ACTA SCIENTIAE

ISSN: 2178-7727
DOI: 10.17648/acta.scientiae.6839

The Perspective of Public Schools Mathematics Teachers on Their Knowledge and Teaching Practice in Connection With the Bncc

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Received for publication on 21 Sep. 2021. Accepted after review on 15 Oct. 2021.
Designated editor: Claudia Lisete Oliveira Groenwald

ABSTRACT

Background: The curricular structure of Brazilian basic education has changed in recent years. With the promulgation of the National Common Curricular Base (BNCC) for elementary and high school education, there is a need to change the curricula of state and municipal networks, which takes place precisely with the actual implementation in schools. **Objective**: To understand the view of mathematics teachers on capacity and knowledge they must have for the effective application of the BNCC in the classroom considering all the requirements, especially the skills and competencies that contemplate the curricular base. **Design**: Applied work, with quantitative bias, as the work presents statistical analyses. **Setting and participants**: Twenty-four high school mathematics teachers of the state network of the municipality of Itumbiara-GO. **Data collection and analysis**: Questionnaire applied to mathematics teachers, with percentage and inferential analyses such as Cronbach's Alpha and correlation test. **Results**: The teachers believe that they know well the specific competencies and skills required in mathematics and its technologies, but they do not know well other areas of the BNCC and feel very insecure about applying these concepts in class. **Conclusions:** We noticed that the teachers play a fundamental role in implementing the BNCC in schools successfully, requiring pedagogical support such as formative courses and teaching materials to help correct the knowledge gaps they have for that task.

Keywords: BNCC; Competencies and skills; Mathematics teachers; Teachers' perception.

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Perspectiva dos professores de matemática de escolas públicas sobre conhecimento e prática docente que possuem relacionados à BNCC

RESUMO

Contexto: A estrutura curricular da educação básica brasileira vem passando por mudanças nos últimos anos. Com a promulgação da Base Nacional Comum Curricular (BNCC), para o Ensino Fundamental e o Ensino Médio, surge a necessidade de mudança dos currículos das redes Estaduais e Municipais, que se desenrola exatamente com a implantação efetiva nas escolas. **Objetivo**: Compreender a visão dos professores de matemática sobre sua capacidade e conhecimento exigidos para aplicação efetiva da BNCC em sala de aula, levando em consideração todos os requisitos necessários, especialmente as competências e habilidades que contemplem a base curricular. **Design**: Trabalho aplicado, com viés quantitativo, visto que são feitas análises estatísticas. **Ambiente e participantes**: Vinte e quatro professores de matemática do enino médio dos colégios estaduais do município de Itumbiara-GO. **Coleta e análise de dados**: Questionário aplicado aos professores de matemática, com análises percentuais e inferenciais como o Alfa de Cronbach e teste de correlação. **Resultados**: Os docentes possuem a visão de que sabem bem sobre as competências e habilidades específicas da área de matemática e suas tecnologias, mas não conhecem bem outras áreas da BNCC e ficam muito inseguros na forma de aplicação desses conceitos nas atividades das aulas. **Conclusões:** Percebe-se que o docente tem papel fundamental para o sucesso no processo de implantação da BNCC nas escolas, necessitando de apoio pedagógico como cursos de capacitação e materiais didáticos, que auxiliem a corrigir as lacunas de conhecimento que possuem para que consigam aplicá-la efetivamente em sala de aula.

Palavras-chave: BNCC; Competências e Habilidades; Professores de Matemática; Percepção dos Professores.

INTRODUCTION

Brazilian education has undergone many curricular transformations in recent years with the implementation of the BNCC (National Common Curricular Base) for the elementary school and more recently with its approval for high school, according to the resolution of the National Council of Education (CNE) that:

> Establishes the National Common Curricular Base in the High School Stage (BNCC-EM), as the final stage of basic education, under the terms of article 35 of the LDB, concluding the set constituted by the BNCC of early childhood education and elementary school, based on CNE/CP Resolution No.

> 2/2017, based on CNE/CP Opinion No. 15/2017 (Brasil, 2018b).

These curriculum changes are necessary due to the progress in several aspects such as technological evolution and social behaviour, and relations. With the school inserted in this context of change, Lopes and Macedo (2011) emphasise that schooling only makes sense to the extent that it builds conditions for subjects to solve real social problems.

In this perspective, the BNCC indicates work to be done considering competencies and skills that students must achieve to establish a quality education that leads the students to grow as citizens, providing means for them to exercise their citizenship, understanding their rights and obligations in the social environment. Perrenoud (2000) talks about working with competencies and skills, saying that several countries tend to guide the curriculum to build competencies from elementary school.

There is a difference between enacting a new guiding basis, establishing new curricula for education, and introducing this document into school practice. For Valente et al. (2020), there is a tensioned relationship between what is written in the official document and what will be concretised in teaching practice.

> Between official regulatory documents and teachers' professional practices, there is always a tensioned relationship of greater or lesser intensity, depending on the context of the establishment of the official references. But it is a tensioned relationship. The differences between discourses on practice and practice itself are at the heart of those tensions. (Valente et al., 2020, p. 66)

For this curricular -and consequently educational- transformation to occur, the teachers' role as active agents in this change process is very important, understanding that their qualification is a crucial factor for the successful implementation of the BNCC. On this issue, Nakad and Skaf (2017) say that qualification must be offered before the new curriculum teaching starts, so that it enables and enhances the possibility of a proper response to the implementation of the document by the actors involved.

One of the important texts on basic education in Brazil is the Law of Guidelines and Bases of Education (LDB), Law N. 9.394 of December 20, 1996, which establishes in its article 22 that "Basic education aims at developing the student, ensuring him/her the necessary common education for

citizenship and providing him/her with means to progress at work and in subsequent studies" (Brasil, 1996). This law represented an advance in Brazilian education, establishing criteria for the organisation of the federative entities and their respective domains of activity, with early childhood education and elementary education being under the responsibility of the municipalities and the high school being in the hands of the states.

The LDB has changed over time, but a common national curriculum base covering all the country's characteristics was already being conceived since its creation. With the amendment of the LDB through Law N. 12.796 of 2013, article 26 stated that the curricula of early childhood education, elementary school, and high school must have a common national base that must be complemented in each education system and each school by a diversified part, according to the regional and local characteristics of society, culture, economy, and students (Brasil, 1996).

Thus, in 2014, with the creation of the National Education Plan (PNE), the process of building a curriculum base began with a consultation with various sectors of civil society, such as public universities and class council entities: Union of Municipal Education Directors (UNDIME), National Council of Education Secretaries (CONSED) and educational NGOs. Public consultations were also held with school education professionals, teachers, principals, and education technicians, through reflective stops called "D" day of the BNCC.

> After the approval of the BNCC at the end of 2017, MEC started a process of dissemination in several communication channels, including on its website. [...] the "D-Day" was defined so that the state and municipal departments of education started the discussion about the Base with teachers and other education professionals, aiming at the reformulation of the Brazilian Basic Education Curriculum Matrix. (Oliveira & Oliveira, 2019, p. 165)

The BNCC is articulated in a set of competencies and skills that students must achieve for quality education, making them protagonists in their own educational process. Understanding the meaning of competency and skill is paramount for the correct implementation of the BNCC guidelines and the expected curricular change. In this document, competency is defined as the "mobilisation of knowledge (concepts and procedures), skills (practices, cognitive, and socio-emotional), attitudes, and values to solve complex

demands of everyday life, the full exercise of citizenship and the world of work" (p. 8).

In general, competency is considered something greater, a set of knowledge, skills, and attitudes that, when mobilised, act and modify a given situation. Perrenoud (2000) defines competency as the ability to mobilise several cognitive resources to face a specific situation. In the BNCC, ten general competencies that contemplate all areas of knowledge are presented: 1- knowledge; 2- scientific, critical, and creative thinking; 3- cultural repertoire; 4- communication; 5- digital culture; 6- work and life project; 7- argumentation; 8- self-knowledge and self-care; 9- empathy and cooperation; 10- responsibility and citizenship (Brasil, 2018a).

The curriculum document indicates that learning must be based on a common part, with the definition of the essential knowledge that will be offered in the four areas of knowledge, and by a diversified base called formative itineraries, according to article 36 of the LDB of 1996, which regulates:

> The high school curriculum will be composed of the National Common Curricular Base and formative itineraries that should be organised by the offer of different curricular arrangements, according to the relevance to the local context and the possibility of education systems, namely:
> I – Languages and their technologies;
> II – Mathematics and its technologies;
> III – Natural Sciences and its technologies;
> IV – Applied human and social sciences;
> V – Technical and vocational education (Brasil, 1996).

In the BNCC, the life project arises from the need for the school to integrate those students so that they have the feeling of belonging, which makes the teaching and learning process more pleasurable and the students more engaged and autonomous.

> [...] the Life Project comes as an alternative to rescue human values and the recognition of the person as a being capable of reviewing their life history and projecting a dignified and promising future, expanding their horizons through a curriculum that promotes self-knowledge, learning linked to the students' needs and expectations and that proposes referrals to a better life, for themselves and for the world of which they are subject participants. (Fodra & Nogueira, 2017, p. 255)

The text also brings the curricular reference to the structuring axes, namely the scientific research, creative processes, mediation and sociocultural intervention, and entrepreneurship. The formative itineraries provided for in the BNCC text are closely related to the life project, which is an essential support for the new curriculum proposal, and are also constituted by the structuring axes that, together with the integrating projects, form a learning unit.

> [...] the student will be able to choose between the five areas of knowledge mentioned in the law, defined according to the school's proposal: languages, mathematics, natural sciences, humanities, and technical and vocational education. Each school must offer students at least one of the five formative itineraries. (Teixeira et al., 2017, p. 16034)

An important topic of the study can be foregrounded: mathematics and its technologies. Mathematics in high school must follow the structuring done in elementary school through the units: numbers and algebra, geometry and measurements, and probability and statistics, making this area be applied in reality to solve practical problems.

To achieve meaningful learning, mathematics teachers must develop the skills of the area in the students through the objects of knowledge (contents) worked in the classroom. According to the BNCC, the competencies are:

> 1. Use mathematical strategies, concepts, and procedures to interpret situations in different contexts, whether daily activities, facts of the natural and human sciences, or economic or technological issues, disclosed by different means, in order to consolidate a general scientific education.
> 2. Articulate mathematical knowledge by proposing and/or participating in actions to investigate challenges in the contemporary world and making ethical and socially responsible decisions, based on the analysis of problems of social urgency, such as those related to health, sustainability, the implications of technology in the world of work, among others, by using specific mathematical concepts, procedures, and language.
> "Use mathematical strategies, concepts, and procedures in their fields - arithmetic, algebra, magnitudes and measurements, geometry, probability and statistics - to interpret, build models, and solve problems in different contexts, analysing the

> plausibility of the results and the adequacy of the solutions proposals to build consistent arguments"
> 4. Understand and use flexibly and fluidly different (algebraic, geometric, statistical, computational, etc.) mathematical representation records, in the search for solution and communication of problem results, to favour the construction and development of mathematical reasoning.
> 5. Investigate and establish conjectures on different mathematical concepts and properties, using resources and strategies such as observation of standards, experiments, and digital technologies, identifying whether an increasingly formal demonstration in the validation of these conjectures is needed (Brasil, 2018a, p. 523).

Those competencies should be worked through the skills that make up each object of knowledge, developing skills in students according to the guidelines brought by the BNCC and adapted to the reference curriculum of each State. The skills must be associated with the units of knowledge defined by the specific areas themselves, and according to the BNCC, for mathematics and its technologies, the units of knowledge are: numbers, algebra, geometry, magnitudes and measurements, probability and statistics (Brasil, 2018a).

Each competency has its skills that constitute its purpose but are still interconnected so that the teaching and learning process does not occur vertically but non-linearly. A competency can be considered a set of skills, but the same skill can co-participate with several other different competencies.

> A competency leads to the use of several skills, and the skills are articulated in a new competency. Competency thus would be constituted by several articulated skills. The same skill can contribute to the acquisition of different competencies. A skill can be a competency to be developed and once this competency is mastered, it can become a skill for the development of another competency [...] (Castagnaro, 2021, p. 39)

For Castagnaro (2021), "teachers and students need to understand and accept new more effective and creative methods to absorb the information"; thus, the skills provide a relationship of confidence and exchange between mathematics teachers and students, making the process of teaching and learning more playful and active. The development of competencies resulting from the skills acquired is closely associated with the active learning process. Acquiring a practical knowledge of a theme requires the student to "get their hands dirty", to participate dynamically in the classes. Camargo and Daros (2018) state that

as active methodologies are based on student autonomy and protagonism, they focus on the development of competencies and skills based on collaborative learning and interdisciplinarity, providing development for personal and professional life.

The competencies and skills for high school are a sequence of those presented for elementary school. The BNCC for the area of mathematics and its technologies proposes the expansion and deepening of essential learning developed until the 9th grade of elementary school" (Brasil, 2018a). Whether the student has fully developed the skills of the previous stage or not, the skills and competencies for high school must be addressed, because "the investigative process in which they will engage will enable the discoveries and expected learning" (Brasil, 2018a).

By analysing the competencies, we can better understand the relationship with your skills. For specific competency 1 in mathematics and its technologies for high school, students must acquire skills related to interpreting everyday facts, making critical analyses with a scientific basis, and connecting this interpretation of daily reality with the knowledge about natural sciences and humanities. Ramos (2017) does not talk specifically about competency 1, but his research perfectly matches this competency when he says that mathematical literacy allows the student, when involved with the process of building mathematical models, to acquire the ability to worry about the results of society outside school, understanding the mathematical language in several social dimensions. For Pimentel and Santos (2020), there is a connection between mathematics and natural sciences that, in addition to representing a piece of the natural world, can enable the modelling of several phenomena by the joint manipulation of the two areas, obtaining a connection of objects with some analogy, thus showing the importance of mathematics for the explanation of natural phenomena as mentioned in competency 1.

Competency 2 complements competency 1, so that, besides using mathematical concepts to interpret social reality, the humanities, and the natural sciences, it adds research and analysis to the problems encountered in the interpretation of situations experienced. According to the BNCC:

> The competency extends the previous one by placing students in situations in which they must, together, make decisions about issues of social impacts that mobilise them and, thus, propose and/or participate in initiatives and/or actions aimed at solving those problems. The skills indicated for the development of this competency put into play the mathematical

> knowledge and tools necessary to develop a project whose purpose is to answer questions such as those related to the different geographical and/or social territories and to base conclusions on them. (Brasil, 2018a, p. 526)

This competency is connected with the idea of a student researcher that questions his/her reality, where the desire to want to know is implicit, solving problems. Lamonato and Passos (2012) state that mathematical research brings students closer to the research activity, making them researchers and discoverers, establishing evidence, regularity and similarities in their reflections, elaborating hypotheses and conjecture discoveries through socialisation with the community.

Competency 3 concerns the use of mathematics and its technologies, such as algebra, geometry, arithmetic, probability and statistics, to find solutions that answer the problems (Brasil, 2018a, p. 523). This competency is consistent with problem solving, using the mathematical modelling perspective to understand the real processes and try to solve or improve the proposed tasks.

This perspective of working on mathematics with problem solving is not new. Polya (1995), in his publications, established a methodology that comprised four phases: understanding the problem, establishing a plan, executing the plan outlined, and analysing the solution found. Problem solving is an important strategy not only for mathematics but also for human development because, according to Monteiro et al. (2020), we managed to develop many skills, starting from the historical need of the individuals to solve practical problems related to situations of their daily lives, seeking solutions and thus also developing the knowledge of other areas. Also, for Camargo and Daros (2018), problem-based learning places the student at the centre of the process as a protagonist. For the authors, however, it is necessary to structure the scenario of the creation of this problem comprising knowledge so that learning and knowledge appropriation actually occur.

During the teaching and learning process in mathematics, strategies are always used to help understand the problem or the proposed situation better so that these problems can be solved better too. With this, resources such as schematic drawing, graphic creation, pattern representation, among others, are used. This is the content elucidated in competency 4, which states the different semiotic representations that the mathematics resolution process can have, helping the student's understanding.

> The skills linked to this competency deal with the use of different representations of the same mathematical object,

> since they have a decisive role in student learning. By being able to use mathematical representations, understand the ideas they express and, when possible, convert between them, students begin to master a set of tools that significantly enhances their ability to solve problems, communicate, and argue; finally, expand the ability to think mathematically. In addition, the analysis of the representations used by students to solve a problem allows us to understand the ways they interpreted it and how they reasoned to solve it. (Brasil, 2018a, p. 530)

A researcher of semiotic representations, Duval (2012) says that during a mathematical activity, we must mobilise several representation records. Thus, the student can understand the mathematical concept well and not confuse the object represented with its representations. This statement is also confirmed by the BNCC, which points out that at least two different representations are indispensable for the student to understand the concepts and procedures, and the exchanges of records are essential for deepening logical-mathematical reasoning (Brasil, 2018a).

And finally, competency 5 is the most comprehensive and profound of the competencies studied, regarding the conjecture of practical situations, demonstrating its validity through mathematical formalisation, using technological and digital means for this proof, whether using or producing software or even doing computer simulations. The BNCC brings this argument, showing the importance of the role of deductive reasoning for mathematics and the understanding of the world.

> The development of this specific competency presupposes a set of skills aimed at investigating and formulating explanations and arguments that can emerge from empirical experiences. Students should make inductions through research and experiments with concrete materials, visual aids, and digital technologies. Thus, when formulating conjectures through their investigations, they should seek counterexamples to refute them and, when necessary, seek arguments to validate them. This validation does not need to be done only with empirical arguments but should also include more "formal" arguments, without the need to demonstrate several propositions. (Brasil, 2018a, p. 532)

A significant highlight is that in several competencies and skills, the use of Digital Information and Communication Technologies (TDICs) is

explicitly or implicitly suggested, not only for the area of mathematics and its technologies but for all areas of knowledge. Carneiro et al. (2020) emphasise that the use of digital technologies is a right of the students and teachers and that they should be offered digital literacy, as the BNCC text brings references about competencies in the use of digital technologies.

This use can be done directly with competencies and skills related to the very use of technologies or by supporting other competencies and skills in specific areas. General competency 5 is an example that highlights this need to use technologies in education:

> Understand, use, and create digital information and communication technologies in a critical, meaningful, reflective, and ethical way in the various social practices (including school practices) to communicate, access, and disseminate information, produce knowledge, solve problems and exercise protagonism and authorship in personal and collective life. (Brasil, 2018a, p. 9)

Speaking exclusively of the area of mathematics and its technologies, there are other specifications in the BNCC text for the use of TIDCs, such as skill 1 of specific competency 1: "interpret economic, social, and natural sciences situations that involve the variation of two magnitudes, by analysing the graphs of the functions represented and the rates of variation with or without the support of digital technologies." References to the use of digital technologies are also found in skill 3 of competency 2: "plan and perform actions involving the creation and use of applications, games (digital or not), spreadsheets for family budget control, simulators of compound interest calculations, among others, to apply mathematical concepts and make decisions." This reference to the use of technological material in skill 2 of competency 3 is also found: "solve and elaborate problems whose models are the polynomial functions of the 1st and 2nd degrees, in different contexts, including or not digital technologies." But there are still indications in other skills, besides those mentioned, that allow and require teachers to use technology in class.

The interest of this study is, specifically, in the mathematics teachers' understanding of the BNCC document and the connection between their classes and the competencies and skills required for mathematics and its technologies. The question arises: what is the mathematics teachers' view on the education and knowledge required for them to effectively apply the BNCC in the classroom, considering all the requirements, especially the skills and

competencies that contemplate the curricular base? To answer this question, the objective was to investigate and understand the knowledge that basic education mathematics teachers present about the BNCC for the application of activities in the classroom.

METHODOLOGY

The work was developed in the form of applied research, because it was carried out with a specific group of selected teachers. Mascarenhas (2012) says that we use applied research to study the problem in a context, seeking solutions to the challenges faced in this specific environment. This type of research is linked to the researcher's practice. The study has a quantitative characteristic since we carried out an inferential and descriptive statistical analysis of the sample data.

The study was conducted with basic education mathematics teachers from the state school system in the municipality of Itumbiara, GO. Thirty-four mathematics teachers from nine state schools of[1] the municipality that offer elementary and high school were considered for the population. To calculate the sample size, we used the Barnett formula (1991). Of the 34 questionnaires sent to the teachers, 28 were answered and returned, of which 26 were included in the analyses as a sufficient number for the sample. The inclusion took place randomly according to the ordinal sequence of responses in the datasheet.

We applied a questionnaire with three sections, the first to collect basic information from the participants, the second to verify perceptions about the BNCC and the third to show the use of the BNCC in the preparation and application of mathematics classes. The first part of the questionnaire contained four questions: "What is your biological gender?"; "At which stage of teaching is your greatest workload?"; "What is the education regime in which you are hired?"; "How long have you been a teacher in basic education?" The second part contained eight items: "My general knowledge about the BNCC"; "General skills and competencies necessary for all students"; "Specific skills and competencies in mathematics and its technologies"; "Contents to be addressed with students, related to the BNCC, in my area of knowledge";

[1]The data and information obtained in this article are an integral part of a research approved by the Human Research Ethics Committee of the Lutheran University of Brazil, ULBRA/RS, under number CAEE 39838220.7.0000.5349, opinion number 4.428.417.

"Training itineraries"; "Life project recommended by the BNCC"; "Structuring axes, integrating the training itineraries"; "Integrating projects." These items were categorised as: I do not understand, I understand little, I understand, and I understand a lot. The third part of the questionnaire contained five items: "Add to the content skills and competencies required by the BNCC"; "Prepare didactic/pedagogical materials using the BNCC"; "Make technological and digital integration in the room, according to the guidelines of the BNCC"; "Perform necessary interdisciplinarity among other areas of knowledge and mathematics"; "Integrate the various fields of the BNCC as formative itineraries and structuring axes with the area of mathematics and its technologies." These items were categorised as: I am not confident, I feel little confident, I feel confident, I feel very confident.

We contacted the participants by messages through the *WhatsApp* app, with the application of the questionnaires asynchronously, as the Covid-19 pandemic made it impossible for us to hold a face-to-face meeting. The questions were prepared in *Google Forms* and sent to the participants via WhatsApp.

For the analysis of the collected data and statistical measurement of the results, the Likert scale was used, as this analysis methodology is widely used in opinion surveys. Lima et al. (2012) express that when answering a questionnaire based on this scale, the participants specify their level of agreement or disagreement with a statement. This measurement scale can be used with several categories, ranging from 3 to 11. In this research, we used the scale with four categories, excluding the central category, which indicates the participants' neutral answers. We did not expect participants to remain neutral when answering the questions; they had to choose between agreement or disagreement. For Alexandre et al. (2003), when we do not include the neutral central category in the research, the respondents tend to mark the direction they are "inclined". We analysed the data through Microsoft Excel®, Minitab®, R and RStudio *software packages*.

Descriptive statistical analyses of the sample were carried out, with percentage comparisons of the structured data, which were presented in graphs for better visualisation. Among the statistical trials, inferential tests were performed, such as Cronbach's alpha, which evaluates whether a questionnaire is reliable for the answers presented, within the study in question, i.e., whether the questionnaire applied to mathematics teachers provided reliable information about their perceptions related to BNCC and its application in the activities done in classes. We also used Pearson's correlation to identify

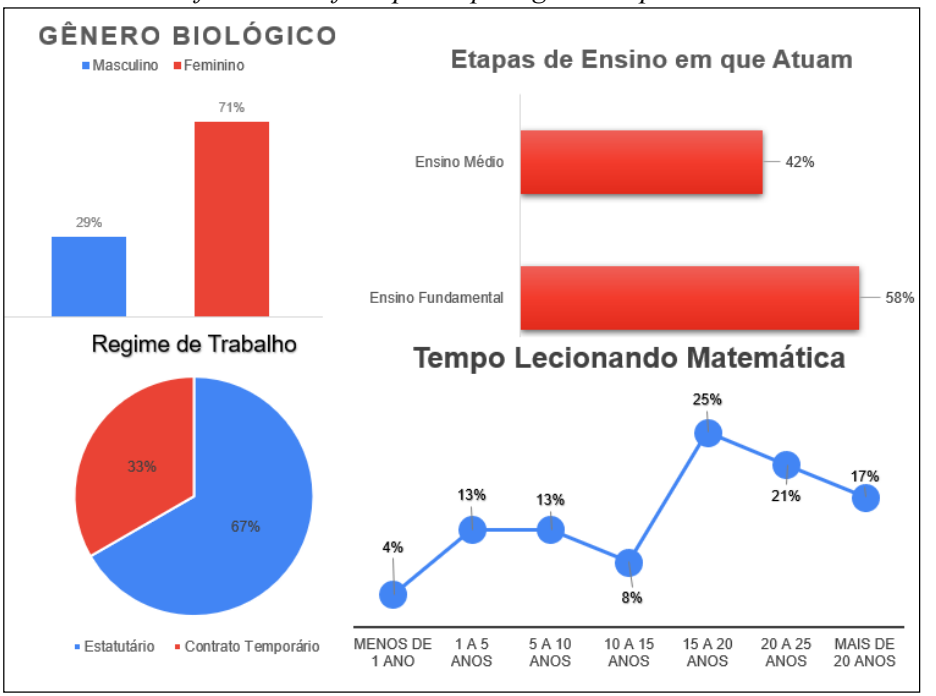
whether there was a relationship of uniformity between the teachers' answers and the degree of relationship of those perceptions.

RESULTS AND DISCUSSION

The questions in the first part of the questionnaire requested general information such as biological gender, teaching stages in which they teach (elementary or high school), time in which they teach mathematics, work regime (statutory or employment contract), emphasising that under the statutory regime, the teacher holds a permanent position in the state education network. The data are shown in figure 1. By analysing the answers, we verify that most respondents are women, corresponding to 71% of teachers in the area of mathematics. Probably this much greater result in favour of women was due to the participatory portrait of the teachers in basic education in the country. According to the national profile report of basic education teachers, there is predominance of around 81% of women in all stages of basic education and especially for high school, of 59.6% (Carvalho, 2018, p. 18).

Figure 1

General information of the participating and respondent teachers.



Most teachers, 58%, work in elementary school, and 42% in high school. Regarding the work regime, 67% are permanent teachers in the state school system, while the remaining 33% are governed by the temporary employment contract. These percentages show that all teacher training efforts regarding the BNCC, or implementation of new public policies, will have continuity due to the high rate of career teachers in the basic education state teaching of the municipality. Gatti and Barreto (2009) state that, in their opinion, the satisfaction with a career, where the permanent teacher is inserted, among other factors of teacher appreciation, is essential to raise the quality of teaching in a lasting way.

Policies for better qualification in basic education include teacher pre-service and continuing education and the constant renewal of motivation for teaching work, satisfaction with wages and career, which implies the implementation of various actions for the management of teaching personnel in an integrated manner. Isolated policies, specific actions not interconnected by a common purpose to build a professional social value do not impact enough in

improving learning in school systems. The analyses of the small impact of specific initiatives or their failure in the last 30 years clearly reveal the need for integrated and lasting policies (Gatti & Barreto, 2009, p. 253).

In the second part of the questionnaire, we examined both the knowledge that mathematics teachers presented, from their point of view, in relation to the competencies and skills that students must achieve with the BNCC and other parts that make up the document. For this question, we analysed Cronbach's alpha, obtaining 0.8771 in this trial as result, which shows us that the Likert scale for this question is really consistent and provides us with solid data regarding the desired information. Freitas and Rodrigues's (2005) results show the same characteristics of the analysis we performed. They applied a questionnaire to a university faculty using the Likert measurement metric, then calculated the reliability scores of the answers presented, obtaining high degrees for Cronbach's alpha, showing that this technique is used to give scientificity to the research data.

By analysing Figure 2, we can see that the first four items present agreement (I understand and I understand a lot), above 75%, according to the answers presented by the teachers. In descending order: "Specific skills and competencies in mathematics and its technologies", 92%; "Objects of knowledge to be addressed with the students, related to the BNCC, in mathematics and its technologies", 88%; "General knowledge about the BNCC", 83%; "General skills and competencies necessary for all students", 79%.

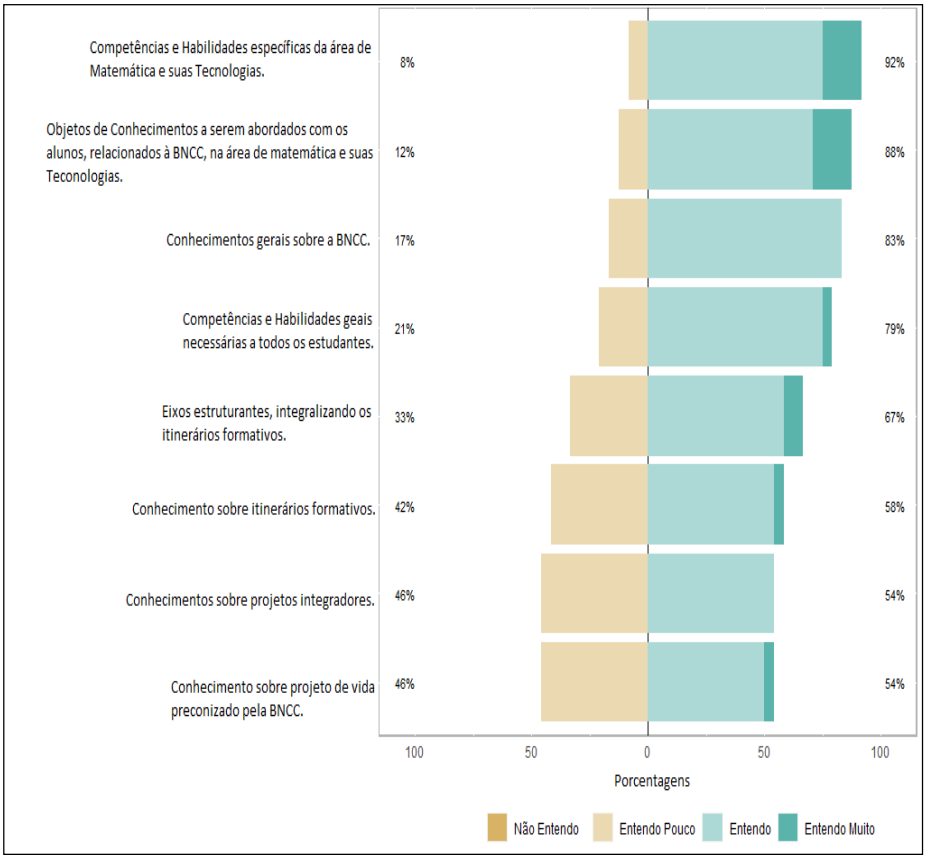
The data suggest that teachers have excellent general knowledge of the BNCC, understand very clearly the competency and skills that must be worked with students and that they know very well what content is established with the general skills necessary for students. This analysis is corroborated by Rodrigues and Groenwald (2018), noting that mathematics teachers of the final years of elementary schools (5th to 9th grades) in the municipality of Canoas-RS have good knowledge of the BNCC document, realising that teachers understand well the competencies and learning objectives that will lead students in what they need to learn. This view is also supported by Medeiros (2019), noting that teachers demonstrate that they know the BNCC and its objectives. Moreover, more than once the document is seen as a "guide" for teaching, a direction.

Organising in ascending order the level of agreement of the last four items of the graph, we have: "Knowledge about life project recommended by the BNCC", 54%; "Knowledge about integrative projects", 54%; "Knowledge about formative itineraries", 58% and "Structuring axes, integrating the

formative itineraries", 67%. These items in Figure 2 show around 50% for agreement (I understand and I understand a lot) and 50% for disagreement (I do not understand, I understand a little).

Figure 2

Mathematics teachers' perception about competencies, skills, and central axes of the BNCC.



With this observation, we ponder that teachers have not understood much, so far, about the diversified part of the BNCC, which corresponds to the studies by Guimarães and Castro (2020), who researched elementary school science teachers and found that 60% of them know little about the BNCC. According to the authors, this is because the teachers only heard about it from

media advertisements and never read the document. Other authors also share the idea that teachers do not fully know the BNCC because they had contact with the document through media or other forms with insufficient explanations. Reis and Gonçalves (2020) say that:

> Although the document states that the BNCC is a demand of society that has been widely discussed by civil society and, also, that it would be the solution to the educational inequalities in the country, the first contact we had with the idea of the BNCC was through an advertisement broadcast on television by the Ministry of Education. (Reis & Gonçalves, 2020, p. 169)

Table 1 presents information on Pearson's correlations of each item in figure 2 for a comparison of the relationship between the teachers' answers. Two pieces of information are shown in the cell, the first is the Pearson correlation coefficient (r), and the second is the p-value. The analysis takes into account the proximity of the value of the coefficient r to 1 and the p-value < 0.05, for the significance level of 5%. When examining items R2, R3, and R4, we can see that there is a strong correlation between the teachers' answers between R3 and R4, $r = 0.929$ and $p = 0$; there is also a correlation, but not as strong with R2 and R3, $r = 0.418$ and $p = 0.042$ and with R2 and R4, $r = 0.52$ and $p = 0.009$.

Comparing items R2, R3, and R4 in table 1, with the first four items in figure 2, we identified a great agreement in the level of knowledge that teachers have about these points of the BNCC. It is clear, therefore, that these answers are very linked since, when a teacher knows one of those areas, the analysis shows that he is very likely to know the others very well as well.

Table 1

Correlations presented by mathematics teachers' perceptions of competencies and skills and central axes of the BNCC.

	R1	R2	R3	R4	R5	R6	R7
R2	0.791 0						
R3	0.076 0.726	0.418 0.042					
R4							

	0.242	0.52	0.929				
	0.254	0.009	0				
R5	0.298	0.392	0.562	0.601			
	0.158	0.058	0.004	0.002			
R6	0.261	0.206	0.271	0.327	0.421		
	0.218	0.333	0.2	0.118	0.041		
R7	0.376	0.446	0.639	0.683	0.838	0.674	
	0.07	0.029	0.001	0	0	0	
R8	0.262	0.207	0.155	0.226	0.575	0.793	0.738
	0.217	0.332	0.468	0.287	0.003	0	0

Notes:
Cell Contents:
Pearson's correlation (r)
P-value
R1 – General knowledge about the BNCC.
R2 – General skills and competencies necessary for all students.
R3 – Skills and competencies specific to mathematics and its technologies.
R4 – Objects of knowledge to be addressed with students, related to the BNCC, in mathematics and its technologies.
R5 – Knowledge about formative itineraries.
R6 – Knowledge about life project recommended by the BNCC.
R7 – Structuring axes integrating the formative itineraries.
R8 – Knowledge about integrative projects.

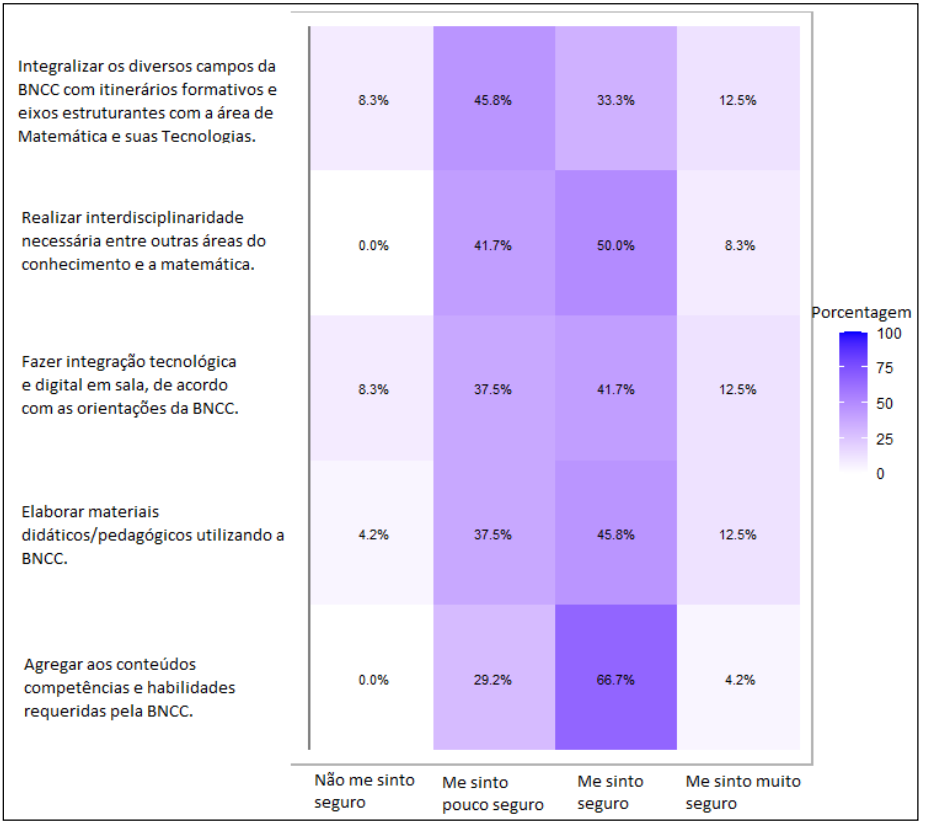
We also verified this connection between the answers presented in the last four items of figure 2, which are the same as in table 1, R5 – Knowledge about formative itineraries, R6 – Knowledge about life project recommended by the BNCC, R7 – Structuring axes integrating the formative itineraries and R8 – Knowledge about integrative projects. We identified this fact because table 1 tells us that there is a correlation between R5 and R6 ($r = 0.421$; $p = 0.041$), R5 and R7 ($r = 0.838$; $p = 0$), R5 and R8 ($r = 0.575$; $p = 0.003$), R6 and R7 ($r = 0.674$; $p = 0$); R6 and R8 ($r = 0793$; $p = 0$) and R7 and R8 ($r = 0.738$; $p = 0$).

Thus, we infer that there is an interrelationship between these responses, confirming the fact that when the teacher does not know very well

about some of these items, they relate them to the lack of knowledge of others, presenting compliance, since all these items are in the diversified part of the BNCC, of which teacher know little. This is a very relevant remark because the teachers are the main agents to put into practice the precepts of the BNCC applied in the classes. For Striquer (2019), teachers are, *a priori*, the main recipients of the prescriptions that make up the BNCC, since they are accountable for the didactic transposition of the propositional normative plan established in the BNCC.

Figure 3

Mathematics teachers' perception of confidence in applying and using the BNCC in their teaching practice.



Thus, that the teachers do not master a part of the curriculum base is at least worrying for the success of this implementation. Citing Dias (2016), the teacher is an important agent of reforms because he is the one from whom we

expect the commitment to make efforts so that such reforms are achieved and successful. Silva e Silva's (2020) work also shows that half of the teachers surveyed from Nazaré da Mata - PE answered that they have regular knowledge about the BNCC, i.e., 50% of teachers do not have good knowledge about the curriculum base.

The third part of the questionnaire aims to know how safely teachers can in their teaching practice, teaching mathematics classes, incorporating the competencies and skills proposed by the BNCC. The results are shown in figure 3.

By doing the Cronbach's alpha trial in the answers given to the question of the teachers' application of skills and competencies in the contents worked in the classroom, we obtained an alpha value of 0.8959, which represents a uniformity of the data and a guarantee that the answers are in accordance with the knowledge that needs to be covered. The result after the compilation and processing of those data presented in figure 3 leads to the finding that the perception that teachers demonstrate in relation to the feeling of confidence and lack of confidence in applying competencies and skills in activities in classes is not so clear, because the darkest part of the graph is in the middle quartiles, which leads us to analyse that they are between "I feel little confident" and "I feel confident". The only item that differs, with 66.7% of the answers is: adding to the content competencies and skills required by the BNCC. This feeling of vagueness, shown through the reposts given by the participants, is also evidenced in table 2 of the correlation between the items that, as seen, have a high degree of relationship between the answers, due to the verification of the coefficient r and p-value.

Table 2

Categories of action and microactions performed for the Class

	C1	C2	C3	C4
C2	0.43 0.036			
C3	0.345 0.099	0.872 0		
C4	0.514 0.01	0.747 0	0.713 0	
C5	0.392	0.685	0.754	0.818

	0.058	0	0	0

Note:
Cell Contents:
Pearson's correlation (r)
P-value
C1 – Add to the content competencies and skills required by the BNCC.
C2 – Prepare didactic/pedagogical materials using the BNCC.
C3 – Make technological and digital integration in the room, according to the guidelines of the BNCC.
C4 – Perform necessary interdisciplinarity among other areas of knowledge and mathematics.
C5 – Integrate the various fields of the BNCC with formative itineraries and structuring axes with the area of mathematics and its technologies.

Thus, the vague answer to an item makes us deduce that it will also lead to an answer of vagueness in others regarding the confidence of those teachers in relation to applying skills and competencies in the effective work in the classroom, showing at the end that teachers are not very confident about whether they can effectively apply the BNCC in class activities. This last analysis is not in line with Rodrigues and Groenwald (2018), who, according to most teachers' position, believe that the implementation of the BNCC will not bring difficulties, as it guides educational systems through the learning and development of students throughout basic education. However, Medeiros (2019) corroborates the results presented, saying that teachers' discourse is guided by the need for adaptation as something unquestionable, and that most teachers have been trying to adapt their lesson plans in relation to the reference curriculum document.

Another factor that may be influencing the lack of confidence is the teachers' difficulty with the objects of knowledge of the discipline itself, and Pertile and Justo (2020) demonstrate that teachers seem to lack the mathematical knowledge necessary for all processes. It is important to emphasise that the lack of confidence that mathematics teachers present in applying the BNCC concepts in the classroom is directly related to the misunderstanding expressed by teachers in specific areas of the curricular document. Thus, it is necessary to provide a process of initial and continuing education, so that teachers can correct the difficulties presented.

In her work, Margoni (2020) verifies that the implementation of the BNCC may make teachers feel insecure, because not everyone has received training and those who have received it state that they are not aware of the

complete document. [MARGONI] Still in this line, Ferraz (2019) certifies the need for qualification, saying that teacher education (initial and continuous) is a discourse present in the main educational reforms, representing one of the pillars to ensure the implementation of the BNCC throughout the educational system of the country. In addition to the difficulties already presented by teachers, these educational activities are also necessary due to the complex challenge of structuring a new curriculum in competencies and skills. As Vargas et al. (2017) say, in this new proposal, teachers will need to understand the whole of their action to come into line between the proposal and practice.

FINAL CONSIDERATIONS

The proper use of the BNCC in public schools involves the work of professionals who are directly related to teaching: the teachers. Offering special attention to these professionals is very important for the successful implementation of the curriculum base.

The question, then, arises: what is the mathematics teachers' view on their education and knowledge required for the effective application of the BNCC in the classroom, taking into account all the necessary requirements, especially the skills and competencies that contemplate the curricular base? To answer this fundamental question, we investigated public schools mathematics teachers' perceptions about the BNCC and if they can apply it in the classroom.

Data analysis suggests that teachers have good knowledge of the general competencies and skills and competencies of the specific area of mathematics and its technologies. This is interesting because although the BNCC has been in force for not very long, it shows that teachers are aware of the curricular change in basic education that is going on in the country. On the other hand, they still do not have sufficient knowledge about the diversified part of the BNCC, such as formative itineraries, structuring axes, life project, and integrative projects.

Regarding the application of those competencies and skills that the curricular base requires in the effective work with students, teachers reveal not to feel confident, which reveals an obstacle that must be considered in the elaboration of public policies for implementing the BNCC, through the reference curricula of state networks. The results indicate that although teachers have a good view of the general part, it is clear that there is still a lack of knowledge about the diversified part and that they lack confidence in applying

and inserting competencies and skills in the activities in class, which makes it difficult to implement them in the schools studied.

For mathematics teachers to apply their knowledge in accordance with the new proposals of the curriculum base, they need support, which can come through support in studies, courses and elaboration of materials aimed at this specific area that helps teachers overcome the lack of confidence they showed to have in the research. Therefore, studies aimed at the elaboration and application of courses for teacher education, production of didactic materials that take the BNCC guidelines into consideration, along with other measures, are indispensable for the insertion of any new curricular practice, leading to professional growth, students' learning and, consequently, improvement in the quality of Brazilian education.

AUTHORSHIP CONTRIBUTION STATEMENT

GFS was responsible for the collection, data analysis, and writing of the work. PTCL supervised, corrected, and contributed to the analyses.

DATA AVAILABILITY STATEMENT

The data collected to support the results of the study will be made available upon prior request to the corresponding author (GFS).

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