Using Active Learning Methodologies from the "KAA" Perspective: a Case Study for Engineering Education

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Abstract

This work aims to study the relations between Problem-Based Learning (PBL) approaches in engineering education and the evaluation methodology in an under graduation and multidisciplinary engineering discipline in the area of new product development. Students were divided into two classes: a basic Problem-Based Learning (PBL) approach, such as teamwork, and a non-structured mission with specific deliverables. The other has the same basis but added Integration Scenarios (IS). IS demands students to think about a fictitious company where they could produce and sell the new product developed. Both disciplines were based on a Mechatronic Reference Model (MRM) for new product development. A new framework of students' grades connecting Knowledge, Abilities, and Attitudes (KAA) was used to evaluate their performances. As a result, we analyze students' perception of the learning experience in both classes. The most well-developed competencies were teamwork and leadership.

Keywords
PBL methodology; engineering education; performance evaluation process; KAA perspective, new product development.

1. Introduction

In engineering schools, educators face several challenges, including the difficulties of teaching demanding technical content, the constantly evolving technologies, and the industry's demand for highly qualified professionals that can be absorbed immediately. For centuries, lecturing (expository explanation) has been the norm in the engineering classroom. Nevertheless, several authors advocate that the pedagogy based only on expository explanation leaves engineering graduates poorly prepared to understand the profession's complexities (Melsa et al., 2009).

More specifically, teaching approaches based only on expository lectures emphasize procedural knowledge and do not keep the students' attention, which leads to low-frequency rates (Mills and Treagust, 2003). In other words, students may not feel motivated to go to classes and might have difficulties retaining information passed on lectures, which emphasize memorization and recollection. The emphasis on memorization, rather than on practice, does not allow students to see the content's application, contributing to the high evasion rates in the engineering courses. Also, traditional methodologies do not focus on non-technical skills, such as communication and collaboration, highly valued in the job market (Nguyen, 1998; Reis et al., 2017).

According to the Brazilian Association of Engineering Education, evasion rates reach almost 50% in Brazil (Abenge, 2018). A report by the American Society for Engineering Education (Education, 2012) highlights that it is necessary to train engineers that can deal with the multifaceted nature of the 21st century. A recent recommendation for engineering curricular guidelines in Brazil (published by the Brazilian National Education Council) recommends that engineering courses adopt a teaching methodology based on skills instead of based solely on content. Engineering education should go beyond the technical content by including practical attitudes and ethical behaviors (Abenge, 2018).

In the last decades, one of the teaching methodologies that has attracted a lot of attention is *active learning*. Active learning methodologies are generally defined as teaching techniques that engage the students in the learning process by requiring them to do meaningful activities and reflect on what they are doing. Previous works have shown that active learning can improve students' attitudes and writing/thinking skills (Bonwell, 1991). Although there is an agreement that the learning assessment must be aligned with the principles of active learning, currently, there is no consensus on which evaluative practices lead to better learning performances in active learning. This article does not aim to discuss the multiple causes of professional successes or failures in engineering education. Our attention is on the undergraduate learning experience in engineering courses.

The rest of this paper is organized as follows. Section II presents the methodology of the whole research. According to a bibliometric and classificatory analysis on applying the PBL in teaching Engineering. Section III presents our literature review. Section IV presents a case study in innovation and new product development course for engineering students focusing on issues related to the evaluation of competencies, considering the perspective of the three dimensions of the KAA applied to the PBL. Section V discusses the results, and in Section VI, we concluded the paper with main contributions, limitations, and future research methods.

2. KAA Competences

Bloom et al. (1984), classifies the evaluation processes in three types: (i) Diagnostic Evaluation (analytical), (ii) Formative Assessment (controller), and (iii) Summative Evaluation (classificatory). The diagnostic evaluation has three objectives. The first is to identify the reality of each student. The second is to check the student's current abilities and the pre-requisites for the process, and the third consists of identifying the causes of recurrent difficulties in learning.

The formative evaluation aims to control the educational efforts' output quality and, as such, should be performed throughout the school period to verify whether the students are achieving the objectives established. On the other hand, the summative evaluation could evaluate in a general way the degree to which the results have been achieved along, and at the end, of a course." (Bloom et al. 1984). These three evaluation forms should be linked (or adjusted) to ensure the effectiveness of the teaching evaluation system. They should provide a successful teaching-learning process.

However, before we deal with the evaluation process, it is paramount that the pedagogical approaches based on expository classes explanation remain dominant in engineering education. Specifically, the approach based on expository classes emphasizes procedural knowledge and does not keep the students' attention, which leads to low rates of dropout (Mills and Treagust, 2003). According to the Brazilian Association of Engineering Education, evasion rates reach almost 50% in Brazil (Abenge, 2018).

Although there is no unanimous agreement on the meaning of "competence", many authors define this as the ability to perform specified tasks (Veraldo, 2017). According to Leme (2015), competence is composed of the following elements: knowledge, ability (know-how), and attitude. These three elements (knowledge, ability, and attitude) put together are referred to as KAA (Rabaglio, 2001).

The "K" in KAA refers to knowledge and corresponds to the knowledge acquired during life, in the schools, universities, etc. According to Zamyatina (2014), engineering graduates should demonstrate "Knowledge" of basic engineering principles, including developing and using new products and systems and understanding society's technological development's importance and strategic value.

The first "A" in KAA refers to the ability to perform a task, physical or mental. According to Bloom et al. (1984), "Ability" is associated with the student's capability to convert and use knowledge. Given the concept of "Ability" as know-how, it is understood as a technical capacity (Durand, 1998). The second "A" in KAA refers to an attitude related to behaviors in the face of everyday situations and tasks. It is worth pointing out that although knowledge and ability are well-defined terms, the meaning of attitude is less clear, being a more abstract concept that is not easily observable. Leme (2015) refers to attitude as being what leads us to exercise our given knowledge.

In general, the results highlight the benefits of using the learning approach by greater absorption of technical content by students and developing multidisciplinary abilities. As Barbalho et al. (2017), few studies relate grades in PBL-based disciplines to project management elements as scope, risk, and schedule definitions.

However, our goal is to investigate the theme of performance evaluation, considering using the PBL methodology for various engineering courses. Publications of interest were located searching the databases "Scopus" and "Web of Science" for works published between 2007 and 2018. More specifically, we looked for the most cited (referenced) evaluation methods, which consider the active PBL methodology and the KAA perspective (Durand, 2006).

To perform the described search, we adapted the bibliometric research methodological approach. The following filters were applied: (1) database: Scopus; topics: project-based learning, educational technology, active learning, teaching methods, and problem-based learning; period: 2007-2018. This search returned 3,417 articles. Then, we adjusted the filter to (1) topics: PBL, active learning OR learning; (2) journal-title: IEEE transactions on education; and (3) period: 2007-2018. Now, the search returned 12 articles.

Five articles were identified in which it was not possible to point out the evaluation of attitudes in their text (Chau, 2007; Castro-Schez et al., 2014; Promentilla, 2017; Aziz, 2010; Hosseinzadeh, 2012). Only one of the articles did not mention skills or attitudes, giving a strict focus on assessing the Knowledge element (García and Hernandez, 2010).

Another six articles focused on more traditional exams denoting summative assessments but reported developing the three competencies (Tan, 2018; Martinez-Rodrigo, 2017; Calvo, 2018; Arbelaitz, 2016; Lamar, 2012; Hoic-Bozic et al., 2009). In general, they do not approach the three KAA dimensions in the form to align their evaluative instruments to their educational objectives

The other articles analyzed effectively fulfilled the three pillars of KAA competencies and the PBL methodology. However, they opted for several instruments of formative assessments (Margallo et al., 2019; Fonseca et al., 2017; Othman et al., 2017; Cobb, 2008; Vosinakis, 2012; Martínez, 2011; Habash and Suurtamm, 2010). In the work of Hu et al. (2015), the KAA dimensions were planned, worked in the teaching-learning process, and evaluated appropriately. Among the studies analyzed, the main terms cited and related to the KAA aspects were organized in Table 1.

Table 1. Description and Classification Assessment Instruments and Competencies.

Knowledge	**Ability**	**Attitude**
Design project to civil engineering	Entrepreneurship	Agility
Development of new products	Ability to synthesize	Autonomous work
Eco-design	Relationship interpersonal	Critical thinking
Environmental sustainability	Business abilities	Dynamism
Functional and / or digital prototype	Communication	Effective meetings scheduling
Language processor techniques	Creativity	Ethics
Project management	Interpretation	Initiative
Queuing systems	Multidisciplinary Teamwork	Leadership
The relevance of environmental issues	Problem-solving	Participation
Robotics	Reasoning	Resilience and flexibility
Simulation techniques	Self-assessment	Responsibility
Social entrepreneurship and	Self-directed learning	Self-motivated
Socially conscious design projects	Self-management skills	Sense of professionalism
Software engineering	Time management	Setting goals
Technical projects	Working group	Strategic thinking
Development of educational software	Written and verbal communication	Team proactive

The KAA (i.e., the competency assessment) is used in this work as a dividing line in the evaluative context proposed by the PBL methodology. More specifically, we believe that active methodologies cannot be applied to the educational methodologies independently. Therefore, we analyzed and classified the articles that resulted from our search according to the elements of KAA considered in work and the most used evaluation instruments.

As already mentioned in Leme (2015), "Knowledge" is the know-how associated with the study acquired in schools, books, work, and life. Courses are generally organized in various disciplines to provide the "Knowledge" that must subsidize professionals' training (technical training). In the six articles evaluated, the evaluation of "Knowledge" was generally performed in traditional ways, like performing theoretical exams.

Teamwork was the Ability most cited in the articles evaluated, followed by oral communication. Among other abilities cited by the authors are written communication, systemic vision, critical analysis, problem-solving, independent study, and self-regulated work. Leadership was the Attitude more referenced, although this dimension did not have broad coverage for all articles evaluated. Although we expected to find more formative and diagnostic assessments in these works, their evaluative instruments consisted mostly of written exams. Several abilities and Attitudes can be evaluated within the KAA perspective, along with active methodologies, if the educator uses other instruments, such as a "logbook" containing student photos to take notes during and after the encounters.

3. Methodology

The methodology used in this study follows protocols for research, classification, and bibliometric analysis (Weitzel, 2006). Currently, several databases use bibliometric indicators and provide a bibliometric analysis of scientific production. Two of the most common platforms are the Web of Science (WoS) and the Elsevier Scopus platform. The data presented in this study was obtained using these two platforms.

After an amount of reference gathered, common bibliometric issues as main authors, journals, keyword network, highlighted countries, and institutions were identified (Luz et al., 2019). A qualitative analysis protocol was then applied for understanding the foundation and main concepts of the gathered literature. A classificatory study (Reis et al. 2017) was performed on the references well positioned on the research topic, as discussed in the following section.

This intervention's two methodological approaches were organized together around projects that contemplated developing the intervened discipline syllabus. In this case, the PBL model, a reference for this intervention, is inspired by the State University of New Jersey's model in the United States (Hmelo-Silver, 2004). The Integration Scenario came from the University of São Paulo model in São Carlos (USP) (Mundim et al. 2002; Lima, 2002; Barbalho et al. 2004). The educational activities were developed in an educational modality that combined PBL's already well-studied active environment with Product Development teaching's specificities through IS.

4. Case study

The need to evaluate learning consistently with the epistemological assumptions that guide an active learning-based curriculum was determinant for our timely research interest. It motivates a little more extensive evaluative practice for a product development discipline. The study conducted allows us to reflect, analyze, and conclude by best practices for performance evaluation. Therefore, a list of the abilities and attitudes identified in the bibliographic research was used to evaluate performance focused on active methodologies' cross-cutting skills. After defining the competency elements to be evaluated, the evaluation instruments began to be used to evaluate the students' performance. Data were gathered in the course, which is next presented.

4.1 Process of Innovation and Product Development

The course Process of Innovation and Product Development (PIPD) has a workload of 60 hours. This discipline has an updated menu to the global market, which aims to awaken in academics the following concepts and techniques: (1) Project of the production system; (2) Innovation and new product development; (3) Organization for Innovation; (4) Innovation Funnel; (5) Breakthrough innovation; (6) Design thinking; (7) methods, (8) techniques and innovation tools (9).

Being a discipline offered by the Faculty of Technology, 50% of the vacancies are occupied by engineering courses on the main campus. It currently has fifteen undergraduate courses for engineers in different areas, from the most traditional as Civil, Electrical, and Mechanical, to more contemporary areas such as Mechatronics, Software, Computing, Energy and Network Engineering. In this way, the proposed discipline complements the actual syllabus of engineering courses in the University.

The remaining places are commonly filled by students from other areas, which varies widely. Either way, the classroom's multidisciplinarity is ensured, bringing the teaching experience closer to the job market situation where engineers need to work with a wide range of professional profiles. In Mechatronic Reference Model 12 phases, in a stage-gate© representation, prescribes the whole activities on a knowledge map for mechatronic new product development. The model reflects best practices detected in the literature regarding the development of mechanics, electronics, software, and control systems (Barbalho and Rozenfeld, 2013).

4.2 Evaluative elements

As previously presented, the PBL methodology without the integration scenario connection was applied in one of the 2019.1 classes (-PBL, containing 20 students). The didactic experience completed using the scenarios was applied in the other class 2019.1 (+PBL, containing 35 students). It is important to point out that the two classes' income would have similarities or differences since they were offered with similar characteristics: morning shifts, multidisciplinary and menus classes, programmatic content, evaluation models, and similar didactic practices. The only difference between the classes is eliminating the Methodology Scenario of Integration in the Class -PBL.

We used continuous evaluation to observe the aspects of skills and attitudes, and it was done mainly through notes and feedback captured through face-to-face contact with students. Among the main actions, some can be cited:

- Mapping of the data: such as, for example, course of origin and semester of students for a diagnostic evaluation through an electronic form, which facilitated the capture of information and organization of work teams.
- Observation and recording of the group's daily behaviors: during each face-to-face meeting and by the WhatsApp group created for dissemination and interaction with students, whenever the students' posts were considered important for conflict resolution workgroups.
- Record important observations during presentations of project steps: annotations were stored individually.
- Weekly evaluation activities through a Moodle virtual learning environment: through weekly meetings, face-to-face feedback about partial presentations was returned to each group, and specific notes were made about the perception of knowledge accumulated by the students.
- Questionnaire to evaluate the process of the proposed methodology: the questionnaire aimed to understand students' relationship with the teaching method applied, assess how each student perceived the methodology, and how studying the content in a practical way may have helped make learning more concrete.
- Aspects of verification of the apprehension of basic concepts of innovation and product development were tested in this questionnaire, which was applied only at the end of the school semester.

4.3 Data Collections

Thirty-nine students were participating in the analysis in 2019.1. Of the 39 students in 2019.1, 24 composed the +PBL class, and 15 were part of the -PBL class. This evaluation was used to measure aspects of the "knowledge" element of KAA. These students answered the questionnaire applied at the end of the discipline.

Of the total number of respondents, 54% are students of the courses of the various engineering of University of Brasília (UnB), 25% of the physiotherapy course, 7% of Chemistry or Chemistry Technology and 16% are divided into students of Biotechnology, Law, Design, Physiotherapy
, Agronomy and Computer Science. 46% of the students are female, and 54% are male. The students' average age is 22.6 years, ranging from 18 to 38 years, comprising students from the 1st to the 12th.

The objective of verifying the general perception of alumni regarding the whole approach developed. Specifically, we choose to compare the students of the +PBL (the class with PBL and integration scenario) and -PBL classes (the only-PBL-based approach). The data analysis was performed through a radar graph, as follows.
The topics below were divided into +PBL and -PBL classes of 2019.1. is information presents the students' individual opinions and then grouped by the class in which they developed their activities.

5. Results and Discussion

The following questions were asked to students through a questionnaire without the need for student self-identification. The purpose was to evaluate the proposal and analyze the class's perception about the experience under the methodology of teaching-learning and evaluation proposed. The questions are stated below:

1. Has the discipline added relevant knowledge to my training?
2. Has the discipline made it possible to develop my entrepreneurial skills?
3. Did attending the discipline increase my interest in entrepreneurship?
4. Did the discipline meet my expectations?
5. Would I recommend discipline to my classmates?
6. Was the format of the meetings during the semester quiet?
7. Was the methodology used in the course innovative?
8. Were the teaching materials used/recommended (texts, books, videos) adequate?
9. Was the teacher's role important to my learning in the discipline?

10. Has the use of the Moodle environment contributed to the best use of the discipline?
11. Was the use of WhatsApp useful for better communication and monitoring of discipline?
12. Would the use of E-mail be useful for better communication and monitoring of discipline?
13. Were the evaluation activities requested in the discipline challenging for me?
14. Is the evaluation format used in the course fair?
15. Did I feel motivated to do my best in the development of the discipline's activities?
16. Have I actively participated in all the proposed activities?
17. Have I actively participated in my working group discussions?
18. Do I consider working in groups much better than alone?

As can be seen, different kinds of questions were asked — The questions one to three concerns with the knowledge' 's contents. The general satisfaction elements are found on questions four to nine. The communication technologies were evaluated on questions ten to twelve. The students were assessed about methods of learning on questions 13 and 14. Questions 15 to 18 asked about a self-evaluation.

5.1 Graphical Results

5.1.1 +PBL Class

The Graph presented in Figure 1 shows that, in general terms, the 18 questions answered by the students in the first semester of 2019 showed a positive evaluation by the students of the +PBL class. In this class, where the methodology proposed by the thesis was applied in full, the result was distributed as well: 56% kept most of the answers in indicator five (better positioning), 22% in indicator four, 22% in indicator three.

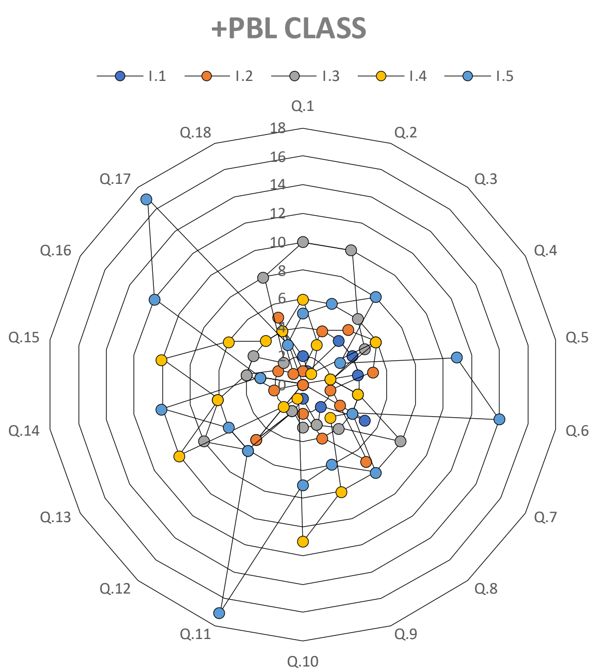

Figure 1. Relationship between the 18 questions for the student's perception and their likert +PBL class indicators. Source: authors.

Table 2 presents the details by question referring to Figure 1 confirming the distribution of answers by index according to the Likert scale (I.1, I.2, I.3, I.4, and I.5). Thus, the three questions better evaluated were: Q17 (Have I actively participated in my working group discussions?), Q11(Was the use of WhatsApp useful for better communication and monitoring of discipline?) and Q6 (Was the format of the meetings during the semester quiet?). It would be possible to develop numerous perspectives from these data. However, to know that the students approved their participation in the group discussions, they approved the format of the meetings, and the use of Whatsapp to complement the class's communication was quite gratifying. A lot of effort was applied to these activities, and we did not know if it was a possible path for convergence between these hybrid teaching strategies.

Table 2. Descriptive statistics of individual performance that made up knowledge.

+PBL Class					
Question	I.1	I.2	I.3	I.4	I.5
Q.1	2	1	10	6	5
Q.2	1	4	10	3	6
Q.3	4	5	6	1	8
Q.4	4	6	5	6	3
Q.5	4	5	2	2	11
Q.6	0	2	4	4	14
Q.7	5	3	8	4	4
Q.8	2	7	4	3	8
Q.9	3	4	3	8	6
Q.10	1	2	3	11	7
Q.11	2	2	2	1	17
Q.12	5	5	6	2	6
Q.13	0	0	8	10	6
Q.14	0	2	6	6	10
Q.15	3	4	4	10	3
Q.16	0	2	4	6	12
Q.17	0	1	2	4	17
Q.18	4	5	8	4	3

5.1.2 -PBL Class

The Graph presented in Figure 2 reports that, in general terms, the 18 questions obtained a positive evaluation also by the students of the- PBL of 1.2019. In this class, where the Integration Scenario was not part of the proposed methodology, much of the proposal was successfully implemented. The result was distributed as well: 89% kept most of the answers in indicator five, 11% in indicator four, and 6% in indicator two. Table 3 presents the details by questioning, referring to Figure 2. That is, of the three questions, two coincided with the answers of the +PBL class. Here we consider question 5, where students agree to recommend the discipline to other students. This tendency in the indication of the discipline can confirm the class's good perception concerning the discipline strategy besides having agreed with their participation and the classes' format.

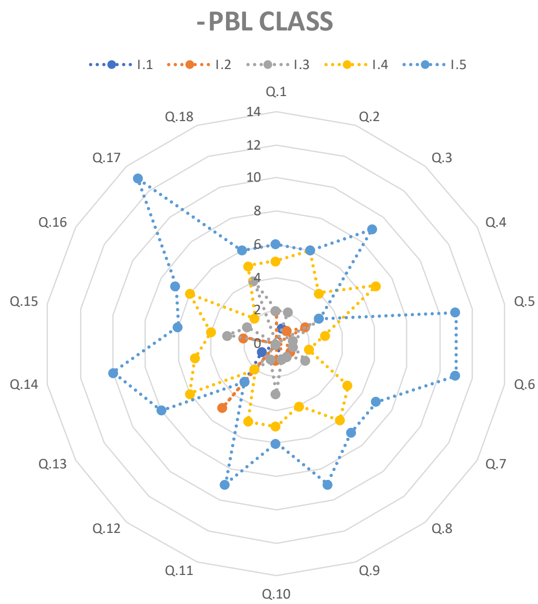

Figure 2. Relationship between the 18 questions for the student's perception and their Likert - PBL indicators. Source: authors

In the class where we applied only the PBL methodology without the combination of the second methodology (IS), the three questions with the best evaluations were: Q5 (Would I recommend discipline to my classmates?), Q6 (Was the meetings' format during the semester quiet?) and Q17 (Have I actively participated in my working group discussions?).

Table 3. Quantitative distributions of answers by questions: -PBL class.

- PBL					
Question	**I.1**	**I.2**	**I.3**	**I.4**	**I.5**
Q.1	0	2	2	5	6
Q.2	1	0	2	6	6
Q.3	1	1	0	4	9
Q.4	0	2	3	7	3
Q.5	0	0	1	3	11
Q.6	0	1	1	2	11
Q.7	0	1	2	5	7
Q.8	0	1	1	6	7
Q.9	1	0	1	4	9
Q.10	0	1	3	5	6
Q.11	0	0	1	5	9
Q.12	3	5	2	2	3
Q.13	1	0	0	6	8
Q.14	0	0	0	5	10
Q.15	0	2	3	4	6
Q.16	0	0	2	6	7
Q.17	0	0	0	2	13
Q.18	0	0	4	5	6

5.2 Proposed Improvements

In six of the 20 articles evaluated in section 3, the evaluation of "Knowledge" was generally performed in traditional ways, like, for example, by performing theoretical exams. However, for the case study in the discipline of PIPD, we chose to apply an evaluation of its own based on the perspective of the KAA (i.e., the competency assessment). We believe that active methodologies cannot be applied to the educational methodologies independently; they need to be combined (learning and evaluation). The performance evaluation for the PIPD discipline was structured in various competencies verified at various times by various evaluation instruments, as can be conferred in Table 1.

Teamwork was the ability most cited in the evaluated articles of section 3, followed by oral communication. In this case study, teamwork was also one of the best-evaluated skills followed by leadership, which was more referenced in the bibliometric study. The bibliometric study brought us a measure of how disciplines for engineering courses under PBL methodology developed their performance evaluation. Although we expected to find more diagnostic assessments in these works, their evaluative instruments consisted mostly of written exams. In this experience, the abilities and attitudes were evaluated continually, employing observation and group discussions and the participation of teammates in oral presentations.

The evaluation method could be more effort-driven once the professor must attend all classes and all the time. Moreover, a tendency for the subjective influence of professors' perception and lifestyle can emerge. In this work, we tried to present the combination between active learning and an evaluation process also active. Several abilities and attitudes can be evaluated within the KAA perspective, along with active methodologies, if the educator uses other instruments to facilitate their acting in class, such as a "logbook" containing student photos so that they can take notes during and after the encounters. We also suggest that this course has more than one unique professor to decrease the time-consuming evaluation method. They can discuss each professor's subjective thinking before assigning grades for students.

6. Conclusion

The questionnaire applied aimed to understand the students' final perception of the set of formative elements of the applied methodology involving educational technologies and evaluative instruments and thus, from the results of the questionnaires, it is possible to infer that most students considered the experience positive for learning and would recommend it to other students.
Soft skills are the competencies of the 21st century recognized by the market as the differential of the future professionalism. Among the best-known soft skills are self-knowledge, communication, proactivity, emotional intelligence, creativity, and interpersonal abilities. The term KAA incorporates the vision of Hard skills, as in the K for "Knowledge", and soft skills, as in the AA for "Abilities" and "Attitude". Thus, it enables an up-to-date view to measure performance in an engineering education context. However, we believe that there are gaps in terms of the adequacy of how the performance assessment is done and the formation of those who evaluate – the educators. The engineering educators are not generally prepared for the evaluation of abilities and attitudes. However, they acknowledge that engineering students need more than the -called "hard abilities" to prepare for the job market.

The need for a learning evaluation technique, which is coherent with the epistemological assumptions that guide a curriculum that uses an active methodology, is determinant for the timely and somewhat broader interest in evaluative practices utilized in the context of active learning, mostly in PBL. Thus, it aims to allow an active evaluation addressed to active learning methodologies. This research allows us to realize how positive it is to have parameters like that of professional life in the classroom for evaluation.

The KAA assessment is a breakthrough in clarifying that the form of evaluation needs to accompany academic evolution to represent the professional market. Only the final grades taken based on written exams do not express the results reliably. This work is the first step in research where we can change some classroom elements a make some longitudinal analysis that would go throughout the professional life of former students to know the real impact of academic evaluation for them.

This analysis aimed to understand some studies where the PBL methodology applied in engineering education had positive results regarding its performance evaluation. Thus, we conclude that in some cases, the evaluative instrument's definition was a lack of alignment with the other aspects: abilities and attitudes. We understand that the PBL already predicts these three pillars (Knowledge, Abilities, and Attitudes); however, not all articles brought interest in evaluating skills and attitudes.

In summary, in our research, we have found many interesting engineering education's works, which use the PBL methodology. In terms of works that aligned learning and assessment instruments, we found that most of the works had issues evaluating purely interactive performance definitions. More specifically, the knowledge, abilities, and attitudes that should be explored in active methodologies and the evaluation methodologies that measure their degree of achievement in the teaching-learning process are not aligned. Another point worth highlighting in the list of lessons learned is that active learning can be combined with several evaluative instruments, giving the teacher an expressive number of performance assessment options.

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