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ARTICLE

REMEDIATION FROM PRINT TO DIGITAL NARRATIVES: A PROPOSAL FOR AN ACTIVE METHODOLOGY USING SCRATCH[1]

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ABSTRACT: This study was motivated by a concern with the recurring reports of teachers and professors who work in High School and Higher Education about the deficiency of students regarding natural language written in the standard norm and the organization of solutions to problems related to employing strategies associated with computational thinking (CT). Given this challenging context, we conducted an Integrative Literature Review to analyze didactic sequences of works involving the construction of multimodal narratives in Elementary School, which simultaneously work on developing written language and CT. In addition, classroom teachers were also interviewed to listen to their experiences regarding the investigated theme. Four volunteers participated in these exploratory interviews. As a result of the Integrative Literature Review and the interviews, we proposed a didactic sequence that includes remediation as the axis around which natural language written in the standard norm is articulated with the authorship of digital narratives to strengthen the student as a writer and the conscious use of linguistic varieties and to develop computational thinking. For future research, it is important to apply the proposed didactic sequence in a classroom context for its validation and improvement.

Keywords: Digital Narratives, Remediation, Scratch, Computational Thinking, Written Language.

REMIDIAÇÃO DO MEIO IMPRESSO PARA NARRATIVAS DIGITAIS: UMA PROPOSTA DE METODOLOGIA ATIVA USANDO O SCRATCH

RESUMO: Este estudo foi motivado por uma inquietação diante dos recorrentes relatos de docentes que atuam nos Ensinos Médio e Superior quanto à deficiência dos estudantes no que diz respeito à linguagem natural escrita na norma padrão e à organização de soluções para problemas relacionados ao

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uso de estratégias associadas ao pensamento computacional (PC). Diante desse contexto desafiador, realizou-se uma Revisão Integrativa de Literatura com a intenção de analisar as sequências didáticas de trabalhos que envolvem a construção de narrativas multimodais no Ensino Fundamental, as quais trabalham simultaneamente o desenvolvimento da linguagem escrita e do pensamento computacional. Além disso, foram, também, entrevistados professores de sala de aula, com o propósito de ouvir suas vivências a respeito do tema investigado. Essas entrevistas exploratórias contaram com a participação de quatro voluntários. Como resultado da Revisão Integrativa de Literatura e das entrevistas, propôs-se uma sequência didática que inclui a remidiação como o eixo em torno do qual a linguagem natural escrita na norma padrão articula-se com a autoria de narrativas digitais, para promover o fortalecimento do estudante como escritor, o uso consciente de variedades linguísticas e o desenvolvimento do pensamento computacional. Por fim, para pesquisas futuras, considera-se importante a aplicação da sequência didática proposta em contexto de sala de aula, para sua validação e seu aperfeiçoamento.

Palavras-chave: Narrativas Digitais, Remidiação, Scratch, Pensamento Computacional, Linguagem Escrita.

REMEDIACIÓN DE MEDIOS IMPRESOS PARA NARRATIVAS DIGITALES: UNA PROPUESTA DE METODOLOGÍA ACTIVA USANDO SCRATCH

RESUMEN: Este estudio tuvo como motivación la inquietud causada por los reportes recurrentes — por parte de los docentes que trabajan en la educación secundaria y superior— acerca de la deficiencia de los estudiantes con respecto al lenguaje natural escrito en la norma estándar, y la organización de soluciones a los problemas con el uso de estrategias asociadas con el pensamiento computacional (PC). Para hacer frente a este contexto desafiante, se llevó a cabo una revisión integradora de la literatura con la intención de analizar las secuencias didácticas de trabajos que involucran la construcción de narrativas multimodales en la enseñanza fundamental, donde se trabaja simultáneamente con el desarrollo del lenguaje escrito y el pensamiento computacional. También fueron entrevistados profesores con el propósito de escuchar sus experiencias en relación al tema investigado. Como resultado de la revisión integradora de la literatura y de las entrevistas, se propuso una secuencia didáctica que incluye la re-mediación como eje en torno al cual se articula el lenguaje natural escrito en la norma estándar con la autoría de narrativas digitales; con el fin de promover el fortalecimiento del estudiante como escritor, el uso consciente de variaciones lingüísticas, y el desarrollo del pensamiento computacional. En la realización de las entrevistas exploratorias con los docentes, se contó con la participación de cuatro voluntarios. Finalizando, para futuras investigaciones se considera importante aplicar la secuencia didáctica, propuesta en este estudio, en el contexto del aula para su validación y perfeccionamiento.

Palabras clave: Narrativas Digitales, Remediación, Scratch, Pensamiento Computacional, Lenguaje Escrito.

INTRODUCTION

This study was motivated by the concern felt by its authors when faced with the recurrent reports of teachers and professors who work in High School and Higher Education regarding the deficiency of students concerning natural language written in the standard norm and the organization of solutions to problems related to employing strategies associated with computational thinking (CT). For Piaget (2012), reflective abstraction is the basis for forming formal thinking, which, in turn, is considered a prerequisite for formalizing problems at the computational level. Brito and Madeira (2015) drew attention to the fact that a large part of high school students has difficulties in formalizing problems into computational language due to their deficiency in basic mathematical knowledge and poorly built capacity for solving problems that require high abstraction levels. In addition to the authors who corroborate Brito and Madeira (2015), others identify additional factors connected to the dropout rates, failure in subjects, or passing with minimal results of students in computer science courses. Among these authors, we can cite the following:

1. Hinterholz and Cruz (2015) and Santos *et al.* (2015). Factor: Problem solving ability.
2. Brandão, Simão, and Souza (2014). Factor: Mastery of text interpretation and comprehension.
3. Souto and Duduchi (2009), Souza, Andrade, and Martins (2020) and Ribas, Dal Blanco, and Lahm (2016). Factor: Mathematical foundations.
4. Ribas, Dal Blanco, and Lahm (2016). Factor: Prerequisites in knowledge of programming logic, computers and software (games, internet, etc.).

Along the same line, but concerning the Portuguese language, Motta (2010) stated that the results of official exams such as the National High School Exam (ENEM) are alarming and prove what teachers and experts have reported about the low levels of use of the standard norm in students' writing. For the author, there are multiple culprits for this disaster:

> [...] the school that does not demand much from the student; the teacher who has not sought to rescue the quality in textual production; the students who do not show interest in evolving; but the responsibility must also extend to the students' parents who do not always have time, disposition, or conditions to monitor the performance of their children. (MOTTA, 2010, p. 2).

In this logic, given these challenges, we conducted an integrative literature review to analyze didactic sequences of works that involve constructing multimodal narratives in elementary school (a widely used strategy for developing written natural language with computational thinking) to evaluate what is already done and propose alternative procedures to work on these competencies. In addition, classroom teachers were interviewed to record their experiences regarding the construction of such multimodal narratives.

Thus, in order to organize the investigative route and record the methodological process and results, this article was divided into six sections in addition to this introduction. In the section called "Conceptual Foundation," the theoretical foundations that guided the methodological proposal are presented. In the "Methodology," the criteria used in the integrative literature review and the asynchronous interviews with classroom teachers are detailed. Subsequently, "Results of the Literature Review" discusses the evidence found in the literature review. In the "Results of Asynchronous Interviews" section, the considerations, and experiences of the participating teachers regarding the authorship of multimodal narratives are explained, followed by the methodology to be applied in classroom in the "Methodological Proposal" section, which is based on the literature review and the reports of the classroom teachers. Lastly, in "Final Considerations," the study results are highlighted, pointing out suggestions for future studies.

CONCEPTUAL FOUNDATION

To define the age range of students to support the integrative literature review, we considered the studies conducted with participants between seven and twelve years old, considering that, in the light

of Piaget's studies (2012), there is a transformation in this period that makes the child able to perform operations of all kinds. The operation, according to Piaget (2012), is understood as follows:

> [...] the notion of operation applies to very diverse, though well-defined, realities. There are logical operations, such as those that compose a system of concepts or classes (gathering of individuals) or relations; arithmetic operations (addition, multiplication, etc.), and their inverses [...]. An operation is then, psychologically, an action of any kind (bringing together individuals or numerical units, displacing etc.) whose origin is always motor, perceptual, or intuitive. (PIAGET, 2012, p. 48).

Therefore, in this period of life, the subject becomes mature enough to acquire the ability to organize the world logically but still does so in dependence on the concrete to perform abstractions (SOUZA; WESHLER, 2014). Given this stage of development of the individual, Scratch, a programming environment in blocks, has been used as a teaching alternative, with which students employ their logical ability to solve concrete problems. The practice of this ability, which still relies on the concrete in this period of a person's development, is essential for developing formal thinking, which is characteristic of the next stage of development and does not depend on the concrete world to perform operations and reflections on operations (PIAGET, 2012). In this context, in addition to the need for concrete at the stage before formal thinking, Moran (2018) highlighted the importance of so-called active methods.

> Deeper learning requires frequent practice spaces (learning by doing) and opportunity-rich environments. Therefore, multisensory stimulation and valuing students' prior knowledge to anchor new knowledge is crucial (MORAN, 2018, p. 3).

In other words, with active methods, in which students become responsible for their learning in a practical way, the subjects are expected to get involved voluntarily with their learning, instigated by curiosity, and hence promote their qualification. Thus, learning stops being an imposition from the teacher to the student and starts being perceived as an opportunity for personal growth. The evaluations, in this perspective, are not punitive but seek reflection on the process and self-improvement, both in the student and the teacher.

From this perspective, regarding assessment in an active method environment, João Mattar (2017) made the following observation:

> [...] assessment must be integrated into the learning process, continuously monitoring the learner, not limited to a grade at the end, and involving frequent feedback and not summarizing numbers. It should also evaluate not only the student but also the teacher and the adequacy of the teaching plan to the proposed objectives. It should also include hetero-evaluation (by the teacher, colleagues, professionals, experts, etc.) and self-assessment. (MATTAR, 2017, p. 97).

Therefore, evaluations, in the context of active methods, become a valuable instrument of growth for the student and constant reflection for teachers about their pedagogical practices and strategies. This study focused on using Scratch to support the authorship of digital narratives due to its wide dissemination in educational environments. Nevertheless, some reflections about the use of digital technologies, in general, in Education are appropriate at this point. There is a vast amount of literature on this subject (LÉVY, 1999; BONDIA, 2002; MORIN, 2003; MORAN, 2007; ILLERIS, 2009; MOREIRA, 2011; PAVANI; PARENTE; ORMANEZE, 2013; BANNELL *et al.*, 2016; MATTAR, 2017). Even from various theoretical assumptions, numerous texts have called attention to the fact that digital technologies are neither good nor bad, and their use represents a gain for learning only if they are situated in plan that integrates them into experiences that make sense to the student. In this context of integrated use of digital technologies, we can understand the little effectiveness, for instance, of isolated workshops with a technicist purpose, which are, most of the times, tedious and meaningless, in which the functionalities of applications or programming languages are randomly exposed without linking them to a project that speaks to the student's reality and educational needs, and without having their pedagogical purposes clear in a teaching plan. In this sense, Andrade and Sartori (2018) warned that:

> Life in the 21st century, especially the life of children and young people in big cities, has been increasingly mediated by the digital technologies of the urban age of consumption and information. Since the 20th century, this context has forced schools to rethink the relationship between theory and practice, science and technique; this happened, for instance, when many schools inserted into their routines the digital technology of computers, televisions, and, in some schools, tablets and digital whiteboards. However, the technological change alone did not bring more learning or innovation. (ANDRADE; SARTORI, 2018, p. 175).

To emphasize what matters most for education, the authors pondered whether:

> Dealing with intelligence technologies in the digital age involves recreating senses and meanings for the knowledge constructed and shared in networks. To innovate is to change actions, and behaviors, that is, to assimilate, in the experience of the gestures of narratives, of the daily journeys in the contexts of each classroom, new significant learning, and teaching experiences. (ANDRADE; SARTORI, 2018, p. 176).

Thus, in the quest to change behavior, digital technologies in education are seen as facilitating means integrated into a didactic sequence, which is organized to achieve what Young (2007) calls "powerful knowledge":

> It is powerful because it enables children to interpret and control the world; it is shared because all our children should be exposed to it. It is fair that it should be so. It is unfair and biased when children are given poor-quality knowledge that fails to take them beyond their experience (YOUNG, 2007, p. 249).

In this sense, in order to empower students, Moran, Masetto, and Behrrens (2013, p. 13) proposed an innovative education supported by four pillars: "integrative and innovative knowledge, development of self-esteem and self-knowledge, formation of creative students, and formation of students with social and individual values." Therefore, by integrating digital technologies in a teaching plan designed to support the development of cognitive and cultural aspects of students, one avoids the mistake of assuming that the use of technologies, by itself, can produce improvements in learning (LIVINGSTONE, 2008).

As for the concept of computational thinking, the founding element of this study, we resorted to Ribeiro, Foss, and Cavalheiro (2020):

> [...] the emphasis of computational thinking is not only on the products themselves (proofs or algorithms) but on the process of constructing these products. In addition to the abstractions required to describe algorithms, computational thinking also encompasses techniques for constructing algorithms, which are problem-solving techniques that can be applied in different contexts. […] This ability to systematize, represent, and analyze the problem-solving activity is called computational thinking (RIBEIRO; FOSS; CAVALHEIRO, 2020, p. 17).

In this way, the techniques of computational thinking, cited by the authors, relate to strategies that allow the transformation of information contained in a given problem into data that can be structured in such a way that dynamics compatible with programming languages can be applied, which will be transformed into machine language, so that the computer can perform the proposed tasks in order to solve the problem presented. At this point, it should be noted that human thought (HT) has the potential to generate conventions for communication, such as

1. Human Language (HL) - addressed to humans and, to some extent, to animals, which can understand human language always to a limited extent. Different conventions result in different languages.
2. Machine Language (ML) - mediated by the various programming languages and directed at machines.

From this point of view, the strategies used to communicate with humans through HL are broader than computational languages because they involve cultural and affective factors. From the authors' point of view of a text, HL presents two subsets: Human Spoken/Gesticulated/Tactile Language (HSGTL) and Written Human Language (WHL). The counterpart of these subsets, from the point of

view of the interpreter (human being), is the ability to hear/see/feel by touch and read/feel by touch — with content comprehension negotiated according to cultural and affective values (HALL, 2014).

Thus, to generate meaning production in HSGTL and WHL, a series of human thinking strategies are used, which Koch (2020) identifies as cohesion, coherence, situationality, informativeness, intertextuality, intentionality, acceptability, contextualization factors, consistency and relevance, focus, and shared knowledge. However, the author draws attention to the fact that these strategies are under constant revision by scholars in the field of meaning production.

Machine Language, in turn, consists of protocols that use a binary system for communication in machines equipped with hardware and software, which enable the interpretation of these conventions; that is, the production of machine language is intermediated by programs called compilers, which are associated with programming languages using specific instructions, thus allowing the steps to be encoded and organized in the algorithms. Thus, from the point of view of the coding author, there is the production of a code, and from the interpreter's point of view (machine), there is the decoding and execution of the orders in this code.

An algorithm is a sequence of structured, unambiguous, and finite steps to solve a specific problem. From this angle, the algorithmization process uses a series of strategies of human thought systematized with a view to their implementation utilizing computational artifacts. It integrates computational thinking, which still has abstraction, pattern identification, and decomposition as basic elements. Computational thinking implies discipline to systematize and organize the solution of a problem.

Moreover, as machines do not have the complications generated by cultural factors and do not have affective problems or existential crises, communication strategies with them are objective, following a model of encoding sender → decoding receiver, which does not apply to humans (HALL, 2014). Hence, the strategies used in constructing algorithms to implement in machines can sometimes coincide with the strategies used for building meaning in WHL or HSGTL and are sometimes inadequate for communication with people because of the complications arising from the cultural and psychic complexity of human beings.

Thus, at the level of strategies, a symbiosis will occur between the HWL or HSGTL and computational thinking in the set of strategies that are common to them. It is known that knowledge's genesis lies in the learner's interaction with the object of study (PIAGET, 2012). Therefore, every time the student interacts with the object of study using strategies common to the sets (WHL or HSGTL and CT) to author a satisfactory solution to a problem (e.g., cohesion and coherence strategies), they strengthen their ability to use them in both (WHL or HSGTL and CT).

When it comes to the sense-making of digital storytelling, a product aimed at humans, the symbiosis occurs through the intentionality of provoking a reaction in the user. Together, the WHL or HSGTL and the programming actions (resulting from computational thinking) increase the users' intellect since they reach their senses more fully, especially sight and hearing. Thus, there must be harmony between the communicative intent of the author of the WHL or HSGTL text and the programming in the context of today's technological limitations in order to generate a coherent message.

In this sense, the authorship of digital narratives using Scratch is a widely employed strategy in elementary schools to work simultaneously on developing natural written language and developing computational thinking. To conceptualize digital narratives, Preradovic, Lesin, and Boras (2016, p. 95) based their study on the multimodal process using digital resources, state that: "digital narrative commonly refers to the process of developing a multimodal narrative (which includes photos, videos, sound effects, music, or text) using digital tools." Girmen, Özkanal, and Dayan (2019), nonetheless, are narrower in their definition and include the integration of written language with multimedia elements as a mandatory feature of digital narratives:

> Digital storytelling, a functional approach to integrating writing skills with technology, is also used to enrich learning environments. There are many different definitions of digital storytelling, but in general, they all revolve around combining the art of storytelling with various digital multimedia.[2] (GIRMEN; ÖZKANAL; DAYAN, 2019, p. 55).

Therefore, when the written language is integrated with multimedia elements in an authoring environment that uses programming, the construction of meaning emerges from the harmonically constructed whole. This blending of written language with multimedia elements, if performed by the process of remediation, makes it possible to work, in an integrated way, on two fronts that, in recent years, have sparked great debates in Portuguese language teaching: linguistic variation and the standard norm.

Remediation, according to Bolter and Grusin (2000), means "the formal logic by which new media technologies reshape previous media forms" (BOLTER; GRUSIN, 2000, p. 273); that is, the process of remediation is the passing of ownership from one media to another, when one media is represented in another. This definition presupposes something developed in one media, which one must now desire to represent in another media. This indicates that to use this technique in the authorship of digital narratives, it is necessary to have a previous narrative created in a different media (e.g., film, print, and radio).

In this characteristic of remediation, one can observe the unique opportunity to recode the standard texts written in the printed medium into Scratch in a process involving computational thinking and integrating non-linguistic elements, favoring multilingualism. Thus, the remediation technique becomes central to the proposal of this study and involves the authorship of a text written in the standard norm for the printed medium and its remediation to Scratch.

Given the characteristics of Scratch, it is expected that, in the process of remediation, the language that had been written in the standard norm, by the requirement of the method proposed herein, undergoes profound changes, migrating to a linguistic variation specific to the new context built in the digital narrative, thus favoring what Faraco (2015) calls the pedagogy of linguistic variation, which advocates a pedagogy of the Portuguese Language that is well informed in the sociolinguistic context. Therefore, the teaching of Portuguese involves several dimensions and, therefore, several intersecting and interrelated pedagogies. Thus, we should think of a pedagogy of orality, reading, text production, grammar, construction of meaning, and pedagogy of linguistic variation, which should seek to integrate the phenomenon of linguistic variation positively and productively in all dimensions of Portuguese teaching, recognizing linguistic variation as intrinsic to the reality of any language and understanding that there is no such thing as a completely homogeneous language.

In this case, Faraco (2015) understands that language heterogeneity mirrors society's heterogeneity. For the author, every language is always heterogeneous in the multiple dimensions of language use. Hence, a consistent understanding also includes the many conditioning factors of linguistic variation, including the territory and its demographic history, socioeconomic hierarchies and their effects on education and access to cultural capital, the different age groups of speakers, the gender of each speaker, the activities in which the speaker is immersed at each moment, the context of interaction, and so on.

With this broad horizon as a reference, it is also worth thinking about a pedagogy of linguistic variation translated into methodological procedures in classroom. In other words, a pedagogy that does not run away from the heterogeneous reality of language but can aggregate it to the set of other pedagogies of this language. In this way, it will be possible to provide students with the opportunity to know and understand linguistic variation, respect its diversity, and move safely through the use of language in different contexts, including the formal context.

Furthermore, this heterogeneous reality of language and society opens up an opportunity to develop transdisciplinary didactic projects at school involving different areas of knowledge. In this way, a message of linguistic respect will be transmitted, knowing that each person's way of speaking mirrors their socioeconomic and sociocultural background. This means that speakers do not only have an individual history since their individuality results from their experience within a given society at a given historical moment. Working with such varieties in school, therefore, creates a favorable environment for understanding not only the individual but also the history and organization of a given society.

From this perspective, by placing the study of the standard norm in the universe of linguistic variation, this variety of language is given a new meaning that justifies its study and domain while preserving respect for other varieties that, in their contexts, acquire their values. Finally, using the

standard norm in environments where it is poorly understood or where another linguistic variety dominates is a basic error of communication (BORDIEU, 1989).

METHODOLOGY

This section will present the methods used in the literature review and the asynchronous interviews with classroom teachers.

Literature Review

The literature review followed the model of Integrative Review based on Moher *et al.* (2010) to analyze the didactic sequences reported in scientific papers about the construction of digital narratives in elementary schools in Brazil and, based on the results of this analysis, to propose procedures with the potential of offering pedagogical alternatives to work computational thinking and natural written language in the process of creating digital narratives. To this end, three databases were used: Periódicos Capes, Mendeley, and Google Scholar, using the following descriptors: "digital narratives" and "education." The research period was from 2015 to 2020, and 164 studies were found, nine of which (five articles and four master's dissertations) were used in the qualitative synthesis.

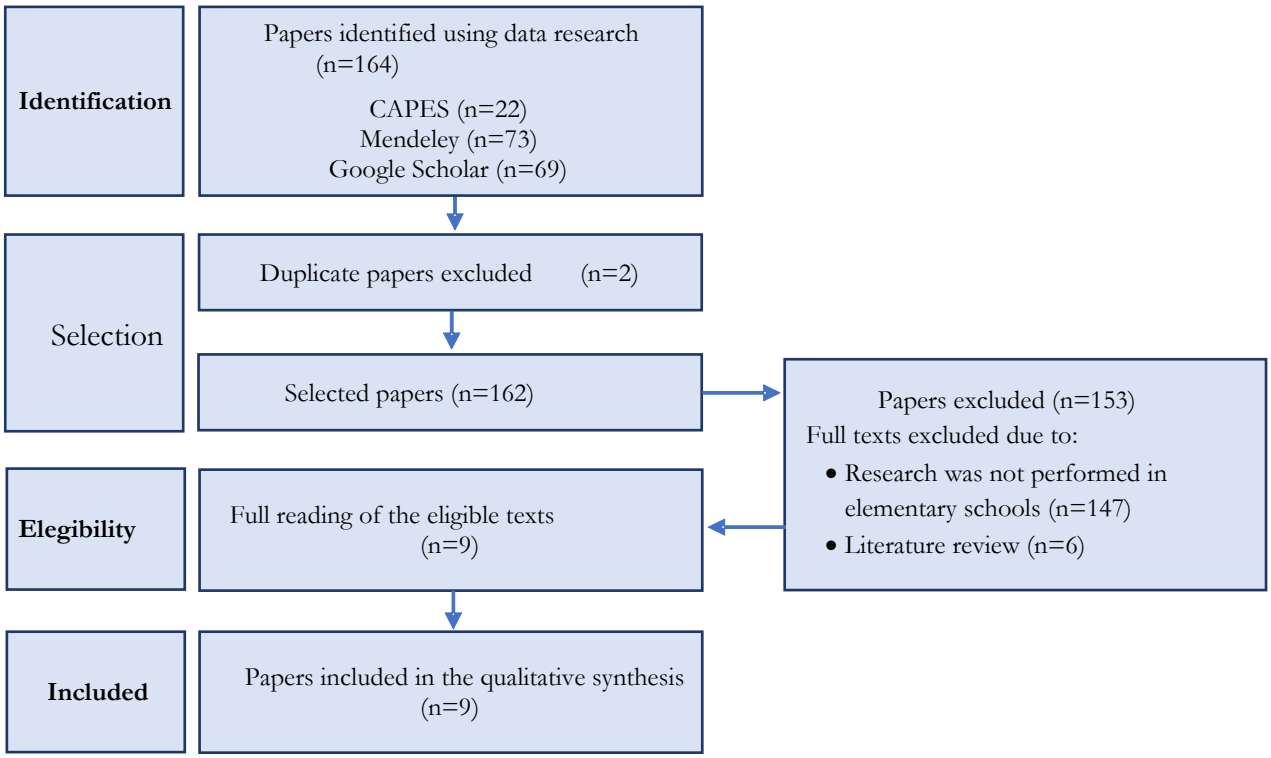

FIGURE 1 - Integrative Review Map

Source: Adapted from Moher *et al.* (2010).

Asynchronous interviews with classroom teachers

The invitations for participation were sent to the researchers' contacts and the "Scratch Brazil" WhatsApp group. In the invitation, the context of the study was explained, and the consent of the participants was requested; we also guaranteed the confidentiality of the answers of the interviews, in which their identities would be preserved, and the results obtained would be used only to improve this study's methodological proposal.

The asynchronous interviews were performed via WhatsApp with the volunteer classroom teachers. The interviews revolved around the main axes that guide our proposed methodology: 1) Construction of the script/argument; 2) Authorship of the digital narrative; 3) Evaluation of the process.

There was an asynchronous dialogue between the researchers and the participants, in which the opportunity was given for clarifications about the study, as well as for the teachers' free manifestation regarding the axes of the methodology and its applicability in their work contexts.

RESULTS FROM THE LITERATURE REVIEW

The studies included in the qualitative synthesis are listed in Box 1.

Box 1 - Texts of the qualitative synthesis

AUTHOR	YEAR	SOURCE/TYPE	OBJECTIVES
ALMEIDA, S. L. S.	2020	University of Brasília - UnB Master's thesis	To observe how elementary school teachers and students develop digital narrative projects using computing and the benefits of this use in the teaching-learning relationship.
BROCHADO, E. A.; HORNINK, G. G.	2020	Brazilian Journal of Pedagogical Studies - RBEP Article	To understand how 6th- and 7th-grade students in Portuguese Language classes learn to author digital narratives using Scratch.
CASTRO, A. de.	2017	Federal University of Technology Master's thesis	To introduce programming notions to children in the early elementary school years in the context of building digital narratives.
CRUZ, W. D. D.	2016	Pontifical Catholic University of São Paulo Master's thesis	To identify and analyze the knowledge developed and/or mobilized in the digital narratives produced by the students in the project "Light in My Life." To this end, a documentary survey of the narratives produced and published on the web was carried out.
ROCHA, M. A. S.; HORNINK, G. G.	2020	International Congress on Education and Technologies Article	This paper presents a didactic sequence that uses Scratch as a possibility of authorial creation in Portuguese Language classes, thus contemplating the general competencies of the Base Nacional Comum Curricular (BNCC). The goal is to describe a work possibility that contemplates the requirements proposed for using new digital media.
SILVA, M. A. da; BROCHADO, E. A.; HORNINK, G. G.	2018	#Tear: Journal of Education, Science, and Technology Article	To understand the contributions of the social-historical-cultural theory in the construction, in pairs, of digital narratives, through the Scratch software, with 6th-grade students in a state school in Campos Gerais/MG.
SILVA, M. A. da; HORNINK, G. G.	2019	International Congress on Education and Technologies Article	To understand the development of literary creativity, from the construction of digital narratives in Scratch, with students from the second cycle of an elementary school in a public school in southern Minas Gerais.
STELLA, A. L.	2016	State University of Campinas - UNICAMP Master's thesis	To analyze the use of technological resources associated with the disciplines of the elementary school curriculum. The context for using resources was the introduction of programming language concepts based on playful digital narratives, which can complement the process of logical reasoning development in children. For this, Scratch was used.
ZANETTI, H. A. P. *et al.*	2017	Journal of Technology, Society, and Knowledge Article	To present a proposal for a set of pedagogical practices to explore the content of programming logic and computational thinking in the context of creating digital narratives.

Source: Prepared by the authors

The integrative literature review analyzed didactic sequences of the production and evaluation process of Elementary School digital narratives. From this analysis, we found that the evaluation in all the studies presented (Table 2) revolves around the finished product and not the process of text construction, which is associated with computational thinking in the composition of the digital narrative. Therefore, the elements of the student's logic are lost and consequently, there are no safe criteria for elaborating more effective teaching-learning strategies that aim at developing text production in natural language and computational thinking since the refinement of teaching strategies derives from observing the whole process of constructing digital narratives and not only of what is presented as a finished/final product.

Another common feature of all the studies analyzed is the simplification of writing, which, in most cases, is restricted to a few dialogues without the pedagogical intention of working with linguistic variations to provide the full development of students as writers who can express themselves both in the standard variety of language and its other varieties depending on the chosen narrative context. In this sense, these simplified texts do not meet what is expected in terms of text production in elementary school, as stated in the BNCC:

> Text production (shared and autonomous writing) — (EF35LP25) Create fictional narratives, with some autonomy, using descriptive details, sequences of events, and appropriate images to support the meaning of the text, and markers of time, space, and character speech. (BRASIL, 2018, p. 132-133).

Therefore, the complexity of the written language expected in elementary school goes far beyond a few scenes with isolated lines from the digital narratives found in the literature review. This type of simplified language is a characteristic of digital narratives, so there is a need to work on the natural text in a stage prior to its incorporation into Scratch to optimize the methodology, thereby guaranteeing the student fuller development.

Another fact observed in the literature review is that the textual production of digital narratives using Scratch is not harmonically associated with computational thinking development, and this is likely because the BNCC (BRASIL, 2018) does not make this association explicitly since computational thinking is treated transversally and not specifically linked to programming. In this sense, it is worth considering the excerpts about computational thinking in elementary school present in the document:

> The area of Mathematics, in Elementary School, focuses on understanding concepts and procedures in its different fields and developing computational thinking aimed at solving and formulating problems in various contexts. (BRASIL, 2018, p. 471).
> Computational thinking: involves the ability to understand, analyze, define, model, solve, compare, and automate problems and their solutions, methodically and systematically, through the development of algorithms (digital technologies and computing). (BRASIL, 2018, p. 474).
> Use, propose, and/or implement solutions (processes and products) involving different technologies, to identify, analyze, model and solve complex problems in various areas of everyday life, effectively exploring logical reasoning, computational thinking, the spirit of inquiry and creativity (Digital technologies and computing). (BRASIL, 2018, p. 474).
> In addition, the BNCC proposes that students use technologies, such as calculators and spreadsheets, from the early years of elementary school. Such enhancement enables them, when they reach the final years, they can be stimulated to develop computational thinking through the interpretation and elaboration of algorithms, including those that flowcharts can represent. (BRASIL, 2018, p. 528).

Despite the absence, in the reviewed studies and the BNCC (BRASIL, 2018), of an association between textual production in digital narratives and computational thinking, it is evident that, for the construction of digital narratives, computational thinking strategies are at the service of the production of meaning of the text in natural language produced in a previous step. This says that natural language in a digital narrative using Scratch is closely linked to computational thinking strategies to produce a cohesive and coherent narrative.

This influence of computational thinking strategies in the construction of meaning in the digital narrative, based on a text written in natural language, is not addressed in the studies analyzed. This is the originality of the present work and the respective methodological proposal. In other words, the strategies of computational thinking used in a narrative should be in harmony with the meaning intended by the author when he wrote the text in natural language. Thus, it is reasonable to think that the principles of textual construction of the meaning of a text in natural language are intimately linked to the logic of computational thinking in a digital narrative, in a relationship of interdependence and symbiosis.

In this logic, four were the main findings coming from the integrative literature review:

1) The evaluation of the narratives is focused on the finished/final product, and the student places the simplified natural text directly into Scratch.
2) The natural language texts produced in the narratives fall short of what is expected for students in years 3 to 5 of elementary school, in terms of textual production, due to the characteristics of digital narratives.
3) There is no phase before the finished/final product in which natural language texts are worked on with greater ease, enabling the student to produce more mature texts.
4) Since there is no text prior to the finished/final product, the remediation process is impaired, as it is no longer possible to establish a relationship between natural written language production and computational thinking, which should be done from a natural language text written prior to the development of the digital narrative in Scratch.

Thus, we are facing a pedagogical approach that feeds and tends to perpetuate the deficiencies both in the production of text in natural language according to the standard norm and in the understanding of programming logic to solve a problem that, in this case, would be the construction of the meaning intended by the author of the text written in natural language. To break with this insufficient paradigm, there is a need for an alternative methodological solution that incorporates elements capable of promoting the construction of standard texts with the maturity expected from elementary school students. Moreover, this methodological solution should enable the conscious use of linguistic variants and, at the same time, strengthen the development of computational thinking, which is inserted in the BNCC, exactly by the nature of the contemporary context of a digital world, in which a digital culture was established, implying the development of skills and competencies for the construction of a digital intelligence, which allows the student to live adequately in this new dual social configuration (face-to-face and virtual).

RESULTS OF THE ASYNCHRONOUS INTERVIEWS

In all, four teachers gave their consent to participate in the interviews. All four participants belonged to educational institutions with a computer lab and an operational internet connection. To present the results obtained, the participants were named A, B, C, and D. The interviews were originally designed for the teachers to reflect on the axes of the methodological proposal of this study (1. Construction of the script/argument; 2. Authorship of the digital narrative; 3. Evaluation of the process) and evaluate its applicability in their work environments. However, the teachers preferred to narrate their classroom experiences with the authorship of multimodal narratives. Thus, the interview results were enriched with these experiences, which significantly contributed to the construction of the methodological proposal that will be presented in the next section.

Participant A has a degree in Pedagogy and a specialization in Technologies in Education; he taught elementary school in a private school and worked with Scratch, in an interdisciplinary way, in the area of mathematics. In the interview, this participant reported the work developed with 3rd-grade classes in the first quarter of 2021. The activities orbited around the concept of location, exploring the cartesian axes in an informal way. According to teacher A, there was a joyful involvement of students in creating texts and dialogue balloons, as well as excitement in the presentation of their work. In this context, the didactic sequence included: 1) Unplugged activities involving location problems on a printed grid; 2) Presentation of the Scratch tools; 3) Activity with tablets, in which students put into practice what they had learned about Scratch. Additionally, according to the report, the students created several scenes with content learned in math classes and presented their work to the class. In the composition of the narratives,

dialogues and other texts were created directly in Scratch, and there was no mention of the evaluation process.

Participant B has a BA, MA, and PhD in Languages. He taught Portuguese Language in a public elementary school. Although his experience did not directly involve Scratch, his testimony was rich in actions that can be used with this programming language, so he was included in this study. Teacher B recounted his experience constructing narratives in the form of comics as an extra activity done during after-school hours in the first semester of 2019 for students from 7th to 9th grade. Nine students signed up for this activity. The drawings of comics were hand-drawn by the student authors, with the possibility of digitalization, for sharing the work, which opened the opportunity for digital manipulation of the images. Regarding the didactic sequence, it included: 1) reading famous comics; 2) creating stories in written Portuguese language; 3) studying the parts that make up the "Comics" media; 4) studying drawing techniques; 5) transposing the stories to the HQ media. The dialogical evaluation focused on the texts of the stories and on how they were transposed to the comic book media, with division into scenes and drawings of the contexts and characters. In his comic book workshops, participant B stated that he always works with a simplified form of script, separating into columns the image and verbal resources (such as speech balloons and recollections) and sound resources (onomatopoeia). According to the participant, the focus of the work was always the page and distribution of the narrative in each panel. For instance, if the student planned an action sequence on a page with five panels, he needed to select each cut he would make of the scene (framing and angle) and how he would make the transition from panel to panel, almost as if he were building a paragraph of text. Therefore, the teacher sought to reconcile teaching the expressive role of verbal language (e.g., in dialogues) with the more general character of mastering a multimodal language, emphasizing the imagetic character of this media, which operates from visual grammar.

Participant C has a degree in Computer Science and worked as a Robotics teacher in private educational institutions; the participant had classes ranging from 6th- to 9th-grade elementary school students. In their report, the participant reported not often using Scratch in the classroom; however, in the face of the pandemic context, the participant realized that Scratch was a great alternative to developing computational thinking and programming practices. The teacher also stated that his students had difficulty producing the written part of the narratives and preferred to focus their attention on programming in Scratch. At this stage, as participant C reported, he used to recommend to his students to look for programs made in Scratch that worked similarly to what they wanted to serve as inspiration. He also stated that his students did not give enough importance to the planning part, the narrative creation, and the algorithm. According to the teacher, the students wanted to go straight to the programming part of Scratch, and the teacher did not mention the evaluation process.

Finally, Participant D served as an Instructional Designer for a non-profit institution. From 2016 to 2020, he and his team provided a vibrant, inclusive learning environment that was open to the community and offered a variety of events and activities. Students and the community created, experienced, and learned hands-on through projects, courses, and workshops organized by the space's staff and partners. As reported, during the COVID-19 pandemic, they worked remotely with the external public, offering online training courses, seminars, classes, and workshops. This public consisted of children, young people, and adults who would like to learn English differently. The teacher was working, at that moment, with a bilingual education class composed of children between 8 and 10 years old. As reported, there were six-hour meetings every week, in which some approaches that facilitated the investigation were used, such as project pedagogy and learning by doing.

Moreover, according to participant D, when planning a lesson for his students, there were always at least three pedagogical objectives: two related to the areas of science, technology, engineering, art, and mathematics, and a strong component of English language teaching. Moreover, the teacher said he used different approaches since he frequently attends continuing education courses to acquire pedagogical repertoire. For example, as he said, in a class based on project pedagogy, when he made the list of what he needed to learn to answer the pedagogical guiding question, he had already added the linguistic objectives (genre, format, appropriate language, jargon, etc.). When working with Scratch, participant D stated that he tried to keep in mind the pedagogical principles of the platform developed

from the concepts of Seymour Papert (1928–2016), one of the founders of the Media Lab[3] who, in turn, was inspired by Jean Piaget, with whom he worked in the 1960s. In the lockdown period, participant D developed a project with his students and was concerned with giving them visibility in a remote teaching situation. In this sense, the project's didactic sequence included: 1) reading books with a theme about families; 2) concepts such as diversity, cultural habits, and geography; and 3) reading in English (vocabulary, textual genre, format, audience, use of images, etc.). For the project's first deliverable, the students wrote a text, for their books, about their families. After completing this step, the students used some tools (among them Scratch) to create digital books that would make their texts visible to the whole school community. Like participants A and C, participant D did not mention his evaluation strategies.

In summary, participants A, B, and C have in common the development of writing directly in multimodal narratives without a previous step of developing the story argument in standard written language. This practice, also found in the integrative literature review, leads to the abbreviated use of written language typical of comics and digital narratives. It is noteworthy, however, that participant B made mention of a multimodal narrative script, which is different from the script called "screenplay." The script, as conceived for video production, is understood and oriented as follows:

> At this point, you write the text as if it were an essay. Put everything you have imagined into it, making one topic lead to another. Don't worry about other things; just concentrate on the description of the scene you imagine, scenarios, dialogues, actions, etc., and forget everything else. This is not the time to worry about camera framing or your movements. This step is later in the technical script. When you finish the script, you will already have a good idea of how your video will look. (BRASIL, 2010 , p.7).

This writing exercise requires the author to produce an articulated text in which the story is told in a complete, cohesive, and coherent way. Participant D mentioned the authorship of a text produced prior to the stage of its transposition to Scratch, which values the full development of the written language in English for the age group in question. Furthermore, it is significant to note that three participants did not want to go into the merits of the evaluation, despite being explicitly asked about it.

It is also noteworthy that participant A mentioned the collaborative action between him, who worked in a lab, and the mathematics teacher, who worked in classroom. This collaboration could also work for Portuguese Language, in which students would bring their texts (already developed with the Portuguese Language teacher) and carry out the transposition procedures of these texts and the programming of digital narratives in the lab. Undoubtedly, this kind of procedure would remove from the Portuguese Language teacher "the obligation" of being a programmer and mastering Scratch.

PROPOSAL OF A DIDACTIC SEQUENCE

The BNCC (BRASIL, 2018, p. 487) presents in its text, in footnotes 60 and 61, some concepts that can be useful for constructing an active method that privileges the symbiosis between natural language and computational thinking:

> The practices of reading and producing texts built from different languages or semiosis are considered multilingual practices to the extent that they require literacies in various languages, such as visual, sound, verbal, and body languages. The new literacies, on the other hand, refer to a set of specific digital media practices that operate from a new mentality governed by a different ethic (BRASIL, 2018, p. 487).
> Remediation is the process by which a genre or utterance migrates from one media to another. [...] (BRASIL, 2018, p. 487).

From this point of view, the concept of remediation to achieve multilingualism may be the missing element to promote a quality leap in the production process of digital narratives. In this sense, what is proposed in this study is the use of this technique to solve the problems found concerning text production in natural language regarding the quality and textual maturity expected from 3rd- to 5th-grade students. At the same time, it is expected to better prepare the students in relation to computational

[3] Teaching lab located at the Massachusetts Institute of Technology (MIT).

thinking, which should help them find solutions for the communicational intentions of the text written in natural language when remediated to Scratch.

However, before presenting the proposal for the didactic sequence, it is important to consider the need for prior planning. In this perspective, Foohs, Correa, and Toledo (2021) alerted to the following care:

> The first requirement is the space where the activity will be developed. Space concerns relate to the number of machines used, how students will work (in pairs, in groups, or individually), and also considerations regarding internet access. Scratch is also available offline via download, so you can work even in environments without internet access. In the planning, the teacher will also evaluate the effort time to develop the activity. Based on the tool use's learning curve, the teacher will plan the time for each activity session. Getting this metric right will depend on the teacher's knowledge of the software and the group's capabilities (FOOHS; CORREA; TOLEDO, 2021, p. 91).

As for the objectives, the authors made the following points:

> Scratch is a friendly tool, but programming concepts can be a complex subject, depending on the planned route and the expectation of the product shared by the large group. At this point, the teacher's experience with the tool assists them in making decisions regarding the project that will be undertaken and the complexity expected in the narratives the students will produce. Based on the educator's knowledge of the available tools, the project objectives will become clearer and more personalized for the construction of sequential narratives. (FOOHS; CORREA; TOLEDO, 2021, p. 92).

Therefore, after this stage of prior planning, to strengthen the natural language written in the standard norm, the conscious use of linguistic variations, and the development of computational thinking, the following didactic sequence is proposed:

1. Problematization of the theme, textual type, and genre.
2. Production of the text in natural language following the standard norm.
3. Appropriation of Scratch resources.
4. Remediation of the text written in the standard norm for Scratch, with the use of linguistic variations compatible with the constructed context.
5. Sharing digital narratives.

This didactic sequence incorporates the pillars proposed by Moran, Masetto, and Behrrens (2013), explained in the "Conceptual Foundation" section above. Specifically, in this didactic sequence model, the appropriation of a programming language is integrated, in an innovative way, with the development of the natural language in use. It is innovative because this integration strengthens the sense of self-esteem and self-knowledge through recognizing the communicative value of linguistic variation, strengthens the use of language in the standard norm, and contextualizes the teaching of programming strategies. The conscious effort to transform the standard norm into a linguistic variety appropriate to the characteristics of digital narratives contributes to the formation of more creative students, with social and individual values, because the habit of valuing language in use in its many varieties leads the individual to value himself in his communication context and to value the other in his communicational circumstances. Furthermore, in this didactic sequence, the procedural evaluation focuses on the production of texts in the standard norm and the remediation process of these texts to Scratch to form writers sensitive to the sociolinguistic context.

In problematizing the themes, types, and textual genres, it is important to explain to the students what it is intended that they produce. This means having classes dedicated to reading, understanding the theme, and exposure to the types and genres that will be worked on. This is a moment of enjoyment and internalization of textual structures, which can be quite enjoyable and serves as preparation for the authoring phase of a text in the standard norm.

In producing a text in the standard norm, one can work in small groups, favoring the process of idea generation and mutual support. The teacher, then, assumes the role of reader of the texts produced and not of an assessor to only assign a grade. As a reader, he will suggest changes in the text until it

reaches a satisfactory version. A limit of versions can be set, considering the time available for such curricular content within the planning of the school year. For Possenti *et al.* (2008):

> [...] to rewrite is also to make the text more appropriate to a certain purpose, a certain type of reader, a certain genre [...] when the student's text is subject to revision, we suggest that the errors [...] should be commented on and analyzed by the teacher (and students) and corrected when the texts are rewritten. (POSSENTI *et al.* , 2008, p. 13).

In this same line of thought, Fuhr and Sturm (2021) pointed out:

> The teacher's role should be that of a legitimate reader, capable of acting as a reader interested in the student's text and not as a hunter of errors, a practice normally done and that, many times, does not provide growth to the student nor effective improvement of his text. Of course, the function of the Portuguese Language teacher does not exclude care with the grammar of the language, which should serve as a guide for the students' production; however, the grammatical aspects cannot be considered a value in themselves, even in the evaluation. Thus, the evaluation of a text would comprise the pragmatic aspect, related to its functioning; the semantic focused on coherence (meaning); and the formal, which deals with cohesion (organization), the last two being responsible for the textuality, which makes a text not just a sequence of sentences. (FUHR; STURM, 2021, p. 2).

In the appropriation stage of Scratch resources, the students will learn the program in a laboratory space ("hands-on"), aiming to transpose the previously written text to the Scratch environment. Thus, there is no need for students to learn all of Scratch's resources, nor for all students to learn the same resources, but only those that concern and make sense concerning the text they wish to transpose.

In the step of remediation to Scratch, students will build the digital narrative with the resources they have previously learned. This moment can be very pleasurable since, with computational thinking strategies, students become authors of commands, and the machine executes them, producing the intended effects. Moreover, at this stage, students can consciously use a linguistic variety different from the standard norm, depending on the contexts of the narratives. It is also important to note that, still at this stage, the student will be urged to build the appropriate algorithms to solve the problems intrinsic to the programming necessary to cause the planned interactions. These interactions (between the narrative elements or between the narrative and the reader) can be complex, depending on the stage of development the student is at. In this sense, respect for the student's level of proficiency is of fundamental importance for him to persevere in the task of self-improvement, which the teacher should always stimulate.

Regarding the assessment of computational thinking, criteria used in programming classes can be used, such as:

1. Data collection: the process of gathering the appropriate information.
2. Data analysis: finding the meaning of data, finding patterns, and drawing conclusions.
3. Data representation: representing and organizing data in appropriate graphs, charts, words, or pictures.
4. Decomposing the problem: breaking tasks into smaller, manageable pieces.
5. Abstraction: reduce complexity to define the main idea.
6. Algorithms and procedures: series of ordered and chained steps to solve a problem or achieve some end.
7. Automation: using computers, or machines, to do repetitive or tedious tasks.
8. Simulation: representation or model of a process. The simulation also involves ongoing experiments using models.
9. Parallelization: organizing resources to simultaneously perform tasks to achieve a common goal.

Finally, in the sharing stage of the digital narratives, students will post their work in the space provided for this on the Scratch website and present their stories to their peers. Furthermore, for each of the phases foreseen in this didactic sequence, numerous classroom practices can be used from the

perspective of active methods. Therefore, it will be up to each teacher to choose the practices that best fit their context.

CONCLUDING REMARKS

This study was motivated by the concern with the recurring reports of teachers who work in Secondary and Higher Education regarding the deficiency of students concerning natural language written in the standard norm and the organization of solutions to problems related to the use of strategies associated with computational thinking. In this sense, for its realization, as research strategies, interviews with classroom teachers were used, in addition to the Integrative Literature Review.

In this follow-up, as a result of the Integrative Literature Review and the asynchronous interviews with classroom teachers, a didactic sequence was proposed that includes remediation as an axis, around which the natural language written in the standard norm is articulated with the authorship of digital narratives to promote the strengthening of the natural language written in the standard norm, the conscious use of linguistic varieties, and developing computational thinking.

It is noteworthy that, although the exploratory interviews with classroom teachers had the participation of few volunteers, the reports of their experiences were significant and contributed considerably to formulating the proposed didactic sequence.

The didactic sequence presented in this work does not awaken, yet, educators' need for formative and investigative actions, as found in the literature review. However, as the concept of remediation, which is already integrated into the BNCC, is consolidated in classroom practices, the model proposed in this study will tend to be more attractive to teachers who aim for teaching capable of promoting the strengthening of the student as a writer, the conscious use of linguistic varieties, and developing computational thinking.

Hence, we believe in the opportunity and significance of the proposal of this didactic sequence, for it incorporates innovative elements that facilitate the formation of creative students with social and individual values and stimulates the formation of the habit of appreciating language in its many variations, thus leading the students to value themselves in their communication context and value other individuals in the communicational environment.

For today's youth, the digital is not only an extension of the face-to-face, but it is intertwined with the latter in consumption and experience relations. More and more young people initially meet and establish ties in virtual environments and then transport these actions to the physical world. Whether this is controversial or desirable is a question beyond this study. Lastly, it is pivotal that future studies apply the proposed didactic sequence in a classroom context for its validation and improvement.

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Marcelo Magalhães Foohs: conceptualization, methodology, research, formal analysis, data curation, writing - original draft.
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DECLARATION OF CONFLICTS OF INTEREST

We declare that this article has no personal, commercial, academic, political, and/or financial conflicts of interest.