Project method in the education background: a review of recent literature

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Abstract

Although Project Methodology is known to be an effective tool in teaching physical concepts while at the same time fostering essential skills, it received surprisingly little academic interest over the last years. For this comprehensive review of research published on Project Methodology and closely related didactic methods during the years 2000 to 2013, we looked at the 26 international and 14 national (Brazilian) journals on physics education considered the most important (Qualis rated with A1, A2 and B1) by the Brazilian funding agency CAPES. We found that the topic is not only under-researched in general, particularly in Brazil, but that important aspects of such student centered approaches require more attention in both academic research and its application at day-to-day teaching, such as: Conceptual development, teachers resistance against increased student autonomy, effectiveness of Project Methodology different educational levels, and teacher training strategies that encourage more teachers to really implement student centered approaches in class, to name but few. This review itself aims at helping interested teachers and researchers to gain an overview and deeper understanding of Project Methodology, as well as summarizing the current discussion on the subject in the scientific literature. Furthermore, we hope that the ideas and experiences in the examined articles inspire both academics and practitioners to explore further the potential of Project Methodology and similar methods.

Keywords: Physics education, Project Based Learning, Review.

Resumen

Aunque se sabe que la Metodología de Proyectos es una herramienta eficaz en la enseñanza de conceptos físicos y al mismo tiempo fomenta las habilidades esenciales, ha recibido sorprendentemente poco interés académico en los últimos años. Para esta revisión exhaustiva de la investigación publicada sobre Metodología de proyectos y métodos didácticos estrechamente relacionados durante los años 2000 a 2013, analizamos las 26 revistas internacionales y 14 nacionales (brasileñas) sobre educación física consideradas las más importantes (Qualis calificadas con A1, A2 y B1) por la agencia brasileña de financiamiento CAPES. Encontramos que el tema no solo está poco investigado en general, particularmente en Brasil, sino que aspectos importantes de tales enfoques centrados en el estudiante requieren más atención tanto en la investigación académica como en su aplicación en la enseñanza cotidiana, tales como: Desarrollo conceptual , la resistencia de los maestros contra una mayor autonomía de los estudiantes, la efectividad de la Metodología de Proyectos en los diferentes niveles educativos y las estrategias de formación de maestros que alientan a más maestros a implementar realmente enfoques centrados en el estudiante en clase, por nombrar solo algunos. Esta revisión en sí tiene como objetivo ayudar a los profesores e investigadores interesados en obtener una visión general y una comprensión más profunda de la Metodología de Proyectos, así como a resumir la discusión actual sobre el tema en la literatura científica. Además, esperamos que las ideas y experiencias de los artículos examinados inspiren tanto a los académicos como a los profesionales a explorar más el potencial de la metodología de proyectos y métodos similares.

Palabras clave: Educación física, Aprendizaje basado en proyectos, Revisión.

I. INTRODUCTION

According to Bruns, Evans and Luque [1], today's education will decide the success or failure of the Brazilian economy in an increasingly competitive global market.

"Labor market data in Brazil are signaling that 21st century skills are important for the next generation of workers. Producing graduates with these skills will be a critical challenge for the education system over the next decade—graduates with the ability to think analytically, ask critical questions, master new skills and content quickly, and operate with high- level communication/interpersonal skills, including foreign language mastery and the ability to work effectively in teams" [1].

Among effective methods for promoting such abilities according to Gibbs (1995); Donnelly and Fitzmaurice (2005) cited by O'Neil and McMahon [2] and Helle, Tynjälä and Olkinuora [3] is the Project Method [4], a form

of implementation of the Project Based Learning, which was promoted through many variations and under many different names. The Project Method is based on contracts between learner and teacher; while the project itself consists of a final product, presentation and self-assessment. It promotes[1] critical thinking, self-learning and self-assessment, including leading students to possess conceptual knowledge, procedural and attitudinal more depth and extent, favoring the permanence of such knowledge longer in the cognitive structure of students [5, 6, 7]. Due to the increasing importance of these skills in practically all discussions about educating in the 21st century, it was considered timely to review the literature on this teaching method. The objectives of this review are: 1) to provide support to scientists interested in deepening the understanding of the Project Method with a comprehensive review of related research in the twenty-first century; 2) to provide teachers, who want to implement the Project Approach in their courses, with ideas discussed in the literature.

As shown in Figure 1, the research efforts related to Project Methodology were reduced over time. If added the articles in national and international journals in the first seven years studied, there are 26 articles and in recent years 22 items. By observing Figure 2, it can be noted that there are few studies on this topic in national journals, which points to the need to implement further studies in this area.

The journals covered in this research are the following: Ciência e Educação; Physics Education; Science & Education; Science Education; Studies in History and Philosophy of Modern Physics; Enseñanza de lãs Ciencias; Revista Eletrónica de Enseñanza de las Ciencias; Historical Studies in the Physical and Biological Sciences; Advances in Physiology Education; Revista Brasileira de Ensino de Física; Revista Brasileira de Ensino de Ciência e Tecnologia; Philosophy of Science; Annales de Didactiqueet de Sciences Cognitives; Caderno Brasileiro de Ensino de Física; Revista Electrónica de Investigación em Educación em Ciencias; Cadernos CEDES; Computers and Education; Investigações em Ensino de Ciências; Revista Eletrônica do Mestrado Profissional em Ensino de Ciências; Ensaio: Pesquisa em Educação em Ciências; Historical Studies in the Physical and Biological Sciences / Historical Studies in the Natural Sciences; Revista de Enseñanza de la Física; Experiências em Ensino de Ciências; Cadernos de Pesquisa; Science, Technology and Society; International Journal of Science Education; Revista Brasileira de Pesquisa em Educação em Ciências; Scientia e Studia (USP); SEED Journal. Semiotics, Evolution, Energy, and Development; Science in Context; História, Ciências, Saúde-Manguinhos; The Physics Teacher; American Journal of Physics; Research in Science & Technological Education; Revista da Sociedade Brasileira de História da Ciência; Public Understanding of Science; Journal of Research in Science Teaching; Journal of Science Communication; Revista Eureka sobre Enseñanza y Divulgación de las Ciencias; Alambique (Barcelona).

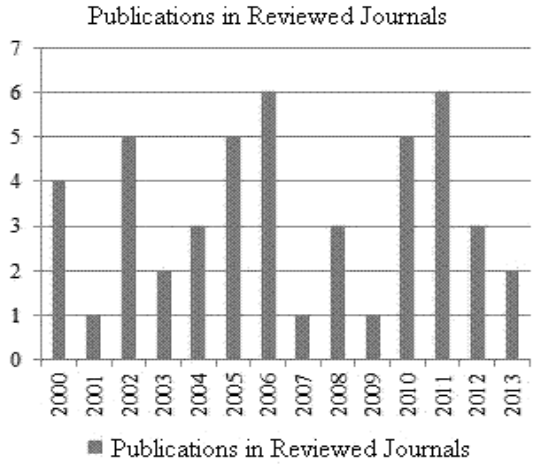

FIGURE 1. List of articles found in journals in the last fourteen years.

FIGURE 2. List of items found in national and international journals in the last fourteen years.

In section 2 there is a description of the methodology used for categorizing and analyzing the articles and in the section 3 we present the summaries of these articles: 1) the methodology applied by each group and achievements in their projects (Implement Method Methods. Projects), 2) the parallel between Project Method and other Methods (Comparison of Project Method with other teaching methods); 3) the integration of other projects with method (Integration Project Method with other references); 4) the articles that emphasize the theoretical discussion (Theoretical discussion).

[1] The Project method is characterized in general way by its integrator and interdisciplinary aspects. It is a monitored activity that implies a need for clarity regarding the evaluation criteria. This activity, collaborative in nature, promotes, in turn, the development of various skills: Social (group work) negotiation; skills related to learning how to learn (questioning, listening, analyzing and arguing), metacognitive skills (planning, conduct and evaluation of the project), and own cognitive processes (decision making, critical thinking, classification, recognition, understanding of reality, etc.).

II. METHODOLOGY

According to the suggestion of Bardin [8], items are categorized in four categories: Forms of implementation of the proposal (Section Ways to implement the Project Method), respectively, comparison and integration of Project Method with other methodologies (section Comparison of Project method with other teaching methods and section Integration Project method with other references) and articles that emphasize the theoretical discussion (Theoretical discussion section). These categories and the number of articles in each one of them are systematized in Table I.

TABLE I. Category and number of items in each one.

Categories	*Number*
Way to implement the Project Method	26
Comparison of Project Method with other teaching methodologies	5
Integration Project Method with other references	16
Theoretical discussion	8

The classification of the articles in groups proposed here is not, of course, the only possible and some of these may fall into more than one category. It is worth mentioning that the data presented here are those that appear in the articles, missing in some cases greater information.

III. RESULTS

The first three sections intended to highlight what is already being developed in the Project Method, pointing the paths that are still missing in this field.

Ways to implement the Project Method

Analyzing the articles in this category, it appears that only a few works involved comparative studies using control and experimental groups [9, 10] and showed that groups using the method Projects presented better learning outcomes than the groups submitted to the traditional method (lecture followed by problem solving). Furthermore, there is the development of skills related to scientific research in the first group.

Only one article [11] carried out research with the use of pre-tests and post-tests in a relatively large group (24 teachers and 2500 students) focusing on the issue of learning context in elementary school.

Two studies [12, 13], specifically, dedicated to solving problems of physics and biology, suggested by teachers, focusing attention on conceptual development.

Six research using computational tools [14, 15, 16, 17, 18], in High School and in the University, demonstrated that the easiness of sharing information and the organization of work in teams, in the virtual environment, helps collaborative learning.

Seven studies [19, 20, 21, 22, 23, 24,. 25] showed differentiated levels of structuring (problem of choices, group formation, project construction, division of tasks, evaluation of the work by tutors and students, presentation of results). All but two of these works [23, 24] were based on the student activity including the choice of the research problem. Previous knowledge was valued and the results achieved have shown that with the use of this methodology, the development of certain skills is provided, (procedural learning, self-efficacy, critical, self-assessment capacity), interdisciplinary and meaningful learning of content covered.

The other works [26, 27, 28, 29, 30] presented greater difficulty of categorization, because they stopped to issues such as project management in engineering [29], joint videos methodology [30], the context analysis [26] or curriculum analysis [31], as well as analysis of psychological aspects of students [28], and never making further observations on the learning results.

It is known that the Project Method, as well featuring Barrows [32], is a method of student-centered learning, guided - not taught - by tutors (teachers) to solve a problem, which constitutes a stimulus for self-directed learning and the acquisition of new knowledge and skills. However, some initiatives such as the Borges and Caldeira [23], as well as Moje et al. [24] works, seem to show that there is still great resistance on the part of organizers /creators of the projects that the students take part in the election of research problems and a tendency, not widespread, to minimize the importance of the preconceptions of these students in learning new content.

Comparison of Project Method with other teaching methods

When a comparison was made, Problems Methods and other methods [33, 34], it was found that the latter one is more suitable for practical application knowledge in engineering, for example, and allows better organization of time. However, the former one is more appropriate to the acquisition of new knowledge.

When comparing the research based on problems with other types of research, as the guided in the laboratory type [35], the theory of experimental activity and appreciative inquiry [36] and the Science, Technology and Society [37], the results were inconclusive, particularly under conditions of low difficulty, that seems acceptable.

Integration Project Method with other references

The articles describing research that sought to integrate the Project Method to the Theory of Meaningful Learning (TML) from the perspective of Ausubel [5] [38, 39] we concluded that both initiatives have shown results of meaningful learning and they complement each other, and show no signs of divergence. It can be seen in Table II where there are convergence points according to the authors.

TABLE II. Similarities between the Theory of Meaningful Learning and Project Methodology.

Theory of Meaningful Learning and Research Methodology
Engagement of students, as for the occurrence of meaningful learning students need to have the intention to; **development of hypotheses** to a problem, in which students do not know the answer, in which it is likely to occur the identification of possible prior knowledge of students as well as the possibility that the investigative activities give students the possibility to reorganize their knowledge in cognitive structure, to have contact with new sources of information, and for this purpose it can also be applied prior questionnaire; in the MLT is also important to occur evaluation of learning, which in Project Methodology can be done through the production and presentation of the final work, the preparation of articles and scripts, their production also allows students the dissemination of results; the **Problem Resolution**, inherent to Project Methodology, for which the students should mobilize knowledge of acquired experience, depending on the problem, this can provide the development of critical thinking in students, enabling them to apply their knowledge in new situations, which is one of the assumptions of Significative Learning Theory (SLT). Through Project Methodology and SLT can be understand **how to build science**, identifying that there is no scientific method and realizing the political, social and historical nature that surrounds it; both emphasize **the importance of socialization of knowledge** that occurs from the language.

It was observed in some studies, although one seeks an innovative methodology, that schools should encourage students to have autonomy [40], to seek answers to research problems [41], that the Project Methodology leads to meaningful learning [39]. In some initiatives [42, 43] the themes of the projects were chosen by teachers not by the students. These points to a likely internal contradiction in the developed project: If students are able to collect data, to collect testimonials, to socialize their results and other similar activities, why wouldn't they be able to choose their own theme and research problem?

Work related to the integration of Project Method with other references indicated that: When there is a homogenization of the groups, after identifying them with a careful planning, learning outcomes are better [44]; this learning, in a process of respect and peers cooperation, is lasting [45], but this also requires that educators / mentors beyond the domain of the technology are actually present in the virtual environment [46], have interpersonal skills, which causes an increase in motivation and consequent improvement in learning [47].

Although some initiatives in higher education level have used the Project Method secondarily [48], others which, however, when comparing groups (control and experimental) who worked with the same content in traditional classes and research classes, proved that in the second one, there was the development of skills needed to learn how to learn (questioning, organization and application of knowledge). In order to make this happen, contemporary issues, mediated by technology, should be included in the process and the integration of different methods improves motivation and learning [46].

From all that has been discussed up to here, it is clear that the integration of different methods, when they occur in a consistent and coordinated way, brings good results for learning in the elementary school, secondary school or even higher school.

Theoretical discussion

In this section we sought to clarify similar terms, and often confused with each other, related to Project Methodology and list the factors identified in the literature as crucial for an effective implementation of this method.

Prince and Felder [49] aim to define teaching methods and inductive learning compared to the methods of deductive research. They concluded that, in general, inductive methods are more effective than deductive methods, or at least have the same effectiveness to achieve a wide range of learning outcomes. In the deductive method, used more in education, one starts often from the content itself to finally show exemplifications. But in the inductive method, topics, comments, case study, problems are introduced and later theories are taught. Among the inductive methods the authors highlight the Learning for Research, Problem Based Learning, Project Based Learning Teaching Based on Case, Learning by Discovery, Just-in-Time-Teaching; noting that the method should be chosen depending on the learning objectives. The Learning by Research is the simplest, because it is provided script to students and the problems are more closed, it can be used in an initial state; Problem Based Learning is, according to the authors, the most complex and difficult to implement the methods contained in this article, because it involves solving a real problem which needs specific knowledge and skills, it takes time for students to develop and resolve the issue; Problem Based Learning also requires considerable skill of the instructors to work with unfamiliar issues and problems and deal with interpersonal problems that usually occur in group work, and they also must have the mastery of content. It is also recommended that instructors have at least two semesters of experience with cooperative learning in more traditional teaching. It is desirable that students and instructors gained experience in inductive methods, from simple to the complex. Trainers should also anticipate that students will present resistance to inductive methods and be aware of effective strategies to reduce them [50, 51, 52, 53]. Problem Based Learning develops professional skills of students, teamwork, to teach yourself, integrate curriculum materials, for those who have these Problem Based Learning goals should be adopted. Project Based Learning, also called Hybrid Problems and Problem-Based Approach, is recommended in engineering courses, and courses that deal with the development of processes and products and laboratory classes. Projects must be authentic and be directed to the instructor learning objectives, this should facilitate the learning skills to work in groups and keep all responsible for the project. Project Based Learning consists of open activities and much little things are

directed, in other words it is more structured than the Problem Based Learning. Teaching Based on Case should be used when goals include making authentic decisions and complex situations, to understand ethical and professional responsibilities, current topics or skills to realize solutions in Engineering in social and global context, preparing students to make decisions, taking into account technical, economic, social and psychological aspects, confronting ethical dilemmas. Just-Time-Teaching should be used when: 1) The instructor wants students to keep up to date on the readings and assignments of a course; 2) software is available for use by the posting of the students and for online work. The teacher should have enough knowledge on the subject and flexibility to change / build their classes according to student responses, since more preparation time is required than in traditional classes. The authors do not recommend - in engineering-Learning by Discovery which provides little or no instructions from trainers.

O'Neil and McMahon [2] discuss the ways that student centered learning (SCL) is set, pointing out different ways that this can be used as an organizing principle of teaching and assessment practices; explore the effectiveness of the methodology and finally include some criticism. According to Kember (1977) cited by O'Neil and McMahon [2], there are two broad guidelines in teaching, the design centered on the teacher and the student-centered.The author advocates the use of the latter, in which students choose what, how and why study a particular subject. So these have authority over the situation, which leads them to be safe, emphasizing the ability to think and learn for themselves, that is, the emphasis is in what students do and not the teacher's achievements. Gibbs (1995) cited by O'Neil and McMahon [2] considers prior knowledge, the process and the competence rather than the content, that learning is decided through negotiation between teacher and student.

According to Brandes and Ginnis (1986) cited by O'Neil and McMahon [2] and by Rogers [3] on the ACE: 1) The student has full responsibility for their learning; 2) involvement and participation are needed; 3) the relationship between learners is more egalitarian than the teacher centered learning and tends to promote growth and development;4) the teacher becomes a facilitator, a resource; 5) the learner's experience influences in their education; 6) affective and cognitive domain are not separable; 7) learners perceive themselves as a result of the learning experience. In the teacher centered learning students have low choice and power. The following implications for the curriculum are identified by the authors: 1) Modularization, in this system students can choose the subjects they will do. Donnelly and Fitzmaurice (2005), cited by O'Neil and McMahon [2], point out the importance of students not to choose the subjects at the beginning of the course, but to do so only once they are informed by lectures, due to the difficulty of choosing and the danger of decline in the development of social learning, which can lead to loss of student engagement; 2) the teacher seeks to develop skills and not content. The authors suggest four implications for the SCL:1) More active students in acquiring knowledge; 2) students tend to become more aware of what and why they are doing something; 3) teachers focus on interaction, using tutorials and other discussion groups; 4) the focus of the classes is the development of skills. The authors show that SCL has the following difficulties in the evaluation regarding the teaching of Traditional Method:1) These notes are overly used, while county and learning process is rather emphasized as students are used to it tends to be resistance; 2) in the Traditional Method students are compared to each other, emphasizing the competition and not personal improvement, it is important for self-evaluation and negotiation of the evaluation process. This should be formative (feedback, notes throughout the year, self-assessment and peer review), as well encourages a more focused education to students, which increases the teacher's work. The authors also present the following critical SCL: 1) Individual learning can be harmful when the teacher does not consider the whole class needs, not teaching general pedagogical principles and education; 2) if students do not have similar minimum knowledge they will have difficulty to share knowledge; 3) there is a resistance to this methodology, mainly due to its low efficacy (students must leave their comfort zone) and because few students know the SCL. According to the research conducted by Lea et al. (2003) cited by O'Neil and McMahon [2], in a psychology course that contained 48 students, only 40% of them had heard about SCL. As students interact with the methodology there is a decrease in resistance. The authors highlight the following improvements in the ACE: 1) Globally is an effective approach to develop learning content and skills, said Lea et al, 2003 cited by O'Neil and McMahon [2]; 2) Lonka and Ahola (1995) cited O'Neil and McMahon [2] found, in classes of the sixth year of a high school, indications that those who learn from the SCL do learn more slowly, but develop more skills and more detailed knowledge; 3) Hall and Saunders (1997), cited O'Neil and McMahon [2], found an increase in participation, in motivation and in notes in the first year of Technological Education.

Prince [54] defines active learning as any institutional method that engages students in the learning process, in which they do activities that lead to meaningful learning and students to think about what they are doing. The author defines three forms of active learning, collaborative learning, cooperative and Project Based Learning. The first can refer to any instructional method in which students work together in small groups, from a common goal, encompasses all instructional methods based on group. Cooperative learning is defined as a structured group work where students aim to common goals as they are evaluated individually. The focus is on cooperation rather than competition to promote learning. The Project Based Learning starts with relevant problems that are introduced or prepared by students, which serve to give them context and motivation for learning. Project Based Learning is always active and generally collaborative and cooperative, typically involves a significant amount of self-learning by students. The author highlights the following common problems found in the literature about the active learning:

1) What is being studied? Standard and Schmidt (2000) cited by Prince [54], highlight the fact that the students work in small groups have positive effects on academic achievement, while self-learning has a slight negative effect on these results; 2) What Works? There are problems in data analysis, using both qualitative and quantitative methodology. The author reached the following conclusions:

1) The student engagement benefit is consensus in the literature;

2) Students remember most content if short activities are used, in contrast to the trend of teaching as much content as possible;

3) The literature suggests that a cooperative and collaborative means produces better results than a competitive learning;

4) A discipline should not be based entirely on teams, as identified in the work of Springer et al. (1999) cited by Prince [54] and also one should not disregard the individual responsibilities in the cooperative learning;

5) Universities using non-traditional school promote academic achievement and more positive attitudes of students;

6) Project Based Learning presents the most difficult method to analyze because it includes various activities;

7) Depending on the emphasis and how to implement the results of the Project Based Learnings are better;

8) It is unlikely that Project Based Learning improves students' grades, but very likely to improve the attitudes and their study habits;

9) If students are taught according to these Project Based Learning retain content longer increases critical thinking and problem-solving ability, especially if the Project Based Learning is coupled with implicit instruction of these skills;

10) Education cannot be done based on active learning alone, but the instructor needs a clear understanding on what these methods do, and what the criteria are for choosing one over another, knowing the advantages and disadvantages of each.

Helle, Tynjälä and Olkinuora [3] explore in their article the pedagogical and psychological arguments that support the implementation of Project Based Learning, as it has been implemented and the impact on learning in post-secondary school education. The meta-study is based on qualitative review of published articles, created by more than one researcher, thus reducing problems of interpretation and subjectivity, which was also done in this study.Most of the articles focuses on the description of the implementation of individual courses, it is important to highlight the research and practice, but in need of well-founded theoretical research, as they practically do not exist. In addition the term Project Based Learning has different activities that are welcome for a detailed description of the course containing, for example, time, details required for the proposed impact, cost-effective, class size, and other expenses necessary things so that the proposal can be reproduced and that is contextualized results. Practitioners and curriculum developers are encouraged to reflect on the proposal and the possibilities of implementing Project Based Learning with a clear and realistic set of goals; because too many goals make it unfeasible to focus on all. Many authors state general and poorly contextualized goals. The authors argue three topics related to goals:

1) The importance of specificity, for example, put a goal to develop communication skills (very general), but this can be divided into several others, such as ability to conduct interviews and to give bad news;

2) there is congruence between stated goals and activities in which students are engaged;

3) evaluation.

Even if the specific objectives are chosen, there is the question of who should do the evaluation; this should be done, according to the authors, in three ways: Self-assessment, peer review and evaluation of the instructor, and the evaluations should be recursive. But there are some questions:

1) On what evidence the mark or student assessment should be based?

2) How each assessment is reflected in the final grade? In summary the authors highlight missing work in the area that details the proposal, which is well-founded, that defines feasible goals to reach.

The link between Deductive Teaching Methods, Inductive, and Centered Learning in the Student, the Active Learning, Collaborative Learning, Cooperative Learning, Project Based Learning and Project Methodology is summarized in Figure 3.

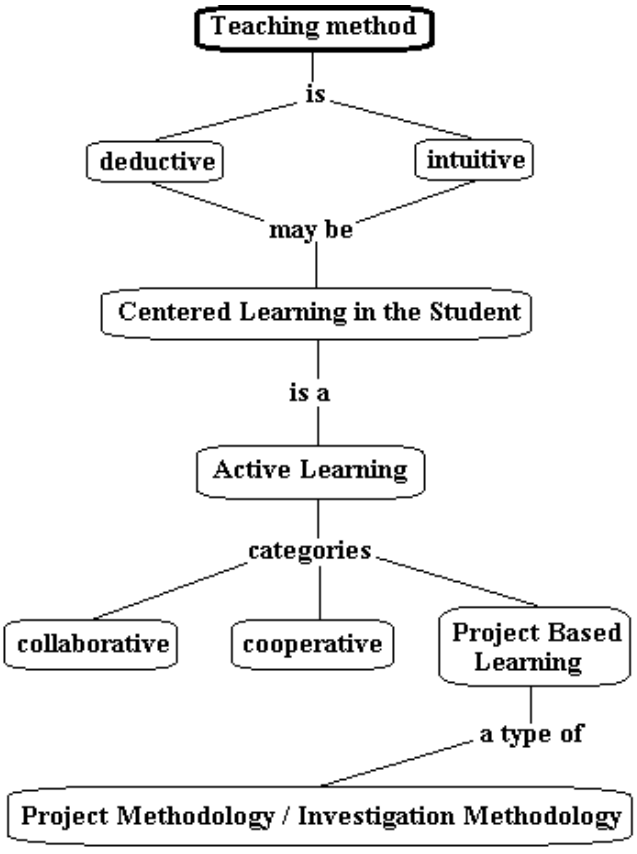

FIGURE 3. Links between concepts related to Project Method.

Carvalho [55] classifies the performance of the teacher and students at different levels of involvement with the investigative activity and proposes a scale to study what he calls the degrees of freedom offered by teachers to students.

This scale is shown in Table III, where P indicates the teacher and student. Grade I no investigative activities, and then they start and are extended up to the Grade V, which is primarily carried out research at academic level (masters and doctorate). At this level, the student, together with the teacher determines the problem to be researched, unaided, draw up hypotheses, the work plan, get the results and together with the teacher and according to already developed research (society) formulate conclusions. The order in which appears the student (S) and the teacher (T) indicates the role of who is highlighted, for example, the V stage the student is most responsible for developing the problem to be investigated.

TABLE III. Degree of teacher / student freedom in investigative activities. Source: Carvalho [55].

Degree	*I*	*II*	*III*	*IV*	*V*
Problem	-	P	P	P	A/P
Hypothesis	-	P/A	P/A	P/A	A
Work plan	-	P/A	A/P	A	A
Data getting	-	A/P	A	A	A
Conclusion	-	A/P/ Class	A/P/ Class	A/P/ Class	A/P/ Society

Cattai and Penteado [56] aimed to categorize ways of working with project for ten Math Teachers and the relationship of this initiative with training process. Therefore, they applied an interview with these teachers working in primary and secondary schools. They concluded that there are three ways to use projects: I) individually or on its own initiative, using one or more subjects per class; II) at the suggestion of the school, all disciplines work with the same theme, without integration; III) collectively. There is no evidence that the initial training of teachers led them to work with projects. This preparation was built over their careers through continuing education courses, experience and inferences of its features.

Crawford [57] research aimed to identify what are the beliefs and practices of a biology teacher, high school, who developed and taught successfully, research-based lessons. This teacher has developed and implemented an educational proposal, which had the following steps, in chronological order: 1) Initial questions; 2) gather data sources; 3) provide instructions; 4) help students plan and to make data collection; 5) teach analyze them systematically; 6) encourage students to ask questions and initial inferences; 7) observe and criticize the writing of scientific articles; 8) prepare a final presentation found by students, for a review board, composed of scientists and other citizens. The author concluded that to develop lessons based on research, the classroom needs to have the following characteristics:1) Education from real problems; 2) rigor with the data; 3) collaboration between the students and the teacher; 4) connection with society; 5) teacher has the behavior of a scientist; 6) develop in students the ability to learn how to learn; 7) believe in the work of the students. From interview students the researcher concluded that most of them value the connection of projects with the community and with society. Students criticize the implementation of the proposal on two points: a) many activities in a short time; b) complexity of the work.

There is no consensus on the definition of the design method. However, from various authors [58, 38, 22, 41] it was concluded that there are some features common to this teaching methodology: Need the teacher to identify students' prior knowledge; emphasis on more questions than answers in; issuing hypotheses; search for information; dissemination of results; teacher has mediating role of knowledge; need to study not only broader problems, but also the classic problem solving; importance of context; training problems by students; solving problems in increasing level of complexity; use of a sequence of steps that guide the research; User open ended problems; presentation of an initial problem that can be proposed by the teacher or the students. The final destination of the research should be the social application of the contents studied, related to the chosen themes emerged.

According to Zompero and Laburú [38] in the United States, there are different approaches to investigative activities. Because of these differences, was published in the official document of American education, entitled National Research Coucil, the main features that must result in education with investigative activities. The features listed in the document are: Engagement of students in the activity, prioritizing evidence, explanations formulation for the evidence, articulate explanations to scientific knowledge, communicate and justify explanations.

Most of the literature lacks a clear distinction between research and investigation. In this paper the research is being used in a broader perspective, being understood as that which leads the student to be autonomous in their learning, ‘the only man who is educated is one who has learned how to learn; who learned how to adapt and change, knowing that no knowledge is secure, that no process of seeking knowledge offers a safe base’ [4].

IV. CONCLUDING REMARKS

The present article highlights, summarize, what is already being developed in the Project Method, pointing the paths that still remain to be outlined in this relatively new field. In addition, we sought to clarify similar terms and sometimes confused related to Project Methodology. Finally, we identified the factors mentioned in the literature for the Project Method to be implemented effectively.

It was found that the groups that used the Project Based Learning showed better learning outcomes and skills development related to scientific research when compared to those submitted to the Traditional Method.

Only two studies focused attention on the conceptual development - indicating therefore lacking research in this

area. Some studies have shown that ease of information and the organization of work in a team share in the virtual environment helps self-efficacy, critical and self-assessment capacity, interdisciplinary, conceptual and procedural meaningful learning of the content covered.

It was also found that there is a teachers' resistance to provide full autonomy to the students, for sometimes they did not let them choose the theme.

It was agreed that Project Based Learning is more suitable for the application of practical knowledge in engineering, for example. Have the Problem Based Learning is best suited to the acquisition of knowledge. When comparing the Project Based Learning with the Guided Research Laboratory, the Theory of Experimental Activity, CTS and Appreciative Inquiry results were inconclusive, especially in a situation of low difficulty, pointing to the need for more research in the area.

There was consensus in the research that the Project Method and Theory of Meaningful Learning are complementary.

When there is homogenization of the groups, after identifying them from careful planning, learning outcomes are better; this learning, a process of respect and cooperation among peers is durable, but this requires that educators / mentors beyond the realm of technology, are actually present in the virtual environment, have interpersonal skills, which causes an increase in motivation and consequent improvement in learning.

From all that has been discussed it is clear that the integration of different methods, when there is a consistent and coordinated manner, brings good results to learn whether in elementary school, secondary school or higher.

Synthesizing found to achieve the third objective; it was found that the teaching methodologies can be deductive and inductive. The two can emphasize the role of teacher or student (Learning Based on Student). This is an Active Learning, in which the student does not passively receive information, but actively. Learn collaboratively, cooperative and from the Project Based Learning, which is one of the ways the Project Method, also known as Research Method, which consists of specific steps that lead students to have autonomy in learning, as well as the development of other skills such as critical thinking. According to the review of the literature there is no differentiation between research and investigation.

In order to effectively implemented the Project Method, the literature suggests that it is applied in an increasing level of complexity; it is important for teachers to participate in continuing education courses; that teaching is made from real problems; there must be rigor with the data dealing; collaboration between students and teachers; the work must have some connection with society; teacher must have the behavior of a scientist and develop in students the ability to learn how to learn; they must believe in the work of students, using contemporary themes, mediated by technology; the integration between different methods improves motivation and learning.

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