineering programs, and comprising a population of 598 students and 62 teachers: although all teachers agreed to take part in this research, only 54% (325) decided to contribute to this study.

3 Results

In order to report the findings of this research into the use of the PBL and the PLE methodologies in the engineering programs of three Brazilian universities located in São Paulo, whose advertisements mention an investment in modern educational methodologies, this section was divided into two parts directly linked to the three intermediate objectives previously established: the underlying concepts in the educational methodologies adopted by the studied universities (intermediate objective 1); and the examination of the perceptions of teachers and students on the educational methodologies adopted by the studied universities (intermediate objective 2).

3.1 Underlying concepts in the educational methodologies of the studied universities

In order to identify the underlying concepts in the educational methodologies adopted by the studied universities, the main data collection technique was a closed questionnaire (Figures 3 and 4).

3.1.1 Construction of the closed questionnaire

The closed questionnaire was designed (Figure 2) so that respondents could specify their level of disagreement or agreement on a symmetric five point Likert scale for a series of given statements related to this study's research context (see 1.3): 1) directly related to Bloom's Taxonomy, the first six questions were meant to identify the universities' basic sequential model for dealing with topics in the curriculum, in terms of their programs' expected levels of learning, from lower to higher mental skills; 2) openly associated with Kolb's Learning Cycle, questions seven to ten tried to find out whether the sequence of experiencing, reflecting, thinking and acting was covered by the educational methodologies adopted by the studied universities;3) questions eleven, fourteen, seventeen and twenty were intended to determine the level of presence of elements and dynamics from traditional teaching and learning in

the educational methodologies adopted by the studied universities; 4) questions twelve, fifteen, eighteen and twenty-one aimed at determining the level of occurrence of elements and dynamics from the PBL methodology in the educational methodologies adopted by the studied universities; 5) questions thirteen, sixteen, nineteen and twenty-two were planned to assess the level of incidence of elements and dynamics from the PLE methodology in the educational methodologies adopted by the studied universities.

	questions	underlying concepts
1	This program emphasizes recognition and remembrance of professional concepts and practices.	expected levels of learning, from lower to higher mental skills, based on Bloom's
2	This program emphasizes the understanding of professional concepts and practices.	
3	This program emphasizes the application of concepts and practices in specific professional situations.	
4	This program emphasizes the examination of relationships between professional concepts and practices.	
5	This program emphasizes the blending of professional concepts and practices for new applications.	
6	This program emphasizes judgment of the value of new applications for the blending of concepts and practices.	
7	This program emphasizes students' contact with real situations from their future professional life.	sequence of experiencing, reflecting, thinking and acting, related to Kolb's Learning Cycle
8	This program emphasizes students' reflexive observations about their contact with real situations from their future professional life.	
9	This program emphasizes the development of new concepts or models by the students based on their reflexive observations about their contact with real situations from their future professional life.	
10	This program emphasizes the testing by the students of new concepts or models developed by them based on their reflexive observations about their contact with real situations from their future professional life.	
11	This program emphasizes the recollection of previously adopted procedures and solutions.	elements and dynamics from traditional teaching and learning
14	This program emphasizes expository lectures complemented by practical lessons to start and assist the learning of professional concepts and practices.	
17	In this program, the curriculum is organized by subjects, with emphasis on the memorization of professional concepts and practices.	
20	In this program, teachers are specialists who transmit their knowledge to the students.	
12	This program emphasizes the direct transfer of previously adopted procedures and solutions to current problems.	elements and dynamics from the PBL methodology
15	This program emphasizes the use of topics from everyday life to start and assist the learning of professional concepts and practices.	
18	In this program, the curriculum is organized around problems, with emphasis on the identification of professional concepts and practices	
21	In this program, teachers are specialists who propose questions and stimulate discoveries by the students.	
13	This program emphasizes the creative adaptation of previously adopted procedures and solutions to current problems.	elements and dynamics from the PLE methodology
16	This program emphasizes the creation of products/processes/systems to start and assist the learning of professional concepts and practices.	
19	In this program, the curriculum is organized around projects, with emphasis on the application of professional concepts and practices.	
22	In this program, teachers are specialists who propose projects and stimulate discoveries by the students.	

Figure 2: Construction of the closed questionnaire – Source: developed by the authors

3.1.2 Application of the closed questionnaire

A synthesis of the answers obtained from the application of the closed questionnaire to the students and teachers from the three universities can be seen in Figures 3 and 4, respectively.

	synthesis of universities A, B and C students' answers	1	2	3	4	5
	1 = I totally disagree / 2 = I disagree / 3 = I don't know / 4 = I agree / 5 = I totally agree	%	%	%	%	%
1	This program emphasizes recognition and remembrance of professional concepts and practices.	15	23	17	21	24
2	This program emphasizes the understanding of professional concepts and practices.	16	35	15	15	19
3	This program emphasizes the application of concepts and practices in specific professional situations.	18	33	16	18	15
4	This program emphasizes the examination of relationships between professional concepts and practices.	20	36	16	15	12
5	This program emphasizes the blending of professional concepts and practices for new applications.	20	37	18	15	11
6	This program emphasizes judgment of the value of new applications for the blending of concepts and practices.	29	34	19	9	8
7	This program emphasizes students' contact with real situations from their future professional life.	22	31	17	14	15
8	This program emphasizes students' reflexive observations about their contact with real situations from their future professional life.	24	34	17	13	12
9	This program emphasizes the development of new concepts or models by the students based on their reflexive observations about their contact with real situations from their future professional life.	22	37	16	14	12
10	This program emphasizes the testing by the students of new concepts or models developed by them based on their reflexive observations about their contact with real situations from their future professional life.	21	34	17	15	12
11	This program emphasizes the recollection of previously adopted procedures and solutions.	18	30	16	18	17
12	This program emphasizes the direct transfer of previously adopted procedures and solutions to current problems.	16	25	18	21	19
13	This program emphasizes the creative adaptation of previously adopted procedures and solutions to current problems.	23	33	18	16	9
14	This program emphasizes expository lectures complemented by practical lessons to start and assist the learning of professional concepts and practices.	20	26	16	23	15
15	This program emphasizes the use of topics from everyday life to start and assist the learning of professional concepts and practices.	18	35	17	16	14
16	This program emphasizes the creation of products/processes/systems to start and assist the learning of professional concepts and practices.	26	37	17	11	9
17	In this program, the curriculum is organized by subjects, with emphasis on the memorization of professional concepts and practices.	17	28	17	22	16
18	In this program, the curriculum is organized around problems, with emphasis on the identification of professional concepts and practices	24	32	18	16	11
19	In this program, the curriculum is organized around projects, with emphasis on the application of professional concepts and practices.	27	38	18	11	6
20	In this program, teachers are specialists who transmit their knowledge to the students.	11	17	13	18	40
21	In this program, teachers are specialists who propose questions and stimulate discoveries by the students.	24	29	18	17	11
22	In this program, teachers are specialists who propose projects and stimulate discoveries by the students.	25	39	18	11	6

Figure 3: Synthesis of universities A, B and C students' answers – Source: developed by the authors

	synthesis of universities A, B and C teachers' answers	1	2	3	4	5
	1 = I totally disagree / 2 = I disagree / 3 = I don't know / 4 = I agree / 5 = I totally agree	%	%	%	%	%
1	This program emphasizes recognition and remembrance of professional concepts and practices.	53	9	7	22	10
2	This program emphasizes the understanding of professional concepts and practices.	31	10	6	21	31
3	This program emphasizes the application of concepts and practices in specific professional situations.	10	11	6	22	51
4	This program emphasizes the examination of relationships between professional concepts and practices.	9	19	6	12	53
5	This program emphasizes the blending of professional concepts and practices for new applications.	9	18	7	15	51
6	This program emphasizes judgment of the value of new applications for the blending of concepts and practices.	9	20	7	20	44
7	This program emphasizes students' contact with real situations from their future professional life.	11	22	9	20	38
8	This program emphasizes students' reflexive observations about their contact with real situations from their future professional life.	11	23	10	28	28
9	This program emphasizes the development of new concepts or models by the students based on their reflexive observations about their contact with real situations from their future professional life.	12	23	9	33	22
10	This program emphasizes the testing by the students of new concepts or models developed by them based on their reflexive observations about their contact with real situations from their future professional life.	12	25	7	34	22
11	This program emphasizes the recollection of previously adopted procedures and solutions.	14	26	7	32	20
12	This program emphasizes the direct transfer of previously adopted procedures and solutions to current problems.	18	28	9	30	15
13	This program emphasizes the creative adaptation of previously adopted procedures and solutions to current problems.	21	28	8	29	14
14	This program emphasizes expository lectures complemented by practical lessons to start and assist the learning of professional concepts and practices.	23	29	9	28	10
15	This program emphasizes the use of topics from everyday life to start and assist the learning of professional concepts and practices.	26	31	10	24	9
16	This program emphasizes the creation of products/processes/systems to start and assist the learning of professional concepts and practices.	30	26	9	25	10
17	In this program, the curriculum is organized by subjects, with emphasis on the memorization of professional concepts and practices.	25	23	7	19	25
18	In this program, the curriculum is organized around problems, with emphasis on the identification of professional concepts and practices	18	19	6	21	36
19	In this program, the curriculum is organized around projects, with emphasis on the application of professional concepts and practices.	11	23	7	22	36
20	In this program, teachers are specialists who transmit their knowledge to the students.	12	26	7	30	25
21	In this program, teachers are specialists who propose questions and stimulate discoveries by the students.	14	24	7	31	24
22	In this program, teachers are specialists who propose projects and stimulate discoveries by the students.	15	25	7	28	24

Figure 4: Synthesis of universities A, B and C teachers' answers – Source: developed by the authors

3.1.3 Results from the closed questionnaire

In order to understand the level of (dis)agreement from students and teachers in the closed questionnaires, the answers "I don't know" were ignored, and two clusters were formed: one with the answers "I totally disagree" and "I disagree"; and another with the answers "I agree" and "I totally agree" (Figure 5).

	consolidation of universities A, B and C students' and teachers' answers	students		teachers	
	"I totally disagree" and "I disagree" / "I agree" and "I totally agree"				
1	This program emphasizes recognition and remembrance of professional concepts and practices.	38	45	62	32
2	This program emphasizes the understanding of professional concepts and practices.	51	34	41	52
3	This program emphasizes the application of concepts and practices in specific professional situations.	51	33	21	73
4	This program emphasizes the examination of relationships between professional concepts and practices.	56	27	28	65
5	This program emphasizes the blending of professional concepts and practices for new applications.	57	26	27	66
6	This program emphasizes judgment of the value of new applications for the blending of concepts and practices.	63	17	29	64
7	This program emphasizes students' contact with real situations from their future professional life.	53	29	33	58
8	This program emphasizes students' reflexive observations about their contact with real situations from their future professional life.	58	25	34	56
9	This program emphasizes the development of new concepts or models by the students based on their reflexive observations about their contact with real situations from their future professional life.	59	26	35	55
10	This program emphasizes the testing by the students of new concepts or models developed by them based on their reflexive observations about their contact with real situations from their future professional life.	55	27	37	56
11	This program emphasizes the recollection of previously adopted procedures and solutions.	48	35	40	52
14	This program emphasizes expository lectures complemented by practical lessons to start and assist the learning of professional concepts and practices.	46	38	52	38
17	In this program, the curriculum is organized by subjects, with emphasis on the memorization of professional concepts and practices.	45	38	48	44
20	In this program, teachers are specialists who transmit their knowledge to the students.	28	58	38	55
12	This program emphasizes the direct transfer of previously adopted procedures and solutions to current problems.	41	40	46	45
15	This program emphasizes the use of topics from everyday life to start and assist the learning of professional concepts and practices.	53	30	57	33
18	In this program, the curriculum is organized around problems, with emphasis on the identification of professional concepts and practices	56	27	37	57
21	In this program, teachers are specialists who propose questions and stimulate discoveries by the students.	53	28	38	55
13	This program emphasizes the creative adaptation of previously adopted procedures and solutions to current problems.	56	25	49	43
16	This program emphasizes the creation of products/processes/systems to start and assist the learning of professional concepts and practices.	63	20	56	35
19	In this program, the curriculum is organized around projects, with emphasis on the application of professional concepts and practices.	65	17	34	58
22	In this program, teachers are specialists who propose projects and stimulate discoveries by the students.	64	17	40	52

Figure 5: Consolidation of universities A, B and C students' and teachers' answers – Source: developed by the authors

With reference to the programs' expected levels of learning (Figure 2), students seem to view them as focusing on lower rather than higher mental skills, while their teachers seem to view them as stimulating higher rather than lower mental skills (e.g. question 6).

Regarding the sequence of experiencing, reflecting, thinking and acting (Figure 2), again, students seem to see less of a practical connection of their programs to their professional reality than their teachers seem to do (e.g. question 10).

As to the presence of elements and dynamics from traditional teaching and learning (Figure 2), both students and teachers seem to feel they still play an important part in the educational methodologies adopted by the studied universities (e.g. question 20).

Concerning the level of occurrence of elements and dynamics from the PBL methodology in the educational methodologies adopted by the studied universities (Figure 2), once more, it seems to be less concrete to students than to teachers (e.g. question 21).

About the level of incidence of elements and dynamics from the PLE methodology in the educational methodologies adopted by the studied universities (Figure 2), this time again, students seem to be (much) less aware of their occurrence than teachers do (e.g. question 22).

3.2 Perceptions of teachers and students on the educational methodologies of the studied universities

In order to examine the perceptions of teachers and students on the educational methodologies adopted by the studied universities, the main data collection technique was an open questionnaire (Figure 6).

Open Questions
01. The most positive aspect(s) of the educational methodology adopted by this program is(are) ... **personal opinion**
02. The least positive aspect(s) of the educational methodology adopted by this program is(are) ... **personal opinion**
03. My suggestions for improvement of the educational methodology adopted by this program are ... **insight**

Figure 6: Open questionnaire – Source: developed by the authors

3.2.1 Construction of the open questionnaire

The open questionnaire was designed (Figure 6) so that respondents could offer their personal opinions (questions one and two) and meaningful insight (question three) concerning the educational methodologies adopted by the studied universities.

3.2.2 Results from the open questionnaire

Basically, neither students nor teachers seemed to be willing to write down their thoughts regarding the educational methodologies adopted by the studied universities, for they either left the questions unanswered or wrote “no comments” on the blank spaces.

However, from the answers of those who contributed, it could be argued that, in line with the findings from the closed questionnaire, students timidly perceive and teachers openly support the universities’ educational methodologies. Another finding was that students strongly endorse the universities attempts to revamp their educational methodologies by means of the PBL and the PLE, while teachers, almost secretly, confess facing difficulties in trying to implement them.

4 Discussion

In face of the analyzed data, it can be argued that the PBL and the PLE methodologies are at an initial stage of adoption in the engineering programs of the studied universities.

On the one hand, it looks as if students are still gaining awareness of these new approaches, as it can be seen in questions 9, 10, 19, 22, 27 and 28 of the closed questionnaire.

On the other hand, the difficulties mentioned by the teachers while dealing with the implementation of the PBL and PLE methodologies, can be seen in questions 12, 14, 15, 16 and 17.

Therefore, although it can be inferred that the studied universities are trying to re-shape their relationship with knowledge and perceive education as the intentional bond between thought and action, it must also be recognized that they still have a long way to go …

In this sense, additional studies are needed in order to find out the impacts of this decision to adopt/adapt the PBL and the PLE methodologies in/to engineering programs on the students' performance and on the teachers' practice.

Hopefully, the latter will be the topic of these authors' next paper …

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