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Definition of Sustainability Indicators Applicable to Educational Units

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Abstract: Education is one of the main tools to lead to sustainable development and, for it to happen, the school environment must become a reference capable of influencing the community. In Brazil, environmental education is expected to be carried out at all levels of education, but educational units are not evaluated for the effectiveness of the sustainable actions they perform. This work develops sustainability indicators applicable to educational units in the Brazilian territory. The quantitative-qualitative research was conducted based on the adaptation of consolidated sustainability tools, double-validated by a Survey with specialists in sustainability and education. The resulting model was structured around three axes: management, physical structure, and education for sustainability, and has indicators in categories and subcategories (levels 1 and 2). The model can support the development of an environmental certification instrument and guarantee the quality of education for sustainability in formal education.

Keywords: Environmental education, sustainable school, indicator, sustainability, education in Brazil.

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1. INTRODUCTION

The construction of knowledge on sustainable development is increasingly evident in academic, governmental, and social spheres (BARBOSA *et al.*, 2019). This knowledge, which is expected to be acquired through inclusive, equitable, and quality education by 2030, is included in Sustainable Development Goal 4 (SDG 4) and can be understood as one of the main ways to ensure the minimization of current problems and the transformation of the world with a simultaneous focus on human well-being, economic prosperity, and environmental protection (UNITED NATIONS, 2015).

Education for Sustainability (EfS) provides an opportunity to look at the learning process, where there is great potential to revolutionize habits and customs that lead to a more sustainable life (BRITO; SIREVES; CUNHA, 2019). EfS involves several actors in the educational universe and must be addressed from an interdisciplinary perspective, where knowledge development considers the relationships between the natural and social environment. The discussion on environmental complexity encourages the involvement of new social actors with the aim of generating an articulated educational process committed to sustainability (ALMEIDA; SCATENA; LUZ, 2017).

The constant construction of new possibilities and reflections that promote culturally diverse spaces with socio-environmental awareness expands the knowledge of managers, students and the school community towards healthy attitudes and habits. Thus, the school environment plays a fundamental role in social development and assumes an effective position in the efforts for the environment, with the premise of constituting a more participatory space that accumulates social functions (BRITO; SIREVES; CUNHA, 2019). The school, as a sustainable space, must continuously promote environmental education actions towards the idea of a sustainable school, with actions related to the axes: physical space, management, and curricular organization (BAGANHA et al., 2018).

According to Saraiva *et al.* (2019), schools can act as vehicles for disseminating the importance of sustainability. In this context, students are agents for disseminating knowledge and practices to their families and society, positively transforming their daily lives in a natural way. Environmental education must act to build values and attitudes to promote action and critical positioning, covering social, political, economic, ethical, and cultural issues, always focusing on sustainability (SBARAINI *et al.*, 2018). Participation, co-creation, and co-responsibility are decisive and concrete factors for solving common challenges with a collaborative approach, considered by Grandisoli et al. (2020) as the "tripod of education for sustainability".

Sustainable schools generate repercussions from their actions in all the pillars of sustainability, as well as coherence between their practical activities and teaching, always emphasizing the richness of experiences (DOURADO; BELIZÁRIO; PAULINO, 2015). The promotion of dialogue as a theoretical and methodological principle unites science and the community with the precepts of social learning and environmental education, strengthening the union of academia, public authorities, and society for a real transformation in learning and sustainable results (KOURY; SGROI; TOLEDO, 2020).

In Brazil, the National Environmental Education Policy (PNEA) has guidelines that support an integrated understanding of the environment in its multiple and complex relationships, with multidisciplinary aspects that aim to guarantee the democratization of environmental information and stimulate critical awareness of sustainability issues. In PNEA, formal environmental education is defined as an integrated, continuous, and permanent educational practice at all levels and modalities of education; and informal environmental education includes educational actions and practices aimed at raising collective awareness of environmental issues, such as educational programs and campaigns, and information on topics related to the environment (BRASIL, 1999). The PNEA differs from other environmental policies in that it does not establish rules and sanctions, but only assigns responsibilities and obligations with the aim of promoting environmental education in society (GUERRA; ORSI, 2017).

One of the most compelling ways to measure sustainability in educational units is the use of indicators that, in addition to qualifying organizations, can guide changes in environmental issues so that schools could become benchmarks for sustainable actions and induce social change in their surroundings (LIZANA *et al.*, 2021). Despite the existence of the PNEA and national guidelines for education for sustainability, in Brazil there is no federal program for environmental certification of educational units. This work aims to develop sustainability indicators applicable to educational units in Brazil.

2. LITERATURE REVIEW

The use of sustainability indicators is essential to promote collective reflection on the design, preparation, fulfillment, and development of work in educational units, as well as the evaluation of processes and confirmation of the results obtained. The construction of research indicators means transforming concepts and their relationships into categories that progress to specific configurations and applications (BRITO; SIREVES; CUNHA, 2019). Indicators also help the local administration to integrate sustainability aspects in performance management, improving the support for decision-making processes, as well as subsidizing reporting and supporting conscious cost reduction (RAHDARI; ROSTAMY, 2015).

The use of indicators is common in the construction sector, mainly due to the high environmental impact of this activity. The sector has sustainability assessment tools that are consolidated and disseminated worldwide, such as Leadership in Energy and Environmental Design (LEED), the Building Research Establishment Environmental Assessment Method (BREEAM), and the Sustainable Building Tool (SBTool), that promote building certifications (SARAIVA et al., 2019). However, due to the different uses of buildings, it is necessary to develop sustainability methodologies that consider their characteristics and functions, as well as environmental, social, cultural, technological and economic issues, approaching the specificities of the countries in which they are applied (SARAIVA; ALMEIDA; BRAGANÇA, 2019).

For example, school buildings and the educational environment have peculiarities that must be considered when incorporating sustainability principles, and it is necessary to

develop a specific methodology for evaluating these specificities (SARAIVA; ALMEIDA; BRAGANÇA, 2019). One of the difficulties in applying building sustainability tools to schools is the fact that the indicators are specific to the phases of the construction process, considering different perspectives of the building life cycle (SARAIVA et al., 2018).

The need for specific sustainability indicators for schools has led to studies that propose changes to consolidated tools such as LEED, BREEAM, and SBTool, with the inclusion of indicators that promote sustainability awareness among students. In this way, the school building is used as an example to be observed, promoting sustainable attitudes and environmental education in the everyday school life (SARAIVA et al., 2019). The adaptation of methodologies with the aim of creating tools specifically applicable to the assessment of the sustainability of school buildings is already a reality in some countries and is of great importance since there is currently no instrument internationally capable of measuring sustainability in the existing different territorial conditions (SARAIVA; ALMEIDA; BRAGANÇA, 2019).

There are indicators that focus on issues external to the building, such as the evaluation of thermal, visual, acoustic, air quality, and ergonomic comfort, as well as the environmental comfort of classrooms in schools in different regions of Brazil and abroad. School environments have very different characteristics in terms of social, cultural, economic, and climatic aspects, which once again demonstrates the great need to adapt sustainable methodologies to the specificities of each region (SARAIVA et al., 2018; SARAIVA et al., 2019). The inclusion of sustainability in schools can also be proposed to evaluate the benefits of innovative environmental approaches based on indicators that measure and promote a low-carbon economy (LIZANA et al., 2021).

The evaluation of extra-building elements is also addressed when the active participation of students is encouraged, with action plans covering waste minimization, evaluation of school areas, biodiversity, energy, water, transport, health, and well-being (ECO-Schools, 2014). A case study conducted by Fehr and Andrade (2016) identified the impact that a school has on its surroundings and the urban environment in general, with indicators covering the amount and type of food consumed in the canteen, rainwater harvesting options, and extracurricular environmental education activities. The authors state that this information can support the preparation of sustainability reports.

To introduce, implement, and monitor an environmental management system specific to the context of elementary school in Africa, a practical cross-curricular approach to education for sustainability was developed as an integral part of school management and curricular activities, with the aim of integrating teaching and learning with issues related to the environment, based on the identification of key indicators (SOUSA; RICHTER; RAATH, 2017).

Well-structured public policies generate new demands for instruments to evaluate quality improvements, such as the analysis of large-scale longitudinal documents based on indicators to systematically analyse or monitor related educational processes and policy efforts. This process is taking place in Germany with the Education for Sustainable Development project (HOLST et al., 2020). In Taiwan, environmental education facilities

and sites are seen as professional entities to provide teachers and students with learning experiences and leisure activities related to the environment. To this end, the development of an evaluation system to enable high schools to select environmental education facilities and sites has become necessary, with sustainability indicators that adapt to the local needs and scenarios (HO; CHEN; HSU, 2017).

In Brazil, at national and state level, the promotion of sustainability in the school context is guided by the National Articulation of Public Policies for Environmental Education (ANPPEA), aimed at proposing and implementing Public Policies for Environmental Education (PPEA). The organization's main objective is to evaluate initiatives and public policies that aim to achieve the SDGs. To this end, the Brazilian System for Monitoring and Evaluating Public Policies on Environmental Education (Monitora EA) was developed. This platform acts as a mirror that reflects policies, projects, programs and actions related to environmental education, which can be monitored, analysed, and evaluated based on specific indicators (TRAJBER, 2019).

An educational space becomes sustainable when the entire school undergoes transformations, with aspects ranging from its physical structure, management, and the impacts to the community, producing knowledge and attitudes favourable to environmental sustainability (BRITO; SIREVES; CUNHA, 2019). To this end, studies evaluating sustainability in educational units are necessary, involving applied methodologies using qualitative-quantitative and mixed methods in: case studies (ex. LIZANA et al., 2021; FEHR, 2015; SOUSA; RICHTER; RAATH, 2017; SARAIVA et al., 2019); consultations with experts through the application of questionnaires (HO; CHEN; HSU, 2017; SARAIVA et al. 2019); indicator proposals (SARAIVA; ALMEIDA; BRAGANÇA, 2018); or documents (HOLST et al., 2020). Among the management tools with the potential to assess sustainability in school units are: A3P, Eco Schools, Sustainable and Resilient School Seal, Sustainable School, GRI and LEED Schools:

> - A3P: The Environmental Agenda for Public Administration, created in Brazil, supports the promotion of socio-environmental responsibility in the administrative and operational activities of public administration (MMA, c2020), based on management elements that induce the mobilization of society towards sustainability and the adoption of effective sustainable use practices. Education is a tool of enlightenment and publicity (BATISTA et al., 2019).

> - Eco-Schools: This tool was developed in the UK to promote personalized and accessible learning on the themes of sustainability and resilience, with the aim of empowering students to make a difference by teaching them how to apply their knowledge in their communities (Eco-Schools, C2021). Activities cover topics such as water, energy, soil, recycling, and finances, with the goal of raising children's environmental and economic awareness (KORKMAZ; YILDIZ, 2017).

- Sustainable and resilient school label: A public policy proposal developed for the municipality of São José dos Campos (Brazil), with the aim of promoting sustainable structures in schools and evaluating actions that promote socio-environmental responsibility and protection against disaster risks in the school community (SÃO JOSÉ DOS CAMPOS, 2019).

- Sustainable School Label: This public policy developed in the state of Ceará (BR) aims to evaluate actions and projects that promote socio-environmental responsibility among all those who are part of state schools (SEMA, c2021), developing the school environment as a sustainable educational space (RODRIGUES; LEITE, 2017).

- GRI: The Global Reporting Initiative is a tool made up of indicators that present, identify, assess, and manage sustainability in companies and institutions, with a focus on sustainable development (GRI, c2021). This initiative is considered the most important and widely accepted internationally, supporting sustainability reports from institutions of different sizes around the world (MASCENA; FISCHMANN; BOAVENTURA, 2018).

- LEED School: A tool administered by the United States Green Building Council (USGBC) that recognizes best practices in the design, construction, operation, and maintenance of school buildings. The standard recognizes high-performance schools (USGBC, 2017) through a complex rating system that produces positive environmental and human impacts (THOMBS; PRINDLE; 2018).

3. MATERIALS AND METHODS

This is a qualitative-quantitative study (GERHARDT; SILVEIRA, 2009) to define sustainability indicators for educational units, which was developed based on a literature review, consultation with experts and propositions and validations, according to the stages shown in Figure 1.

Figure 1: Project stages[1]

Source: Authors, 2020.

1 - The figures used are available in a folder in the cloud for viewing the original file.

1.1 Choice of environmental management tools

The identification of environmental management tools applicable to sustainable schools was carried out through a participatory workshop, during the strategic planning phase of the Sustainable Schools Extension Project, with the participation of researchers from UNESP, Federal University of São Paulo (UNIFESP) and experts of the São José dos Campos Municipality and Rotary Club. The workshop, held in 2019, aimed to develop agents who would implement and multiply sustainable environmental solutions in educational units and establish benchmarks for the environmental certification of schools in the municipality (PINTO, 2019; GENTILI, 2014).

1.2 Drawing up individual mind maps

The indicators for each of the tools were schematized in individual mind maps, keeping their original structures, using the MindMeister software. This method of formulating, analysing, organizing, and presenting ideas allows information to be illustrated, making it easier to understand the tools in general, as well as their categories and indicators hierarchies (MARQUES, 2008).

1.3 Overlaying and systematizing the indicators

The indicators were systematized by overlaying the individual maps generated using MindMeister software. Subsequently, based on the analysis of three environmental engineering researchers involved in the project, duplicates were excluded and clustering, and organization patterns were proposed. The resulting mind map had its results classified into axes, categories and subcategories at levels 1 and 2, and was sent to the group of experts for preliminary validation.

1.4 Preliminary validation preliminar

A survey, a systematic method for collecting information (GROVES *et al*., 2009), was applied to a group of experts representing the research's target audience. As proposed by SOUZA *et al*. (2015), the questionnaire consisted of objective and discursive questions in which the reference group of experts was asked to assign values on a scale of 1 to 5, in ascending order of relative importance, to each of the five questions, which involved questions about the scope of the essential aspects of sustainability, the possibility of qualitative and quantitative evaluation, the existence of redundancy, analysis of the conciseness of the proposed set of indicators and observation of dependency relationships, as well as openness to comments and suggestions.

The preliminary validation was applied via the Google Forms in the second half of 2021, with the aim of identifying any problems, such as missing data and potential outliers (VASKE, 2019) in the axes, categories and subcategories of levels 1 and 2 resulting from the superimposed mind map. The data resulting from this validation was analysed by the environmental engineering experts involved in the project, to include suggestions and revise the proposed model.

1.5 Validation of the Axes, Categories, and Subcategories

The revised model, resulting from the overlapping of tools and suggestions from the preliminary validation (containing axes, categories, and subcategories of levels 1 and 2) was developed and submitted to a broader validation where environmental education and sustainability assessment experts from all over Brazil were consulted, in accordance with YIN (2016). The validating agents were invited to answer a questionnaire which, as in the preliminary validation, involved the fundamental aspects of building indicators from the perspective of stakeholders (SOUZA *et al*., 2015). To choose the survey respondents, knowledge and experience in the field of study, as well as professional relevance to the topic, were taken into consideration (MUSA *et al.,* 2015). The evaluation was quantitative and qualitative in nature, with a field of suggestions for those questions that received scores below 4.

To assess the effectiveness of the changes to the proposal resulting from the preliminary validation, the respondents were also asked to report their participation in the previous phase of the survey and, if so, to answer whether they considered that their suggestions had been taken into account in the revised model being validated.

4. RESULTS AND DISCUSSION

The results obtained at each stage of the project are presented below. It should be noted that the maps obtained are available as complementary material, in their complete versions.

1.1 Individual tools and mind maps

Based on the participatory workshop held in 2019 with 19 participants (teachers, researchers, the community, public authorities and sustainability experts), the following tools were identified as relevant for measuring sustainability in educational units: A3P, Sustainable and Resilient School, Eco School, Sustainable School, LEED Schools, GRI. Among the justifications for this selection were the different sustainable approaches that encompass topics such as education, building and management (public and private).

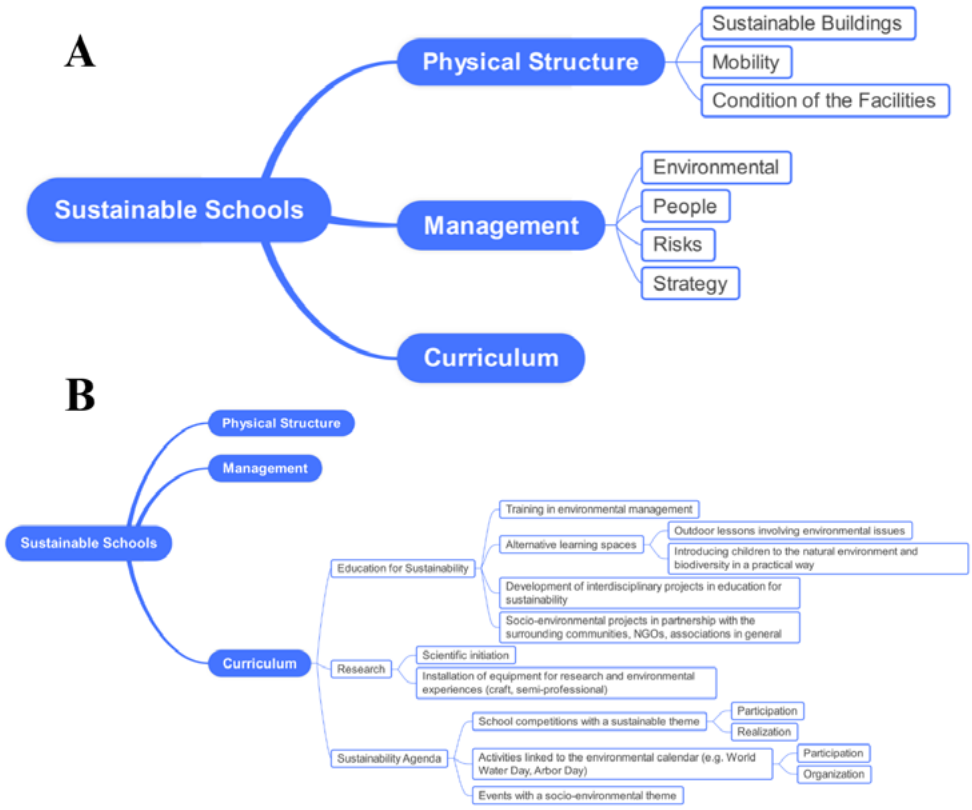
These tools had their approaches described in the literature review, where their central objectives were highlighted. For each of the tools, a specific Mind Map was drawn up containing their indicators, made available online on the Google Drive platform, where it is possible to interactively visualize the information through the Google Drive platform, supplementary material 1. The structures of the different levels of aggregation and linkage of the indicators have been preserved.

1.2 Preliminary systematization of sustainability indicators

Overlaying the mind maps of the previously selected tools resulted in a systematization of sustainability indicators at different hierarchical levels, organized into three axes:

management, curriculum, and physical space (MOREIRA. 2012), as shown in Figure 2. Part A of this figure shows the axes and categories of the Map and part B shows an example of the Curriculum axis. The complete Mind Map can be accessed at supplementary material 2 and has not been shown here due to the low readability of its many components.

Figure 2: Preliminary systematization of sustainability indicators



Source: Authors, 2020.

Despite not having a single set of indicators, the axes were chosen based on the content of the adopted management tools. For Management, we mainly considered A3P, which focuses on sustainable public management, and GRI, a consolidated tool for managing sustainability indicators in the business world.

The Physical Structure was composed of, but not limited to, indicators from LEED Schools, a tool focused on the construction and maintenance of school buildings. The Curriculum was made up of the Eco Schools, Sustainable Schools, and Sustainable and Resilient School tools, since these were specifically designed to address sustainability in educational units. The indicators in these tools also contributed to the other axes.

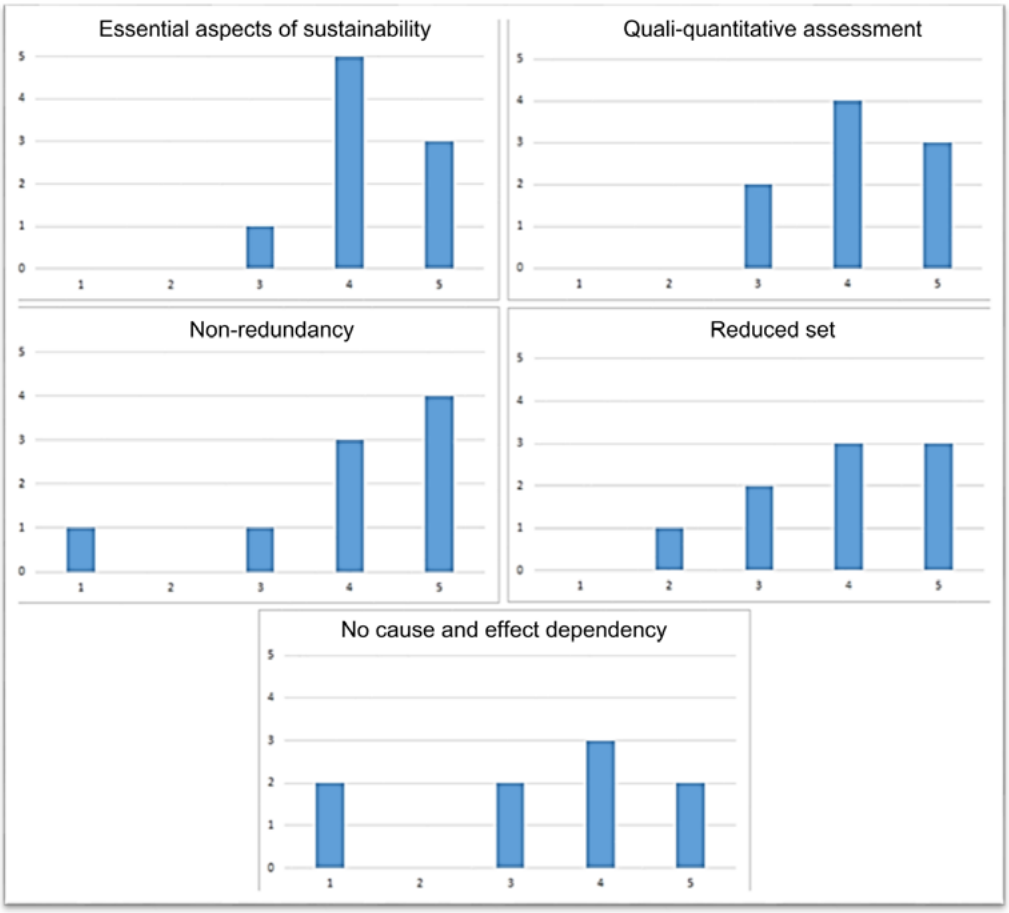
The proposed axes converge with those mentioned by Baganha *et al.* (2018), who

point to "Physical space", "Management" and "Curricular organization" as the centralities of the ideal sustainable school. On the other hand, this overlap covers different approaches to sustainability, generating a new tool, more complete than the others, with depth in the three pillars of sustainable schools, considering the world scenario and national specificities, as well as the specific needs of school units, as suggested in the study by Saraiva, Almeida, and Bragança (2019).

1.3 Preliminary validation of level 1 and 2 axes and categories.

Preliminary validation was carried out in the first half of 2021 by nine experts in environmental education and sustainable schools. They were invited to evaluate the preliminary map resulting from the overlay and systematization and answer objective questions about the comprehensiveness of the essential aspects of sustainability, the possibility of qualitative and quantitative evaluation, the existence of redundancy, the analysis of the conciseness of the proposed set and the observation of dependency relationships. The answers obtained are shown in Figure 3.

Figure 3: Results of the preliminary indicator assessment survey



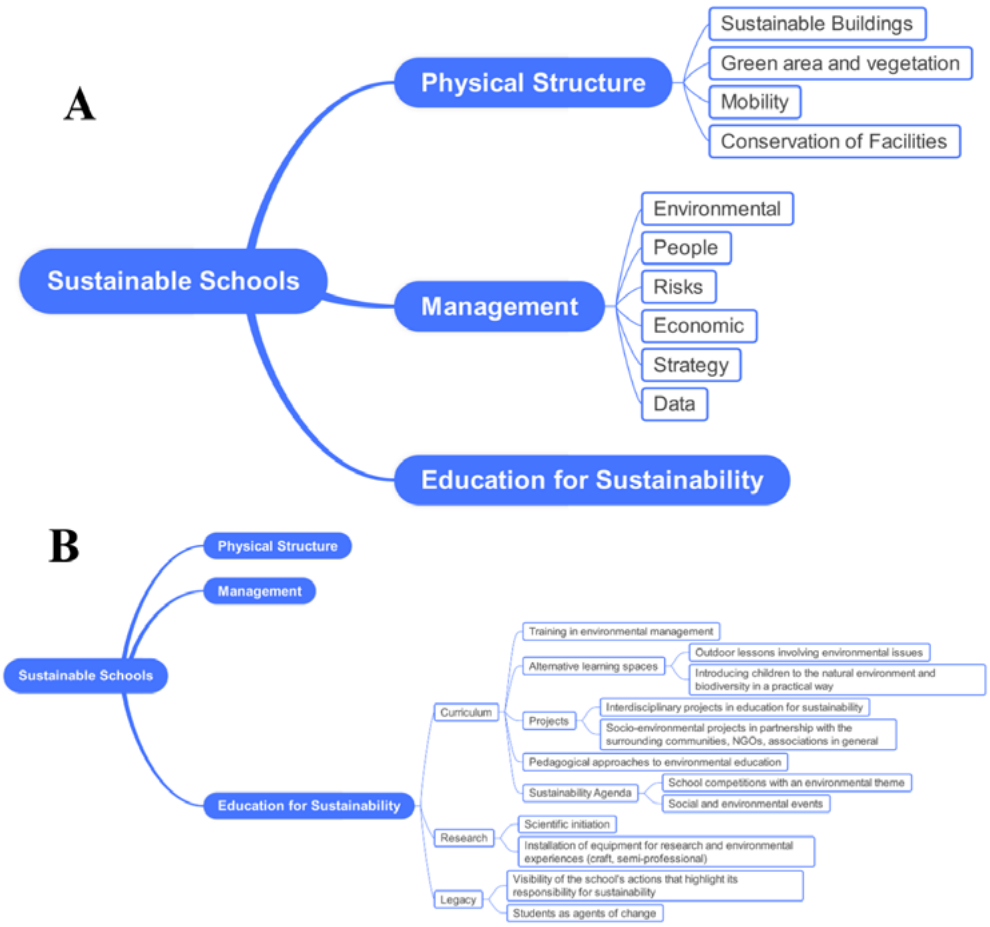
Source: Authors, 2020.

The questions received satisfactory scores above 4, except for the question on the absence of a causal relationship, which received an average score of 3.3. This may be related to the fact that the question about the absence of a "strong dependency relationship" may have been interpreted by respondents as "any dependency relationship". Given the hierarchy already presented by the map, it was expected that the experts would check the dependency relationships between the categories and subcategories of different axes.

Although the survey achieved a good result, all comments and suggestions for changes and improvements to the tool were considered. The main changes to the proposed indicator model focused on the curriculum axis, which was now classified as "education for sustainability" with the categories "Curriculum", "Research" and "Legacy". The subcategories "Pedagogical approaches to environmental education" and "Students as agents of change" were also added. There were no changes to the "Physical Structure" axis.

In Management, the level 2 subcategory "Job Satisfaction" was added to the subcategory "Employees", and "Interpersonal Relations" was added to "Community (internal + external)", both linked to the "People" category. Under Risks, the level 2 subcategory "Fire Brigade" has been added to "Fire Prevention"; "Monitoring External Context" is now considered under "Strategic Management". These changes are reflected in the map in Figure 4.

Figure 4: Overlapping Mind map with adjustments



Source: Authors, 2020.

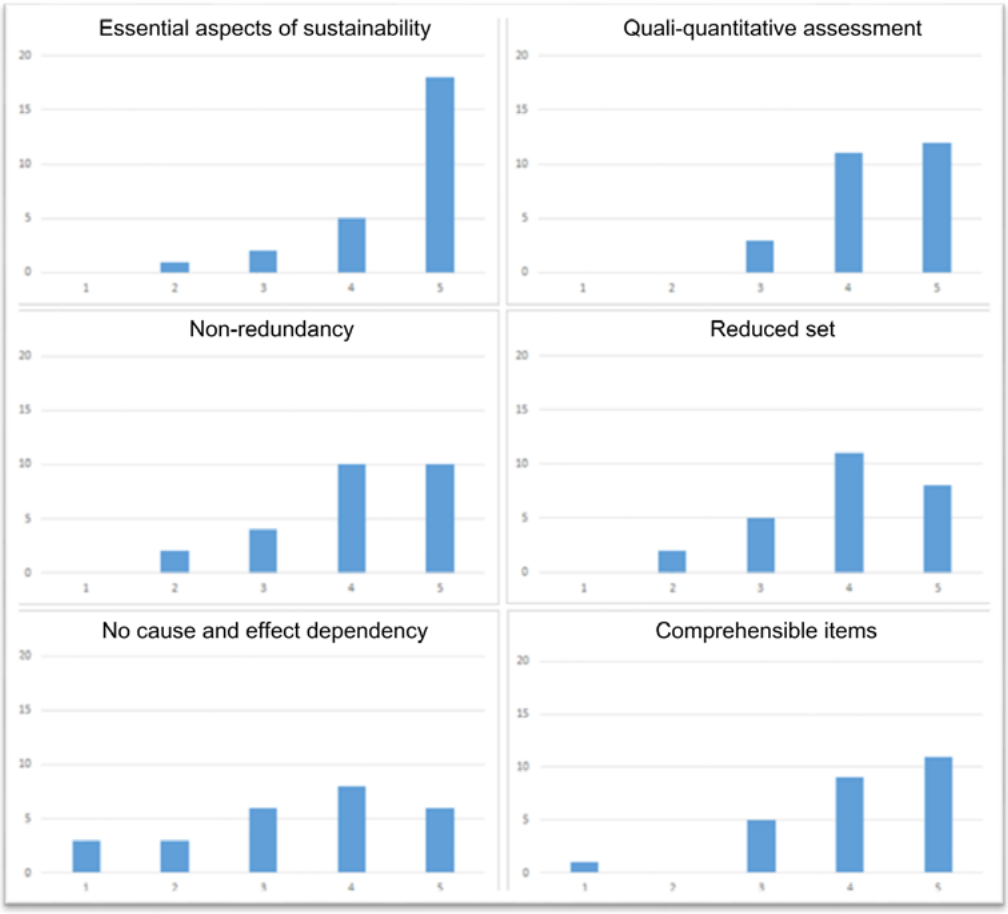
The changes were concentrated on the curriculum axis, later renamed Education for Sustainability. This can be explained by the specialization of the respondents, most of whom were professionals in the field of education with a focus on sustainable education, as well as the fact that more consolidated tools were used for the management and physical structure axes. This reinforces the need to develop internationally recognized

tools to measure sustainability in school units, paying attention to the diversity of their social, cultural, economic, and climatic characteristics, as stated by Saraiva *et al.* (2018) and Saraiva *et al.* (2019). To see the full map, please check supplementary material 3 because it is unreadable when fully added.

1.4 Validation of the proposed sustainability indicators

The sustainability indicators applicable to educational units were validated by 26 experts from all over Brazil, most of whom were environmental engineers and basic and higher education educators. The results of the quantitative objective questions can be seen in Figure 5.

Figure 5: Results of the validation of the sustainability indicators



Source: Authors, 2020.

As in the preliminary validation Survey, the questions about the presentation

of the essential aspects of sustainability, the possibility of qualitative and quantitative evaluation, and the lack of redundancy were well evaluated, with averages above 4. The new question, which deals with a clear understanding of the proposed indicators, also received a satisfactory score, with an average of 4.1. Even though it had been reframed, the question that addressed the dependence of cause and effect between the indicators generated doubts and some respondents. They did not understand it in a negative question, because of this their evaluation reaching an average of 3.4, similar to that given in the first consultation with experts.

The question stating that the proposed set of indicators is "as concise as possible in terms of subcategories to cover the essential aspects of sustainability in schools" achieved an average score of 3.9. Although this score is close to satisfactory, it represents an opportunity to improve the proposal by reducing the number of subcategories.

In the field of suggestions for those questions in which respondents gave scores lower than 3, there were comments about the need to deepen the political dimension, since environmental actions are listed and encouraged, for the most part, by municipal, state, and federal policy. The same expert respondent also mentioned the need to look at the existence of a ''municipal environmental structure'', i.e. the existence of a well-structured environmental department that could support educational initiatives in a broad way, suggesting the study of the Blue Green Municipality Program to better support these issues (SMA, 2013).

For the education for sustainability axis, it was suggested that environmental education be given greater relevance, as well as a new approach to issues surrounding teacher training and the main topics covered in schools across Brazil, considering local specificities. In addition, some respondents used the essay field to praise the research and the comprehensiveness of the material presented for validation.

Around 30% of the participants in this phase of the survey took part in both surveys. Of these, 87.5% said that their suggestions in the preliminary validation were accepted and incorporated into the proposed set. The average scores were very similar when comparing the two rounds of validation, even with the difference in the number of respondents, which reinforces the consistency of the proposed indicator model. Considering the scores obtained, despite the new suggestions, the model was considered valid, consisting of three axes:

- Physical structure, comprehending four categories, seventeen level 1 subcategories and fourteen level 2 subcategories;

- Education for sustainability, comprehending three categories, nine level 1 subcategories and six level 2 subcategories; and

- Management, comprehending six categories, twenty-five level 1 subcategories and fifty-seven level 2 subcategories.

In addition to the validated axes, categories and subcategories, there are indicators at other hierarchical levels resulting from the first overlap, which can be accessed via the supplementary material 4.

5. CONCLUSIONS

Education for sustainability in Brazil is an essential component of teaching at all levels of education, but this public policy does not have adequate tools for evaluating its effectiveness. In this context, this work was developed using a participatory methodology that proved to be suitable for the proposed goal.

It can be concluded that the adaptation of consolidated sustainability tools as a framework for a new specific model generated convergence of expert opinion and acceptance of the proposed indicators. In addition to the three axes, thirteen categories, fifty-one level 1 subcategories and seventy-seven level 2 subcategories already validated, there is an opportunity to develop and detail the activities of the subcategories, so that the model becomes suitable for use in different regions. There is also an opportunity to continue the study, with the aim of building a mathematical model for classifying the sustainability maturity levels of educational units, as well as validating it in a case study.

It is understood that the presented model can support the development of environmental certification tools for educational units in Brazil, securing improvements in the quality of formal education for sustainability. As such, it contributes to the advancement of science and the transformations necessary for sustainability.

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Definição de Indicadores de Sustentabilidade Aplicáveis a Unidades Educacionais

Barbara Silva e Souza
Ricardo Gabbay de Souza
Arthur Bispo Ferreira
Fabiana Alves Fiore

Resumo: A educação é uma das principais ferramentas para conduzir ao desenvolvimento sustentável e, para tal, o ambiente escolar deve se tornar referência capaz de influenciar a comunidade. No Brasil, a educação ambiental é prevista para ocorrer em todos os níveis do ensino, mas as unidades educacionais não são avaliadas quanto à efetividade das ações sustentáveis que conduzem. O presente trabalho objetivou a proposição de indicadores de sustentabilidade aplicáveis a unidades educacionais no território brasileiro. A pesquisa quanti-qualitativa foi desenvolvida a partir de adaptação de ferramentas de sustentabilidade consolidadas, duplamente validada por Survey com especialistas em sustentabilidade e educação. O modelo resultante foi estruturado a partir de três eixos: gestão, estrutura física e educação para a sustentabilidade e possui indicadores em categorias e subcategorias (níveis 1 e 2). O modelo pode subsidiar a elaboração de instrumento de certificação ambiental e garantir a qualidade da educação para a sustentabilidade no ensino formal.

Palavras-chave: Educação ambiental, escola sustentável, indicadores, sustentabilidade, educação no Brasil.

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Resumen: La educación es una de las principales herramientas para conducir al desarrollo sostenible y, para ello, el ámbito escolar debe convertirse en un referente capaz de influir en la comunidad. En Brasil, se espera que la educación ambiental se realice en todos los niveles educativos, pero las unidades educativas no son evaluadas en cuanto a la efectividad de sus acciones sostenibles. Este trabajo propuso indicadores de sostenibilidad aplicables a unidades educativas en el territorio brasileño. La investigación cuantitativa-cualitativa se realizó con base en la adecuación de herramientas de sustentabilidad, doblemente validadas por una encuesta a especialistas en sustentabilidad y educación. El modelo resultante se estructuró en tres ejes: gestión, estructura física y educación para la sustentabilidad y cuenta con indicadores en categorías y subcategorías. El modelo puede apoyar el desarrollo de un instrumento de certificación ambiental y garantizar la calidad de la educación para la sostenibilidad de la educación formal.

Palabras-clave: Educación ambiental, escuela sustentable, indicadores, sustentabilidad, educación en Brasil.

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