DiversitasJournal
ISSN 2525-5215
Volume 8, Número 3 (Jul./Set. 2023) p. 3151 - 3165
https://diversitasjournal.com.br/diversitas_journal

Digital booklet: E-waste management through educational actions in basic education

SANTOS, Janaina Luiza Simões dos[1]; PEREIRA-SILVA, Rafaela Alves[2]; SEVERO GOMES, Bruno[3]

[1] 0000-0002-86644-9569; Federal University of Pernambuco, Graduate Program in the National Network for the Teaching of Environmental Sciences – UFPE. Av. Prof. Moraes Rego, 1235, CEP-50670-901, Cidade Universitária, Recife – PE, Brasil. janainaluiza2019@gmail.com

[2] 0000-0001-6622-8372; Academic Unity of Serra Talhada. Federal Rural University of Pernambuco, CEP-56900-000, Serra Talhada, PE, Brasil. rafaela.news1@gmail.com

[2] 0000-0002-0365-2026; Federal University of Pernambuco, Graduate Program in the National Network for the Teaching of Environmental Sciences – UFPE. Av. Prof. Moraes Rego, 1235, CEP-50670-901, Cidade Universitária, Recife – PE, Brasil. bruno.severo@ufpe.br

ABSTRACT

The correct direction of electronic waste (e-waste) goes far beyond measures aimed at environmental conservation. In addition, it is about management models that aim to guarantee collective actions generating socio-environmental awareness that, when correctly applied, going beyond school walls. In this way, the present work aimed to promote environmental education through the use of a digital booklet, so that it collaborates to share the theme in the teaching and learning process in basic education. The content of the booklet was designed to be used in an interdisciplinary way by teachers in different areas of knowledge. The research was carried out in a state school in road Aldeia, Pau Ferro, located in the municipality of Camaragibe -PE, Northeast of Brazil, an effective qualitative research was carried out, thus obtaining data that together with a bibliographic research contributed to the elaboration of the educational product. After submitting the educational product developed to the analysis of educators, it was found that it can help students understand the importance of correctly disposing of e-waste and the permanent construction of awareness, sensitization guiding the practice of these socio-environmental actions through Education.

ARTICLE INFORMATION

Article process:
Submitted: 03/10/2022
Approved: 17/08/2023
Published: 21/08/2023

Keywords:
Environmental education, Electronics, Consumerism

Palavras-Chave:
Educação ambiental, Eletroeletrônicos, Consumismo

RESUMO

O direcionamento correto dos resíduos eletroeletrônicos vai muito além de medidas voltadas à conservação ambiental. Além disso, trata-se de modelos de gestão que procuramgarantir ações coletivas gerando conscientização socioambiental que, quando aplicadas corretamente, extrapolamos muros escolares. Dessa maneira, o presente trabalho teve como objetivo promover a educação ambiental através do uso de uma cartilha digital, de modo que colabore para a divulgação do tema no processo de ensino e aprendizado na educação básica. O conteúdo da cartilha foi pensado para ser utilizado de forma interdisciplinar pelos docentes em diversas áreas do conhecimento. Uma pesquisa qualitativa efetiva foi realizada em uma escola estadualna estrada de Aldeia, Pau Ferro, localizada no município de Camaragibe–PE, Nordeste do Brasil, cujos resultados, juntamente com uma pesquisa bibliográfica, contribuíram para a elaboração do produto educacional. Após submeter o produto educacional desenvolvido à análise de educadores, foi verificado que este pode contribuir para que os educandos compreendam a importância do descarte correto dos resíduos eletroeletrônicos, para a construção permanente da conscientização e sensibilização, norteando a prática dessas ações socioambientais através da Educação.

DOI: 10.48017/dj.v8i2.2447

Introduction

Electro-electronic waste, popularly known as "e-waste", is electronic products and their parts that have been discarded without the intention of reuse (Dwivedy & Mittal, 2012; Step Initiative, 2014). E-waste may be originated from: homes, industries, hospitals, businesses, or from other countries for processing, or as a credit for making their country cleaner. Examples of e-waste include: batteries with no useful life, cell phones, tablets, computers, notebooks and other electronics that are burnt out, obsolete, out of date and defective.

According to Forti et al. 2020, Brazil ranks 5th in the world, leading the way as the largest producer of electro-electronic equipment waste (WEEE) in Latin America, generating an average of 1.5 million tons per year, only 3% of which has been collected to be recycled or properly disposed. This waste pollutes the environment because it contains a mixture of metals, such as copper, aluminum, iron, alloyed, covered or mixed with various types of plastics and ceramics (Hoffmann, 1992).

For Lima (2020), the recently deactivated dump known as Céu Azul, located in Camaragibe next to a public school in the Aldeia neighborhood, has a 29-year history of pollution on 12.47 hectares of land occupied by waste, failing to comply with the Brazilian Solid Waste Law and the deadline set by the National Solid Waste Policy for its closure (which ended in 2014). In addition, the municipality of Camaragibe is part of the Small Coastal River Basin Groups, with the Capibaribe and Beberibe rivers being the main ones that supply the populations of the Aldeia and Recife Metropolitan regions. However, without a proper disposal of electrical and electronic waste and other materials exposed directly to the ground, the groundwater is contaminated with toxic substances, putting human health at risk through food (Moreira, 2007).

It is therefore important to make the population aware of the risks and alert them to the correct disposal of e-waste. An effort must therefore be made to promote different strategies that make environmental education effective so that negative impacts on the environment can be mitigated. In addition to enabling citizens to practice sustainability, meeting the needs of the current generation without compromising future generations. Furthermore, the 6th Article of the National Curriculum Guidelines for Environmental Education (BRASIL, 2012) states that schools should adopt an environmental approach that considers the interface between nature, socio-culture, production, work and consumption, overcoming the depoliticized, uncritical, naive and naturalistic view currently very present in

the pedagogical practice of educational institutions (Moreira, 2001). One of these approaches is through digital workbooks.

The Digital Booklet is a didactic and pedagogical resource that facilitates the teaching-learning process and is an important tool to be used in the classroom, enabling interdisciplinary integration with a light, playful and reflective language on the issues that affect students' daily lives (Nepomuceno & Garcia, 2019).

In view of this, the aim of this work was to promote environmental education through the use of a digital booklet, in order to help disseminate the theme in the teaching and learning process in basic education at a state school located in the neighborhood of Aldeia, Camaragibe-Pernambuco.

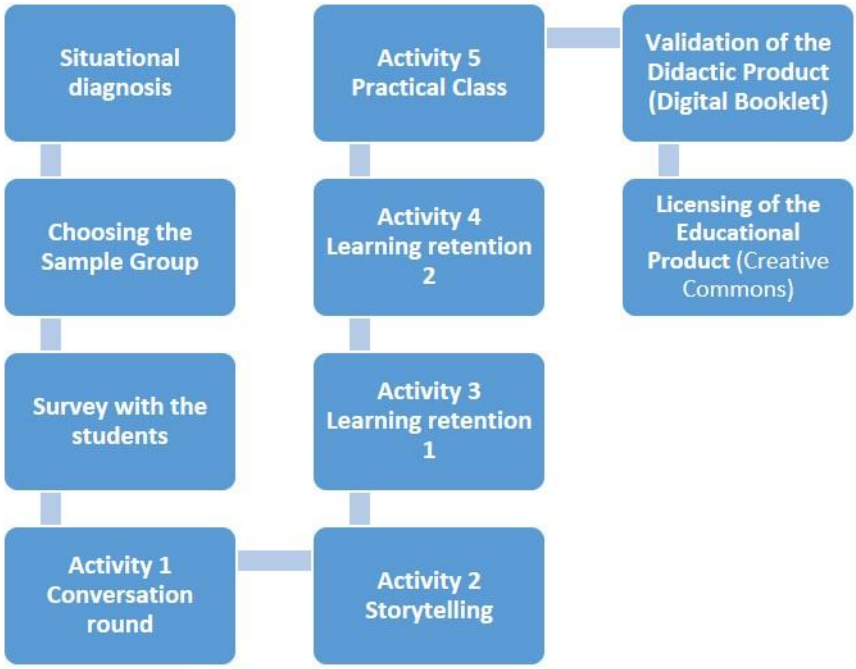
Methodological procedures

The methodology followed in this study was based on a qualitative approach through observations and interviews using a semi-structured questionnaire (link) about the theme: correct disposal of e-waste and its impact on the environment. According to Cyriaco (2017), a qualitative research, by definition, is descriptive, so the data is not reduced to variables, but generates themes that are observed and explored as a whole. The method of analysis is inductive or inferential, i.e. conclusions are drawn from in-depth analytical interpretation of the interviews and observations.

In parallel with the observations and interviews, a literature review was carried out on the same subject of the study, which contributed to the development of the educational product. In addition, educational action plans were drawn up using Environmental Education strategies, such as: conversation circles, storytelling with reflective debates, fixation exercises and practical lessons, up to the final product (the preparation of the booklet) as a continuation of the Environmental Education strategy at the school, as shown in figure 1.

Figure 1.

Flowchart summarizing the research stages.



Note: Prepared by the author, 2020.

Situational diagnosis

In order to develop the digital booklet, a bibliographical survey was carried out on the problem of electro-electronic waste, as well as the impacts caused by the incorrect disposal of this type of waste on the Aldeia road, km 7, Pau Ferro, Camaragibe-Pernambuco, as well as in the vicinity of the selected school. This bibliographic survey was part of the literature review of the master's thesis of the first author.

Choosing the Sample Group

The research was carried out in 2019 with elementary school students in the final grades, from 6th to 9th grade, in the morning shift of the State School Major Lélio, which serves elementary and high school students and is located on the Aldeia road, Pau Ferro, Camaragibe, Pernambuco, northeastern Brazil. A round table discussion was held with the students about the theme, organized in a sample group of four classes with five students per class (n=20), who were randomly divided into students from the final years of elementary school (6th to 9th grade - aged from 11 to 14).

Survey with the students

Activity 1 - Conversation round. The round table discussion included students and teachers and had the following questions on the agenda: electronic waste or electrical and electronic waste? Are all the same? Am I a consumerist or a consumer? Disposal sites, are you responsible for what you collect? Awareness x sensitization x sustainability, which one do you identify with more? Post-consumption, socio-environmental impacts, what are the risks? Do my actions reflect my world? What is important about this Neighborhood?

According to Méllo et al. (2007), round of conversations prioritize discussions around a theme (selected according to the objectives of the research) and, in the dialog process, people can present their elaborations, even contradictory ones, and each person encourages the other to speak, making it possible to express a particular position and listen to the other's point of view.

Activity 2 - Storytelling. In the second moment, in order to bring the target audience closer to the local reality, stimulating awareness of the issues linked to the correct disposal of e-waste in their locality, some excerpts from the book The Little Prince were read; a literary approach with the aim of awakening sensitivity to the problem presented through the economic, social and environmental aspects of post-consumption of e-waste (Table 1).

In this activity, seven students were randomly chosen to read excerpts from The Little Prince. In order to facilitate interaction between the researcher and the participants, the book chapters were shared among the students, so that they could relate the stories to their real life experiences about the theme and express their opinions on the social/economic/post-consumer/environmental aspects of everyday school life and the environment in the Aldeia region. This reflective moment lasted 20 minutes.

Table 1.

Excerpts from the book The Little Prince used as a reflective activity to elaborate the digital booklet on electro-electronic waste.

Book Excerpts	**Chapters**	**Reflective Aspects**
" Ele fizera na época uma grande descoberta. Mas ninguém lhe dera crédito, por causa das roupas que usara".	**Student A Chapter IV**	**Social/ Economic/ Post-consumption/Environmental**

O acendedor de lampiões: " Talvez porque é o único que se ocupa de outra coisa que não seja ele próprio".	**Student B Chapter V**	**Social/ Economic/ Post-consumption/Environmental**
" Mas só há você no seu planeta!".	**Student C Chapter XI**	**Post-consumption/ Environmental**
"Onde estão os homens? – Os homens? Eu creio que existem seis ou sete. Vi-os há muitos anos. Mas não se pode nunca saber onde se encontram. O vento os leva. Eles não têm raízes. Eles não gostam das raízes.	**Student D Chapter XVIII**	**Social/ Economic/ Post-consumption**
" O essencial é invisível aos olhos".	**Student E Chapter XXI**	**Environmental**
Baobá, "Mas as sementes são invisíveis. Elas dormem no segredo da terra até que uma cisme de despertar"	**Student F Chapter V**	**Social/ Economic/ Environmental**
"Tu te tornas eternamente responsável por aquilo que cativa".	**Student G Chapter XXI**	**Social/ Economic/ Post-consumption/Environmental**

Activity 3 - Learning retention 1. In the third moment, after reflecting on the topic, a random student was chosen to carry out the activity of fixing learning by emphasizing the characteristics of electrical and electronic equipment, the lines and their colors, for their correct disposal, using equipment such as an overhead projector showing slides and figures with the theme "correct disposal of electrical and electronic waste", encouraging students to distinguish the types of lines, such as: white line: large household appliances (stoves, washing machines, microwaves, among others); blue line: small household appliances and power tools. Example: Screwdriver, drill, blender, iron, mixer, among others; green line: computer

and telephony equipment. Example: computer, server, notebook, printer, telephones, cell phones, boards and components for this equipment, among others; gray line: audio and video equipment. Example: stereo, TV, video game, home theater and where they should be disposed of correctly.

Activity 4 - Learning retention 2. In the fourth moment, another pedagogical action was carried out with the presentation of the video: Electronic Waste - Part 2, aired on Jornal Nacional (YouTube, 2019), as a tool to support learning without succumbing to the role of the teacher in classroom activity, with the aim of sensitizing the sample group to the environmental impacts that this equipment has on the environment.

Activity 5 - Practical Class. Collection and delivery of electrical and electronic equipment for proper disposal in one of the authorized networks (Figure 2).

Figure 2.

Delivery of eletro-electronic items to one of the authorized networks

Note: Author (2020)

Validation of the Didactic Product (Digital Booklet)

Pasquali (1997) points out that between six and twenty experts are recommended for the validation process. Vianna (1982) suggests that the number of expert evaluators should be odd to avoid a tie in opinions.

Thus, a group of 13 teachers who work in basic education and who are taking postgraduate courses in the National Network Postgraduate Program for Teaching Environmental Sciences -ProfCiamb, took part in the validation of the didactic product through a questionnaire, based on the following criteria from Capes (2018) for evaluating a

Technical or Technological Production: Adherence, Impact, Applicability, Innovation and Complexity, applying a score of 0-5. The teachers were also asked if they would use or recommend the didactic material as an aid to the students' teaching and learning process.

The criteria established by CAPES (2018) for evaluating a technical/technological production were: **adherence** - This refers to the student's mandatory participation in the product developed, the line of research and the central proposal of the postgraduate program; **applicability** - This includes the ability to apply and reapply the technological product in different environments and social groups; **innovation** - This consists of the originality of the product. After evaluation, it can be classified as a technological product or a technical product; **complexity** - It assesses the degree of interactivity and the knowledge relationships required between those involved in making the product; **impact** - It seeks to verify the changes caused by the introduction of the product into the social environment.

Licensing of the Educational Product

The booklet was the educational product developed and it was licensed through the Creative Commons platform.

Results

Educational activities at school

The activity 1, the round table discussion, was a moment of informal conversation with the students to probe them about their previous knowledge of the subject "correct disposal of electronic waste". During this activity, the students felt motivated to take part in the dialog with a critical look at certain concepts, and they also reflected on the importance of water sources in the Aldeia region, where the school is located, and how they could help to conserve these sources. Based on the students' responses, it was possible to draw up a plan of activities that could help in the development of the students' knowledge in an interdisciplinary way. Recent studies have shown that round table discussions represent a very significant methodology for allowing dialog, reflection, exchanges of experiences and possible interdisciplinary actions (Ziesmann et al. 2022).

The activity 2, referring to the storytelling of the excerpt from The Little Prince, allowed students to reflect about various aspects on the theme and, through their previous concepts, they drew parallels between fiction and reality, relating them to everyday situations. Storytelling thus enabled the students to work on their critical thinking, values and concepts as they discussed each excerpt read, contributing to the formation of the students' personalities, making them sensitive to exacerbated consumerism and socio-

economic and environmental issues. Souza & Bernadino (2011) state out that storytelling is a pedagogical strategy that educates, instructs and develops responsibility and self-expression and, without realizing it, the students build their knowledge about the world.

After this moment of reflection and awareness-raising on the subject, a lesson was scheduled to consolidate learning. A lesson about recycling was presented in Power Point and, at this stage, it was possible to emphasize the characteristics of electrical and electronic equipment, the lines and their different colors for selective collection. In addition, the screening of the video Electronic Waste 2 reinforced all of the content that had been taught in the classroom. These didactic resources, which combine text, images and animation through Power Point presentations and videos, allow the content to be better retained, enabling the construction of knowledge (Nicola & Paniz, 2017). These steps were essential for the students to be able to proceed to the delivery of electrical and electronic equipment to one of the authorized networks (Activity 5. Practical lesson). This way, the students were already aware of the importance of correctly disposing of electronic waste.

This way, the students were motivated to learn more about the subject. As Masseto stated out:

> The way of presenting and dealing with a content or theme that helps the learner to collect information, relate it, organize it, manipulate it, discuss it and debate it with their peers, with the teacher and with other people (Inter-learning), until they produce knowledge that is meaningful to them, knowledge that is incorporated into their intellectual and experiential world, and that helps them to understand their human and social reality, and even to interfere in it (Masetto, 2013, p.145).

Delivering obsolete electrical and electronic equipment to an authorized network was the result of an action chosen by the students and teachers to publicize the theme in a practice that engaged the school community, in which the school received the equipment for a week. They were, then, correctly disposed of at the nearest location to the school, the Guararapes Shopping Center in the municipality of Jaboatão dos Guararapes, as it has a specific collector for this type of waste (Figure 2). This stage was part of activity 5, which led the community through a process of respect for the environment, developing attitudes to protect and care for it and awakening sensitivity to the problem of electronic waste.

In this context, the article 8 of the National Environmental Education Policy (PNEA) states that environmental education activities must be developed in general education and in school education through interrelated lines of action, such as a) training human resources to promote and monitor environmental education activities; b) developing studies, research and experiments; c) producing and spreading educational material and d) monitoring and

evaluating educational and learning activities. In view of these lines of action, it can be seen that this work achieved all of them, since it engaged qualified human resources, with specialization in the environmental area. Other teachers were also trained as they participated in and developed part of the activities, as well as the way in which the research and study actions were developed, focusing on interdisciplinarity and local experiences, seeking to reflect on and solve the problems raised. In addition to the production and application of didactic material, the digital booklet, a subsequent monitoring of learning was carried out by means of an electronic questionnaire on the subject of electrical and electronic waste, available at: https://docs.google.com/forms/d/e/1FAIpQLSfwW03XbNZM4lRKoHL7qU_CF44khzJ6W_SnJ9FP-yEhPorY-g/viewform

The digital booklet

The digital booklet was developed by the first author and it was entitled: The direction of electronic waste through collectives solutions in the school scope, available at: https://cdn2.me-qr.com/pdf/16508096.pdf. The booklet consists of 37 pages and was developed as a learning tool, allowing quick and interactive navigation, encouraging the reader to explore the concepts of e-waste, waste and electronic products, their origin and their divisions, raising awareness of the correct disposal of electrical and electronic equipment. The reader is also directed to the legislation and decrees on the subject, such as the National Solid Waste Policy, PNRS (Law No. 12.305/10).

The benefits and Brazilian actions for the reuse of electrical and electronic equipment are discussed in the booklet through the topic of technological mining. Although it guarantees a subsistence income for people with low social status, it is also a cause for concern because it is carried out without any protection or supervision, causing accidents and even amputation and loss of limbs for those who carry out the practice.

The booklet also provides teachers with quick access to 4 films on the subject, as well as related games and hyperlinks. In addition, the booklet provides the locations and telephone numbers of companies and associations responsible for socio-environmental work, for sharing information, future partnerships and/or projects.

Validation with teachers

According to the “Coordenação de Aperfeiçoamento de defesa de Nível Superior CAPES”, through the Working Group - Technical Production (CAPES, 2018), the booklet is classified as a didactic product, defined as: "Support product for didactic purposes in the mediation of teaching and learning processes in different educational contexts". Therefore,

the educational product was evaluated by teachers involved in basic education who are undergoing professional training through the National Network Postgraduate Program for Teaching Environmental Sciences. 69.23% of them were elementary school teachers and 30.76% were high school teachers, distributed among the subjects of Science, History, Portuguese Language and Geography.

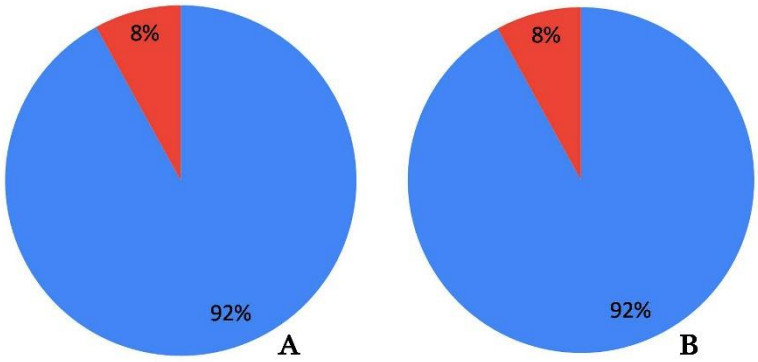
The results showed that 92% of the teachers considered that the technical production (digital booklet) was consistent with the line of research, including the obligation for students to participate in the development of the product and the core proposal of the Postgraduate Program in Environmental Sciences (Figure 3a).

The criterion of impact was considered high, i.e. very relevant as 92% of the evaluators (teachers) gave this item top marks (Figure 3b). According to the Technical Production WG (CAPES2018), in order to assess this criterion it is necessary to describe three sub-items: the demand, the purpose of the research and the area impacted by the production. The demand occurred spontaneously, when the approach to this environmental education work based on the theme of electrical and electronic waste was proposed at the school and supported by the teachers.

Bearing in mind that the objective of the work was based on a current problem that had been previously identified, as the students were exposed to it in the real context of their community, since there was a garbage dump near the school in a neighborhood cut off by springs, however, the problem was not widely discussed. It is also worth noting that there was an increase in the consumption of electronic waste during the 2020-2021 pandemic period, which consequently increased the amount of obsolete electronics.

After carrying out the work and applying the digital booklet, there was a need to set up disposal points in places close to the school and the students' homes, as well as to promote informative actions on the subject for the school community, raising awareness on how to dispose e-waste correctly, and also to encourage projects that work with meta-recycling, by reusing the equipment for a new artistic proposal such as paintings, women's accessories, in the production of new products, thus generating income to improve the lives of children and adolescents in vulnerable situations. As Morin (2011, p.18) states, "education must contribute not only to the awareness of our earthly homeland, but also enable this awareness to result in the will to exercise earthly citizenship".

Figure 3.
Evaluation of the booklet by teachers in terms of the criteria established by Capes. In A: Adherence to the line of research; in B: Impact criterion.



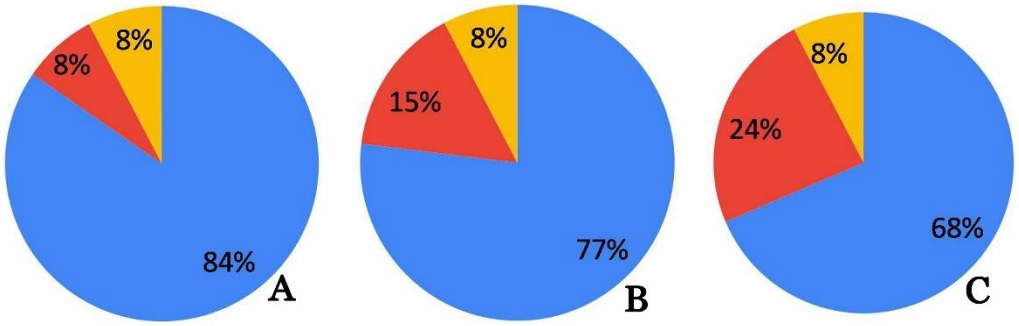
With regard to the applicability criterion, 84% of teachers considered the product to be highly applicable, with the possibility of replication. This shows how easy it is to use the product in the school environment.

Regarding to the Innovation criterion, 77% considered the educational product highly innovative, as they assumed that the booklet with the theme "the management of electro-electronic waste in basic education through educational actions" was innovative. However, 15% considered it to be of medium innovative content, as they felt that the booklet only brought together a combination of pre-established knowledge and 8% of the interviewees considered it to be of low innovative content, as they believed that the booklet evaluated corresponded to an adaptation of existing knowledge.

In terms of the criterion of Complexity (Figure 4), 68.61% of teachers rated the booklet as being highly complex, since it involved a multiplicity of knowledge, involving different areas of knowledge, such as History, Mathematics, Portuguese Language and others that contributed to sharing and interactivity between the content taught, as well as that on environmental sustainability; 8% rated it as being of medium complexity and 24% considered it to be of low complexity. Medium complexity is characterized by the combination of pre-established knowledge and low complexity considers a production based on altering or adapting existing knowledge (RIZZATT, 2020). Figure 4 shows the official criteria established by CAPES for evaluating a technological production, such as a digital booklet, for example.

Figure 4.

Criteria established by Capes (2018) for evaluating a technical/technological production. In A: Applicability criterion; B: Innovation criterion; C: Complexity criterion.



Finally, when asked if they would use or recommend the digital booklet, all of the evaluators said yes, demonstrating full validation of the digital booklet as a technical didactic product that can be used to teach environmental education and effectively raise awareness of the issue of electrical and electronic waste management.

Conclusion

The Educational Actions were fundamental to understanding the students' perceptions and to raising their critical awareness about the problem of electro-electronic waste and changing their behavior through sustainable practices, such as the correct disposal of this type of waste.

The booklet was the final technical product applied at the school after understanding the students' needs and level of their knowledge on the subject. As it is digital, its application has become more feasible, safer and faster. The validation of the digital booklet by teachers from different areas of knowledge corroborates its use in an interdisciplinary approach, which through simple language covered areas such as History, Mathematics, Portuguese Language and other disciplines that contribute to the sharing and interactivity between the content taught, as well as that relating to environmental sustainability.

Therefore, the digital booklet produced a positive result and, after taking on board the suggestions and constructive criticism received by the teachers, it was possible to improve the booklet, generating greater adherence to the product and boosting dissemination and knowledge of the topic of directing electro-electronic waste.

REFERENCES

Brasil. Resolução nº 2 de 15 de junho de 2012. Estabelece Diretrizes Curriculares Nacionais para a Educação Ambiental, 2012. http://portal.mec.gov.br/index

Cyriaco, A. F. F., Nunn, D., Amorim, R. F. B., Falcão, D. P., Moreno, H. (2017). Pesquisa qualitativa: conceitos importantes e breve revisão de sua aplicação à geriatria/gerontologia. *Geriatrics, Gerontology and Aging*, v. 11, n. 1, p. 4-9. https://cdn.publisher.gn1.link/ggaging.com/pdf/v11n1a02.pdf

Diário do Comércio, Brasil é o país que mais produz lixo eletrônico na América Latina.2020. https://diariodocomercio.com.br/livre/brasil-eo-pais-que-mais-produz-lixo-eletronico-na-america-latina,2020.

Dwivedy, M., Mittal, R.K. (2012). An investigation into e-waste flows in India. *Journal of Cleaner Production*, v.37, p. 229-242. https://doi.org/10.1016/j.jclepro.2012.07.017

Hoffmann, J. (1992). Recovering precious metals from electronic scrap. *Journal of the Minerals*, Metals and Materials Society. DOI: 10.1007/BF03222275

Lima, I. S. (2020). Lixão de Céu Azul, em Camaragibe, será fechado em outubro: O lixão é o último em atividade na Região Metropolitana do Recife. *In*: *Lixão de Céu Azul, em Camaragibe, será fechado em outubro*: O lixão é o último em atividade na Região Metropolitana do Recife. [*S. l.*].https://radiojornal.ne10.uol.com.br/noticia/2020/09/28/lixao-de-ceu-azul-em-camaragibe-sera-fechado-em-outubro-195945/index.html. Acesso em: 25 nov. 2020.

LIXO ELETRÔNICO- Parte 2. Vídeo. 7min35s.Publicado pelo canal Krefta Tecnologia em serviços-PR,21mar.2016. https://www.youtube.com/watch?v=LerzgNYWIvU. Acesso em 14 set.2019.

Masetto, M. T. Mediação Pedagógica e o Uso da Tecnologia. In.: MORAN, J. M. MASETTO, 2013. https://www.academia.edu/10222269/Moran_Masetto_e_Behrens_NOVAS_TECNOLOGIAS_E_MEDIA%C3%87AO_PEDAGOGICA

Méllo, R. P., Silva, A. A., Lima, M. L. C. L, Di Paolo, A. F. (2007). Construcionismo, práticas discursivas e possibilidades de pesquisa. *Psicologia e Sociedade*, v. 19, n.3, p. 26-32. https://doi.org/10.1590/S0102-71822007000300005

Moreira, A. F. B. (2001). O campo do currículo no Brasil: os anos noventa. Currículo sem fronteiras, v. 1, n. 1, p. 35-49. https://doi.org/10.1590/S0100-15742002000300005

Moreira, D. (2007). Lixo eletrônico tem substâncias perigosas para a saúde humana. https://computerworld.com.br/acervo/idgnoticia-2007- 04-26-7348055458.

Morin, E. (2011). *Introdução ao Pensamento Complexo*. trad. Eliane Lisboa. 4 ed. Sulina. https://www.editorasulina.com.br/img/sumarios/313.pdf

Neponuceno, A. F., S. F.; Garcia, P. H. (2019). Proposta de uma Cartilha Educativa a Respeito da Evolução Urbana de Três Lagoas para o Auxilio nas Aulas d e Geografia. Mato Grosso do Sul. https://ppggeografiacptl.ufms.br/files/2019/12/29-32.pdf.

Nicola, J. A., Paniz, C. M. (2017). A importância da utilização de diferentes recursos didáticos no Ensino de Ciências e Biologia. *In For*, v. 2, n. 1, p. 355-381. https://ojs.ead.unesp.br/index.php/nead/article/view/infor2120167

Pasquali, L. (1997). Psicometria: teoria e aplicações. Brasília: Editora UnB. p. 161- 200. http://www.de.ufpb.br/~ronei/ermac023.pdf

Periódicos, Qualis. (2018). *Coordenação de Aperfeiçoamento de Pessoal de Nível Superior* (CAPES). https://www.gov.br/capes/pt-br/centrais-de-conteudo/documentos/conselho-tecnico-cientifico-da-educacao-superior/anexos-ctc-es/anexo-01-186.pdf

Rizzatti, I. M., Mendonça, A. P., Mattos, F., Rôças, G., Silva, M. A. B. V. da., Cavalcanti, R. J. de S., Oliveira, R. R. de. (2020). Os produtos e processos educacionais dos programas de pós-graduação profissionais: proposições de um grupo de colaboradores. *Actio: Docência em Ciências, v.* 5, n. 2, p. 1-17. https://periodicos.utfpr.edu.br/actio/article/view/12657

Step Initiative. (2014). “One Global Definition of E-Waste”. United Nations University 3576. https://collections.unu.edu/eserv/UNU:6120/step_one_global_definition_amended.pdf.

Sousa, L. O., Bernardino, A. A contação de história como estratégia pedagógica na Educação Infantil e Ensino Fundamental. *Revista de Educação*, v. 6, n. 12, p. 235-249, 2011. https://doi.org/10.17648/educare.v6i12.4643

Vianna, H. M. (1982). *Testes em educação*. IBRASA.

Ziesmann, C. I., Baumgratz, C. E. & Batista, T. P., E. S. Pauletti. Rodas de conversas e oficinas pedagógicas: uma possível estratégia para sensibilizar e refletir sobre a educação ambiental. *Revista de Educação, Ciências e Matemática*, v. 12, n. 1, 2022. http://publicacoes.unigranrio.edu.br/index.php/recm/article/view/6076