Metrics for the new education: recommendation for constructing PBL indicators

Métricas para a nova educação: recomendação para a construção de indicadores PBL

Flávia Eizerik
Mestre em Engenharia de Produção
Universidade Federal do Rio Grande do Sul
Endereço: Osvaldo Aranha 99 - Porto Alegre - RS - Brazil 90035-190
E-mail: feizerik@gmail.com

Angela de Moura Ferreira Danilevicz
Pós-Doutorado na Bren School of Environmental Science & Management
Universidade Federal do Rio Grande do Sul
Endereço: Osvaldo Aranha 99 - Porto Alegre - RS - Brazil 90035-190
E-mail: angelamfd@producao.ufrgs.br

Istefani Carísio de Paula
Pós-Doutorado em Engenharia de Produção
Universidade Federal do Rio Grande do Sul
Endereço: Osvaldo Aranha 99 - Porto Alegre - RS - Brazil 90035-190
E-mail: istefani@producao.ufrgs.br

ABSTRACT
The aim of the present paper is to propose recommendations for the construction of metrics applied to school projects. Hence, a systematic review of the literature, as well as an analysis of the scenario of project management pedagogy applied to high school education at three private schools in the south of Brazil, has been conducted. From the analysis of these two studies, recommendations have been made as for the development of a system of indicators for educational project management based on three dimensions: (i) maintenance of the Iron Triangle model; (ii) reliability, continuity, and an easily applicable method of measurement; and (iii) adaptability to the specifications of the educational area. As a conclusion, one identifies the need for a further study of the theme, due to the existing knowledge gap concerning the specific indicators for educational projects, since those are not limited just to the pedagogic indicators.

Keywords: Recommendations for indicators, development of indicators, performance indicators, PBL, project management, private education.

ABSTRACT
O objectivo do presente documento é propor recomendações para a construção de métricas aplicadas a projectos escolares. Assim, foi realizada uma revisão sistemática da literatura, bem como uma análise do cenário da pedagogia de gestão de projectos aplicada ao ensino secundário em três escolas privadas no sul do Brasil. A partir da análise destes

dois estudos, foram feitas recomendações quanto ao desenvolvimento de um sistema de indicadores para a gestão de projectos educativos baseado em três dimensões: (i) manutenção do modelo do Triângulo de Ferro; (ii) fiabilidade, continuidade, e um método de medição facilmente aplicável; e (iii) adaptabilidade às especificações da área educacional. Como conclusão, identifica-se a necessidade de um estudo mais aprofundado do tema, devido à lacuna de conhecimento existente relativamente aos indicadores específicos para projectos educativos, uma vez que estes não se limitam apenas aos indicadores pedagógicos.

Palavras-chave: Recomendações de indicadores, desenvolvimento de indicadores, indicadores de desempenho, PBL, gestão de projectos, educação privada.

1 INTRODUCTION

The world has faced several economic crises and social changes since the 1929 Crisis (Yeager, 2018; Coale & Hoover, 2015), including the most recent COVID-19 (Verschuur, Koks, & Hall, 2021), those changes and crises cause the necessity for the service sector's reinvention and adaptation to the new realities that have presented. It is a globalized system where when a crisis affects Asia, it also hits America and Europe (Serrano & Boguná, 2003; Dreiling, 2020), and where the perception of service's value has been changed (Grube, Mayton & Ball-Rokeach, 1994; Bleidorn, Schwaba & Hopwood, 2020).

The service sector has been significantly impacted by the Brazilian economic crisis. This sector has experimented one of the worst historic performances of the last years, presenting in 2016, negative growth rates, and it continuous to decrease in 20201 (IBGE, 2021). Such scenario justifies the reinforcement of the strategic management in the segment. According to Santos (2008), the strategic management is an indispensable tool for any segment of industry or services, due, mainly, to its capacity to enable, when project-oriented, a more productive use of the work forces and company resources. Although private schools are companies that deal with services, they do present particular nuances in their management.

One must, therefore, disregard the traditional view of school as a temple of teaching and learning, and start seeing it as a company (Korman, 2013), that should develop specifics software, management, and costing systems (Eizerik, 2004), undergoing specify adaptations (Khanna & Kareem, 2021), among others. For that reason, the adoption of a project management approach could be an ally for school managers, since it would allow companies to become more organic and updated (Zwikael,

2009). Besides, one notices a shortage of literature on educational project management, unless the outcome is associated with the word 'Pedagogic Project'. The pedagogic project, however, is a document that reflects a strategic planning of the institution's operationalization as a whole, including its policies, guidelines and teaching methodologies, and it does not constitute the object of this research (Gadotti, 1994). It is worth emphasizing, though, that the projects in schools may be linked or not, to the pedagogic project, because they can both be used as managerial tools to leverage strategic purposes as well as for the carrying out of curricular activities.

On the other hand, education also needs to be updated, overcoming the traditional models of school. In this respect, the adoption of projects is presented as an alternative for such updating, through the deployment of the project-based learning (PBL) (Korman, 2013; Nuthall, 2004). According to Barbosa, Gontijo and Santos (2003), Jumaat et al. (2017), Wei & Ye (2019) and Seibert (2021) PBL also reflects a teaching and learning strategy. This logic is aligned with the seminal studies presented by Senge (2005). The author claims that the learning takes place in a hybrid and functional way through the multidisciplinary experience of knowledge. It is also noteworthy that, as to Wujec (2009), the human brain natural methods of learning are more aligned with the teaching through projects than with the traditional classroom practices. And was proved by Fine (2018) in her own class-experiment.

In addition to PBL, one may use tools such as project management, which is provided in two main stances: the agile and the traditional one (Junior, 2013; Project Management Institute, 2018). Both can be explored in their distinct areas of knowledge. The traditional management aims at having a clear scope from the beginning. It has to do, therefore, with scope formalization and documentation as soon as possible, based on practices, tools and methodologies already referenced and experienced (Marques Júnior, Plonski, 2011; Leybourne & Sainter, 2012), as the standardization and the assurance of change control during the whole length of the project. On the other hand, the agile management authors claim that such proposition simplifies management formalization, turning the project process more intuitive, visually-friendly and aligned with the concepts proposed by neuroscience (Junior, 2013). It has the prerogative of the acceptance of scope changes, in an agile way, throughout the whole project. The two proposals are being used by companies of different nature, not being the scope of the present study the analysis of whether or not either one is more suitable for the school setting.

Yet, it is important to stress that many times, projects may occur in schools in a rather spontaneous and even organic way, without an underlying formal methodology of management. And it is precisely these very projects that leverage the changes of direction in the teaching and learning process, and in the activities that are not part of the traditional routine (Yang, 2016). This is why, regardless of the existence or not of a formalized methodology, projects keep being performed in schools (Korman, 2013; Prince & Felder, 2006).

Another point to be considered by PBL is the adoption of performance indicators which, according to Carvalho (2011) and Pegoraro (2014), are of vital importance in any given project. Fritsch, Vitelli and Rocha (2014) claim that the use of indicators to assess the quality of something, is presented, most of the times, without a wide discussion over the determining factors of its design. Korman (2013) adds that these indicators, when existing in schools, are almost always subjective, what ends up by making the concrete evaluation of the results, rather difficult. Therefore, the problem that lies at the very heart of the present research has to with the recommendation of which indicators, found in the technical literature, should be applied to PBL.

Having that said, one aims at proposing recommendations for the construction of indicators applied to educational projects, from the Systematic Literature Review and the analysis of the scenario of PBL management applied to high school education in three private schools of the south of Brazil. As a result, one expects a mapping over the theme, as well as a preliminary view of the reality of project management in schools in Porto Alegre.

This paper consists of four sections, being the first one involved with the contextualization of the research problem. The second one presents the method adopted for the carrying out of the study, while the third one proposes the associated results. Finally, on the fourth and last sections, the final considerations about the research are listed and the outlook for further investigation is suggested.

Under the academic point-of-view, this paper's author does not intend to build generalizations, but aims at searching for evidence in the literature regarding the use of indicators in school projects, which have the potential to be recognized or confirmed in the context of school setting. Although the intervention be specific and placed in schools of a given area of the country, the preliminary approach to the subject through structured research, allows the author to bring evidence from the praxis in order to problematize the theme, which shall be deepened in further stages beyond this investigation. As to the

practical viewpoint, the study contributes with managers due to the topicality of the theme and its strategic relevance in schools.

2 METHOD

In terms of the practical feasibility of this research, three different stages have been performed, were depicted in figure 1 and were further detailed.
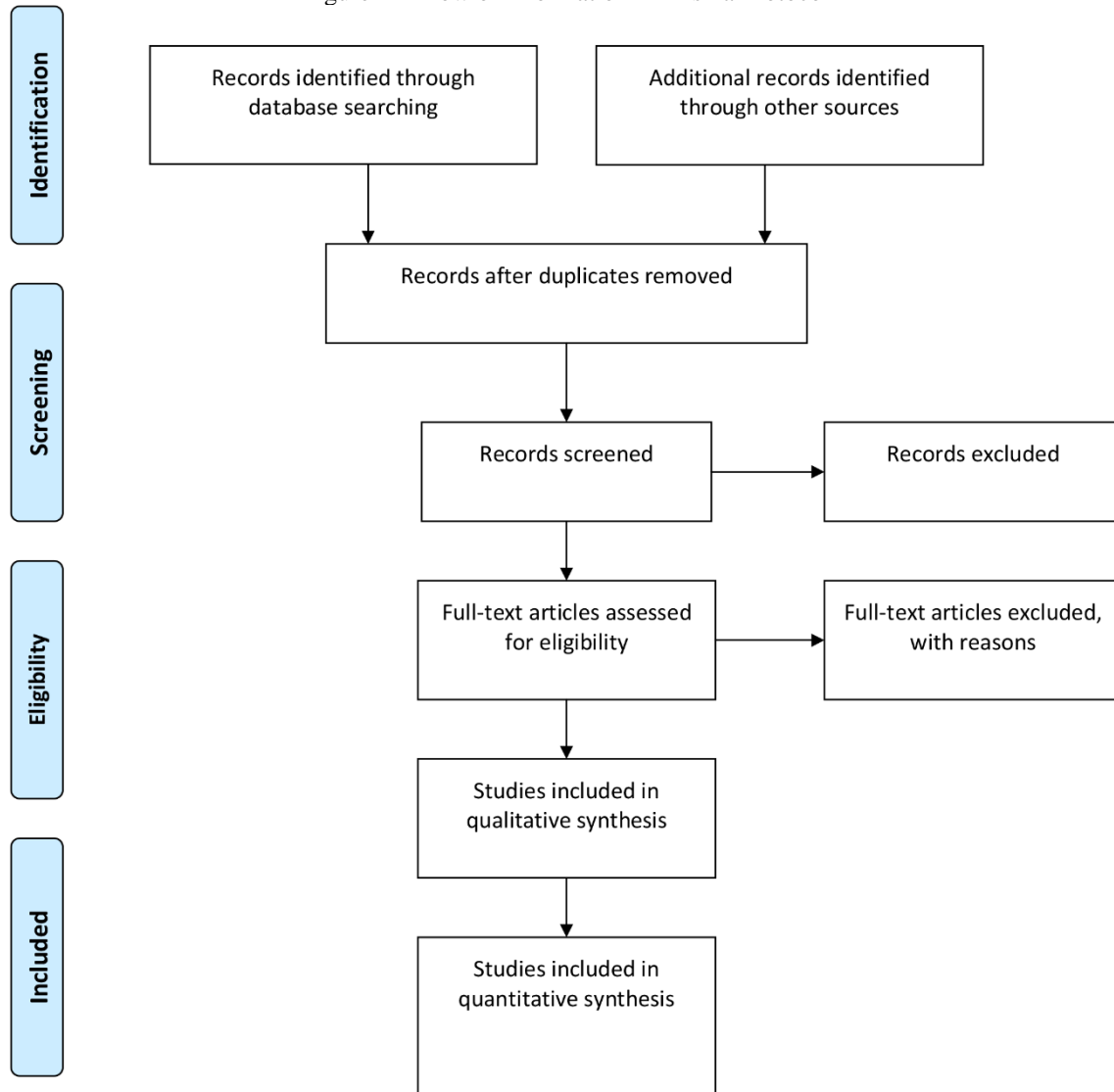
Figure 1 – Research stages
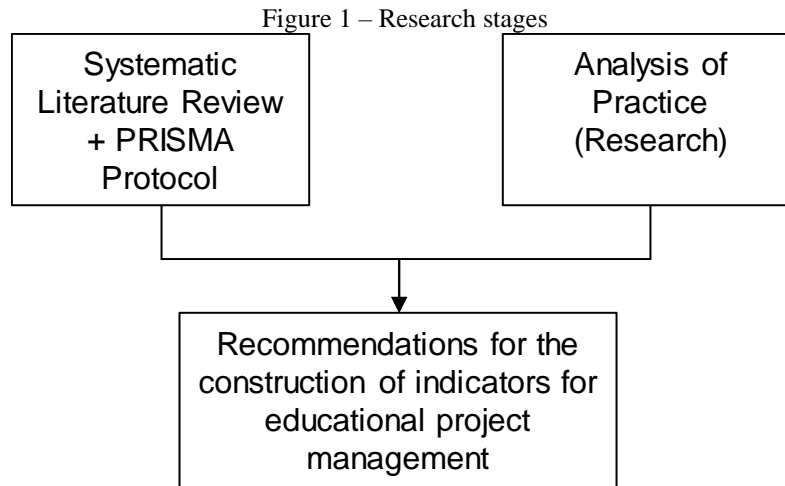
Source: The author

2.1 SYSTEMATIC LITERATURE REVIEW

The first stage contemplates an analysis of the literature, which constitutes, according to Webster and Watson (2002), the initial phase of any scientific study. Its adequate carrying out, according to the authors, should take place in a systematic and strict way, acting as a space to identify areas which present research opportunity.

So as to accomplish this stage, a Systematic Literature Review using the Preferred Reporting Items for Systematic Reviews and Meta-Analyses' - PRISMA protocol and the PICO tool, the acronym for Population, Intervention, Control and Outcome were used (Higgins, et al., 2019). PRISMA is one of the first proposed protocols in the health area, which has evolved out of *Quality of Reporting of Meta-analysis* (QUORUM), incorporating the systematic review function (Galvão, Pansani & Harrad, 2015). Despite its origin, these authors claim that this protocol is relevant, for it can be applied to different areas of study. Adding to this, Moher et al. (2015) and Lippard, Lamm, and Riley (2017), point out that its adoption enables the adequate assessment of the research accuracy. So, Figure 3 presents the phases for the Systematic Literature Review performance and, furthermore, each one is detailed.

Figure 2 – Flow of information in Prisma Protocol

Identification

Records identified through database searching

Additional records identified through other sources

Records after duplicates removed

Screening

Records screened

Records excluded

Eligibility

Full-text articles assessed for eligibility

Full-text articles excluded, with reasons

Studies included in qualitative synthesis

Included

Studies included in quantitative synthesis

Source: Adapted from Moher, Altman, Liberati & Tetzlaff, (2011)

2.1.1 Identification

The identification is PRISMA's first phase, which aims for a general search in virtual databases and other ways of research, such as, but not only, physical libraries, collections, technical reports, among others. It unfolds in two activities: records' identification in database and records' identification in other sources (Moher, et al., 2009). For the carrying out of the identification in databases, it is necessary to define the strings of research which serve to determine the articles to be considered. As in Prisma's flow there is not an activity for the definition of *strings* of research, PICO's tool is linked up with it. This way, according to Moher, Altman, Liberati & Tetzlaff (2011) and Stefana et al. (2015) definition, the question that helps in structuring a string of search is

formulated. In the present study, the question of the research is: which are the indicators, existing in the literature, applied to the Project Based Learning?

It is important to stress that the words identified from this question of the research, were listed in other languages considered relevant for such analysis. Synonyms and variables associated to these words have also been used. With that, through the use of Boolean operators (*or, and , and not*), the following string was formed*:* (((escolas) OR (school) OR (ensino médio) OR (colégio) OR (high school)) AND ((gestão de projetos) OR (project management) OR (project management research) OR (pesquisa em gestão de projetos) OR (Project for learning) OR (projetos para aprendizado) OR (project performance management) OR (performance em gerenciamento de projetos)) AND ((indicadores) OR (indicators) OR (key perfomance indicators) OR (KPIs) OR (indicadores chave) OR (performance indicators) OR (indicadores de performance) OR (criteria) OR (critério) OR (performance measurement) OR (medidas de perfomance) OR (parameters) OR (parâmetros) OR (bookmarks) OR (marcadores) OR (success criteria) OR (parâmetros de sucesso) OR (critical success factors) OR (fatores críticos para o sucesso) OR (customer satisfaction) OR (satisfação do cliente) OR (student satisfaction) OR (satisfação do estudante) OR (relationship quality) OR (qualidade do relacionamento) OR (student fidelity) OR (fidelidade do aluno) OR (motivação escolar) OR (school motivation)) AND NOT (projeto pedagógico))).

2.1.2 Screening

Thus being, with the search string determined, PRISMA's second phase, called screening, takes place. This phase aims at the exclusion and elimination of duplicated articles or of those which do not refer directly to the parameters of the research carried out, such as, but not only, publication year, editorial language, and area in which the texts fit into. This way, the results' record is generated, thus eliminating repetition. Afterwards, upon consideration of the defined parameters, the number of selected and excluded articles, is registered (Moher, et al., 2009).

To do so, one has chosen to make use of the online databases for the scientific research, since these present a wider range of articles and books than the physical libraries available for researchers. The databases used in the search were the *Science Direct* and *ISI Web of Knowledge*, two acknowledged bases in the area of engineering and that carry magazines related to the research themes.

2.1.3 Elegibility

All the articles selected during the screening phase, fitted into the theme of study. For that reason, the reading of the titles and articles' summaries was done so as to classify them as relevant or non-relevant (Moher, et al., 2009) to the theme.

In order to better organize this phase, a table with the following items was drawn up: title of the article, authors, year of publication, theme, sub-area of knowledge, adequacy to the theme of research and, for the excluded ones, the reason for this exclusion. Those considered eligible, were the ones selected for the new protocol phase.

2.1.4 Inclusion

Therefore, after Eligibility, there happens the Inclusion phase, in which the selected articles are carefully analyzed (Moher, et al., 2009). So, the analysis of criteria applied to the articles, has been generated, namely: country of study, indicators' application, indicators' purpose and kind of indicators. Based upon these criteria, a table compiling the data of the selected publications was drawn up. At the end of this phase, PRISMA's protocol ended, and the second stage called research with managers has begun.

2.2 RESEARCH WITH MANAGERS

Upon completion of the Systematic Literature Review with the PRISMA protocol, we moved on toward the stage of research with managers of projects in schools. The main goal was to evaluate the way through which the tangible and non-tangible results obtained with the projects' execution, whether they were formalized or not, have been measured. The research took place in July/2016, through a questionnaire sent, by e-mail, to the ones who have answered, namely, the head teachers and a project manager. This script contains open questions, which allowed managers to speak up over the subject, without the researcher's interference, and was divided into three parts: (i) initial questions for understanding the context and the interviewee; (ii) questions on project management in the school setting; and (iii) final questions, for open manifestation over the theme.

During the initial questions' stage, the interviewee's upbringing was brought in, for how much time has he been working with projects and which are the specific skills that have enabled them to work with project management. In the second part, school motivations to work with this guidance were evaluated; how long they have been working with PBL; who is qualified to suggest ideas for projects; if there is documented project

formalization and if these projects are in conformity with the school strategic goals. In the same part, it is verified the existence of performance indicators, as well as possible ways for measuring them. In the last part, space is given for the managers' manifestation over the theme and possible availability of documents adopted by school.

Therefore, three schools were selected based on convenience criteria, with the purpose of carrying out a survey of their everyday lives as to educational project management, as well as the existence and control of potential indicators. The three selected schools demonstrated, simultaneously, the following characteristics: i) be on the market for more than fifty years; (ii) work with PBL for more than four years, although it was not dealt with by this name; and (iii) be affiliated with the *Sindicato dos Estabelicimentos do Ensino Privado do Rio Grande do Sul* (Union of Private Educational Establishments of Rio Grande do Sul – SINEPE/RS).

3 RESULTS

This section contains the detailing and the discussion of the results concerning each one of the stages of this method of work.

3.1 RESULTS OF THE SYSTEMATIC LITERATURE REVIEW

From the operationalization of the first two phases of the Systematic Literature Review (identification and screening), one has obtained 182 articles. These were then divided by areas of study, that is: education, management, health, information technology (IT) and others.

Figure 3 – articles divided by areas of study
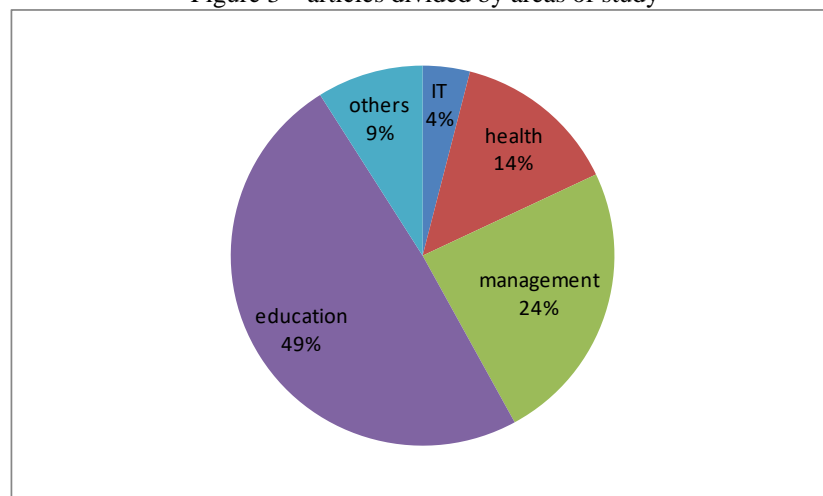
Source: The author

Giving continuity to Prisma protocol, we move on towards the eligibility phase, in which, as Figure 3 allows us to see, almost half of the obtained articles (49%), are from the educational area, in compliance with the cornerstone of the research. All the others were rejected. The remaining totality of 89 articles was analyzed from the reading of these. As a result, we have obtained seven articles (4% of the total), which were considered relevant and were, therefore, used in the present research. The other 96%, even though, had within their content the key-words sought by this research, were not directly aligned with the theme of investigation.

The analysis of the selected articles (Figure 4), the final phase of Prisma protocol, the inclusion, was performed following five parameters: year of publication, country of application, kind of application, kind of target and kind of indicators. The 'kind of application' parameter aims at verifying if the article fits into project management and/or pedagogy. The 'kind of target' parameter considers the unfolding in managerial, pedagogical and/or *Iron Triangle goal*. Finally, the 'kind of indicator' parameter identifies if the presented metrics have been measured objectively or subjectively.

Figure 4 – Compilation of the parameters for the analysis of the selected articles

Authors	Year	Country	Type of Application		Type of Objective			Type of Indicators	
			Management Projects	Pure Pedagogy	Managerial	Educational	Iron Triangle	Objective	Subjective
Desaulniers	2003	Brazil	x	x	x	x			x
Lovat e Clement	2008	Australia		x		x			x
Azma	2010	Iran	x		x			x	
Gomez-Sevilha e Sanches-Mendoza	2013	Colombia	x		x				x
Fernandes	2014	Portugal	x	x	x	x	x		x
Ramirez-Cardona et al.	2015	Colombia	x		x		x	x	
Fritsch et al.	2016	Brazil	x		x			x	

Source: the author

Having that said, a brief description concerning the focus of each of the seven articles is presented next. Concerning Desaulniers (2003), it is possible to notice the attempt to propose diagnoses for educational and non-educational organizations through the employment of indicators. These organizations that work with processes following a complex and inter-disciplinary approach, should have a monitoring based upon this diagnosis. During the research, although the propositions have taken into consideration both the pedagogical as well as the managerial aspect of the project; subjective indicators have been generated as a result.

On the other hand, in the next article, Lovat and Clement (2008), the teacher is regarded as a knowledge advisor, responsible for a more sophisticated education, driven by projects and problems. There is also the reflection about the quality of the teacher,

which should be measured by values learnt in projects. This research keeps its cornerstone designed for a kind of pedagogical and subjective indicator, while placing the teacher and not the student as the focus of study.

Another approach, presented by Azma (2010), includes a study in a cluster of Iranian universities. His aim was to evaluate the performance of these universities through a framework with qualitative and quantitative indicators, without specifying which one should be applied to school multidisciplinary projects.

Gómez-Sevilla & Sánchez-Mendoza (2013) findings aim at demonstrating the functioning of a system of qualitative indicators for the evaluation of a PBL system. Though this article offers an interesting and deep discussion on the subject proposed, it fails to deliver a neutral approach, since the article tends to focus on Christian values that, not always, can be applied to every educational institution, since it is focused on Jesuit schools.

Next, Fernandes (2014) introduces a study about the students and teachers' perception over the works based on PBL. As the word perception is part of the article's goal, the same may be understood as a qualitative study, in which the ones interviewed, present the advantages and disadvantages of this pedagogy. Although this article fails to present qualitative indicators, it still suggests an alternative according to the participants of the project. It stresses the advantages of this pedagogy, such as, the learning involved in teamwork, the improvement of communication, the increased motivation and the relation between theory and practice. On the other hand, there were also some drawbacks, such as the dependence upon the final grade, that was attached to teamwork and the lack of consideration for each student's intellectual effort, not to mention the less amount of free time enjoyed by students (Fernandes, 2014).

Ramírez-Cardona, Calderón-Hernández and Castaño-Duque (2015) describes an investigation, whose focus is the identification of the aspects that boost educational quality. The answer lies in managerial indicators, with a special focus on *Iron Triangle*. At the end of the text, we are told that there is a discrepancy between what the institutional projects propose and what *is expected from the project proposal, by the teacher's point-of-view; and what is perceived as* quality by the student's turn.

Finally, Fritsch, Vitelli and Rocha (2016), presents a discussion on indicators of quality on education, focusing on the age-grade discrepancy. This implies the analysis of students who are delayed more than two years concerning their grade and the reasons for that. The results suggest that the current way of assessment employed by the public

schools of Rio Grande do Sul, reveals dated patterns of teaching and that the indicators taken for granted as being the quality ones, in fact, are not; since they serve as a backdrop of our reality, which affects the overall standards of education.

3.2 RESULTS OF THE RESEARCH WITH MANAGERS

After reading and understanding the selected articles, we moved on towards the second stage of the research, which had to do with data collection from schools, so as to justify the use of indicators. The sample to which we had access, as above mentioned, includes schools that apply project management, in a formal or informal way and are advanced in this pedagogic procedure. Figure 7 offers information derived from the research, that reflects the specific scenario of these three institutions, but not necessarily depicts the reality of the city or state where they are located. In the same vein, it is important to point out that such information does not stand for the reality of public schools, since the present study took place in three private educational institutions.

The selected high schools, henceforth called School A, B and C, present different sizes. School A has, approximately, 300 students; while School B has about 120 students enrolled. Finally, School C has more than 400 students. As to the offered courses, schools A and C welcome elementary school students, from kindergarten up to the third year of high school. School B, on the other hand, does not work with elementary education on the first grades; but takes care of this group through a special governmental program called "Youth and Adult Education" (EJA) and offers college education, besides the graded high school. The compilation of data on the surveyed schools is detailed on Figure 4.

Figure 5 – Profile of the surveyed schools

	School A	School B	School C
Year of foundation	1922	1958	1886
Number of students (estimated)	300	120	400
Manager's qualification	Production engineer	Production engineer and quality manager	Ph.D. in Education
Time using PBL in this school	desde 2009	desde 2011	desde 2010

Source: the author

The reality of these schools is shown on (i) initial questions, which introduce the school and its respective manager. According to Figure 5, the two managers who work on project management (Schools A and B), are graduated in Production Engineering,

while the responsible for School C, holds a Ph.D. Hence, just the managers from Schools A and B have a background connected to project management. On the other hand, one can notice that in the setting of School C's manager, there is still a bit of confusion between Project Management in Education and the Pedagogic Project. Regardless of this context, these schools have been working with projects since 2009, 2011 and 2011, respectively.

Let us now start the detailing of each school: school A teaches religion, culture, language, and tradition. It has about 300 students in its high school and welcomes mainly students from the middle class. Although it is focused on the High School National Exam (ENEM), its main motto is culture and religion. On the other hand, school B is a secular school that deals with a different kind of student. Its focus is on the recovery of self-esteem and the willingness to study, besides the respect for the individuality and singularity of each one in a constructive way (teachers, students, staff, and collaborators). So, its focus is not on ENEM, but on the improvement of the   students' standards of living, reinstating them into society. Following this line of reasoning, this school is devoted to the low-income family classes (social rank C) and has 120 students in its high school level. Finally, we analyze school C's approach, whose work is geared towards not only religion and culture, but also language and tradition. This school counts with 400 students in its high school classes and it is mainly designed for the upper classes. It is also focused on content since it has been reaching expressive results at ENEM.

Next, we focus on the second group of answers, (ii) main questions.Here, we have reached the cornerstone of PBL. Below, on Figure 6, it is presented a table with the results of the central questions' axis.

Figure 6 – Main aspects of project management

Query	School A	School B	School C
PBL's Motivation	Superior Diligence	Traditional education variance	Strategic management
Project's management model	Own, within a traditional logic	Own, within a agile logic	Own, within a traditional logic
Project management responsibility	Project management office	Project department	Direction of school
Project's starting ideas	Teachers and school staff	Teachers and school staff	Teachers and school staff
Projects related to strategic planning?	Yes	Yes	Yes
Projects per year (average)	60	20	30
Kind of indicators' control	By projec action status document	By the creation of new indicators for each project	By only *Iron Triangle*

Source: the author

In the answers to these questions, one has found, in the first place, the institution motivation to work with projects, what, can be noticed in school A's management guideline, which believes in the decentralization of the role of management concerning task performance. School B, on the other hand, supports that the traditional classroom setting, which circles around the chalkboard and chalk model, be somehow enriched and updated into an alternative atmosphere, where the interdisciplinary among subjects, is encouraged. In contrast, school C's motivation lies in its own strategic planning. It is worth highlighting that while schools A and C have developed their own traditional-oriented model, school B has been structured towards a more agile approach. One has also to stress that while school A has a project-office and school B counts with a professional devoted to projects, school C leaves this management to the school board.

Even with their different responsibilities concerning management, the ideas for projects, in the three schools, can come both from teachers as well as from employees. Schools B and C develop strategically oriented projects. School A, on its turn, although has the same approach, not always establishes a clear distinction between projects' targets and the strategic planning. In this respect, school A accomplishes about 60 projects a year. These very projects, by the way, have their approval conditioned to their connection with the school mission, what, by its turn, reinforces the school's explicit relation to its strategic targets. School C, which counts with an average of 30 projects a year, only

allows its projects to be approved if they, in their executive proposal (term of opening), make it clear the links between them and the institution strategic targets.

The control of the indicators was analyzed, considering both the kind of existing indicator as well as the one who is responsible for this control and inquiry. The three schools adopt their own model of management. School A has a document which identifies the institution project action status, while school C makes use of a traditional follow-up, focused on *Iron Triangle's metrics* (budget, schedule and scope). This way, it does not use specific KPIs for school projects, paying a special attention only to the observation and control over cost, time and scope. School B, finally, only measures data on the students' participation and their satisfaction. Such indicators, to a smaller or larger degree, are monitored by the project-office in school A; by the management director in school B and by management, in school C. Based on these parameters, all of them keep track of the results of the realized projects.

After getting to know the reality of the projects, we moved on to the final issues (iii) which allowed the managers' free manifestation. Among these manifestations, we would like to stress school B's manager's statement, emphasizing how important it is that teachers "buy the project to make it work". This statement is relevant, since the projects are, most of the times, suggested by the teachers themselves; in spite of an occasional resistance to adhere to their peers' project. In addition to the above-mentioned comments, it is important to point out school C's manager's statement, who highlights the slowness in the implementation of work culture by projects. He also mentions the relevance of a permanent structure of support to help teachers avoid succumbing to the "archaic practices of education".

3.3 RESULTS OF THE RECOMMENDATIONS FOR THE CONSTRUCTION OF INDICATORS

According to what has been presented on the previous results, either in the systematic bibliographic review, or in the research with managers, one has identified a lack of parametrization as to the information on school indicators in educational management projects. And, according to Fernandes (2016), the establishment of parameters for the information production and the facilitation of the flow of those to the diversified interested audiences become important elements for the entrepreneurial survival, for, after all, to build a base of information means constructing a base for decision-making.

Hence, this section introduces a list of recommendations for the construction of these indicators of effectiveness in order to clarify the information in order to enable the decision-making. Within each dimension below mentioned, it is necessary that there are as many indicators as needed, if they are associated with the projects' targets. In other words, one should look for the efficiency of the indicators in each one of these dimensions. Therefore, this stage combines the postulated by the literature and the reality found in the research with the managers, towards the generation of guidelines that help consubstantiate indicators connected to PBL, so far, in most of the cases, subjective.

As to Moher, et al. (2015), besides management indicators, the indicators of each project, which are defined still at the planning phase, should be monitored, having as a reference, the product proposal, the process or service generated by the project and the client's expectations. This way, one should generate indicators arising from the client's requirements, which make clear, at the end of the project, if the initial goals have been reached or not. Besides, the same should enable the implementation of corrective measures so as to guarantee the final result.

Ogunlana (2010) complete the idea with the information that there are considerable differences in the demands related to area-oriented projects, since significative variations both by project as well as by area, take place. It is also necessary according to Lim and Mohamed (1999) to make sure that there is a differentiation on the scale of measurement of the project success, namely: the macroscale, which deals with the main scope and the microscale, which has to do with each part. Still, according to these authors, the macroscale dealing with the Iron Triangle, term coined by Atkinson (1999), encompasses project metrics, such as time, cost, and quality. Metrics of time and cost are, clearly, quantitative parameters and measurements, which can be evaluated in any kind of project since they are mathematical quantities. On the other hand, the third dimension, quality, constitutes a subjective matter, as Cooke-Davies (2002) puts it. These metrics should refer not just to the quality of the project, but also to the quality of the final target or product. Therefore, based upon this context, we have developed the recommendations for the construction of indicators.

Being so the case, in the first place, we recommend that the Iron Triangle's control (time, cost and project quality) be kept. This owes to the fact that these monitoring results affect the global perception of project performance as to one of the main interested parts (stakeholders) (Davis, 2017), more specifically, the sponsoring entities. It is worth

stressing that this justifies itself in the school scenario, in which the projects' approval takes place top-down, although its proposition may occur, many times, bottom-up.

At this point, it is possible to find resonance on Lim and Mohamed (1999), and Atkinson (1999), emphasize the importance of having **a macroscale control**, represented by the *Iron Triangle*, and **the microscale**, which measures the results of each part of the project. There are still Cooke-Davies statements (2002), about the metrics that should not just objectify the quality of the project, but also the quality of the final target, its product, for example, the knowledge acquired, the satisfaction with the project and the student's scholar self-esteem.

Likewise, it is necessary to **consider specific issues** associated with the educational sector. Eizerik (2004), Korman (2013), and Eizerik (2020) ratify this position, claiming that schools demand a private treatment. For this reason, it is important that the indicators be developed specifically for this scenario and not, simply, reused by other sectors. This does not necessarily mean that these previously existent indicators cannot be applied towards education. However, the same should be adapted to these particularities. At this point, Fernandes (2014), may serve as a basis for these questions since it presents the students' and teachers' perception on the works with PBL through the advantages and disadvantages of this pedagogy.

In addition, the guideline Construction and Analysis of Indicators (Serviço Social da Indústria, 2010) recommends that, as to **indicators' development,** the same should meet the following requirements: (i) reliability of information, which indicates that the data which compose the indicators, have been collected from reliable sources and through an adequate methodology; (ii) communicability, which defines that the concept of indicator must be easy to understand, of easy calculation, and of clear parameterization; and (iii) availability and periodicity, in where it is necessary to choose data of easy collection, and updateable over time. Still, within this dimension, Project Management Institute (2018) stresses that the indicators should also enable the installation of possible corrective actions so as to guarantee the final result.

To exemplify the requirements of these three recommendations in a school, the following indicators are proposed. Following the first control of the *Iron Triangle*, namely, the time, one of the indicators should be the 'percentage of deadline fulfillment by teachers' and the 'percentage of deadline fulfillment by students. Another example, associated with cost, should be the indicator of the financial value of time spent by the teacher with the project, namely, 'teacher's lesson-time in the project'. Finally, in relation

to quality, the project control of result should be the 'percentage of students' participation in the project'. They are, after all, specific indicators that have been adapted to school reality, which, besides assuring a reliable, continuous, and easily understandable assessment, meets all the requirements presented in the guideline Construction and Analysis of Indicators (Serviço Social da Indústria, 2010). The indicators' variables' answers to be developed can be of three kinds: or dichotomous, or quantitative, or categorical, depending upon the metric at stake and of what is being inquired.

4 FINAL CONSIDERATIONS

This work has aimed at proposing recommendations for the construction of indicators applied to school projects. Such recommendations arose from the Systematic Literature Review and research for the scenario survey of Pedagogic Project management applied to high school in three private schools of the South of Brazil.

This way, it was possible to identify that there are different levels of execution and measurement of the results of the projects in the surveyed high school institutions. In this context, one has realized that there is not such a thing as a unique pattern for the measurement of the results of the projects. Then, the same indicators are not necessarily applied to two similar projects within the same school. That is the reason why projects are not monitored on individual terms, but as a whole. Nonetheless, one has concluded that the development and further dissemination of a specific set of indicators designed for school project management, helped to improve schools' decision-making processes. Perhaps, this set of indicators may, in the future, contribute to the enhancement of performance evaluation among schools and, perhaps, nationwide, stimulating the student's proactive attitudes of placing him or herself as the protagonist of the learning process.

Interestingly enough, taking into consideration that schools have their own models of functioning, it is possible to realize that such models arise from adaptations both of the parameters of Project Management Institute (2018), as well as of an agile project management. This way, one concluded that schools should look for professionals who are qualified in projects. Or, in case school chooses to take advantage of its own work team, it should provide specific training. This professional qualification is necessary to avoid the misunderstanding between the school project from PBL and the pedagogic project itself. This professional qualification should also enable the understanding of all the stages of the project, from the very planning until its closure. It is important to emphasize

that besides the teachers, main target-group of such qualification, school's pedagogic team should be also contemplated. This owes to the fact that the teacher is the one responsible for the project implementation, while the pedagogic team takes care of the initial and final activities. The qualification of professionals fit to work in projects ends up by reflecting an improvement in the quality of the projects developed by a given school.

Furthermore, it was possible to find in literature a wide range of Project indicators, presented in their most diversified ways and contexts, always directly connected to project management and to the I*ron Triangle*. Nevertheless, the findings originating from the Systematic Literature Review, allow us to conclude that there are still few studies regarding educational project management. This is justifiable, since the identified articles contain, most of them, qualitative indicators or adopt the *Iron Triangle* without adaptation. However, the question posed at the beginning of the present paper, still needs to be answered. Thus, one ratifies the need for further studies for the generation of a set of objective indicators designed for project management, as well as a system for the monitoring of these indicators.

Moreover, one suggests that the future system of control for PBL indicators, follow the recommendations presented in this article. Besides, it is highly recommended that the studies on the 'development of key-indicators for Project management on PBL' be expanded, since this is precisely the point where *stakeholders* find it more difficult to follow up on their projects. This set of indicators should be functional, useful and within parameters suitable for educational institutions.

In view of the conclusions herein presented, as suggestions for future works, one indicates the realization of a research designed for the development and dissemination of a set of specific indicators for schools. In the same vein, it is recommended the development of specific qualifications either for teachers as well as for the pedagogic team aiming at the planning of activities with projects.

REFERENCES

Atkinson, R. (1999). Project management: cost, time and quality, two best guesses and a phenomenon, its time to accept other success criteria. *International journal of project management*, *17*(6), 337-342.

Azma, F. (2010). Qualitative Indicators for the evaluation of universities performance. *Procedia-Social and Behavioral Sciences*, *2*(2), 5408-5411.

Barbosa, E. F., de Figueiredo Gontijo, A., & dos Santos, F. F. (2003). Inovações pedagógicas em educação profissional: uma experiência de utilização do método de projetos na formação de competências. *Educação & Tecnologia*, *8*(2).

Bleidorn, W., Schwaba, T., & Hopwood, C. J. (2020). Health adversity and value change. *Social Psychological and Personality Science*, 1948550620901980.

CARVALHO, M. M. D. (2011). Sistemas de indicadores de sucesso em projetos. *Mundo Project Management*, *7*(41), 9-17.

Coale, A. J., & Hoover, E. M. (2015). *Population growth and economic development*. Princeton University Press.

Cooke-Davies, T. (2002). The "real" success factors on projects. *International journal of project management*, *20*(3), 185-190.

Desaulniers, J. B. R. (2003). Gestão estratégica de competências: uma prática complexa. *Educar em Revista*, (SPE_), 101-119.

Dreiling, M. C. (2020). Trade Globalization and Its Consequences. In *Challenges of Globalization and Prospects for an Inter-civilizational World Order* (pp. 263-291). Springer, Cham.

Eizerik, B. (2004). Proposta de sistemática apoiada no Custeio Baseado em Atividades para avaliação e controle de custos em instituições de ensino.

Eizerik, F., Danilevicz, Â. D. M. F., & de Paula, I. C. (2020). System of management indicators for multidisciplinary educational projects. *education policy analysis archives*, *28*, 116.

Fernandes, D. R. (2004). Uma contribuição sobre a construção de indicadores e sua importância para a gestão empresarial. *Revista da FAE*, *7*(1).

Fernandes, S. R. G. (2014). Preparing graduates for professional practice: findings from a case study of Project-based Learning (PBL). *Procedia-Social and Behavioral Sciences*, *139*, 219-226.

Fine, S. M. (2018). Teaching in the restorative window: Authenticity, conviction, and critical-restorative pedagogy in the work of one teacher-leader. *Harvard Educational Review*, *88*(1), 103-125.

Fritsch, R., Vitelli, R., & Rocha, C. S. (2014). Defasagem idade-série em escolas estaduais de ensino médio do Rio Grande do Sul. *Revista Brasileira de Estudos Pedagógicos*, *95*(239), 218-236.

Gadotti, M. (1994, August). Pressupostos do projeto pedagógico. In *MEC, Anais da Conferência Nacional de Educação para Todos. Brasília* (Vol. 28, No. 8).

Galvão, T. F., Pansani, T. D. S. A., & Harrad, D. (2015). Principais itens para relatar Revisões sistemáticas e Meta-análises: A recomendação PRISMA. *Epidemiologia e Serviços de Saúde*, *24*, 335-342.

Gómez-Sevilla, H. N., & Sánchez-Mendoza, V. (2013). Indicadores cualitativos para la medición de la calidad en la educación.

Grube, J. W., Mayton, D. M., & Ball-Rokeach, S. J. (1994). Inducing change in values, attitudes, and behaviors: Belief system theory and the method of value self-confrontation. *Journal of social issues*, *50*(4), 153-173.

Higgins, J. P., Thomas, J., Chandler, J., Cumpston, M., Li, T., Page, M. J., & Welch, V. A. (Eds.). (2019). *Cochrane handbook for systematic reviews of interventions*. John Wiley & Sons.

IBGE - Instituto Brasileiro de Geografia e Estatística (2021). *Pesquisa Mensal de Serviços.* Retrieved from: https://www.ibge.gov.br/estatisticas/economicas/servicos/9229-pesquisa-mensal-de-servicos.html?=&t=resultados. Accessed March 29, 2021.

Jumaat, N. F., Tasir, Z., Halim, N. D. A., & Ashari, Z. M. (2017). Project-based learning from constructivism point of view. *Advanced Science Letters*, *23*(8), 7904-7906.

Júnior, J. F. (2013). *Project model canvas*. Elsevier Brasil.

Khanna, R., & Kareem, J. (2021). Creating inclusive spaces in virtual classroom sessions during the COVID pandemic: An exploratory study of primary class teachers in India. *International Journal of Educational Research Open*, *2*, 100038.

Korman, R. F. (2019). *Projetos para escolas na prática*. Simplissimo Livros Ltda.

Leybourne, S. A., & Sainter, P. (2012). Advancing project management: Authenticating the shift from process to "nuanced" project-based management in the ambidextrous organization. *Project Management Journal*, *43*(6), 5-15

Lim, C. S., & Mohamed, M. Z. (1999). Criteria of project success: an exploratory re-examination. *International journal of project management*, *17*(4), 243-248.

Lippard, C. N., Lamm, M. H., & Riley, K. L. (2017). Engineering thinking in prekindergarten children: A systematic literature review. *Journal of Engineering Education*, *106*(3), 454-474.

Lovat, T., & Clement, N. (2008). Quality teaching and values education: Coalescing for effective learning. *Journal of moral education*, *37*(1), 1-16.

Marques Junior, L. J., & Plonski, G. A. (2011). Gestão de projetos em empresas no Brasil: abordagem" tamanho único"?. *Gestão & Produção*, *18*(1), 1-12.

Moher, D., Altman, D. G., Liberati, A., & Tetzlaff, J. (2011). PRISMA statement. *Epidemiology*, *22*(1), 128.

Moher, D., Liberati, A., Tetzlaff, J., Altman, D. G., & Prisma Group. (2009). Preferred reporting items for systematic reviews and meta-analyses: the PRISMA statement. *PLoS medicine*, *6*(7), e1000097.

Moher, D., Shamseer, L., Clarke, M., Ghersi, D., Liberati, A., Petticrew, M.,…& Stewart, L. A. (2015). Preferred reporting items for systematic review and meta-analysis protocols (PRISMA-P) 2015 statement. *Systematic reviews*, *4*(1), 1-9.

Nuthall, G. (2004). Relating classroom teaching to student learning: A critical analysis of why research has failed to bridge the theory-practice gap. *Harvard educational review*, *74*(3), 273-306.

Ogunlana, S. O. (2010). Beyond the 'iron triangle': Stakeholder perception of key performance indicators (KPIs) for large-scale public sector development projects. *International journal of project management*, *28*(3), 228-236.

Pegoraro, R. A. (2014). Métricas de avaliação para abordagens ágeis em projetos de software.

Prince, M. J., & Felder, R. M. (2006). Inductive teaching and learning methods: Definitions, comparisons, and research bases. *Journal of engineering education*, *95*(2), 123-138.

Project Management Institute. (2018). *Guide to the project management body of knowledge*. Project management inst.

Project Management Institute. (2018). *Guide to the project management body of knowledge*. Project management inst.

Ramírez-Cardona, C. A., Calderón-Hernández, G., & Castaño-Duque, G. A. (2015). Enfoques administrativos presentes en establecimientos educativos: Un estudio empírico en instituciones colombianas de educación básica y media. *Revista mexicana de investigación educativa*, *20*(66), 911-940.

Santos, A. J. R. (2008). *Gestão estratégica: conceitos, modelos e instrumentos*. Escolar Editora.

Seibert, S. A. (2021). Problem-based learning: a strategy to foster generation Z's critical thinking and perseverance. *Teaching and Learning in Nursing*, *16*(1), 85-88.

Senge, P. (2005). *Escolas que aprendem*. Penso Editora.

Serrano, M. A., & Boguná, M. (2003). Topology of the world trade web. *Physical Review E*, *68*(1), 015101.

Serviço Social da Indústria. Observatório Regional Base de Indicadores de Sustentabilidade.(2010). *Construção e Análise de Indicadores. Curitiba, PR*.

Stefana, E., Marciano, F., Cocca, P., & Alberti, M. (2015). Predictive models to assess Oxygen Deficiency Hazard (ODH): a systematic review. *Safety science*, *75*, 1-14.

Verschuur, J., Koks, E. E., & Hall, J. W. (2021). Observed impacts of the COVID-19 pandemic on global trade. *Nature Human Behaviour*, *5*(3), 305-307.

Webster, J., & Watson, R. T. (2002). Analyzing the past to prepare for the future: Writing a literature review. *MIS quarterly*, xiii-xxiii.

Wei, X. W., & Ye, Y. (2019). Reflecting the teacher's role in a project-based learning (PBL) classroom: lessons learned from students. *Social Science Asia*, *5*(1), 4-11.

Wujec, T. (2009). *Tom Wujec on 3 ways the brain creates meaning*. TED.

Yang, Y. (2016). Making space for active learning: The art and practice of teaching. *Harvard Educational Review*, *86*(1), 143-152.

Yeager, T. (2018). *Institutions, transition economies, and economic development*. Routledge.

Zwikael, O. (2009). The relative importance of the PMBOK® Guide's nine Knowledge Areas during project planning. *Project Management Journal*, *40*(4), 94-103.