

ARTICLE

TIMELINE OF PUBLIC POLICIES FOCUSED ON EDUCATIONAL COMPUTING¹

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RESUMO: Nos últimos cinquenta anos, a computação tem sido gradualmente integrada ao sistema educacional brasileiro. Essa integração passou por várias fases e programas, cada um com suas metas e desafios. Desde o Decreto nº 84.067, em 1979, que instituiu a Política Nacional de Informática, até a criação do ProInfo, em 1997, e a Política de Inovação Educação Conectada (PIEC), em 2023, houve progressos significativos, mas também dificuldades na implementação eficaz dessas políticas. Este estudo busca compreender em um contexto histórico as políticas públicas voltadas para a computação, explorando a sua evolução no âmbito da educação brasileira, destacando iniciativas e programas que moldaram a inserção de tecnologias digitais no ensino. Para a construção deste artigo, foi adotada uma abordagem qualitativa, com pesquisa bibliográfica. Com esse histórico, foi possível construir uma linha do tempo interativa que apresenta as políticas públicas concebidas no Brasil para a informatização das escolas e formação de professores, culminando no ensino da computação, proposto atualmente para as escolas de educação básica brasileiras, na Base Nacional Comum Curricular e seu Complemento.

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Palavras-chave: Políticas públicas, ensino da computação, licenciatura em computação.

TIMELINE OF PUBLIC POLICIES FOCUSED ON EDUCATIONAL COMPUTING

ABSTRACT: Computing has been gradually integrated into the Brazilian educational system over the last fifty years. This integration has undergone several phases and programs, each with its own goals and challenges. From Decree No. 84,067 in 1979, which established the National Informatics Policy, to the creation of ProInfo in 1997 and the Connected Education Innovation Policy (PIEC) in 2023, there have been significant advances, as well as challenges, in implementing these policies effectively. In this study, we aim to understand, in a historical context, public policies focused on computing, explore their evolution within Brazilian education, and highlight initiatives and programs that shaped the integration of digital technologies into education. To develop this article, we adopted a qualitative approach based on bibliographic research. Based on this historical overview, we constructed an interactive timeline presenting the public policies developed in Brazil for the computerization of schools and teacher education, culminating in the teaching of computing currently proposed for Brazilian basic education schools in the National Common Curricular Base and its Supplement.

Keywords: Public policies, computing education, degree in computing.

LÍNEA DE TIEMPO DE LAS POLÍTICAS PÚBLICAS ORIENTADAS A LA COMPUTACIÓN EDUCATIVA

RESUMEN: En los últimos cincuenta años, la computación ha sido gradualmente integrada al sistema educativo brasileño. Esta integración ha pasado por varias fases y programas, cada uno con sus metas y desafíos. Desde el Decreto n.º 84.067, de 1979, que instituyó la Política Nacional de Informática, hasta la creación del ProInfo, en 1997 y la Política de Innovación Educación Conectada (PIEC), en 2023, se han registrado avances significativos, así como dificultades en la implementación efectiva de estas políticas. Este estudio busca comprender, en un contexto histórico, las políticas públicas orientadas a la computación, explorando su evolución en el ámbito de la educación brasileña y destacando iniciativas y programas que han moldeado la incorporación de tecnologías digitales en la enseñanza. Para la elaboración de este artículo, se adoptó un enfoque cualitativo, con base en la investigación bibliográfica. A partir de este recorrido histórico, fue posible construir una línea de tiempo interactiva que presenta las políticas públicas concebidas en Brasil para la informatización de las escuelas y la formación de docentes, culminando en la enseñanza de la computación, actualmente propuesta para las escuelas de educación básica brasileñas en la Base Nacional Común Curricular y su Complemento.

Palabras clave: Políticas públicas, enseñanza de la computación, licenciatura en computación.

INTRODUCTION

Over the past five decades, the integration of computing in Brazilian education has traveled a path full of advances and challenges. From the first steps in the 1970s to the most recent policies, such as CNE/CEB Resolution No. 2, which prohibits the use of cell phones in school premises

(MEC, 2025), government initiatives have sought to adapt the educational system to contemporary technological requirements. While progress has been remarkable, difficulties remain in implementing these policies effectively, reflecting the complexity of integrating technology and education in a country with large regional and infrastructural disparities.

The evolution of public policies shows a continuous effort to democratize access to digital technologies in schools, promote teacher training, and prepare students to work in the labor market and in a society in constant transformation. Programs such as EDUCOM - *Projeto Educação com Computador* (Valente, 2006), PRONINFE - *Programa Nacional de Informática Educativa* (Almeida; Valente, 2016), and ProInfo - *Programa Nacional de Informática na Educação* (Brasil, 2007) were important milestones in this trajectory, despite their limitations and discontinuities. The creation of the Licenciature degree in Computer Science represents a crucial step to train professionals capable of working in basic education; however, uncertainties remain about the consolidation of this field of action and the recognition of the need for these professionals in educational practices (Castro; Vilarim, 2013).

The recent inclusion of computer education in the National Common Curricular Base (BNCC) (Brasil, 2022) and the National Digital Education Policy (PNED) (Brasil, 2023) indicates a significant advance in valuing digital skills as an integral part of students' basic education. However, effective implementation of these policies and the creation of a specific curricular component for teaching computing depend on broader debate and collaboration among managers, educators, and policymakers.

In a historical context, we aim to understand the public policies focused on the teaching of computing, exploring its evolution in the scope of Brazilian education and highlighting initiatives and programs that shaped the insertion of digital technologies in education, culminating in its consolidation as one of the competencies of BNCC to be developed in basic education. The theoretical contribution of this research is to deepen the debate on integrating computing in basic education through a critical analysis of historical milestones, public policies, and movements that led to the formulation of the Supplement to the BNCC.

Through documentary and bibliographic analysis, the study presents a historical panorama that culminates in an interactive timeline of the main educational policies aimed at the informatization of schools, enabling an understanding of the challenges faced and the advances achieved. In addition, the work explores creating training programs for teachers who graduated in computing as a strategy to implement public policies to teach computing in basic education schools.

This study therefore not only offers a comprehensive overview of the evolution of computing education in Brazil, but also contributes to reflection on the importance of effective public policies and adequate teacher training to meet current educational requirements.

RESEARCH METHODS

This study adopts a qualitative approach focused on interpreting subjectivation processes and analyzing human experiences. According to Jaques *et al.* (2020), in qualitative research, the researcher investigates texts, images, and narratives from a constructivist or interpretivist ontological perspective, which views reality not as a fixed, objective entity but as subjective and continually constructed and reconstructed through human interactions. Thus, reality is considered historical, socially constructed, and shaped by the cultural context (Jaques *et al.*, 2020).

To analyze the evolution of public policies on computing in Brazilian education, we used bibliographic research as a data collection method, which, according to Gil (2008, p. 69), is "essential for historical studies". The documents examined include laws, decrees, ordinances, government programs, and other official records outlining the trajectory of information technology in schools, as well as academic studies, articles, books, and theses discussing the teaching of computing in Brazil.

The historical survey covers the first initiatives of informatization in schools, from public policies to the approval of the BNCC in 2017, which introduced the teaching of computing in basic education, to the approval of its supplement in 2022, which structured this proposal across the school years.

To conduct the historical survey, we used Google Scholar, as the search scope was not limited to peer-reviewed scientific articles. The investigation also demanded access to national legislation, both old and recent, as well as normative documents and publications published on official websites. In this sense, Google Scholar proved an appropriate tool for broadening the range of results, enabling the location of academic publications, legal documents, and other relevant institutional sources in a single search environment. The search was conducted from October 2023 to February 2024, as one of the specific objectives of the doctoral thesis entitled "*Ensino da Computação na Educação Básica: Implementação do Complemento à BNCC nas Escolas Públicas Municipais de Santa Maria, RS*", defended in July 2025. Based on the identification and analysis of these materials, the study examined public policies and relevant legislation, enabling the creation of an interactive timeline tracing the evolution of public policies aimed at informatizing Brazilian schools and training teachers licensed in Computer Science.

This timeline serves not only as a visual tool, but also as an educational resource that synthesizes the main milestones and challenges identified in the analyzed studies on the implementation of computing education in basic education. The method used provided a comprehensive and critical view of the evolution of information technology public policies in education, until their consolidation into the term computing, from their inclusion in the BNCC, highlighting the importance of adequate teacher training and the need for effective public policies to meet current educational demands in an increasingly digital world. This section then presents the public policies identified in this research.

BRAZILIAN PUBLIC POLICIES AND COMPUTER SCIENCE EDUCATION

In Brazil, information technology has been used in education for just over half a century. Although it may seem like a long time, it may not have reached its full potential because of constant technological updates. According to Valente and Almeida (1997), the use of technology in education began in the 1970s, with some activities developed at universities in Rio de Janeiro and Rio Grande do Sul. At the same time, the Universidade de Campinas used computing to run simulations in chemistry and physics. In addition, the Instituto de Matemática, Estatística e Ciência da Computação developed software to teach programming languages to graduate students in Education. This system was part of a project "coordinated by Prof. Ubiratan D'Ambrósio and financed by the Organization of American States" (Valente; Almeida, 1997, p. 5, our translation).

In 1979, Decree No. 84,067 (Brasil, 1979) was instituted, creating the Secretaria Especial de Informática (SEI, Special Department of Informatics), linked to the Conselho de Segurança Nacional (National Security Council), to provide advice in the formulation of the Política Nacional de

Informática (PNI, National Informatics Policy), defined as a “higher body of guidance, planning, supervision, and inspection, especially with a view to scientific and technological development in the sector” (Brasil, 1979, p. 1, our translation). From these initial activities, we prepared a document on the application of information technology in basic education, funded by the Programa de Reformulação do Ensino (PREMEN, Education Reformulation Program) of the Ministério da Educação e Cultura (MEC, Ministry of Education and Culture). However, a program was established in the 1980s, only after two National Seminars on Informatics in Education, for the development of activities focused on the use of computers in public schools, called the Projeto Educação com Computador (EDUCOM, Project Education with Computers) (Valente; Almeida, 1997, p. 5). This project was implemented in five universities: Universidade Federal de Pernambuco (UFPE), Universidade Federal de Minas Gerais (UFMG), Universidade Federal do Rio de Janeiro (UFRJ), Universidade Federal do Rio Grande do Sul (UFRGS), and Universidade Estadual de Campinas (UNICAMP). These universities were established as reference centers for the project, which aimed to use the computer as a resource for teaching and learning.

According to Valente and Almeida (1997, p. 6, our translation), “the great challenge was to change the educational approach: to transform an education centered on teaching, on the transmission of information, to an education in which the student could perform activities through the computer and, thus, learn”. However, more than forty years after this proposal, this transformation in teaching and learning is still sought; thus, integrating information technologies enhances this process.

EDUCOM was implemented by SEI, with support from the Conselho Nacional de Desenvolvimento Científico e Tecnológico (CNPq) and the Financiadora de Estudos e Projetos (FINEP), starting in 1983 with the formation of its action team. Subsequently, in 1986, the project's activities were effectively initiated in schools (Valente, 2006). The reference centers have developed activities such as Logo² and differentiated applications in Mathematics, Physics, Chemistry, Biology, and Portuguese Language. Additionally, they conducted a bibliographic survey on information technologies in education, as well as on the formation of work teams and the implementation of activities in schools within the municipal, state, and federal education networks (Chaves *et al.*, 1983).

According to Oliveira (1997), each center developed different activities according to its needs. For example, EDUCOM-UFRJ was transformed into the Coordenação de Informática no Ensino Superior in 1989, directing its research toward educational technology and the cultural effects of computer use in teaching and learning. The EDUCOM-UFMG Center sought to investigate the use of computing in special education, as well as the creation and evaluation of educational programs using computers. EDUCOM-UFPE, on the other hand, focused its research on computer-based music education, computing in special education, and human resources training.

Studies conducted in the reference centers formed the basis for the approval of Law No. 7,232 in 1984 (Brasil, 1984), an important milestone for computing in Brazilian education. This Law established principles, objectives, and guidelines of the PNI to stimulate the “growth of informatics activities in a manner compatible with the country's development” (Brasil, 1984, p. 2, our translation). It also determined the application of public financial resources in computing activities,

² Logo - Uma linguagem de programação voltada para a educação
https://aprendizagemcriativa.org/sites/default/files/2020-11/Logo_uma_linguagem_de_programacao_voltada_para_a_educacao.pdf

as well as the training of human resources for service in the field and the “granting of tax and financial incentives, in favor of national companies, aimed at the growth of computing activities” (Brasil, 1984, p.2, our translation). According to Oliveira (1997, p. 27, our translation), with the approval of this Law, “a new chapter in the history of Brazilian education arises, characterized by federal government actions aiming to bring computers to basic education public schools”.

From the year 1987, an Immediate Action Program in Informatics in Education was developed with two objectives: a) creating Centers for Informatics in Education (CIED) to act as multipliers within public schools and b) establishing a human resources training program to work in these centers, called Projeto Formar (Rios; Habowski; Conte, 2018). Through this program, actions were taken to reformulate computing in education, culminating in the creation of the Programa Nacional de Informática Educativa (PRONINFE, National Program of Educational Informatics) and, at this time, ending funding for the EDUCOM project.

PRONINFE was created in 1989 by Ordinance No. 549 (Almeida; Valente, 2016) and “started from the assumption that information technology is a cultural asset to which everyone should have free access” (Almeida; Valente, 2016, our translation). Its primary objectives were to support the development of computing in basic education and in undergraduate and special education; promote the development of support infrastructure and the training of professionals to work within educational institutions; and disseminate the results of research projects and monitor and evaluate projects aimed at the use of computers in education (Almeida; Valente, 2016). Despite being well elaborated, the project was never implemented, according to Almeida and Valente (2016). According to Rios, Habowski, and Conte (2018, p. 5, our translation), PRONINFE was “a mirror of inconsistencies already found in EDUCOM, in which determinations arrive ready and, therefore, decontextualized from school daily life, as teachers and researchers are excluded from the processes of thinking and discussing”.

Almost ten years after the creation of PRONINFE, in 1997, through Ordinance No. 522 (MEC, 1997), the Programa Nacional de Informática na Educação (ProInfo, National Program for Informatics in Education) was created by MEC, whose purpose was to promote the pedagogical use of information and telecommunications technologies in public elementary and secondary schools of state and municipal networks (MEC, 1997). In 2007, the ordinance was transformed into Decree No. 6,300/07 (Brasil, 2007), which defines in its second article that ProInfo will achieve its goals and objectives through collaboration between the Union, the States, the Federal District, and the Municipalities, through accession (Brasil, 2007), passing to the MEC the function of implementing Information Technology Laboratories in the schools contemplated, with the use of budget amounts from the Fundo Nacional de Desenvolvimento da Educação (FNDE, National Fund for Education Development) (Gomes; Santos; Medeiros, 2021).

The objectives of ProInfo have not changed much since the ordinance was created, until Decree No. 6,300/07. According to the decree, the following are the Program's objectives:

- I - promote the pedagogical use of information and communication technologies in basic education schools in urban and rural public education networks; II - promote the improvement of the teaching and learning process with the use of information and communication technologies;
- III - promote the training of educational agents involved in the program's actions; IV - contribute to digital inclusion by expanding access to computers, connection to the World Wide Web, and other digital technologies, benefiting the school community and the population close to schools; V - contribute to the preparation of young people and adults

for the labor market through the use of information and communication technologies; and VI - promote the national production of educational digital content (BRASIL, 2007, p. 1, our translation).

ProInfo included schools with more than thirty students and electricity, and required the absence of an Information Technology Laboratory. The machines ran the Linux Educacional operating system, based on the Ubuntu Linux distribution. The program was structured in two formats: 1) ProInfo Urbano, which had fifteen workstations, each with one or more monitors for student use, in addition to two stations for the school's administrative area, as well as a network server, a router, and a laser printer; and 2) ProInfo Rural, which had four workstations, also with one or more monitors for student use, in addition to a server and an inkjet printer (Basniak; Soares, 2016).

According to Martins and Flores (2015), in the first phase of Proinfo, between 1997 and 2006, 14,521 of the 168,436 Brazilian schools were contemplated, at the federal, state, and municipal levels, totaling 8.62% of public schools. According to the authors, this percentage shows that the program was insufficient to achieve its goals during the study period. In the second phase of Proinfo, between 2007 and 2016, five schools from five cities were selected to receive the One Computer per Student Program (PROUCA): São Paulo (SP), Porto Alegre (RS), Palmas (TO), Piraí (RJ), and Brasília (DF). In this program, teachers and students were provided with a Classmate laptop and, later, tablets (Basniak; Soares, 2016).

PROUCA was established by Law No. 12,249 of 2010 (Brasil, 2010, p. 1, our translation), which, among other aspects, establishes, in Chapter II, Article 7, the objective of the project: "promote digital inclusion in public schools [...] through the acquisition and use of computer solutions". According to Almeida and Valente (2016, p. 64, our translation), "150,000 laptops were distributed to 350 state and municipal public schools, urban and rural, and each school should not exceed 500 students and teachers".

The most current public policy was launched in August 2023, under Ordinance No. 33, entitled Política de Inovação Educação Conectada (PIEC, Connected Education Innovation Policy) (MEC, 2023), which defines criteria for transferring financial resources to public schools of basic education to provide access to or improve internet speed in schools. To be met, institutions must have at least one enrolled student, an electrical network, and their Own Executing Unit³. In addition, the Departments of Education select eligible schools and designate a representative who must participate in training on the AVAMEC platform, a virtual environment organized by the Ministry of Education for various educational activities.

In view of the public policies described so far, we verify the government's intention to insert technologies within the school environment to provide students with better conditions of action in society and to meet the emerging demands that the technologies themselves have created through their evolution. This corroborates Oliveira (2022, p. 12, our translation), who states that it is necessary to create "public education policies appropriate to a market in constant transformation and that allow practical interaction between students and the labor market".

³ "It is a civil society with legal personality under private law, non-profit, which can be established at the initiative of the school, the community, or both. Several nomenclatures are used to name the Executing Unit (UEx); here are some examples: Caixa Escolar Associação de Pais e Professores Associação de Pais e Mestres Círculo de Pais e Mestre Unidade Executora" (MEC, 2014, p. 3).

In addition to the digital tools introduced in schools, public policies also sought to train human resources to act in the face of these technologies, first through the development of short-term programs for professionals working in the Departments of Education and, later, through the creation of undergraduate programs to meet demand. Following the article, the history and evolution of these undergraduate programs will be presented, with a focus on the Licenciature degree in Computer Science, which trains professionals to work in basic education schools where these policies are implemented.

LICENTIATE DEGREE IN COMPUTER SCIENCE AS A SUPPLEMENT TO PUBLIC POLICY

In the 1970s, the first computers began to arrive at Brazilian universities and, since then, their insertion in basic education has been studied, as well as the training of human resources to work with public school students at the federal, state, and municipal levels, in line with Valente and Almeida (1997). Computer Science programs were created to study these new teaching possibilities and computational tools, first at the Universidade Federal da Bahia (UFBA) and Universidade Estadual de Campinas (UNICAMP). Later, they were established at the Universidade de São Paulo (USP), Universidade Federal de Minas Gerais (UFMG), Universidade Federal de Pernambuco (UFPE), Universidade Federal da Paraíba (UFPB), and Universidade Federal do Rio de Janeiro (UFRJ) (Cabral *et al.*, 2008).

Recognizing the need to train professionals for basic education, educational policies such as EDUCOM (1983 - 1989) and PRONINFE (1989 - 1997) led to the establishment of the first Licenciature degree in Computer Science at the Universidade de Brasília (UNB) in 1997. However, discussions for its creation began in 1989. The Universidade de Santa Cruz do Sul (UNISC) was the second to offer the program, which began in 1999. Since 2012, the number of institutions offering this training has grown significantly (Santos; Hinterholz; Silva, 2017).

In 2002, a Reference Curriculum for Licenciature Programs in Computer Science was developed (Raabe; Brackmann; Campos, 2018) to guide the creation of programs aimed at training teachers in the field. This curriculum determined that the trained professional's performance should cover basic education, including the final grades of elementary and high school, as well as vocational education (SBC, 2002). In CNE/CES Resolution No. 5, of November 16, 2016, it was defined that Licenciature Programs in Computer Science should go beyond teaching activities:

I - have solid training in Computer Science, Mathematics, and Education aimed at teaching Computer Science at the levels of Basic and Technical Education and its modalities and the training of users of the Computer software infrastructure in organizations; II - acquire the ability to make use of interdisciplinarity and introduce pedagogical concepts in the development of Educational Technologies, producing an intelligent human-computer interaction, aimed at computer-assisted teaching and learning, including Distance Education; III - develop the ability to act as teachers, stimulating an investigative attitude with a critical and reflective vision; IV - be able to act in the development of advisement, motivation, and stimulation processes of learning, with the selection of computational platforms appropriate to the needs of organizations (CNE, 2016, p. 4, our translation).

According to CNE/CES Opinion No. 136 of 2012, the Licenciature program in Computer Science offers benefits to society by preparing teachers to develop citizens with the skills and competencies necessary to live and prosper in an increasingly technological and globalized world

and contributing to the economic and social advancement of the country (CNE, 2012, p. 4). Although several definitions exist for the role of professionals trained in computer science, uncertainties persist because of the constant changes and updates in this field. Thinking about this, Castro and Vilarim (2013, p. 21, our translation) ask: “What to teach professionals who will teach computer science tomorrow? What are the professional performance spaces? How to overcome prejudices and consolidate training in the face of so many variables?”

In this sense, Matos (2013) raises the question of the graduate's professional identity, because the Licenciature degree in Computer Science does not meet the full curriculum of either the educational or the computational field, which results in low recognition of the program within these two fields. However, the importance of interdisciplinarity for this professional goes beyond this limited perception.

In addition to all the concerns regarding the professionals who graduate from the Licenciature program in Computer Science, there is the need to generate a field of work after their training, given that there is still no computing discipline in the school curriculum of public basic education in Brazil (Castro; Vilarim, 2013; Matos, 2013). The lack of demand for these professionals leads graduates to seek other fields of activity outside their primary training. It creates a need to continue their studies through master's and doctoral programs to enable them to perform at higher levels of education, such as undergraduate and graduate education. On the other hand, the BNCC and the publication of its supplement offer more tangible possibilities for action in basic education. Thus, the next section of this article discusses the teaching of computing in the BNCC supplement.

TEACHING COMPUTING IN THE BNCC SUPPLEMENT

Teaching of computing in basic education has been the focus of several studies and public policies since the introduction of computers in Brazilian universities in 1970. However, these studies continue in academic research, even though computers and the internet are already part of many students' lives (Oliveira, 2022). According to a survey by the Centro Regional de Estudos para o Desenvolvimento da Sociedade da Informação (CETIC, Regional Center for Studies for the Development of the Information Society), as of 2021, 81% of Brazilians aged 10 and older access the internet daily (CETIC, 2021a). This percentage increased considerably due to the SARS-CoV-2 pandemic in the year before the research.

Also, according to CETIC (2021b), 91% of schools have desktop computers in operation, and 79% have laptops. In addition, 57% of schools received new equipment in the past five years, while 23% had their devices updated within the past year. Regarding the use of digital platforms in developing classes, 70% of schools in urban areas used these resources, whereas before the pandemic, this percentage was only 28%. It was also noted that state and private schools reached a higher percentage of digital platform use (80% and 75%, respectively) than municipal schools, which did not reach half that level.

CETIC's research shows that most schools have computers for developing technological activities, which supports teaching computing in basic education, as proposed in CNE Opinion No. 2/2022. This opinion was developed by a commission proposed in 2019, with changes to the team members in 2020 and 2021. Until its approval, it had a permanent collaboration with the Brazilian Computer Society (SBC), the Forum on Licenciature in Computer Science (ForLic), and the Centro de Inovação para a Educação Brasileira (CIEB, Innovation Center for Brazilian Education).

According to the opinion, the study of computing in basic education began with the creation of the programming language Logo, in 1967, by Seymour Papert, Cynthia Solomon, and Wally Feurzeig, as well as with the proposal of constructionism, an approach derived from constructivism, based on the idea that learning occurs through the construction of knowledge. However, from this perspective, the student acquires knowledge mainly through active practice, creating tangible and shareable objects (Raabe; Couto; Blikstein, 2020).

Subsequently, Paul Gilster proposed the concept of digital literacy in 1997, defining four main competencies for its development: the ability to search for information online, familiarity with navigating hypertexts, competence to compile data, and the ability to analyze content (Gilster, 1997). In 2006, Wing defined computational thinking as the resolution and understanding of problems through abstraction processes (Wing, 2006). Thus, this definition has evolved and has even been incorporated into public policies, as evidenced in CNE Opinion No. 2/2022, which describes the concept of Computational Thinking as

the set of cognitive skills to understand, define, model, compare, solve, automate, and analyze problems and possible solutions methodically and systematically through algorithms that are abstract and precise descriptions of complex reasoning, comprising steps, resources, and information involved in a given process. Computational thinking is currently understood as a necessary 21st-century skill (CNE, 2022, p. 12, our translation).

In this sense, Oliveira (2022, p. 12, our translation) states that there is an urgent demand “in computer training to avoid increasing social inequality and educate the population regarding the computational foundations essential to contemporary life”. CNE Opinion No. 2/2022 warns that the simple use and consumption of digital technologies can result in dependence on developed countries. To ensure technological independence, the opinion proposes premises for the inclusion of computing in basic education, dividing learning into three levels:

- 1) Development and recognition of basic patterns of objects (Early Childhood Education);
- 2) Understanding of Computing and its ways of explaining experiences, artifacts, and impacts on social reality, the environment, the economy, science, the arts (Elementary School); and
- 3) Understanding the potential of Computing for problem solving (High School) (CNE, 2022, p. 30).

The CIEB also contributed to studies on computing in basic education. In 2018, after analyzing three experts, the CIEB launched a curriculum that defines three axes for including technology and computing in schools' curricular proposals: Digital Culture, Computational Thinking, and Digital Technologies (Raabe; Brackmann; Campos, 2018).

In addition, the SBC developed guidelines for the teaching of computing in basic education, published by Ribeiro *et al.* (2019). These guidelines highlight the importance of computing in the formation of young people in the 21st Century, as they help in the comprehensive understanding of a world increasingly connected and immersed in digital technologies, enhance the ability of students to learn and solve problems, offer new forms of expression and reasoning, and act as an auxiliary resource in the learning of other subjects (Ribeiro *et al.*, 2019).

Resolution No. 1 of October 4, 2022 (MEC, 2022) was published based on research by the SBC and CIEB and after the approval of the BNCC, in 2017 for early childhood education and elementary education and in 2018 for high school, which introduced the teaching of computing in

basic education and updated the base document. This resolution entered into force in November 2022 and regulates the integration of computing in the different stages of basic education (Brasil, 2022). Since then, schools have debated whether to make computing a specific curricular discipline by hiring a licensed computer science teacher or to integrate it transversally alongside other topics addressed by the BNCC.

Considering these issues, in January 2023, Law No. 14,533 was enacted, instituting the National Digital Education Policy (Brasil, 2023), which defines in its second article the following priority strategies:

I - promotion of digital and informational competencies through actions aimed at sensitizing Brazilian citizens to the importance of digital, media, and informational competencies; II - promotion of online tools for self-diagnosis of digital, media, and informational competencies; III - training of digital, media, and informational competencies, including the most vulnerable groups of citizens; IV - facilitation of the development and access to platforms and repositories of digital resources; V - promotion of certification processes in digital competencies; VI - implementation and integration of connectivity infrastructure for educational purposes, which include universalization of school connectivity to high-speed internet and with adequate equipment for internet access in educational environments and promotion of the ecosystem of digital educational content, as well as promotion of data policy, including mobile access for teachers and students (Brasil, 2023, our translation).

This Law amends two provisions of the Law of Guidelines and Bases of National Education (Law No. 9,394, of December 20, 1996) (Brasil, 1996): Article 4, which addresses the State's duty regarding public school education, and Article 26, which provides for the basic education curriculum. Item XII was included in Article 4, addressing digital education broadly and guaranteeing connectivity for all public basic and higher education institutions. Paragraph eleven was included in Article 26, defining the creation of a curricular component within elementary and secondary education for the teaching of computing.

Although the Ministry of Education vetoed the paragraph defining the creation of the computing curriculum component, claiming that the proposal needs evaluation and approval by the CNE and by the Minister of Education, the Senate retained the paragraph. This suggests that studies on the issue will continue. In the next section, we will explore the timeline developed in this work for the public policies mentioned.

TIMELINE OF COMPUTING TEACHING IN BRAZIL

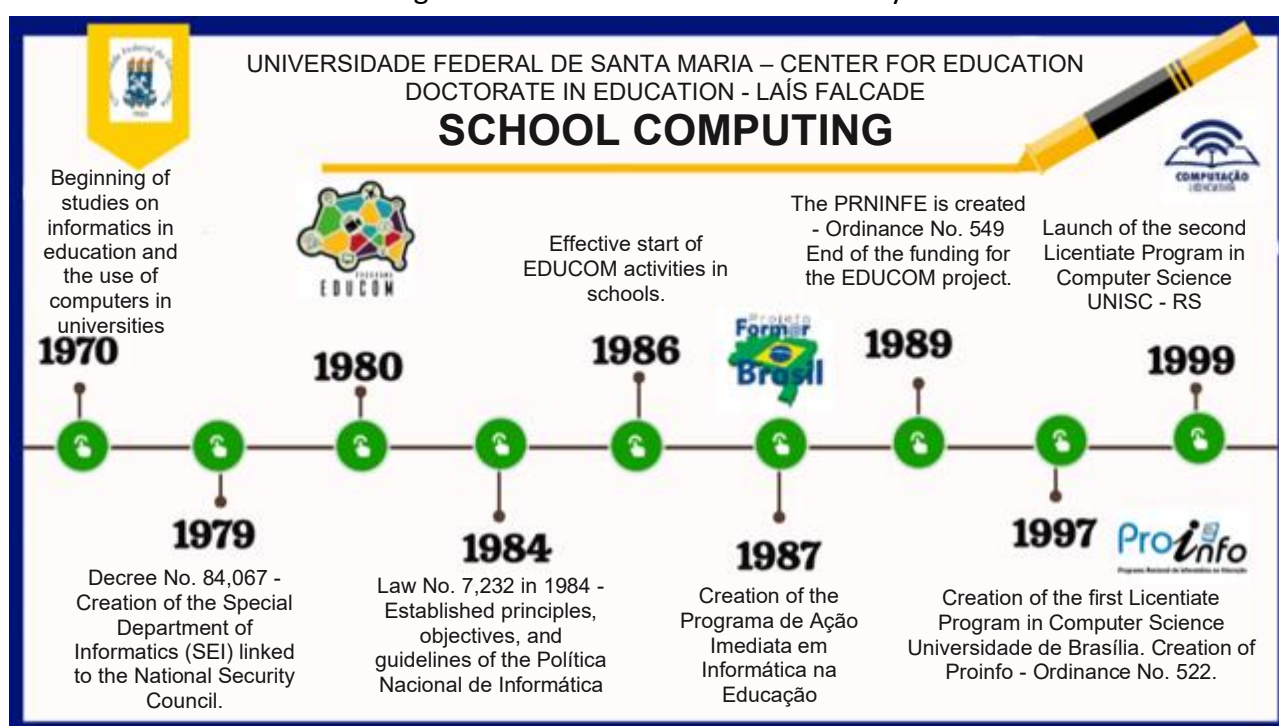
Based on the analyses performed, we prepared an interactive timeline that includes only official documents, legislation, and formally published resolutions to present the results of this study systematically. Although municipal, state, and federal institutions developed several other initiatives and actions during the period investigated, we included in the timeline only the legal and regulatory frameworks officially established, ensuring greater documentary rigor and methodological delimitation. Figures 1, 2, and 3 present an overview of the evolution of discussions on the inclusion of computing within educational spaces, as well as an analysis of the history raised.

At the end of the twentieth century, especially between 1970 and 1999, there was a notable growth in the introduction of technologies in schools through the EDUCOM project, which aimed to computerize educational environments. After six years of inactivity, the project received

effective funding for three years before being shut down with the creation of the PRONINFE project. PRONINFE was designed to last for ten years, but was never implemented.

With the introduction of technologies in schools, it became evident that simply installing equipment would not be enough for effective use, due to school teams' lack of knowledge about these tools. To address this difficulty, the first training initiative was created through the Formar project to train professionals to use technologies and act as multipliers within schools. The end of this period marked the creation of two Licentiate Programs in Computer Science, aimed at training professionals to work in computerized environments, highlighting managers' concern for ensuring the effective implementation of developed public policies. Figure 1 shows the timeline of activities developed in the twentieth century.

Figure 1 - End of the Twentieth Century.



Source: Own authorship (2023).

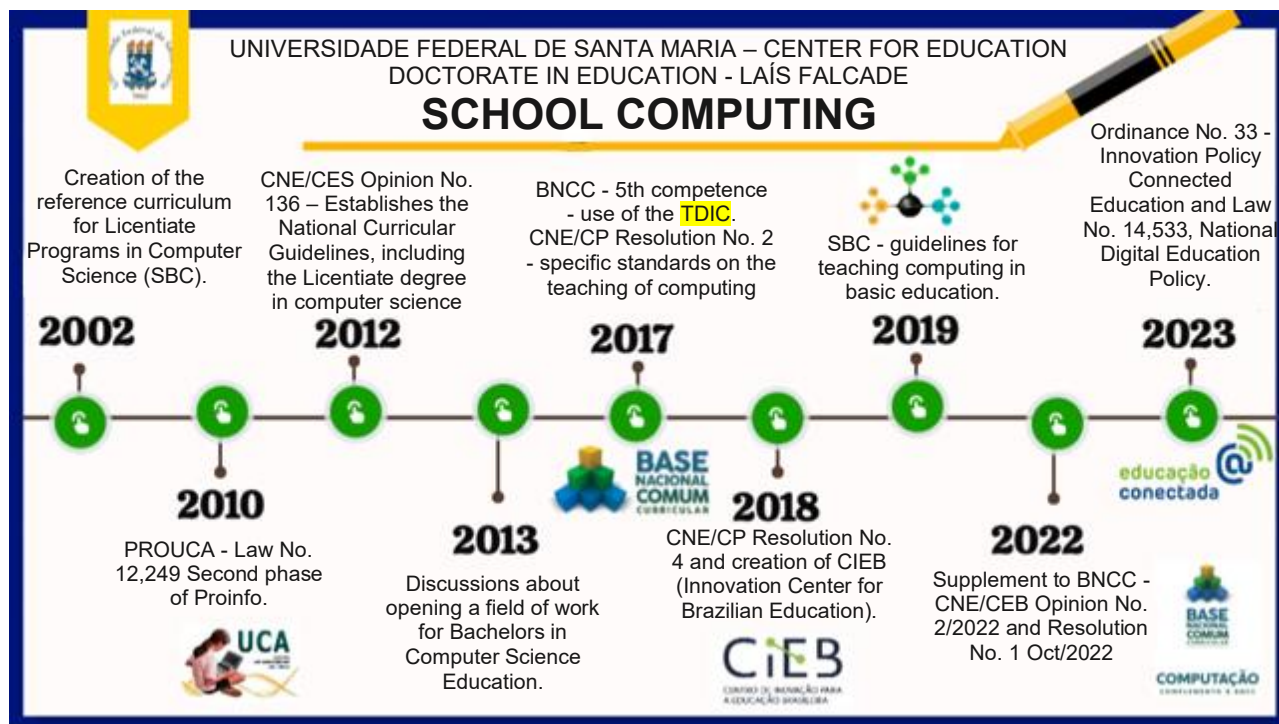
The year 1997 was marked by the creation of ProInfo, and this program led to significant advances in the technologies implemented in schools, with funding from FNDE. This project was developed in two stages: the first occurred between 1997 and 2006, promoting the insertion of computers in urban and rural schools; the second, between 2007 and 2016, covered the PROUCA program, established in 2010, to provide one computer per student in participating schools with a maximum of 500 students and teachers. Despite being one of the most significant public policies, in the first stage it reached less than 10% of Brazilian public schools and, according to Martins and Paiva (2017), did not fully meet its objectives across different regions of Brazil.

At the beginning of the 21st century, public policies that emphasized the use of technologies in education, coupled with the continuous growth of Licentiate Programs in Computer

Science in Brazil, contributed to the inclusion of Information and Communication Technologies (ICT) in the 5th competence of the BNCC, approved in 2017 for early childhood education and elementary education, and in 2018 for high school. After the publication of these documents, a team was formed to study how computing would be taught in basic education. This team had the permanent collaboration of SBC and CIEB.

Based on these studies, the CIEB launched, in 2018, a reference curriculum for the teaching of computing, the SBC published, in 2019, a document with guidelines for computer education in basic education and, in 2022, the CNE released a supplement to the BNCC for the teaching of computing, along with Resolution No. 1 of October 2022, which established a one-year deadline for beginning the activities in schools. Many activities have been conducted since the publication of these documents; however, doubts remain, especially about creating a specific subject for implementing computer education. Figure 2 presents a timeline of organized public policies from the beginning of the 21st century to 2023.

Figure 2 - Beginning of the 21st century.



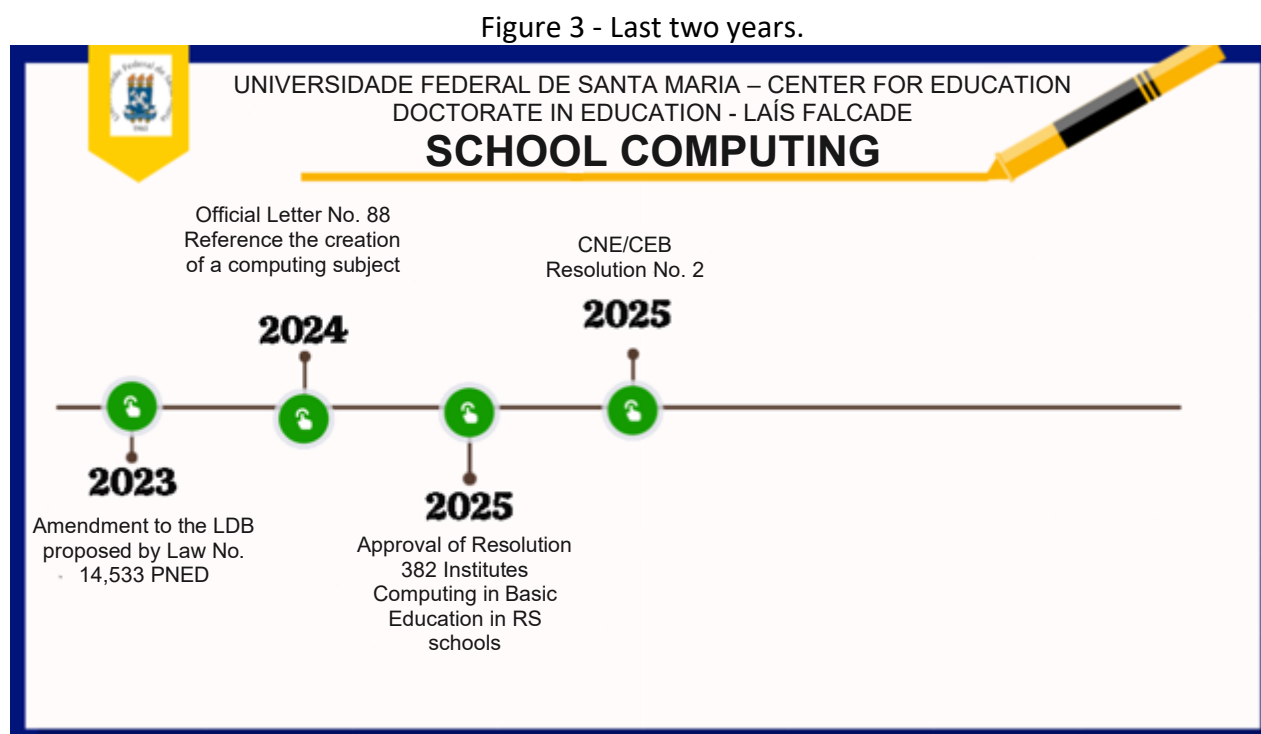
Source: Own authorship (2023).

In 2023, Law 14,533, PNED (Brasil, 2023), was enacted. Among other provisions, it establishes a curricular component for teaching computing. This definition sparked significant controversy, to the point that the Ministry of Education took a position against the aforementioned paragraph, which the Senate ultimately upheld.

In the State of Rio Grande do Sul, Resolution No. 382/2024 instituted the teaching of computing in Basic Education as a supplement to the Referencial Curricular Gaúcho (RCG, Gaúcho Curricular Framework), established by Resolution No. 379/2024. Approved in the first semester of 2025, this supplement recommends creating a specific curricular component for the area. However,

it allows a transversal approach, provided it is accompanied by ongoing teacher training in the axes defined by the BNCC supplement for teaching computing. Also in 2025, CNE/CEB Resolution No. 2 was published, establishing national operational guidelines for using digital devices in school environments and for the curricular integration of digital and media education in basic education.

Figure 3 shows the actions conducted in the last two years regarding the teaching of computing in Brazilian basic education.



Source: Own authorship (2023).

Based on the constructed timeline and the studies presented, it is possible to infer that this path is a promising route to realizing what was idealized in the 1970s, when the first projects to introduce technologies in schools began in Brazil. There is still a long way to go before computing education becomes a reality in all Brazilian basic education. However, many initiatives are already underway in the country, such as the creation of teaching materials that cover the skills proposed in the BNCC supplement and projects that promote this knowledge in public schools, including the teaching of Virtual Reality and the use of Artificial Intelligence.

To date, most public policies in Brazil have focused on equipping schools with technologies, such as the ProInfo and PROUCA programs. In this context, it is necessary to evaluate the current state of this equipment in schools and verify that they have been updated over the years to determine if institutions are prepared to implement computer education as proposed in the BNCC and identify the demands necessary for its effectiveness, both in the scope of physical infrastructure and curriculum.

Some cities have already introduced computing as a curricular component, while others have taken an interdisciplinary approach. It has not yet been defined in a tangible way how learning will be required of students, as this issue is under debate in higher bodies. While there is no definition, each institution can start activities as they consider most appropriate, provided it complies with the regulations established by the BNCC supplement.

FINAL REMARKS

The analysis of the evolution of public policies for teaching computing in Brazil reveals a path marked by advances and challenges, reflecting the growing importance of technology in education. From the first efforts in the 1970s to recent initiatives to integrate computing at BNCC, the path taken illustrates how the education system has adapted to emerging technological demands.

The trajectory of public policies in this study highlights the ongoing effort to modernize and adapt educational processes to technological innovations. The study shows the progressive maturation of government strategies, from pioneering initiatives such as EDUCOM and PRONINFE, which faced implementation limitations, to ProInfo and PROUCA, which represented significant advances in the informatization of schools. However, the limited scope and effectiveness of some programs underscore the need for a more integrated, contextualized approach.

The publication of the BNCC and its Supplement for teaching computing in 2022 (Brasil, 2022) marks a crucial advance, establishing clear guidelines for integrating technology into the school curriculum. The creation of a Licentiate Program in Computer Science reflects the need for specialized teacher training, essential to implementing these policies effectively. However, uncertainties about professional identity and demand for these graduates show the need for continuous reflection on the role of these professionals in basic education and the adequacy of training curricula.

In summary, this study provides a comprehensive view of the evolution of public policies on computing in Brazilian education, underscoring the importance of continuity in adapting educational strategies and training professionals. This study allowed us to create a timeline of actions related to computing in education and how this process unfolded over the years, culminating in the Supplement to the BNCC, which addresses the teaching of computing in Brazilian basic education. For the future, it is important to continue following the actions on the subject and how this implementation will occur, as it is necessary to continue reflecting on past practices and current guidelines to improve policies and ensure that the integration of technology in the school environment effectively contributes to the formation of citizens prepared for the current moment and a digital future.

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The contents underlying the research text are contained in the manuscript.

STATEMENT OF AUTHORSHIP:

Author 1 - Coordinator of the work, active participation in the data analysis, and review of the final writing.

Author 2 - Data collection, data analysis, and writing of the text.

Author 3 - Advisor to Author 1 and revision of the text.

CONFLICT OF INTEREST STATEMENT

The authors declare no conflict of interest with this article.