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Textile waste and education for sustainability: a Brazilian literature review

Abstract

In Brazil, the way to dispose textiles waste is not widely available, and they aren't considered a waste category such as metal, plastics, glass, and paper. Hence, tons of materials are send directly to landfills and open-air dumps. Additionally, the recycling possibilities requires specialized knowledge. The country has three main policies to administrate the environmental problems: National environmental policy (1981); National Solid Waste Policy (2010); National environmental education policy (1999). All of them have a point of convergence on reducing, not generating, reusing and recycling materials. The growing cost to the environment, land, air and water pollution, and to government to dispose, must call attention of the researchers to study and advocate for changes and to raise awareness. Studiers must put a great effort into to collaborate with redesigning and to produce less textiles waste. Following this discussion, this paper is a bibliographical survey in CAPES and SUCUPIRA's databases (Brazilian Federal Agency for Support and Evaluation of Graduate Education), after querying with the keywords related to textile waste generation and education. Comprising the period 2017-2021, the study focuses on scientific documents – master and doctor dissertations – written in Portuguese language. The objective in doing a review of literature was to evaluate it according to the guiding concepts of education, sustainability and textile waste generation. This methodological alternative to conduct this research, and technical procedures, revising scientific information, focused on 13 articles. It is concluded that the bibliographic review articles, related to education and textile waste generation are not emphasized in academic production. Therefore, significant findings in literature could empowered academic public for changing attitude and stimulate new researches.

Keywords: bibliographical survey, Brazilian national policies, textile waste, education

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Introduction

The textile industry is considered one of the most polluting industries on the Planet, especially because it uses many natural resources, such as water and soil, as well as energy sources for production. In addition, there is the aggravating factor regarding the volume of waste. In Brazil, in São Paulo's city, from 2017 to 2023, 20.830 tons of post-consumer clothing and 51.530 tons of cutting scraps were discarded.[1] According to Abit,[2] the textile industry in Brazil was responsible for employing 19.5% of workers in industrial production by 2021, while the manufacturing industry accounted for 6.0% of the total value of production.

Given this large scale production in the textile industry, it is also necessary to discuss post production process, storage and recycling processes. Although the Brazilian legislators had debated the national solid waste policy,[3] the law still contains vaguely mentions to these wastes disposed in urban areas causing environmental problems. The correct reuse and disposal of textile wastes continuous to be a utopian dream, given the little importance to proper environment dispose. The Regulation do not provides conditions that textile waste be properly classified and have an adequate disposal.

People's responsibility about sustainable consumption must be aligned with the challenges of United Nations 2030 Agenda.[4] The role of Education for the Sustainable Development Goals, a holistic and transformative education, fuses with the future of our Planet, and requires transformative teaching methods and techniques that can support autonomy learning process, community participation, a problem-solving orientation, and interdisciplinary studies. It is a huge orientation that can be applied in local contexts with global results.[5] Qblan[6] says that the "key areas of consideration for teacher training and preparation for ESD include: respect for all lifeforms (people, plants and animals); preservation of the planet's natural resources (the oceans and freshwater, the air and land) and responsible consumption strategies that support prosperity".

Wals and Kieft,[7] affirm that the position of ESD in formal, non-formal and informal education for young people is central to address global challenges and the attitudes and values. "The seeds planted in the seventies at many international conferences on environmental education (EE), including the Man and Environment conference held in Stockholm in 1972 and the UNESCO-UNEP conference on Environmental Education held in Tbilisi in 1997, found a fertile soil of broad-based mutual concern for sustainability as expressed at the UNCED Earth Summit in Rio de Janeiro in 1992".

The Education and Training Foundation (ETF)[8] in England give support to teachers and leaders in their professional development goals, and consequently the apprentices. The ETF believes that education interferes in achieving sustainability needs, social justice and inclusive education for sustainable development (ESD). For the organization, therefore, it is verified that exists a difference between education about sustainable development and education for sustainable development. We need solutions not only strategies. To prepare specialists is equally important as to create a sustainable world. Learners must understand how their subjects' areas and common perspectives are interrelated with sustainable development and act upon them and also on new information.

Being a citizen of the global economy means to deal with the SDG goals, and to contribute to political and cultural decisions, promoting sustainable development as part of the objectives of transformative education. To this end, educational institutions need to develop

curricula and courses focused on human rights, environmental justice and environmental education, in order to deepen scientific and technological knowledge that can strengthen the ideas of sustainability for the Planet. In the teaching and learning process, it is very important to emphasize the relational and systemic skills to deal with uncertainties and the common future, the precautionary principles and values to face conflicts and contradictions, the implementation of collaborative innovation, demands and needs, and the motivation to defend sustainability and the complexity of life.

The great number of educational programmes that have emerged internationally to help youth understand and access such structures, to enable them to more effectively influence change. However, "these programmes usually involve relatively small numbers of youth due to their intensity".[9] Taken this framework of scarcity, and academic written production in sustainability and education, following the methodology of bibliographical survey in CAPES and SUCUPIRA's databases[10,11] (Brazilian Federal Agency for Support and Evaluation of Graduate Education), the general objective of this study is to review thesis and dissertations, aiming a synthesis of the current scientific literature. From 2017 to 2021, using keywords education, sustainability and textile waste, this research collected 21 scientific studies, the analysis focused on 13 works.

Material and methods

The narrative literature reviews revisits academic texts regarding the observation, selection, analysis and discussion of theoretical stances, in order to conduct researches. This is possible due to the accessibility of digital data and the open access scholarly literature. But, it's, nevertheless, important to highlight that the abundance of information and the divergent views as characteristics of this research choice. The references of studies and their summarize contents are elements of a particular field. The keywords help the identification of topic clusters, gaps and links regarding the chosen research goal. A description of the databases used can help to define the coverage of literature, authors, journals, and publications. The displaying tables, figures, and graphs derived from software tools can lead to organize a descriptive picture of the field. Similar to this methodology to structure the knowledge in a field, and lead to a discussion, the research must go beyond a descriptive summary of first priority literature.

This article uses narrative literature reviews based on the compilation of thesis and dissertations in CAPES and SUCUPIRA's databases (Brazilian Federal Agency for Support and Evaluation of Graduate Education), open data files. This database contains Excel spreadsheets of all the research carried out in recent years. The research was carried out in May 2023, and the study period was the last five years authors published thesis and dissertations posted from 2017 to 2021. The spreadsheets for these years were downloaded and filtered by keywords, using the following descriptors: solid waste and textile waste. This research does not include other publications, books and papers. It includes a link to complete texts. The connecting words were AND, OR and NOT. It was used the Boolean operators, truncations and proximity operators permitted by the database as a search tool strategy. They were utilized to continue with the search, with the term solid waste being: solid* waste*, while for textile waste: textile* waste*, and then: education*.[1] It is important to note that the selected studies have been read and have contributed to the narrative overviews and debate on textile waste, technology and education for sustainability.

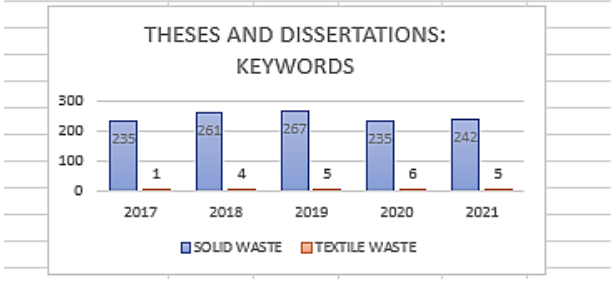
As stated by Green, Johnson and Adams,[12] the main reasons that Scientifics read reviews of literature can be summed up in variety. For the clinical, they save time reading one paper instead of plenty; for decision makers it provides security about building and refining hypothesis; it also can provide results for primary research studies. The presentation of a narrative review should be as objective as possible. It is essential that prospective authors remember that the intention of a narrative review is to describe and synthesize the available literature on a topic, providing a conclusion from this evidence.

Results

The search yielded 1.258 dissertations and thesis on the subject of waste, of which 1.237 used the keyword solid-waste and 21 textile-waste, as described in the Table 1 below.

Table 1 Keyword search results: solid waste and textile waste - between 2017 and 2021

	2017	2018	2019	2020	2021
SOLID WASTE	235	261	267	235	242
TEXTILE WASTE	1	4	5	6	5
TOTAL	236	265	272	241	247



Source: the authors, 2023

From this survey, searches were carried out for the 21 complete works dealing with textile waste, first with the aim of finding in the keywords the combination: textile waste and education. As a result, no work was found with this discussion. In view of this, the resolution was to search for this descriptor throughout the texts.

It is important to note that, according to Table 2, only 13 of the 21 papers were available to be read on the Capes Sucupira platform. The results were obtained for the word education, as shown in Table 2:

Table 2 Results of the search for theses and dissertations from 2017 to 2021 with the word education

Year	Textile waste	Available textile waste	Education for development	Education	Environmental education	Education in references	Does not contain
2017	1	0					
2018	4	3	1	1	1	2	
2019	5	4		1	1	1	2
2020	6	5		1	1		3
2021	5	1		1	1		
Total	21	13	1	4	4	3	5

Source: the authors, 2023

Citation: Munaretto ECPL, Silva MC. Textile waste and education for sustainability: a Brazilian literature review. *J Textile Eng Fashion Technol.* 2023;9(6):170–175. DOI: 10.15406/jteft.2023.09.00352

This result revealed that although the term "education" was mentioned in the papers, it was not a priority in the research. Therefore, the texts were read in their entirety to find the main concepts and technologies in relation to the generation and disposal of textile waste, as shown in Figure 1, with questions and perspectives on textile consumption.

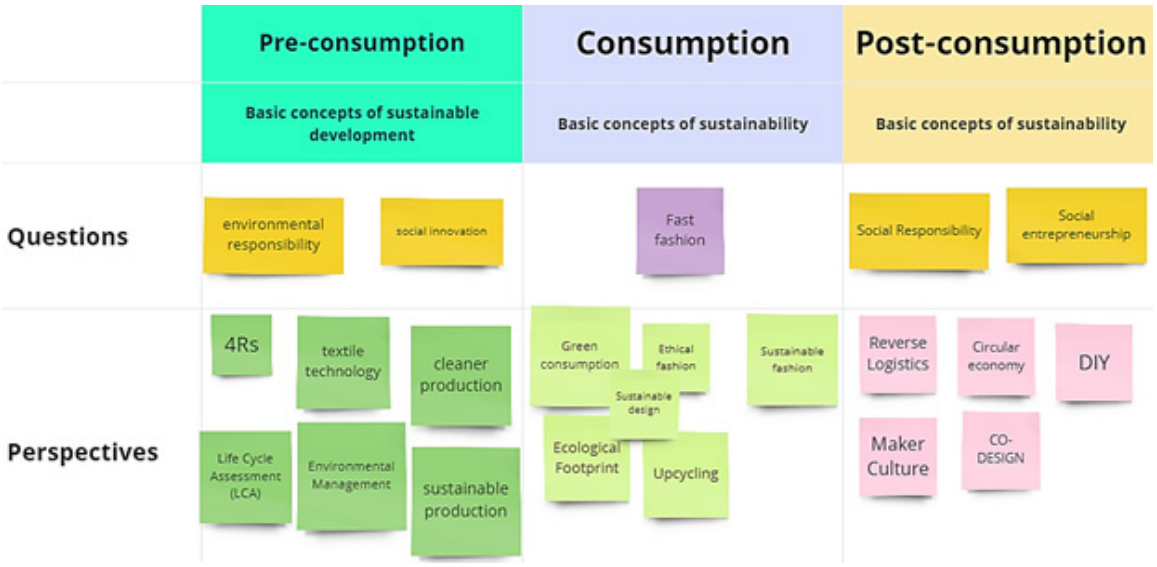


Figure 1 Main concepts covered in thesis and dissertations.

Source: the authors, 2023

The discussions on the reference words that illustrate the main research themes were mainly based on the concepts in the different consumer actions. From this search, it was possible to recognize words that have conceptual similarities and that were taken as possible ways to tackle the problems related to textile waste issues.

Sustainable development in textile waste research: stages of consumption

The concepts of this research were developed by taking consumption as the point of discussion when problematizing textile waste, subdividing it into the following stages: pre-consumption, consumption and post-consumption. These stages present issues related to the entire textile chain, as well as prospects for reduction and recycling. In this way, pre-consumption corresponds to the entire movement that takes place in the industrial phase, in which the urgency of environmental responsibility related to production is debated, so that it becomes more conscious.

The authors point out the dimensions of sustainable development in their research, especially the environmental dimension, which is discussed in almost all of the papers, as can be seen in Figure 2.

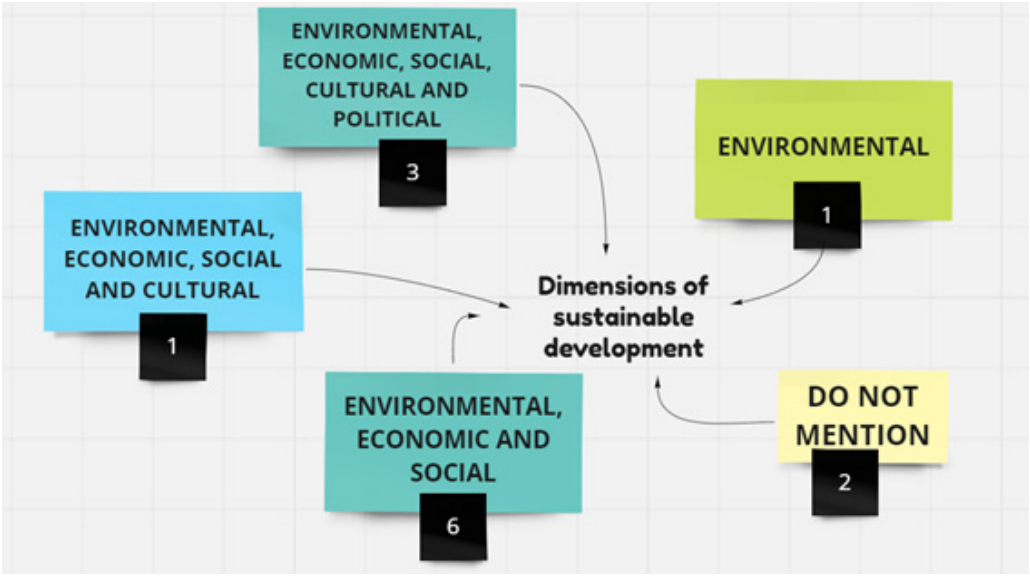


Figure 2 Demonstration of the dimensions of sustainability.

Source: the authors, 2023

Citation: Munaretto ECPL, Silva MC. Textile waste and education for sustainability: a Brazilian literature review. *J Textile Eng Fashion Technol.* 2023;9(6):170–175. DOI: 10.15406/jteft.2023.09.00352

Given this scenario, it is understood that the concept of development, which encompasses the environmental, social and economic dimensions, has the greatest emphasis. Given the approach in the textile industry and retail trade, this emphasis occurs so that the consonance between them can be seen. This niche has a responsibility in terms of the environmental dimension in terms of cleaner production, using less polluting chemicals, recycling water, dyeing and minimizing cuts.[13–15]

It should be remembered that the sustainable development model was outlined in 1992 at the United Nations Conference in Rio de Janeiro, but the concept of sustainable development had already been discussed in the "Our Common Future" report. The five dimensions were attributed by Sachs (2000) and divided into: social, territorial, ecological, cultural and economic sustainability.[16]

Sachs (2000), in his defense of social sustainability, talks about the fair distribution of income and the democratic inclusion of everyone in the community, with companies also driving this process. In this sense, the proposal is to mobilize justice and equity on fronts willing to achieve a greater good, which is a sense of care for the planet and the environment. Responsibilities that can be assumed when the planet's needs are recognized in actions that go from the individual to the global and vice versa. In view of this, the dimensions are not isolated, with complementarity as a premise, as this is an expanded concept of sustainability.

In the research analyzed, the social dimension is discussed in terms of modes of production and the actors on the front line. Workers and their rights are put to the test in the debate on social processes. Sousa[17] highlights in his research that the reasons for the low cost of clothing from China, for example, are directly related to the working conditions, wages and rights of individuals.

On the other hand, the social dimension is also discussed in the research, taking into account projects undertaken by companies in partnership with NGOs and schools, with the aim of social inclusion. These initiatives are advertised by brands and become part of their marketing to win over consumers who favor sustainability in their choices.

In the pre-consumption stage, we have an added economic dimension in which producers' profits are questioned to the detriment of environmental issues, which sometimes tend not to be combined. According to,[18] none of the ten companies the author researched had a "Solid Waste Management Plan (PGRS) or their own environmental plan"; they follow the PNRS. So they send their textile waste to third-party companies that undertake to dispose of it in exchange for a price that is stipulated by quantity, an action that is detrimental to the companies surveyed.

From this, we are interested in the research by Sousa[17] who worked with three companies that did not have sustainability objectives and none of which seemed to be aware of the policies related to the disposal of textile waste, in the interviews given. In these studies, which are concerned with the pre-consumption stage, the environmental concern becomes aggravating, since there is data on what is done with the waste, especially that which is marketed.

As far as the consumption stage is concerned, the research focuses on the responsibility of consumers, since the industry follows the demand expressed by the fashion sector. As a result, the authors address the fast-fashion concept as a perceived problem, since low-quality, low-cost materials find their way into the hands of consumers, who end up discarding clothes and everything that comes from the textile sector very quickly. As a result, new purchases are made and in this cycle more and more waste is generated, causing serious problems for the environment.

On the other hand, the researchers' observation reiterates the existence of a niche market that is betting on conscious consumers, and to cater for them there are brands, industries and even retailers that have included sustainability in their productions to attract the attention of this group. According to Sousa,[17] the end consumer has been questioning how clothes are made and how they are disposed of, thus demanding ethical and sustainable fashion. However, the same author points out that it is necessary to reflect on the labels that bear the mark of sustainability, as some are ecologically false and bear this quality in name only to persuade consumers, without actually making any sustainable proposal.

As for sustainable consumption, the authors point to concepts such as upcycling, green consumption, sustainable design and ecological footprint as likely actions to maximize the life cycle of textile products. These concepts are indicative of consumer positioning, but there is still a huge amount of waste generated from consumption that requires post-consumption action.

It should be noted that most of the authors discuss alternatives for textile waste in the post-consumption stage, ranging from actions in favor of the social dimension, in which they encourage movements to obtain income through reverse logistics, circular economy and co-design. They also address educational movements that promote the idea of producing with sustainable alternative technology, thus discussing concepts such as DIY (do it yourself) and Maker culture.

From these definitions, it can be pointed out that although environmental education was not the main purpose of the research studies revisited, as they deal with the dimensions of sustainable development and include the PNRS and the SDGs, especially target 12, the educational theme somehow enters the discussions.

The PNRS as a basis for thesis and dissertations on textile waste

As these are studies on textile waste in Brazil, it is understandable that the legal basis leans towards Law 12.305/10, which establishes the National Solid Waste Policy (PNRS). It was cited in 7 studies, which, as can be seen in Figure 3, used this document because it guides measures at state and municipal level. The parts selected by the authors refer to basic concepts and legal measures in relation to waste, providing a theoretical basis and serving as a point of analysis for the companies studied.

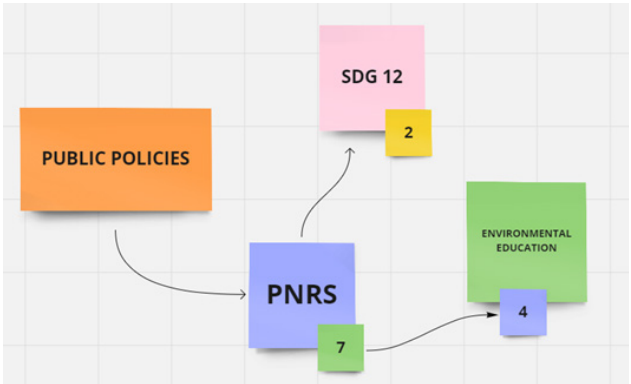


Figure 3 Mind map of public policies in research.

Source: the authors, 2023

From this perspective, the authors used the PNRS to differentiate conceptually between waste and rejects, thus demarcating the potential of waste to the detriment of rejects. Waste is thus demarcated as a potential material that can be reused or recycled, while waste does not have the same potential, justifying its destination in a landfill. With this differentiation clarified, there is an incentive to recycle waste, which is one of the recommended possibilities.[13,18–21]

Researchers warn about the order of priority of waste in relation to its management: non-generation, reduction, reuse, recycling, treatment and proper final disposal. These actions are thus taken in the light of the textile waste issues debated at the different stages of production, consumption and disposal.[13,21,22]

This justifies the fact that these studies address the concept of reverse logistics, which is set out in the PNRS. Since it is a topic that can be combined with recycling and reuse actions in which waste is transformed into products that return to the top of the production chain.[20,21]

Such actions with regard to textile waste are discussed as an example of initiatives from retailers such as the "C&A institute" and "Renner", which according to Silva[14] and Avila[20] propose the idea of a circular economy. Avila,[20] describes that Renner works with the reverse logistics initiative, so boxes have been installed in different stores to collect used clothes from customers, regardless of whether they were purchased in their stores. The destination of these clothes, according to the author, is: "donation; a new product, through upcycling by women who are partners in another Renner sustainability initiative [...] or; a new use, through defibration to transform them into new fabrics".[20]

Considering this, the PNRS research indicates the shared responsibility that needs to be assumed by all those who generate waste, from the pre-consumption stage to post-consumption, indicating thinking about manufactured items based on Life Cycle Assessment (LCA).[17,18,20,21]

With regard to the legislative aspect undertaken by municipalities in order to comply with the PNRS, studies cite the existence or not of the Municipal Integrated Solid Waste Management Plan (PMGRS), in studies that question companies and their waste. In the same way, the PNRS is referred to by research in relation to sustainable development from the political, economic, environmental, cultural and social dimensions, with social control, which culminates in a conceptual integration.[20,21]

As can be seen in Figure 3, the papers on textile waste do not deal with education with the same emphasis. However, as they are based on concepts and issues involved in sustainability, they do not completely escape this theme. This justifies the fact that we found the term "environmental education" mentioned in four studies. These citations were linked to the PNRS, which indicates environmental education as one of the necessary measures for waste management.[20,21]

In this scenario, when dealing with the PNRS in relation to environmental education, it can be observed that it is cited because it is articulated with Law No. 9.795, which is the (National Environmental Education Policy). Thus, environmental education is prescribed as an instrument of the PNRS, and the management of municipalities proposes the existence of programs to promote the "non-generation, reduction, reuse, reuse and recycling of solid waste".[23]

It is important to note that SDG 12, which deals with responsible consumption and production, was mentioned in two studies, as shown in Figure 3. In these studies, the mention was made with the aim of justifying the research, and also raising the debate on the importance of this global issue through the United Nations (UN). In addition, one of the studies looked into target 12.6, which warns companies about the importance of information reports on sustainable practices.[14,22]

As a result, we would point out that the PNRS and the SDGs, as legal fronts that were mentioned above in the studies dealing with textile waste, do so in view of what is in place in Brazil, indicating the need to raise the debate on environmental issues. This is also the reason for the presence of environmental education as an indication in four of the studies, always allied to this discussion.

As such, we note that the researchers describe non-formal teaching practices with the theme of environmental education, although this was not the main focus of the research. In a subtle way, this theme appears in the form of training for employees of the companies surveyed, having been promoted, for example, by unions in the textile sector.[17]

Along the same lines, there are also sustainable fashion workshops with modeling and sewing training for artisans and seamstresses so that they can work with textile waste.[14,15]

We can infer from Silva[14] that there are initiatives that deserve recognition when it comes to reflecting on the issue of sustainable fashion, such as the Ellen Macarthur Foundation, which promotes the idea of questioning: who made your clothes? The authors also point to the existence of NGOs such as Florescer and Sotaque art, Retalho fashion, which promote the idea of using textile waste to promote the idea of sustainability and at the same time generate income for people in vulnerable situations.[14]

It is important to note that although there are programs and actions that promote the use of textile waste, in terms of environmental education, according to Avila[20] and Cardim[18] it is the consumer's attitude that is of interest. Because if there is a conscious and responsible consumer, there is less waste being produced and this requires producers to meet the demand expressed by consumers.

From these perceptions, the authors are emphatic in stating that even retailers, who have economic interests, are seeking to include sustainability on their labels in order to cater to the consumer. It is therefore understood that one of the keys to change lies in the formation of a conscious consumer, and this bet can be made from the educational context. Schools are responsible for training consumers to ask themselves about their real needs before buying products, as well as arguing about how the product was produced.

Although basic education was not raised in the discussions of the research analyzed as a possible avenue for public policy, environmental education based on the PNRS indicates this path.

Final considerations

The topic of textile waste in the field of education is not yet of interest to national academic researchers, however, it can be understood that in view of the issue now present in the country, it is urgent to consider the close connection of the educational approach in the discussions.

Based on these surveys, we want to encourage initiatives to tackle the serious problem of textile waste in the context of academic research. Bearing in mind that the issues are discussed by the authors through measures based on the stages of consumption. Thus, we understand that the reduction of waste generation is still little debated, given the close relationship with consumer behavior, which is educated from socio-educational practices, in formal and non-formal contexts.

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It should be noted that there are currently teaching aids that promote discussions on environmental education, developed on the basis of the Sustainable Development Goals (SDGs). These are available on UNESCO's website and have been created especially for the educational environment: Education for Sustainable Development at School (ESD at School). There are ten booklets in which the 17 SDGs are discussed in a connected way. In these booklets there are various suggestions for activities that can be adapted by teachers according to the pedagogical context.

The booklet Education for sustainable development at school: SDG 12 works to mobilize students to reflect on their role as active consumers who take a sustainable stance towards the market. It is also a project that encourages the school community as a whole to participate in responsible consumption and production practices (UN BRAZIL, 2015).

On the basis of all this, we would like to point out that there are waste management policies in Brazil that promote environmental education as an emerging possibility. Research on textile waste is focused on these policies and tries to warn about the direction of sustainability and the importance of citizens' attitudes.

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Conflicts of interest

Author declares that there is no conflict of interest.

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