# Systematic Literature Review on Unplugged Computing in Basic Education

**José Santos da Silva Filho[1], Marcos C. Lima Filho[1], Marcial P. Fernandez[1]**

[1] Programa de Pós-Graduação em Ciências da Computação (PPGCC) da Universidade Estadual do Ceará (UECE), Campus Itaperi, Fortaleza – CE – Brazil

`santinho.filho@aluno.uece.br, marcos.camargo@aluno.uece.br,`
`marcial.fernandez@uece.br`

*Abstract. This article presents a Systematic Literature Review (SLR) on using Unplugged Computing in Basic Education, analyzing 12 selected studies. The methodology utilized follows the procedures outlined by Bárbara Kitchenham (2004) in her article "Procedures for Performing Systematic Reviews," which includes specific steps for conducting a thorough review. The research focused on studies related to Brazil and consulted articles from Google Scholar, IEEE Xplore, ACM Digital Library, and the proceedings of the Simpósio Brasileiro de Informática na Educação (SBIE). The study addressed three main questions: (1) how Unplugged Computing can serve as a teaching strategy, (2) what activities are feasible in this context, and (3) how research has been evaluated. The results indicate that Unplugged Computing can effectively introduce computer science concepts in Basic Education, identifying several models of activities and highlighting the need for further discussions and research in the area.*

*Resumo. Este artigo apresenta uma Revisão Sistemática da Literatura (RSL) sobre o uso da Computação Desplugada na Educação Básica, analisando 12 estudos selecionados. A metodologia utilizada segue os procedimentos descritos por Bárbara Kitchenham (2004) no artigo "Procedures for Performing Systematic Reviews", que inclui etapas específicas para realizar uma revisão abrangente. O estudo focou em pesquisas relacionadas ao Brasil e consultou artigos das bases Google Scholar, IEEE Xplore, ACM Digital Library e dos anais do Simpósio Brasileiro de Informática na Educação (SBIE). A pesquisa abordou três questões principais: (1) como a Computação Desplugada pode servir como uma estratégia de ensino, (2) quais atividades são viáveis nesse contexto e (3) como a pesquisa foi avaliada. Os resultados indicam que a Computação Desplugada pode efetivamente introduzir conceitos de ciência da computação na Educação Básica, identificando diversos modelos de atividades e destacando a necessidade de mais discussões e pesquisas na área.*

## 1. Introduction

Unplugged Computing has been referenced as a strategy to teach Computer Science in Basic Education. Unplugged Computing activities are a way to enhance the development of Computational Thinking.

Computational thinking is a term that involves solving problems or designing something using computational concepts, but activities that are not restricted to Computer Science scientists. [Wing 2006].

In other words, the author Wing (2006) associates computational thinking with unplugged activities as strategies for Basic Education professionals to develop significantly the competencies and skills proposed by the BNCC (*Base Nacional Comum Curricular*), which includes digital competencies, reading, and logical reasoning.

As excerpted from the MEC (*Ministério da Educação*) portal, which provides the online version of the BNCC for public consultation, the following is addressed: The concern with the impacts of these transformations on society is expressed in the BNCC and is made explicit in the general competencies for Basic Education. Different dimensions that characterize computing and digital technologies are thematized, both in terms of knowledge and skills as well as attitudes and values such as computational thinking: This involves the ability to understand, analyze, define, model, solve, compare, and automate problems and their solutions in a methodical and systematic way through the development of algorithms. [Brasil, MEC, 2018].

We realize the importance of unplugged activities that exercise exactly that: problem-solving, abstraction, decomposition, algorithmic thinking, and evaluation. Unplugged Computing is an ideal way to show basic education students how data scientists think without using computers and bring Computer Science knowledge to places where computers and their technologies are not yet a reality.

A Systematic Literature Review (SLR) was conducted, to answer the goals questions that are at the subject 3.2 of this paper. The main objective is to understand the research scenario regarding experiences reports on Unplugged Computing in Basic Education.

The conduct the SLR, viewpoints of some authors whose related works were published in journals such as *Revista Novas Tecnologias na Educação* (RENOTE), *Congresso Brasileiro de Informática na Educação* (CBIE), *Workshop de Informática na Escola* (WEI), *Simpósio Brasileiro de Informática na Educação* (SBIE), and *Revista Brasileira de Informática na Educação* (RBIE), among others, were presented.

This study aims to contribute directly to a reflection on the studies of Unplugged Computing in Basic Education and to encourage other researchers to conduct new studies in this domain of knowledge to positively impact Computer Science Education.

## 2. Related Works

SASSI et al. (2021), This article aims to present a Systematic Literature Review (SLR) of scientific publications on Unplugged Computing (UC) in Basic and Higher Education.

BORDINI et al. (2017), this article presents a systematic literature review developed to carry out a bibliographic survey with articles that bring activities developed in basic education to improve computational thinking using the methodological strategy of Unplugged Computing.

The elaboration of this work aimed to survey which activities have been applied in the educational field for the dissemination and democratization of computational thinking.

The systematic literature review described in this article differs from the ones mentioned earlier since it emphasizes studies focused solely on Unplugged Computing in basic education in recent years and seeks to analyze the implementation strategies used.

## 3. Methodology

To conduct this work, the methodology proposed by Bárbara Kitchenham (2004) in the article titled "Procedures for Performing Systematic Reviews" was used. According to this author, to execute the SLR (Systematic Literature Review), the following steps are necessary:
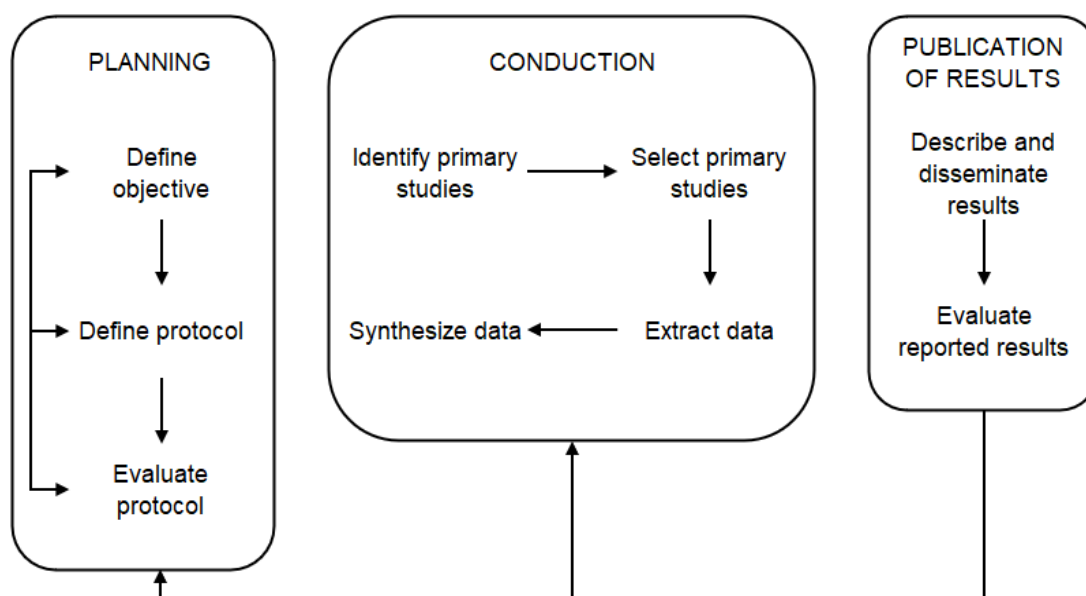


**Figure 1 - Procedures for Performing a Systematic Literature Review**

### 3.1. Planning

The protocol must be followed sequentially for data collection later used in the review.

To develop the protocol used in this article, a central research question was created to delimit the scope of the work, as presented below.

### 3.2. Systematic Literature Review Questions in this Research

The main objective of the SLR is to answer the following research question:

RQ. What is the research scenario in Unplugged Computing in Basic Education?

### 3.2. Applied Questions

From the central question, three more Research Questions (RQ) were defined, followed by their objectives (OBJRQ), which guided the search for related articles and limited the scope of the work:

RQ1. How can Unplugged Computing be a teaching strategy for Computing in Basic Education?

OBJRQ1: Introduce computer science concepts in Basic Education through Unplugged Computing.

RQ2. What Unplugged Computing activities can be implemented in Basic Education?

OBJRQ2: Identify models of Unplugged Computing activities in Basic Education aiming to promote students' cognitive skills and understanding of computer science.

RQ3. How have studies on Unplugged Computing in Basic Education been evaluated?

OBJRQ3: Evaluate the research on Unplugged Computing in Basic Education aiming to identify trends, gaps, and impacts of this approach.

After formalizing the research questions of the systematic review, the process of searching for articles was elaborated.

At this stage, the databases where the searches would be conducted, the keywords and strings used, as well as the criteria for inclusion and exclusion of articles in the SLR, were defined.

## 3.3. Research Database

The research strategy was indexed search bases and the software Covidence for better management of articles. Articles produced between the years 2017 and 2023 were used as the base. The selected databases for the research were:

- Google Scholar,
- IEEE Xplore,
- ACM Digital Libraryç
- Proceedings of *Simpósio Brasileiro de Informática na Educação* (SBIE).

These are widely known bases for the large number of indexed articles and the works published by these bases or indexed by them present high-quality results in the search.

### 3.3.1. Research Keywords

The keywords used were mainly unplugged computing, computational thinking, and basic education.

To search the databases, advanced search settings were defined, and in the various platforms mentioned, boolean operators such as "and" and "or" were organized. Later, the following search string was formalized: ("unplugged computing" OR "computational thinking") AND "basic education."

After organizing according to the search strings, the articles were systematized in the Covidence software. This online tool manages bibliographic references for better preparation and ease of handling the selected works.

Thus, according to Bárbara Kitchenham (2004), a large database was developed to highlight the best way to report each checklist item and then establish evidence to support the inclusion of articles in the final corpus.

According to the methodology, the final selection of articles carried out will be presented in Figure 2.

### 3.3.2. Inclusion and Exclusion Criteria

The most significant articles for the research questions were selected considering the following criteria created to classify the previously analyzed articles.

- Inclusion Criteria (IC)

    o Subdivided into three categories as per Table 1, left side.

- Exclusion Criteria (EC)

    o Subdivided into three categories as per Table 1, right side.

**Table 1 – Classification by IC and EC criteria**

| | Inclusion Criteria (IC) | | | Exclusion Criteria (EC) | |
|---|---|---|---|---|---|
| IC1 | Articles must be available from an open-access web source | | EC1 | Publications that do not have open access (paid or limited) | |
| IC2 | Articles must have been published from the year 2017 onwards | | EC2 | Duplicate articles or those published before the year 2017 | |
| IC3 | Articles must contain research on unplugged computing applied in Basic Education | | EC3 | Articles that do not address the relationship between Basic Education and unplugged computing | |

## 4. Applied Conduction Flow

The evaluated articles were published between the years 2017 and 2023.

### 4.1. Applied Conduction Flow

Applying the previously mentioned search string returned 256 articles. After applying the IC and EC classification for screening in the Covidence software following the flow of Figure 2, was listed 12 potential articles remained.
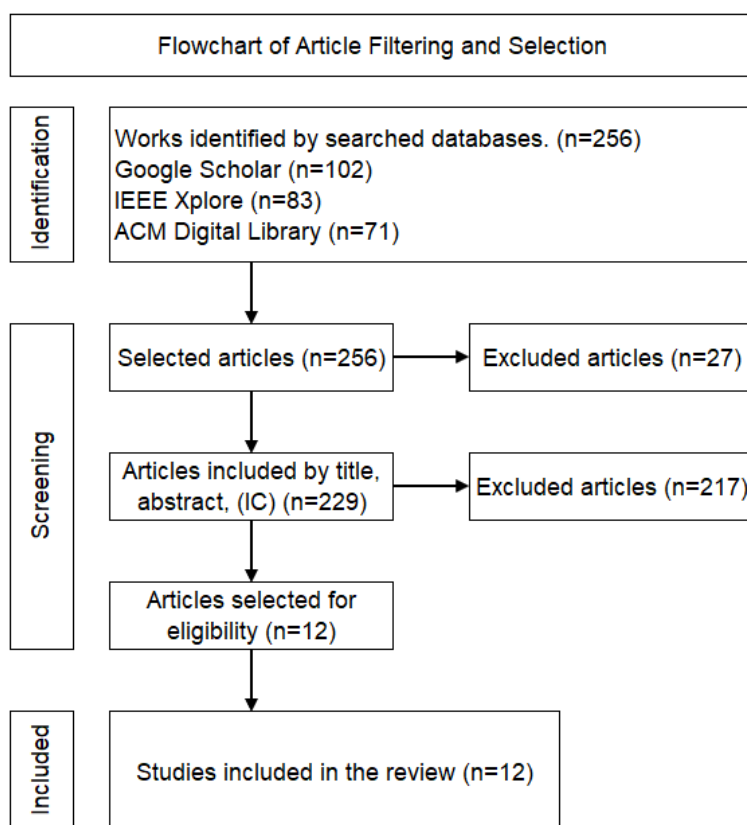
**Figure 2 – Level of coalescence of retrieved articles**

## 4.2. Publication of Results

In this topic, the twelve (12) selected articles for the research will be presented. The organization of the studies regarding the selected ones was given by assigning the identifier A, being added with a number within the range of one (1) to twelve (12) as per Table 2.

**Table 2 – List of selected articles**

| ID | Original title | Authors | Publication Source | Year | Objectives |
|----|----------------|---------|--------------------|------|------------|
| A01 | *Intervenções de Pensamento Computacional na Educação Básica através de Computação Desplugada* | PEREIRA, Francisco Tito Silva Santos | WORKSHOP ON INFORMATICS IN SCHOOL | 2019 | An experience report of unplugged computing activities for elementary school students. |
| A02 | *Desenvolvimento e Avaliação de Material Didático Desplugado para o Ensino de Computação na Educação Básica* | CRUZ, M. E. J. K. da | BRAZILIAN JOURNAL OF INFORMATICS IN EDUCATION | 2021 | Presents a study on the development and evaluation of unplugged didactic materials for teaching computing in Brazilian schools. |

Table continues on the next page…

| A03 | *Uma contribuição na inserção da Computação nas escolas rurais por meio de computação desplugada* | SANTOS, Natália Santana dos | BRAZILIAN SYMPOSIUM ON COMPUTER EDUCATION | 2023 | Article describes an experience report of using unplugged computing activities in rural schools to teach computing to students. |
|-----|-----|-----|-----|-----|-----|
| A04 | *Pensamento Computacional por meio da Computação Desplugada: Desafios e Possibilidades* | OLIVEIRA, Wilk | WORKSHOP ON COMPUTER EDUCATION | 2021 | To outline the proposition of these challenges, difficulties, and expectations of research in Unplugged Computing for teaching computing. |
| A05 | *Normas, Diretrizes e Material Didático para o Ensino de Computação na Educação Básica Brasileira* | KNIPHOFF DA CRUZ, M. E. | BRAZILIAN SYMPOSIUM ON COMPUTER EDUCATION | 2023 | To encourage the use of unplugged computing didactic material that can be utilized in all elementary schools. |
| A06 | *Desplugando: Ensinando Conceitos de Computação na Educação Básica* | DE SOUZA, M. E. J. K. da | CONGRESS ON TECHNOLOGIES IN EDUCATION | 2020 | Presents an experience report of the "Unplugging" extension project that teaches computing concepts using unplugged, playful activities in public schools. |
| A07 | *Um relato de experiência com Computação Desplugada na formação de professores* | ALMEIDA, Diego Lippert de | WORKSHOP ON COMPUTER EDUCATION | 2023 | Presenting unplugged computing proposals for teaching Computational Thinking to children and teenagers in the state of RS, Brazil. |
| A08 | *O Padrão Brasileiro de Computação Escolar* | RIBEIRO, Leila | ACM Technical Symposium on Computer Science Education | 2021 | Discusses and advocates for a Brazilian standard for computing education that includes unplugged computing and its integration into the Brazilian educational context. |
| A09 | Assessing Computational Thinking in CS Unplugged Activities | RODRIGUE, Z, Brandon | ACM SIGCSE Technical Symposium on Computer Science Education | 2017 | Develop and refine a CS Unplugged curriculum for high school classrooms, including an evaluation to map the outcomes of a project-based approach. |

Table continues on the next page…

| A10 | Capture the Flag Unplugged: an Offline Cyber Competition | FORD, Vitaly | ACM Technical Symposium on Computer Science Education | 2017 | The high school students were taught about cybersecurity through an unplugged cyber competition. |
|---|---|---|---|---|---|
| A11 | Unplugged Robotics to Increase K-12 Students' Engineering Interest and Attitudes | MILLER, B | IEEE Frontiers in Education Conference (FIE) | 2018 | One approach to mitigating challenges is by developing an unplugged robotics class that teaches basic concepts of engineering and programming without using computers. |
| A12 | Computer Science Unplugged for Developing Computational Thinking and Mathematical Thinking | NAKAMUR, A, T. | International Joint Conference on Information, Media and Engineering (IJCIME) | 2019 | Suggests a hamburger-shaped flowchart as a didactic material to combine unplugged activities and "unplugged". The use of this flowchart was conducted with children ages 4 to 12. |

## 4.3. Inclusion and Exclusion Criteria

Regarding unplugged computing in basic education, the study analyzed in this SLR has the representation of articles by their corresponding ID for better synthesizing their responses.

### 4.3.1. RQ1. How can Unplugged Computing be a teaching strategy for Computing in Basic Education?

OBJRQ1: Introduce computer science concepts in Basic Education through Unplugged Computing. Below is the list of responses from the corresponding articles to RQ1.

A01: Reports an experience of unplugged computing teaching for middle school students with activities inspired by materials from the CS Unplugged book and Code.org, as well as others developed by the research group.

A02: The unplugged computing didactic material received positive evaluations in both public and private schools, with recommendations provided for future studies.

A03: The strategies used included encouraging investigation and exploration of concepts such as binary numbers, propositional logic, and problem-solving.

A04: Most secondary studies used activities from the "Computer Science Unplugged" book or its Portuguese version for unplugged computing teaching.

A05: Highlights that problem-solving contributes to activating different brain regions associated with imagination and thinking.

A06: Describes the strategies used in the "Unplugging" project, including introductory lectures, unplugged computing workshops, writing evaluations, and student feedback.

A07: The results indicate that unplugged activities provide a playful and interactive environment, arousing participants' interest.

A08: Mention strategies related to implementing unplugged computing education in schools, such as emphasizing computing fundamentals, teacher training, teaching materials, and public policies.

A09: Implementation of a didactic sequence combining unplugged computing activities, confident in developing students' skills.

A10: Describes an offline cybersecurity competition based on the CS Unplugged project to spark interest and increase knowledge in cybersecurity.

A11: Strategies included: engineering and programming classes without computers, pilot classes, and emphasis on integrating computing and robotics education.

A12: Use of a hamburger-shaped flowchart as a learning material.

### 4.3.2. RQ2. What Unplugged Computing activities can be implemented in Basic Education?

OBJRQ2: Identify models of Unplugged Computing activities in Basic Education aiming to promote students' cognitive skills and understanding of computer science.

A01: Use of motivational activities from the CS Unplugged book and Code.org puzzles, as well as activities developed by the research group.

A02: Development of didactic material composed of booklets with challenges related to different unplugged computing concepts.

A03: Unplugged activities such as logic games, binary representation, step-by-step algorithms, and logical thinking exercises.

A04, A05, and A08: It does not cover the central question of this topic.

A06: Conducting unplugged activities involving binary numbers, image representation, text comprehension, and sorting networks.

A07: Use of unplugged activities such as Binary Cards, Algorithmic Parking, Battleship, and Tangram, which can be integrated into other classrooms or used in teacher training groups.

A09: Activities such as logic puzzles, card or board games, pattern recognition, and programming without electronic devices.

A10: Animated activities in Capture the Flag Unplugged to teach cybersecurity without using computers.

A11: Engineering and robot programming classes without computers using a robotic arm and tangible programming blocks.

A12: Use of a hamburger-shaped flowchart as a learning material.

### 4.3.3. RQ3. How have studies on Unplugged Computing in Basic Education been evaluated?

OBJRQ3: Evaluate the research on Unplugged Computing in Basic Education aiming to identify trends, gaps, and impacts of this approach.

A01: Competitions and challenges were motivating elements in activities with expectations of computer use. Promising approach.

A02: It does not cover the central question of this topic.

A03: Highlights the need to promote computing education in rural schools to prepare students for the digital world.

A04: Challenges identified include lack of teacher training, adequate didactic material, impact evaluation, and integration with other subjects.

A05: Importance of presenting teaching tasks as challenging problems to stimulate students' thinking.

A06: Identified gaps such as students unfamiliar with computing concepts needing more adaptation time.

A07: Importance of integrating unplugged computing into teaching, promoting problem-solving, and group cooperation.

A08: Mentioned gaps and controls such as lack of public policies, and inadequate teacher training, among others.

A09: Significant intervention for students and teachers confident in skill development and advancing computational thinking understanding.

A10: Impacts include practical learning, engagement, motivation, and cognitive skills development.

A11: Impacts include equal access, creativity stimulation, and integration with other subjects.

A12: Appreciated results increased in computational and mathematical thinking with improvement in children's responses.

## 5. Results and Discussions

The analysis of the results obtained from the selected articles indicates that unplugged computing has been recognized as a promising strategy for teaching computing in Basic Education. Unplugged activities provide a playful and interactive environment, arousing students' interest and stimulating computational thinking, problem-solving, and group cooperation.

Using renowned materials such as the CS Unplugged book and Code.org is a common approach for developing unplugged activities. These materials offer a solid foundation for teaching computer science concepts without the need for computers. Additionally, creating specific didactic material such as didactic sequences and booklets contributes to an effective implementation of unplugged computing in schools.

However, challenges and gaps identified need to be addressed for effective implementation of unplugged computing in Basic Education. The lack of adequate teacher training is a critical point as educators need to be prepared to teach and guide students in this approach. Furthermore, the lack of appropriate didactic material and the need for public policies and institutional support are important issues that need to be tackled for unplugged computing to be widely accepted in schools.

The SLR can present selection bias as the results are based on a specific selection of articles, which may limit the vision of the unplugged computing field in Basic Education. It is important to consider that some other research and approaches may not have been addressed, leading to a partial view.

Additionally, there may be interpretation bias as the interpretation of results and discussions of articles can be influenced by the perspective of the authors of this article.

Therefore, it is important to be aware of these views when analyzing the article and seek other sources and perspectives to obtain a broader and impartial view of unplugged computing in Basic Education. This allows a more complete understanding of the field, and a more critical evaluation of the results presented.

## 6. Conclusion

Synthesizing the outcomes from those chosen papers suggests that Unplugged Computing is an encouraging technique in teaching computing at Basic Education level. Unplugged activities generate interactive environment that enthuse learners, promote computational thinking skills, problem solving as well as group work. The usage of recognized materials such CS Unplugged book and Code.org along with the generation of specific didactic materials aids in successful implementation of this method.

However, there are still some hindrances including inadequate training for teachers and lack of appropriate didactic materials. The systematic literature review can present selection and interpretation biases, which can limit the field's perspective hereafter necessitating for change by referencing wider sources for a more complete and critical evaluation thereof.

Therefore, it is crucial to promote further discussions and collaborations among researchers in the fields of Computer Science and Education to enrich the existing literature on Unplugged Computing in Basic Education in Brazil. Essential development through knowledge pathways is vital towards addressing challenges related to this educational approach besides exploring its potentials.

## 7. Acknowledgements

## References

KITCHENHAM, Bárbara. (2004) Procedimentos para realizar revisões sistemáticas. Keele, Reino Unido, Keele University , v. 33, n. 2004, pages. 1-26.

BORDINI, Adriana et al. (2017) Pensamento Computacional nos Ensinos Fundamental e Médio: uma revisão sistemática. In: Brazilian Symposium on Computers in Education (Simpósio Brasileiro de Informática na Educação-SBIE). page. 1-3.

WING, Jeannette M. Pensamento computacional. Comunicações da ACM, v. 49, n. 3, pages 33-35, 2006.

BRASIL. Ministério da Educação (MEC). Base Nacional Comum Curricular (BNCC): educação infantil e ensino fundamental. Brasília, DF: MEC, 2018. Available at: http://basenacionalcomum.mec.gov.br/images/BNCC_EI_EF_110518_versaofinal_si te.pdf. Accessed on: Aug. 10, 2024.

SASSI, S. B.; MACIEL, C.; PEREIRA, V. C. Revisão sistemática de estudos sobre computação desplugada na educação básica e superior de 2014 a 2020: tendências no campo. Revista Contexto & Educação, [S. l.], v. 36, n. 114, p. 10–30, 2021. DOI: 10.21527/2179-1309.2021.114.10-30. Available at: https://revistas.unijui.edu.br/index.php/contextoeducacao/article/view/11785. Accessed on: Apr. 6, 2023.

PEREIRA, Francisco Tito Silva Santos; ARAÚJO, Luis Gustavo; BITTENCOURT, Roberto. (2019) Intervenções de pensamento computacional na educação básica através de computação desplugada. In: Anais do XXV Workshop de Informática na Escola. SBC. p. 315-324.

CRUZ, M. E. J. K. da; MARQUES, S. G.; OLIVEIRA, W. (2021) Desenvolvimento e Avaliação de Material Didático Desplugado para o Ensino de Computação na Educação Básica. Revista Brasileira de Informática na Educação, [S. l.], v. 29, p. 160–187,. DOI: 10.5753/rbie.2021.29.0.160. Available at: https://sol.sbc.org.br/ - journals/index.php/- rbie/article/view/2993. Accessed on: Jun. 2, 2023.

SANTOS , Natália Santana dos; MEDEIROS, Andressa de Souza S.; SILVA JUNIOR, Nildo Pereira da; HERCULANI, Júlio Budiski; TONHÃO, Simone de França; CADETTE, William de Araujo; PRATES, Jorge Marques. (2023) Uma contribuição na inserção da Computação nas escolas rurais por meio de computação desplugada. In: SIMPÓSIO BRASILEIRO DE EDUCAÇÃO EM COMPUTAÇÃO (EDUCOMP), 3. , 2023, Evento Online. Anais [...]. Porto Alegre: Sociedade Brasileira de Computação. p. 145-153. DOI: https://doi.org/10.5753/educomp.2023.228136.

DE SOUZA, Givanaldo Rocha; MARINHO, Maria Alice Rodrigues ; AZEVEDO, Vivianne Patrícia Medeiros ; DE FARIA, William Wonder Fagundes (2020). Desplugando: Ensinando Conceitos de Computação na Educação Básica. In: congresso sobre tecnologias na educação (ctrl+e), 5. , 2020, Evento Online. Anais [...]. Porto Alegre: Sociedade Brasileira de Computação. p. 385-394. DOI: https://doi.org/10.5753/ctrle.2020.11416.

ALMEIDA, Diego Lippert de; SANTOS, Fabricia Damando. (2023) Um relato de experiência com Computação Desplugada na formação de professores. In: workshop sobre educação em computação (wei), 31. , 2023, João Pessoa/PB. Anais [...]. Porto Alegre: Sociedade Brasileira de Computação. p. 52-63. ISSN 2595-6175. DOI: https://doi.org/10.5753/wei.2023.229827.

OLIVEIRA, Wilk; CAMBRAIA, Adão Caron; HINTERHOLZ, Lucas Tadeu. (2021) Pensamento computacional por meio da computação desplugada: Desafios e possibilidades. In: Anais do XXIX Workshop sobre Educação em Computação. SBC. p. 468-477.

KNIPHOFF DA CRUZ, Marcia Elena Jochims; MARQUES, Samanta Ghisleni; TAVARES, Tainã Ellwanger; OLIVEIRA, Wilk; SEELIG, Gustavo Baumgarten. (2021) Normas, Diretrizes e Material Didático para o Ensino de Computação na Educação Básica Brasileira. In: simpósio brasileiro de educação em computação (educomp), 3. , 2023, Evento Online. Anais [...]. Porto Alegre: Sociedade Brasileira de Computação . p. 337-346. DOI: https://doi.org/10.5753/educomp.2023.228332.

RIBEIRO, Leila; FOSS, Luciana; CAVALHEIRO, Simone André Da Costa; CRUZ, Marcia Elena Jochims Kniphoff da; FRANÇA, Rozelma Soares de. (2023) O Padrão Brasileiro de Computação Escolar. In: Proceedings of the 54th ACM Technical Symposium on Computer Science Education V. 1 (SIGCSE 2023). Nova York, NY, EUA: Association for Computing Machinery. p. 53-58. Available at: https://doi.org/10.1145/3545945.3569863.

BULCÃO, Jeanne da Silva Barbosa et al. (2019) Computação desplugada divulgada aos descritores de Matemática do SAEB: Um relato de experiência. In: Anais dos Workshops do Congresso Brasileiro de Informática na Educação. page. 407.

FORD, Vitaly; SIRAJ, Ambareen; HAYNES, Ada; BROWN, Eric. (2017) Capture the Flag Unplugged: uma competição cibernética offline. In: Proceedings of the 2017 ACM SIGCSE Technical Symposium on Computer Science Education (SIGCSE '17). Nova York, NY, EUA: Association for Computing Machinery. p. 225-230. Available at: https://doi.org/10.1145/3017680.3017783.

MILLER, B.; KIRN, A.; ANDERSON, M.; MAJOR, J. C.; FEIL-SEIFER, D.; JURKIEWICZ, M. (2018) Unplugged Robotics to Increase K-12 Students' Engineering Interest and Attitudes. In: 2018 IEEE Frontiers in Education Conference (FIE), San Jose, CA, USA.

NAKAMURA, T.; KAWASAKI, T. (2019) Computer Science Unplugged for Developing Computational Thinking and Mathematical Thinking. In: 2019 International Joint Conference on Information, Media and Engineering (IJCIME), Osaka, Japão.