

# Educational products in the teaching area in professional graduate programs in Rio Grande do Sul: the state of knowledge in mathematics

## ABSTRACT

This article presents the results of a study that aimed to understand the state of knowledge regarding educational products developed in professional graduate programs (PPGs) in Rio Grande do Sul, in the field of Education, based on information obtained from the programs' official websites. The research sample consisted of 331 educational products, distributed across nine PPGs. This is a descriptive and analytical study, using a qualitative approach, whose data were analyzed using Content Analysis, as proposed by Bardin. The results showed a significant focus on Basic Education, which corresponds to 78% of the total products analyzed. Furthermore, an influence of the National Common Curricular Base (BNCC) is observed, considering the strong presence of products related to Fractions and Algebra content, although a growth in the approach to topics linked to Probability and Statistics is identified. Regarding the topics covered, the low incidence of products focused on teacher training is noteworthy, representing just over 10%, in contrast to the 43% related to digital technologies. Overall, the results indicate that the recent initiatives promoted by CAPES's Teaching Area, aimed at strengthening Basic Education, seem to be achieving some of their objectives, evidenced by the significant presence of teacher-researchers involved in the pursuit of improving their pedagogical processes.

**KEYWORDS:** state of knowledge; Mathematics education; technical-technological production.

**Luciano Andreatta-da-Costa**

[luciano-costa@uergs.edu.br](mailto:luciano-costa@uergs.edu.br)

[orcid.org/0000-0002-6455-5238](https://orcid.org/0000-0002-6455-5238)

Universidade Estadual do Rio Grande do Sul (UERGS), Porto Alegre, Rio Grande do Sul, Brasil

**Cleci Teresinha Werner da Rosa**

[cwerner@upf.br](mailto:cwerner@upf.br)

[orcid.org/0000-0001-9933-8834](https://orcid.org/0000-0001-9933-8834)

Universidade de Passo Fundo (UPF), Passo Fundo, Rio Grande do Sul, Brasil

# Produtos educacionais da área de ensino nos programas de pós-graduação profissionais do Rio Grande do Sul: o estado do conhecimento em matemática

## RESUMO

Este artigo apresenta os resultados de um estudo que teve como objetivo conhecer o estado do conhecimento acerca dos produtos educacionais desenvolvidos nos programas de pós-graduação (PPGs) profissionais do Rio Grande do Sul, na Área de Ensino, a partir de informações obtidas nas páginas oficiais dos programas disponíveis na Internet. A amostra da investigação foi composta por 331 produtos educacionais, distribuídos em nove PPGs. Trata-se de um estudo de natureza descritiva e analítica, por meio de uma abordagem qualitativa, cujos dados foram analisados à luz da Análise de Conteúdo, proposta por Bardin. Os resultados evidenciaram um expressivo enfoque na Educação Básica, que corresponde a 78% do total de produtos analisados. Observa-se, ainda, uma influência da Base Nacional Comum Curricular (BNCC), considerando-se a forte presença de produtos relacionados a conteúdos de Frações e Álgebra, embora se identifique um crescimento na abordagem de temas vinculados a Probabilidade e da Estatística. No que se refere aos temas contemplados, chama a atenção a reduzida incidência de produtos voltados à formação de professores, representando pouco mais de 10%, em contraste com os 43% relacionados às tecnologias digitais. De modo geral, os resultados indicam que os movimentos recentes promovidos pela Área de Ensino da CAPES, no sentido de fortalecer a Educação Básica, parecem estar alcançando parte de seus objetivos, evidenciados pela presença significativa de professores-pesquisadores envolvidos na busca pelo aprimoramento de seus processos pedagógicos.

**PALAVRAS-CHAVE:** estado do conhecimento; educação Matemática; produção técnica-tecnológica.

## INTRODUCTION

Professional graduate programs (PPGs) in the Teaching Area at the Coordination for the Improvement of Higher Education Personnel (CAPES) are characterized by the development of educational products associated with dissertations and theses. Although these products constitute texts or materials separate from the dissertations or theses, they are intrinsically connected to them, as they represent outcomes derived from the knowledge constructed through research. Moreover, they respond to demands raised by teachers and are closely related to the educational contexts in which they are implemented.

From a formative perspective, educational products constitute significant elements both for teaching practice and for the researcher's own professional development. In other words, the development of an educational product linked to a dissertation or thesis enables reflection on teachers' pedagogical practices within a specific school reality, while simultaneously fostering their development as researchers. The recognition of teachers as researchers of their own practice is considered one of the key strengths of professional programs, as it allows educators to problematize issues emerging from their daily school contexts and, through continuing education, seek alternatives to propose innovative solutions.

In order to understand the characteristics of this type of technical production—as educational products are designated by CAPES, and which have been gaining increasing visibility and volume nationwide—it is relevant to revisit the creation of the Teaching Area within CAPES itself. This approach allows for the identification of the objectives that led such production to become an integral component of final academic works. As part of the broader Multidisciplinary Area, the Teaching Area was one of four areas created on June 6, 2011, through CAPES Ordinance No. 83/2011. Its establishment resulted from the “nucleation of programs from the former Area of Science and Mathematics Education (Area 46), created in 2000 with only seven programs” (CAPES, 2019, p. 3).

One of the defining features of this movement was a shift from the so-called hard sciences or applied research toward “education in” and “teaching of”, particularly due to the growing prominence of multidisciplinary research (Rugarcia et al., 2000). Approximately thirty-five years after the establishment of the first programs of this nature, it is possible to state with confidence that these pioneering initiatives have yielded significant results, particularly in the formation of a critical community in Science, Technology, Engineering, and Mathematics (STEM) Education. In Mathematics Education, for example, among the programs currently recognized by CAPES, the Graduate Program in Mathematics Education at UNESP/Rio Claro stands out as a pioneer, with its master's program initiated in 1984 and doctoral program in 1993, alongside an internationally recognized academic journal.

In this context, Mathematics Education has played a central role in consolidating the Teaching Area. Goulart and Soares (2022), in their analysis of master's programs in Teaching related to Mathematics Education, identified 67 programs out of a total of 182 recognized by CAPES in this area, excluding those whose titles did not include the term “Mathematics”. In the Southern region of Brazil, which includes the state of Rio Grande do Sul (RS)—the focus of this study—21 out of 44 programs include “Mathematics” in their title, highlighting the

importance of Mathematics Education within the Teaching Area. Furthermore, according to Goulart and Soares (2022), the Southern region experienced significant expansion in Mathematics Education master's programs between 2010 and 2015.

This trend toward programs focused on teaching and learning processes, Basic Education, and teacher education has contributed to a strong alignment between the Teaching Area and the professional modality, whose creation and expansion are also relatively recent. Currently, approximately 52% of the PPGs in the Teaching Area are professional programs (Rizzatti et al., 2020). In these programs, students are required to develop an educational product that “must be applied in a real context and may take different formats” (Rizzatti et al., 2020).

In recent years—particularly during the 2017–2020 evaluation period—there has been notable progress in the characterization, validation, and evaluation of educational products. Rizzatti et al. (2020) describe the different types of educational products and their stages of development and propose an evaluation framework based on the following dimensions: complexity, documentation, impact, applicability, alignment, and innovation.

Educational products play a fundamental role in teaching and learning processes, as they allow teachers to diversify instructional activities and expand opportunities for knowledge construction. From CAPES's perspective for the Teaching Area, these products may take various forms, including: didactic or instructional materials; professional training courses; social technologies; software or applications; organized events; technical reports; collections; communication products; manuals or protocols; and letters, maps, or similar artifacts (Rizzatti et al., 2020).

In addition, educational products support the diversification and personalization of teaching, making learning more accessible and inclusive for different student profiles. They also function as powerful tools for innovation and continuous improvement in pedagogical practices, contributing to enhanced educational quality and the development of essential 21st-century competencies, such as critical thinking, creativity, and collaboration. Overall, educational products demonstrate significant potential and relevance in promoting quality education and preparing students to face contemporary societal challenges.

Given the centrality of educational products in professional graduate programs, there is a clear need to analyze this production and identify its main characteristics. Romanowski and Ens (2006) emphasize that studies aimed at mapping and synthesizing academic production enable the examination of existing knowledge, the identification of dominant themes and approaches, and the recognition of research gaps.

Based on this context, the following research question guides the present study: within Mathematics Education, what are the characteristics of the educational products developed in professional graduate programs in the Teaching Area in the state of Rio Grande do Sul? The general objective is to analyze these educational products, outlining an overview and identifying trends in this production. To achieve this objective, institutional websites of professional PPGs in the Teaching Area in RS recognized by CAPES were consulted, resulting in the

identification of a set of educational products that constitute the corpus of this study.

## **MATHEMATICS EDUCATION AND MATHEMATICS TEACHER EDUCATION**

The Mathematics Education movement is strongly connected to Basic Education and teacher education, both of which align closely with the Teaching Area. According to official documents of the area, research in Teaching is considered strategic for promoting transformations in Basic Education and for the education of teachers working at this level (CAPES, 2019). Although the Teaching Area also encompasses Higher Education and Technical Education, this article focuses on Basic Education after presenting the broader panorama.

In professional PPGs, teacher education is commonly referred to as “in-service teacher education”. This form of education is essential for teachers’ continuous professional development and for improving educational quality. In this regard, the works of Francisco Imbernón and António Nóvoa provide important theoretical contributions for understanding the challenges and possibilities inherent in this process, which is central to professional graduate programs. According to the Teaching Area, professional PPGs aim to provide continuing or in-service education for teachers working in Basic Education or other educational contexts. These programs promote teachers’ return to academia, encouraging reflection on their professional practice and the search for alternatives to enhance pedagogical work. Rôças and Bomfim (2018) support this perspective, noting that professional programs enable teachers to reinterpret their practice through reflective processes, which contribute to the formulation of research questions rooted in their lived realities.

Imbernón (2010, 2011) emphasizes teacher education as a continuous and contextualized process centered on reflection on practice and on the construction of knowledge from teachers’ experiences. According to the author, in-service education should provide opportunities for teachers to reassess their beliefs, experiment with new pedagogical approaches, and respond to the demands of constantly changing educational contexts. Continuing education is thus understood as an autonomous and collaborative process in which teachers actively participate in constructing knowledge and improving pedagogical practices.

Similarly, Nóvoa (1992, 1995, 1997) conceptualizes teacher education as a complex and multifaceted process influenced by individual, institutional, and sociocultural factors. He highlights the importance of articulating theory and practice and valuing both academic knowledge and professional experience. Nóvoa also emphasizes the need for educational processes that foster critical reflection, peer dialogue, and teacher engagement in research and innovation. From this perspective, teacher education is understood as an ongoing process of identity construction and professional development throughout the teaching career.

Together, Imbernón’s and Nóvoa’s perspectives offer complementary insights into in-service teacher education, highlighting reflection, collaboration, and contextualization as key elements in promoting professional development and improving educational quality. Applied to Mathematics teacher education, this

understanding reveals that professional programs—such as the Professional Master’s in Mathematics (ProfMat) and professional programs in Education and Teaching—have played a significant role in supporting in-service training. Focusing specifically on the Teaching Area, Mathematics is predominant in professional PPGs, appearing in the titles of 52 out of 103 graduate programs in this area (CAPES, 2025).

The in-service education of Mathematics teachers within the Teaching Area can be examined from two perspectives, as noted in the introduction: teachers as master’s or doctoral students, and teachers as developers of pedagogical or formative activities linked to their dissertations or theses, represented by educational products. In the first case, teachers returning to academia are afforded opportunities to reflect on their practice and propose interventions to improve their teaching. In the second case, educational products—particularly teacher education courses linked to mathematical content and teaching methodologies—gain prominence. Although still limited in number, as revealed later in this study, teacher education courses constitute one of the typologies recognized by the Teaching Area as Technical-Technological Production (Educational Products) and have been the focus of some studies developed within the analyzed PPGs.

Educational products addressing teacher education have been examined in studies such as Souza and Silva (2020), which focus on continuing education in Financial Education—a topic incorporated into Basic Education curricula through the National Common Core Curriculum (BNCC). The authors propose integrating financial education with citizenship education, enabling participating teachers to become familiar with curricular proposals for Financial Education in Basic Education (p. 84). They also emphasize the importance of teachers understanding different pedagogical conceptions related to the theme.

Moreira et al. (2001) also address continuing teacher education; however, unlike the previous study, they do not propose a concrete educational product in the form of a training course. Instead, the term “product” is used more generically, without detailed development. This approach is also present in Mathematics Education research, where teacher education may not be the primary focus of the educational product, but rather the context in which the product is applied. Nevertheless, the present study focuses specifically on the analysis of educational products.

Research articulated with extension activities also contributes to the inclusion of continuing education within professional PPGs. Panossian and Souza (2021), in their study conducted within the Group for Studies and Research on Teacher Education (GeForProf – UTFPR), demonstrate an articulation between research and extension that strengthens network-based research and attracts new researchers. Although educational products are mentioned, they are not emphasized, particularly given the academic nature of the program analyzed. In another extension-related study, Cardoso (2022) proposed an educational product in the form of an extension course for early-years elementary teachers and Pedagogy students. Participants reported that the integration of theoretical and practical components made Geometry—the course focus—more accessible.

Additionally, Frango and Kistemann Júnior (2020) investigated Mathematics teachers’ relationships with mathematical modeling and proposed an educational

product aimed at both initial and continuing teacher education. This product consisted of support material for teacher educators, organized into two sections: theoretical discussions on modeling and investigation in Mathematics classrooms and non-school contexts, and practical proposals involving problem situations. Among their findings, the authors concluded that the investigative scenarios promoted critical engagement in teaching and learning processes.

The training initiatives discussed above are also present in the corpus of the present study, indicating that in-service teacher education is a central focus of professional PPGs and is intrinsically linked to their institutional mission. Furthermore, Mathematics Education, in dialogue with professional graduate programs, has increasingly emphasized the development of didactic interventions.

## METHODOLOGY

This study adopts a qualitative research approach, grounded in the methodology employed by Ghiggi, Rosa, and Vizzotto (2023), who investigated the panorama of Brazilian doctoral theses in Science Education. The present analysis focuses on educational products developed within professional graduate programs in the state of Rio Grande do Sul that belong to the Teaching Area at CAPES.

This focus is justified by the relevance of examining the production of PPGs that participate in the Gaúcha Exhibition of Educational Products, an annual itinerant event held across different institutions in RS. Organized by professional PPGs, the event aims to bring together faculty members, students, alumni, Basic Education teachers, and undergraduate teacher education students to discuss the development and validation of educational products ([www.upf.br/mostragaucha](http://www.upf.br/mostragaucha)). In this context, the present study analyzes only PPGs located in RS and, based on this selection, discusses the characteristics of their educational production.

Following Romanowski and Ens (2006), the criteria for corpus selection were: educational products developed in professional PPGs in RS and linked to the Teaching Area at CAPES; no temporal restriction; reference to Mathematics teaching in the title or abstract; and availability on official program websites. The database was constructed from these websites, where educational products and their corresponding dissertations or theses were identified.

After defining the corpus, the educational products were analyzed in full, along with abstracts and other relevant sections of the associated dissertations or theses. The data were then organized to support analysis and the development of preliminary conclusions.

For data analysis, Bardin's (2011) Content Analysis framework was adopted, following procedures used in previous studies (Ghiggi, Rosa & Vizzotto, 2023; Costa, 2020; Costa & Barreto, 2024). This analytical approach consists of three stages: pre-analysis, material exploration, and data treatment. These stages are detailed in Table 1.

**Table 1**
*Research and Development Stages*

<b>Preliminary analysis</b>	Identifying data sources for consultation
	Reiteration of the question and objective of the study
	Search and selection criteria for the corpus
	Constitution of the corpus (educational products and their respective dissertations)
<b>Exploration of the material</b>	Access to and reading of the material (abstracts of dissertations and characterization of the products)
	Establishing certain categories a priori based on the study's objectives
<b>Treatment of results, inference and interpretation</b>	Summarizing the information in graphs and figures
	Analysis of the results based on the established benchmarks
	Building an overview and trends of educational products

Fonte: Adapted from Ghiggi, Rosa and Vizzotto (2023).

The research followed these steps, which are described below.

**PRE-ANALYSIS**

During the pre-analysis stage, the sources of consultation were identified, namely the institutional websites of the professional graduate programs (PPGs), since the dissemination of academic productions through this communication channel constitutes one of CAPES's evaluation criteria. This analysis focused on PPGs whose official titles include the term "Mathematics", as well as one program that, although not explicitly mentioning Mathematics, includes the term "exact sciences" in its designation, which implicitly refers to the field of Mathematics. Table 2 presents the selected programs, their respective host institutions, and the number of works identified.

**Table 2**
*Number of assignments involving mathematics*

PPG Code	Dissertations	Theses
PPG1	1	---
PPG2	31	---
PPG3	43	1
PPG4	106	5
PPG5	7	---
PPG6	51	---
PPG7	39	---
PPG8	104	---
PPG9	24	---

Fonte: Research data (2024).

Following the identification of the programs, the next stage involved consulting the websites of these programs in order to select the educational products. This consultation revealed that, in the vast majority of cases, the educational products were available. Specifically, in PPG1, access was obtained to the dissertation but not to the educational product; in PPG2 and PPG3, all dissertations and their respective educational products were accessed; in PPG4, 19 dissertations (18%) and 30 educational products (28.3%) could not be located, while all these were found, with the exception of one educational product (20%); in PPG5, materials were available only up to the year 2022, with all dissertations and six of the seven educational products identified; in PPG6, three educational products were not found and three works had not been applied; in PPG7, all dissertations and their corresponding educational products were accessed; in PPG8, 33 educational products and one dissertation were not located; and finally, in PPG9, 12 educational products were not found.

As a result, the study sample was restricted to 331 educational products. The procedure described above, as well as the identification of the number of products that comprised the research corpus, was carried out throughout 2024 by both authors independently, with no discrepancies identified.

## MATERIAL EXPLORATION

In the second stage, material exploration, the abstracts of the educational products and their respective dissertations or theses were read by both authors. At this stage, based on the classification of educational products established in the official documents of the CAPES Teaching Area, an initial set of a priori categories was defined. However, during the exploration of the material, additional categories and subcategories emerged, which were considered emergent. Ultimately, the study adopted the following categories: (i) content; (ii) teaching approaches and didactic resources; (iii) educational level; and (iv) nature of the product, based on a subcategorization of the CAPES classification.

The identification of categories and the classification of studies in relation to them were carried out independently by each author. Subsequently, any discrepancies were compared and adjusted through discussion.

## Content

The presence of content in both titles and abstracts proved to be quite frequent, considering that PPGs in the Teaching Area predominantly emphasize teaching practice through in-service teacher education and draw upon teachers' classroom experiences as the primary research locus. This context confers centrality on specific Mathematics content within educational products, which manifests in different ways, whether through theoretical approaches, teaching methodologies, or the didactic resources employed.

With regard to the content addressed, the reading of abstracts from both dissertations and theses, as well as from the educational products across the different PPGs, required a gradual refinement of the initially proposed classification. According to Bogdan and Biklen's (2010, p. 121) perspective on

flexible research design, researchers should be prepared to adopt “a different tactic or a new approach if the initial idea is not accepted”.

In this sense, as the research progressed, new content areas were identified, leading to modifications in the initial classification. The number of distinct content areas increased from an initial set of twenty to a final total of thirty-three. Given the large number of content areas identified in the analysis, it was decided to adopt the classification framework established by the National Common Core Curriculum (BNCC) (Brazil, 2017) as a reference.

According to the BNCC, content in the area of Mathematics and its Technologies is organized into five units: Numbers, Algebra, Geometry, Quantities and Measurement, and Probability and Statistics. The BNCC also indicates that, as students progress through the later years of Elementary Education and into Upper Secondary Education, certain units are integrated, such as Algebra and Geometry in the study of Functions, and Geometry and Quantities and Measurement in the study of Plane and Spatial Geometry.

Table 3 presents the contents classified within each of the five BNCC units, as well as additional content areas, particularly those specific to Higher Education.

**Table 3**

*Content according to the BNCC*

<b>N</b>	Operations with real/integer numbers; Number Construction/Numbers/Number Systems; Teaching Multiples; Integers; Fractions and Decimals; Financial Literacy/Family Budgeting; Rational Numbers; Operations with Natural/Integer Numbers; Numerical Expressions; Combinatorial Analysis; Percentages; Sequences
<b>A</b>	Functions; Trigonometric Functions; Quadratic Equations; Algebra; Linear Equations/Equations and Inequalities; Derivatives of Functions; Logarithms; Pre-Calculus; Limits of Functions
<b>G</b>	Trigonometry; Spatial Geometry; Plane Geometry; Quantities and Measurements; Geometry
<b>P</b>	Statistic
<b>O</b>	Complex Numbers; Matrices; Logical Reasoning; Logical-Mathematical Thinking; History of Mathematics; Analytical Geometry; Definite Integral; Robotics; Numerical Calculus; Supervised Internship; Computational Thinking; Differential Equations; Spreadsheets for Mathematical Concepts; Calculus II; Programming Logic

**N – Numbers; A – Algebra; G – Geometry, Quantities and Measurements; P – Probability and Statistics; O – Other.**

Fonte: Authors (2025).

It should be noted from the outset that these classifications are always subject to different approaches and, in this work, aim to provide support for the analyses that will be carried out later.

## Teaching Approaches or Resources

Throughout the research conducted on dissertations, theses, and educational products, different approaches and teaching resources employed in the studies were observed. Table 4 presents these approaches and teaching resources identified in the analysis of the educational products. This item includes educational products aimed at teacher training, since they incorporate approaches and teaching resources for the classroom in their proposals.

**Table 4**

### *Teaching Approaches or Resources*

<b>Digital Technologies</b>
Educational products in the form of learning objects, software, websites, and video lessons. This topic also included products that explored the use of calculators and the creation of applications
<b>Games and Play</b>
Educational products in the form of learning objects, software, websites, and video lessons. This topic also included products that explored the use of calculators and the creation of applications
<b>Ethnomathematics and Critical Mathematics Education</b>
These are established theoretical approaches to mathematics, supported by authors such as Ubiratan D'Ambrósio, Paulo Freire, Gelsa Knijnik, among others
<b>Interdisciplinary Themes</b>
Products that explored in a structured way the articulation of Mathematics with other area(s) of knowledge
<b>Teacher Training</b>
This section lists products that focus on teacher training, whether in the form of training courses, research conducted directly with teachers, or other similar initiatives

Fonte: Authors (2025).

## Educational Level

Within the category educational level, the following classifications were considered: Elementary Education (EE), Upper Secondary Education (USE), Vocational Education (VE), Higher Education (HE), Graduate Education, Teacher Education, and Inclusion/Resource Rooms.

## Nature of the Product

The category nature of the product was initially based on the classification of educational products established by the CAPES Teaching Area, as described in the introduction.

Throughout the analysis of the dissertations and their respective educational products, it was possible to identify the following types: didactic sequences, e-books, Potentially Meaningful Teaching Units (PMTUs), activity sequences,

tutorials, didactic materials, educational software, learning units, and teacher education courses.

## RESULTS ANALYSIS

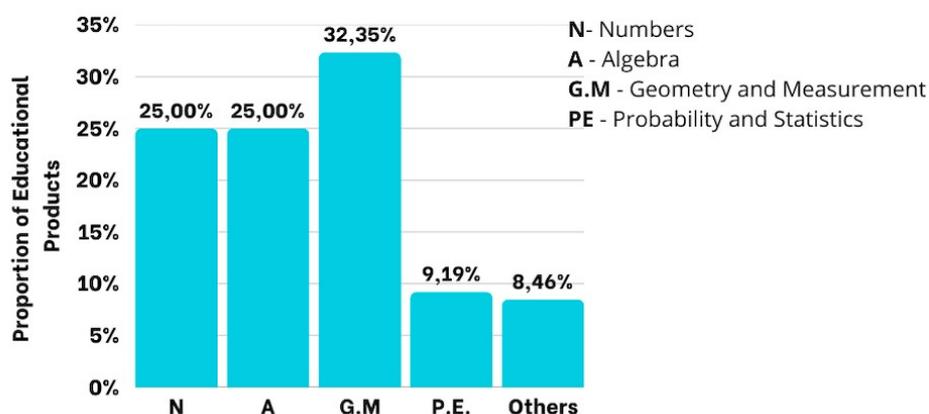
In the third and final stage of the research, related to data treatment, the results are presented in the form of graphs, figures, and tables. Based on these syntheses, it was possible to establish a characterization of the educational products developed by master's and doctoral students enrolled in professional graduate programs in the Teaching Area in the state of Rio Grande do Sul, within the field of Mathematics Education.

## CONTENT

As highlighted in the material exploration stage, content distribution followed the content units (CUs) established by the BNCC. As shown in Figure 1, a relatively high number of studies is associated with the Probability and Statistics unit, likely influenced by its formal inclusion in the BNCC.

**Figure 1**

*Distribution of Educational Products according to BNCC Content Units*



Fonte: Authors (2025).

Educational products developed in the area of Probability and Statistics began to be implemented in school systems after the BNCC (Brazil, 2017), particularly from 2020 onward. Of the 25 educational products identified in this unit, only four were produced prior to 2015, while 13 were developed from 2020 onward, indicating a strong influence of the BNCC. Given the relatively recent inclusion of Probability and Statistics as a specific subarea in the BNCC, closer attention to studies addressing this theme is warranted.

The analysis of the 27 products related to Probability and Statistics reveals noteworthy aspects. First, these products are distributed across different educational levels: five in the early years of Elementary Education, nine in the final

years, eight in Upper Secondary Education, three in Higher Education, and two in continuing teacher education. A similar distribution is observed across the investigated graduate programs, as only one PPG did not present products in this area.

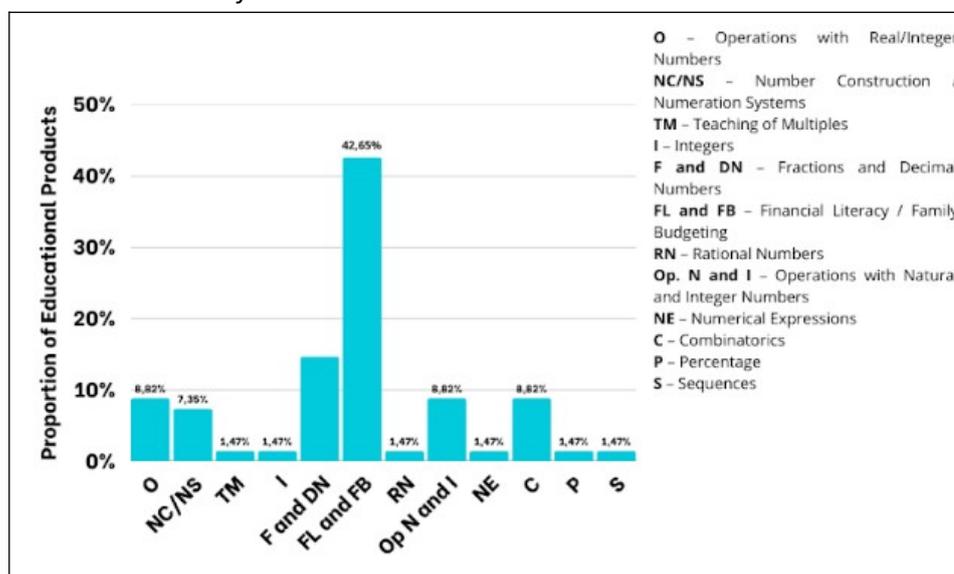
In four relatively recent studies conducted at three different institutions, the theme of Statistical Literacy (SL) was addressed at both Elementary and Upper Secondary Education levels. This finding is particularly relevant, as Statistical Literacy has gained prominence in recent Mathematics Education literature (Monteiro & Carvalho, 2021; Costa Júnior & Monteiro, 2022; Santana, 2016).

Santana (2016), for example, proposed an educational product focused on Statistical Literacy for students in the third year of Upper Secondary Education. Costa Júnior and Monteiro (2022), adopting a dialogical approach, demonstrated how SL can be fostered by addressing topics of student interest, such as femicide rates, which generated greater engagement than previous studies involving lottery data. According to the authors, communicative acts established through dialogue significantly contributed to the development of Statistical Literacy.

In the Numbers content unit, as shown in Figure 2, a predominance of studies related to Financial Education and Financial Literacy/Household Budgeting is observed, also likely influenced by the BNCC.

**Figure 2**

*Distribution of Educational Product Content within the Numbers Unit*



Fonte: Authors (2025).

The strong presence of studies related to Financial Education and Financial Literacy—representing 42.65% of the Numbers unit—indicates a recent trend reinforced by the BNCC. This theme has gained relevance under different theoretical and ideological perspectives. From a market-oriented standpoint, financial education is viewed as a means of fostering interest in financial system and reinforcing the role of financial capitalism in national economic development. Conversely, from a more critical perspective, financial education is seen as a tool to raise awareness of financial indebtedness risks and to question the presumed

benefits of financial markets, particularly when they discourage direct investment in industry and production.

Fractions and decimal numbers also appear frequently among the analyzed educational products, reinforcing findings by Silveira, Souza, and Powell (2024) regarding persistent difficulties in teaching and learning these topics. According to the authors, part of the challenge lies in the differences between representational systems, especially when comparing school mathematics to real-world contexts. Additionally, distinct arithmetic rules used in operations further contribute to students' learning difficulties.

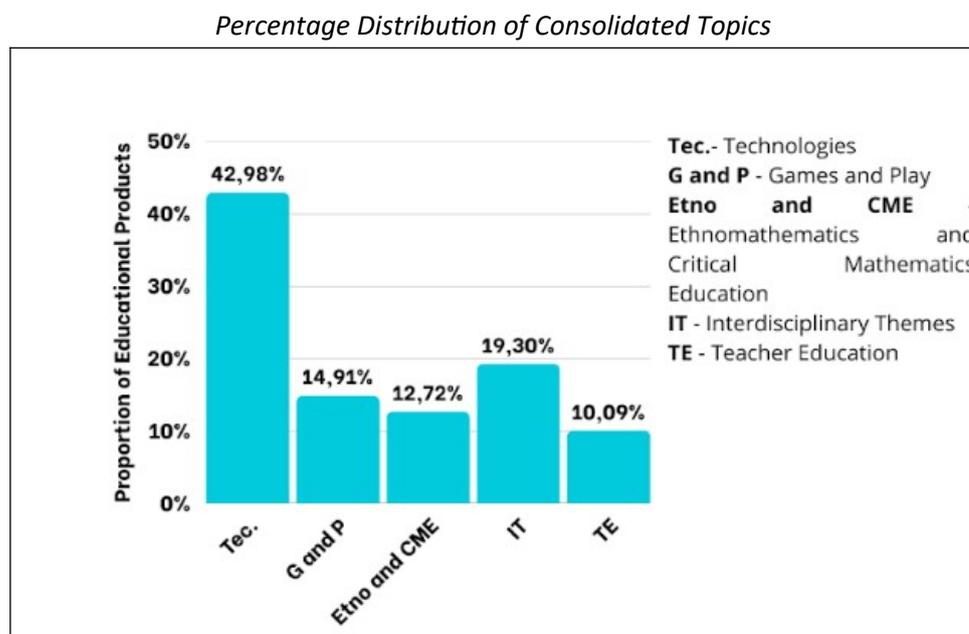
In the Algebra unit, over 60% of the educational products focus on the study of functions, highlighting the importance of functional thinking in Mathematics Education and in students' general education. Tenório, Penna, and Tenório (2015) identified difficulties in understanding polynomial functions, particularly regarding the dependent relationship between variables. Using the educational gaming platform Mangahigh, the authors worked with first-degree polynomial functions, addressing both the derivation of function rules from given situations and the construction of graphs. Students showed greater difficulty when dealing with negative numbers and algebraic representations, especially in calculating angular and linear coefficients.

Within the Geometry unit, a predominance of studies addressing Geometry in a general manner—without specifying subtopics such as Plane Geometry, Spatial Geometry, or Trigonometry—was observed. Historically, Geometry was taught alongside Drawing within Art Education and only became fully integrated into Mathematics curricula in the mid-1990s. During the Modern Mathematics Movement (MMM), Geometry was largely marginalized, which may partially explain the prevalence of broadly defined Geometry-focused products. Silva, Gomes, and Silva (2021), in their mapping of Geometry teaching during the MMM, identified deficiencies in textbooks and student interaction strategies, a concerning issue given the central role of experimentation in Geometry education.

## APPROACHES AND DIDACTIC RESOURCES

The category approaches and didactic resources was consolidated throughout the material exploration stage, as recurring themes and patterns emerged, culminating in the distribution presented in Figure 3.

**Figure 3**



Fonte: Authors (2025).

The predominance of digital technologies was expected, given the close relationship between Mathematics teaching and technological resources such as software, applications, and computational tools. GeoGebra, for instance, offers free tools and fosters a collaborative community that develops and shares educational resources. In PPG4, for example, two of the five doctoral theses explore GeoGebra-based technologies, demonstrating the tool’s relevance and potential for impactful research.

This predominance aligns with findings from a systematic literature review conducted by Motta, Loss, and Pszybyski (2021) involving publications from the Graduate Program in Scientific, Educational, and Technological Education (PPGCET) at UTFPR. Their review identified numerous Mathematics Education products focused on the creation, use, and reuse of mobile educational applications and learning objects for Mathematics and Science education.

The Teacher Education topic stands out due to the relatively small number of educational products, particularly given its importance for professional development. Imbernón (2011) identifies five key dimensions of continuing teacher education: reflection on practice; peer exchange; alignment with professional projects; critical engagement; and institutional professional development. Despite the relevance of teacher education, it remains underexplored in professional PPGs, especially within the Teaching Area. For instance, a search in *Bolema*, a leading Mathematics Education journal, yields only 14 articles for “Teacher Education”, compared to 18 for “GeoGebra” and 40 for

“Digital Technologies”. This disparity underscores the need to strengthen research on teacher education, particularly from perspectives that emphasize reflective practice (Imbernón, 2011) and the interrelation of personal, professional, and organizational development (Nóvoa, 1997).

An important aspect within this category is the strong influence of each program’s research focus. Ethnomathematics is emblematic in this regard: in PPG4, 20 out of 29 products address this theme, all under the same supervision, a pattern not observed in other programs. A similar situation occurs with Didactical Engineering in PPG3, where it underpins approximately 20% of master’s-level educational products, again under a single advisor.

These findings raise an important question for future research: how do individual researchers’ specific interests align with broader academic and professional demands? This issue is particularly relevant for professional PPGs, which must remain connected to practitioners’ real-world contexts.

A significant number of products involve games and playful activities, including roulette-based games for integers, social network interaction studies, adaptations of existing digital games, game-books, and software-based learning environments.

Themes such as comic strips and history of mathematics, explored by Silva Neto, Mendes, and Silva (2019), also show potential for educational products. Although few in number, the identified examples demonstrate strong pedagogical relevance. One notable product from PPG6 involved a comic-style almanac narrating the history of geometric mathematicians such as Thales of Miletus and Euclid of Alexandria, developed for the final years of Elementary Education.

Interdisciplinary themes also appear prominently, indicating efforts to integrate Mathematics with other fields. These include environmental studies, robotics, biology, cartography, physics and astronomy, fractals, literature, philosophy, and scientific literacy, among others.

## EDUCATIONAL LEVEL

Analysis by educational level revealed that 12% of products are related to Higher Education, 34% to Upper Secondary Education, 41% to Elementary Education, and 3% to Early Childhood Education. The limited presence of products in Higher Education and Early Childhood Education highlights a gap in Mathematics Education research within the Teaching Area.

Regarding Higher Education, these findings prompt reflection on university professors’ engagement with pedagogical issues. Studies by Rodrigues et al. (2023) and Soares and Cunha (2010) indicate that faculty priorities often lie in disciplinary expertise rather than didactic concerns, largely due to academic career advancement criteria. Viana, Miguel and Fidalgo (2024) argue that innovative pedagogical methods and teacher education can enhance Higher Education outcomes, noting that teaching experience is often valued over formal pedagogical training, contributing to fragile professional identities in Higher Education.

The low percentage of Early Childhood Education products aligns with findings from the STEM Education Panorama in Brazil (British Council Brazil, 2023), which

indicates limited engagement of young children in STEM-related activities. Internationally, however, initiatives such as Next Generation STEM (2025) and Iowa Regents STEM (2025) promote STEM education in Early Childhood Education to foster creativity and early interest in scientific and technological careers.

It is important to acknowledge differences between Brazilian and North American contexts. Bazzo and Costa (2019) emphasize the role of Engineering in Brazil's technological sovereignty, highlighting the importance of creativity in national development. This perspective contrasts with the North American emphasis on entrepreneurship and individual technological innovation within economies dominated by large technology corporations (Big Techs).

## NATURE OF THE PRODUCT

The nature of the product category exhibited considerable variability over time and across institutions, largely due to the recent regulation and standardization of Technical and Technological Production (TTP) by CAPES, particularly within the Teaching Area. The 2019 area document (CAPES, 2019) marked the beginning of a formal institutionalization process, reinforced by the growing recognition of professional PPGs.

This evolution is evident in the historical analysis of product types. Since the requirement to develop an educational product is relatively recent, earlier products often resemble dissertation summaries. PPG8 exemplifies this transition: as the first professional program in Mathematics Education in RS, with dissertations defended since 2006, its earlier products lacked the didactic specificity seen in more recent productions.

PPG3, whose first dissertations date to 2015, initially emphasized technology-based products such as blogs, websites, and Potentially Meaningful Teaching Units (PMTUs). PMTUs also appeared in four other programs (PPGs 2, 4, 7, and 9), totaling ten products. PMTUs (Moreira, 2011) are grounded in the Theory of Meaningful Learning and are particularly prominent in RS due to the influence of Professor Marco Antonio Moreira (UFRGS), a key figure in the development of professional programs in the Teaching Area.

Another pattern identified in PPG4 is a standardized product format based on activity sequences, including contextualization, objectives, activity descriptions, results, and references.

Didactic sequences were among the most frequent product types, with 53 occurrences, although their structures varied considerably. Activity sequences and instructional guides often served similar purposes. Costa and Gonçalves (2022) argue for greater conceptual clarity and deeper exploration of didactic sequences, a conclusion consistent with the findings of this study.

---

## FINAL CONSIDERATIONS

This study identified key characteristics of educational products developed in professional graduate programs in Rio Grande do Sul within Mathematics Education. Although the scope was limited to a single state, the findings reveal trends and gaps that contribute to understanding educational product development and validation in the Teaching Area.

A strong focus on Basic Education was observed, likely reflecting participants' professional contexts. Conversely, limited attention to pedagogical issues in Higher Education, Early Childhood Education, and Teacher Education indicates areas requiring further investigation. The findings suggest that while classroom-based interventions are consolidated, teacher education is rarely a primary focus.

Topics such as fractions and algebra continue to demand research attention, indicating that BNCC influence remains partial, except in Probability and Statistics. This pattern aligns with studies such as Silva and Moreira (2018), which emphasize algebraic thinking and its relationship to arithmetic in Basic Education.

Recent initiatives by CAPES to strengthen Basic Education appear to be achieving their objectives by valuing teacher-researchers and institutionalizing educational product development. While educational products have long existed in teaching practice, CAPES's recent policies have enhanced their academic, pedagogical, and professional recognition.

Future research will seek to deepen the analysis of the impact of these educational products on teachers' pedagogical practices, building on the findings of this initial study.

## REFERENCES

- Bardin, L. (2011). *Análise de conteúdo*. São Paulo: Edições 70, 2011.
- Bazzo, W. A. & Costa, L. A. C. (2019). A revolução 4.0 e seus impactos na formação do professor em Engenharia. *Revista de Ensino de Engenharia*, 38(3), 28-39.  
<https://revista.abenge.org.br/index.php/abenge/article/view/1542>
- Bogdan, R. & Biklen, S. K. (2010). *Investigação qualitativa em educação: uma introdução à teoria e aos métodos*. Porto: Porto Editora.
- Bolema – Boletim de Educação Matemática. (n.d.). *Bolema*.  
<https://www.scielo.br/j/bolema/>
- Brazil. (2017). Ministério da Educação. Secretaria de Educação Básica. *Base Nacional Comum Curricular: Educação é a Base*. Brasília.
- British Council Brasil. (2023). *Panorama de educação STEM no Brasil: reflexões sobre a análise de dados e documentos bibliográficos*. 1 ed. – São Paulo, SP: British Council Brasil, Fundação Carlos Chagas.
- Capes. (2019). *Documento de Área – Área 46 – Ensino*.  
<https://www.gov.br/capes/pt-br/centrais-de-conteudo/ENSINO.pdf>
- Capes. (n.d.). Plataforma Sucupira. *Documento de Área Ensino*.  
<https://sucupira.capes.gov.br/>
- Cardoso, F. P. (2022). Ensino e aprendizagem da geometria na formação de professores. *Ensino em Perspectivas*, 3(1), 1-8.  
<https://revistas.uece.br/index.php/ensinoemperspectivas/article/view/8923>
- Costa Júnior, J. R. & Monteiro, C. E. F. (2022). A promoção do Letramento Estatístico entre licenciandos em Matemática por meio de interações dialógicas. *Educação Matemática em Revista*, 2(23), 83-93.  
<https://www.sbemrasil.org.br/periodicos/index.php/EMR-RS/article/view/3250>
- Costa, D. E.; Gonçalves, T. O. (2022). Compreensões, abordagens, conceitos e definições de sequência didática na área de Educação Matemática. *Bolema: Boletim de Educação Matemática*, 36(72), 358-388.  
<https://www.scielo.br/j/bolema/a/TBtxkXdxLr5JnHCrcyWfSWL/>
- Costa, L. A. C. (2020). Desafios e avanços educacionais em tempos da COVID-19: a docência no Ensino Remoto em cursos de Engenharia. *Revista de Estudos e Pesquisas sobre Ensino Tecnológico*, 6, e152920.  
<https://sistemascmc.ifam.edu.br/educitec/index.php/educitec/article/view/1529>
- Costa, L. A. C. & Barreto, R. M. (2024). Construindo pontes entre o Design Thinking e a aprendizagem criativa: possibilidades para o ensino tecnológico.

*Revista de Estudos e Pesquisas sobre Ensino Tecnológico*, 10, e232424.  
<https://sistemascmc.ifam.edu.br/educitec/index.php/educitec/article/view/2324>

Frango, E. R. & Kistemann Junior, M. A. (2020). As contribuições de um curso de Modelagem Matemática para a formação e atuação de professores que ensinam Matemática. *Educação Matemática Debate*, 4(10), 1-25.  
<https://www.periodicos.unimontes.br/index.php/emd/article/view/2232>

GeoGebra. (n.d.). *GeoGebra*. <https://www.geogebra.org/>

Ghiggi, C. M., Rosa, C. T. W. & Vizzotto, P. A. (2023). Ensino de Ciências nos anos iniciais: qual o panorama das teses brasileiras produzidas no período 2000–2020? *Revista Brasileira de Pesquisa em Educação em Ciências*, 21(2), 541-578. <https://periodicos.ufmg.br/index.php/rbpec/article/view/41657>

Goulart, M. B. & Soares, M. T. C. (2022). A Área de Ensino ou Área 46 da CAPES e suas relações com a Educação Matemática: um estudo a partir das linhas de pesquisa. *Revista Diálogos em Educação Matemática*, 1(1), e202201.  
<https://www.seer.ufal.br/index.php/redemat/article/view/14457>

Imbernón, F. (2010). *Formação Continuada de Professores*. Tradução Juliana dos Santos Padilha. Porto Alegre: Artmed, 2010.

Imbernón, F. (2011). *Formação docente e profissional: formar-se a mudança e a incerteza*. Tradução Silvana Cobucci Leite. 9. ed. São Paulo: Cortez.

Iowa Regents Center For Early Developmental Education. (n.d.). Disponível em: <https://regentsctr.uni.edu/>

Martins, R. S. & Rezende, D. S. (2019). Revisão sistemática de literatura: guia prático. *Logeion: Filosofia da Informação*, 6(1), 57-73.  
<https://revista.ibict.br/fiinf/issue/view/280>

Monteiro, C. E. F. & Carvalho, L. M. T. L. (Orgs.). (2021). *Temas emergentes em letramento estatístico*. Recife: Ed. UFPE.

Moreira, G. E., Vieira, L. B., Fraz, J. N., Ferreira, W. C. & Teixeira, C. J. (2021). Formação inicial e continuada de professores que ensinam matemática: socializando experiências exitosas do DIEM. *Revista Prática Docente*, 6(1), e001. <https://periodicos.cfs.ifmt.edu.br/periodicos/index.php/rpd/article/view/364>

Moreira, M. A. (2011). *Aprendizagem Significativa: a teoria e textos complementares*. São Paulo: Editora Livraria da Física.

Motta, M. S., Loss, T. & Pszyblyski, R. F. (2021). Tendências e intencionalidades das pesquisas realizadas pelo GPINTEDUC: constatações e percepções dos estudos mediante um mapeamento sistemático de literatura. *Actio: Docência em Ciências*, 6(3), 1-25.  
<https://periodicos.utfpr.edu.br/actio/article/view/14552>

- Next Generation Science Standards. (n.d.). *As três dimensões da aprendizagem de Ciências*. <https://www.nextgenscience.org/>
- Nóvoa, A. (1992). Formação de professores e profissão docente. In A. Nóvoa (Org.), *Os professores e sua formação* (pp. 139-158). Lisboa: Instituto de Inovação Educacional.
- Nóvoa, A. (Org.). (1997). *Os professores e sua formação*. Lisboa - Portugal: Dom Quixote.
- Nóvoa, A. (Org.). (1995). *Professores e sua formação*. Lisboa – Portugal: Dom Quixote, 1995.
- Panossian, M. L. & Souza, F. D. (2021). A Teoria Histórico-Cultural e a Teoria da Atividade em pesquisas sobre formação de professores e o ensino de matemática: o movimento do GeForProf - UTFPR. *Actio: Docência em Ciências*, 6(3), 1-14. <https://periodicos.utfpr.edu.br/actio/article/view/14565>
- Rizzatti, I. M., Mendonça, A. P., Mattos, F., Rôças, G., Silva, M. A. B. V., Cavalcanti, R. J. S. & Oliveira, R. R. (2020). Os produtos e processos educacionais dos programas de pós-graduação profissionais: proposições de um grupo de colaboradores. *Actio: Docência em Ciências*, 7(3), 1-23. <https://periodicos.utfpr.edu.br/actio/article/view/12657>
- Rôças, G., & Bomfim, A. M. D. (2018). Do embate à construção do conhecimento: a importância do debate científico. *Ciência & Educação (Bauru)*, 24(1), 3-7. <https://doi.org/10.1590/1516-731320180010001>
- Rodrigues, M. V., Correa, F. E., Thomas, E., Flora, S. A. D., Torquato, L. O., Meirelles, B. G., Gorski, L., Lunkes, C. R., Guedes, E. C., Frohlich, S., Sabadi, M. D. F., Domingues, V. O., Santos, D. V. & Mumbach, E. (2023). A docência no ensino superior: realidade e desafios. *Ciências Jurídicas*, 27(129), 1-13. <https://revistaft.com.br/a-docencia-no-ensino-superior-realidade-e-desafios/>
- Romanowski, J. P. & Ens, R. T. (2006). As pesquisas denominadas do tipo “Estado da Arte” em educação. *Revista Diálogo Educacional*, 6(19), 37-50. <https://www.redalyc.org/pdf/1891/189116275004.pdf>
- Rugarcia, A., Felder, R. M., Woods, D. R. & Stice, J. E. (2000). The future of Engineering Education I. A vision for a new century. *Chemical Engineering Education*, 34(1), 16-25. [https://www.researchgate.net/publication/283749746\\_The\\_future\\_of\\_engineering\\_education\\_Part\\_1\\_A\\_vision\\_for\\_a\\_new\\_century](https://www.researchgate.net/publication/283749746_The_future_of_engineering_education_Part_1_A_vision_for_a_new_century)
- Santana, M. S. (2016). Traduzindo pensamento e letramento estatístico em atividades para sala de aula: construção de um produto educacional. *Bolema: Boletim de Educação Matemática*, 30(56), 1165-1187. <https://www.scielo.br/j/bolema/a/dFv4bGpf7MwdSGMHjsP34jq/abstract/?lang=pt>

- Silva Neto, B. C., Mendes, I. A. & Silva, L. P. (2019). História em quadrinhos nas pesquisas sobre história para o ensino de matemática (1990-2018). *Rede Amazônica de Educação em Ciências e Matemática*, 7(3), 206-218.  
<https://repositorio.ufpa.br/jspui/handle/2011/14553>
- Silva, J. P. & Moreira, P. C. (2018). Produto educacional sobre educação algébrica escolar: pensamento algébrico, linguagem, generalização. *Revista BOEM*, 6(10), 255-275. <https://repositorio.ufmg.br/handle/1843/39756>
- SILVA, Sidnéia Almeida; GOMES, Larissa Pinca Sarro; SILVA, Martha Raíssa lane Santana da (2021). Ensino de geometria e movimento da matemática moderna: uma análise de histórias produzidas nas pesquisas acadêmicas. *Revista Tangram*, MS, v. 4, n. 3, p. 128-150.
- Silveira, E., Souza, M. A. V. F. & Powell, A. B. (2024). Estudo de frações: superficialidades, parcialidades ou equívocos. *Bolema: Boletim de Educação Matemática*, 38, 1-23.  
<https://www.scielo.br/j/bolema/a/PppNxcM4KPMxZ36qVKtQjLq/>
- SOARES, S. R.; CUNHA, M. I. Formação do professor: a docência universitária em busca de legitimidade [online]. Salvador: EDUFBA, 2010. 134 p.
- Souza, A. S. & Silva, A. M. (2020). Design e desenvolvimento de um curso de formação continuada para professores em Educação Financeira Escolar. *Revista de Investigação e Divulgação em Educação Matemática*, 3(2), 72-89.  
<https://periodicos.ufjf.br/index.php/ridema/article/view/30515>
- Tenório, A., Penna, P. & Tenório, T. (2015). O uso de jogos da plataforma Mangahigh no estudo de funções polinomiais do 1º grau. *Educação Matemática Pesquisa*, 17(2), 257-280.  
<https://revistas.pucsp.br/emp/article/view/21966>
- Viana, A. J. P., Miguel, K. C. D. & Fidalgo, S. S. (2024). O processo formativo do professor universitário. *Revista Contribuciones a las ciencias sociales*, 17(5), 1-16.  
<https://ojs.revistacontribuciones.com/ojs/index.php/clcs/article/view/6806>

**Received:** Jun. 22, 2025  
**Approved:** Jan. 09th, 2026  
**DOI:** <https://doi.org/10.3895/actio.v11n3.20426>

**How to cite:**

Andreatta-da-Costa, L. & Rosa, C. T. W. da (2026). Educational products in the teaching area in professional graduate programs in Rio Grande do Sul: the state of knowledge in mathematics. *ACTIO*, 11(1), 1-24.  
<https://doi.org/10.3895/actio.v11n3.20426>

**Copyright:** This article is licensed under the terms of the Creative Commons Attribution 4.0 International Licence.



**Recebido:** 22 jun. 2025

**Aprovado:** 09 jan. 2026

**DOI:** <https://doi.org/10.3895/actio.v11n3.20426>

**Como citar:**

Andreatta-da-Costa, L. & Rosa, C. T. W. da. (2026). Produtos educacionais da área de ensino nos programas de pós-graduação profissionais do Rio Grande do Sul: o estado do conhecimento em matemática.

**ACTIO**, 11(1), 1-24. <https://doi.org/10.3895/actio.v11n3.20426>

**Direito autoral:** Este artigo está licenciado sob os termos da Licença Creative Commons-Atribuição 4.0 Internacional.

