

# Math Skills Prioritised in the Evaluation of Early Childhood Education

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## ABSTRACT

This study deals with the matter of evaluation in early childhood education concerning mathematical knowledge. It aims to identify which skills are prioritised in the evaluation of preschool classes from a public school. The methodological design is the Case Study, and it is based on the documentary analysis. Fifty-two descriptive evaluation documents elaborated by eight teachers were analysed, taking into account the objectives provided by the Brazilian National Curriculum for Early Childhood Education. The data indicate that most of the mathematical skills related to “Number and Numbering System”, “Greatness and Measures” and “Space and Shape” are evaluated and recorded in the documents. It is noteworthy the absence of references to the notions of successor and predecessor, comparison of numeric writings, the monetary system, and bi and three-dimensional representations of objects.

**Keywords:** Math Education; Evaluation; Early Childhood Education.

## Habilidades Matemáticas Priorizadas na Avaliação da Educação Infantil

### RESUMO

O estudo aborda a avaliação na Educação Infantil no que tange aos conhecimentos matemáticos. Tem por objetivo identificar quais habilidades deste campo de conhecimento são priorizadas na avaliação de turmas da pré-escola, em uma instituição da rede pública. O delineamento metodológico é o Estudo de Caso e tem por base a análise documental. Foram analisados 52 pareceres descritivos, elaborados por oito professoras, tomando-se por referência os objetivos previstos no Referencial Curricular Nacional para a Educação Infantil. Os dados indicam que grande parte das habilidades matemáticas referente aos blocos “Número e Sistema de Numeração”, “Grandezas e Medidas” e “Espaço e Forma” são avaliadas e registradas nos documentos. Chama a atenção a ausência de referências a ideias de sucessor e antecessor, comparação de escritas numéricas, sistema monetário, e as representações bi e tridimensionais de objetos.

**Palavras-chaves:** Educação Matemática. Avaliação. Educação Infantil.

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## INTRODUCTION

The introduction of mathematics education more precociously has gained strength in different contexts. In addition to the importance of this field of knowledge, it has been understood that its initiation with very small children favours cognitive development and learning in general (Nunes & Bryant, 1997; Clements, Sarama & Dibiase, 2004; NCTM, 2008; Ponte & Velez, 2011; Grando & Moreira, 2017). In this sense, the official curricular references (Brasil, 1997, 1998, 2010, 2012, 2014) are attentive to this contemporary tendency and indicate the teaching of mathematical abilities at the earliest levels.

However, the teaching recommendation and the understanding of the favouring of the initiation to Mathematics do not guarantee that this is indeed occurring and underlining in significant teaching processes. Furthermore, it is understood that the acts of teaching and learning are strongly related to the evaluative processes, on which we seek to dwell in this study.

The focus we take is the teaching of Mathematics in Early Childhood Education, specifically in preschool, which serves 4 to 5-year-old children. It is a stage of Basic Education that, only recently (Brasil, 2013), has become mandatory and whose curriculum covers a set of initial skills of this field of knowledge. However, it is noted that Mathematics Education studies for this level of formal education are still very scarce, and researchers are more concerned with the initial years of Elementary School.

Our focus is on evaluation processes and the recording of study learning. Because it is a school stage in which there is no student retention for performance, sometimes it is observed that the evaluation is a little neglected or sustained by intuitive and precarious criteria. In this sense, our research objective was to identify which mathematical skills are prioritised in the descriptive reports of pre-school students, as well as to map through these documents what are the learning indicators observed and the methodological references adopted by the teachers in their processes of evaluation.

It is qualitative research that adopts the design of the Case Study. A public school in the southernmost state of Rio Grande do Sul was chosen with 12 pre-school classes. Data were collected from the descriptive evaluation documents of the first semester of 2017, prepared by the teachers who were willing to participate in the study, and later identified the mathematical skills mentioned and organised according to the blocks of content established for Early Childhood Education. These skills were compared with those approved in the National Curriculum Framework for Early Childhood Education (Brasil, 1998), which is a very significant curricular reference for teachers at this school stage. We sought to identify the prioritised skills and those that are not mentioned in the descriptive evaluation documents.

## CURRICULUM OF MATHEMATICS IN CHILD EDUCATION

According to the National Curriculum Framework for Early Childhood Education (RCNEI) (Brasil, 1998),<sup>1</sup> children are inserted in a world in which mathematical knowledge is inherent, as they make contact with numbers, quantities, relationships with time and space. In Early Childhood Education, this is more evident through the need of children to constitute knowledge that arises in the most varied types of thinking for the understanding of the world in different knowledge and skills. Thus, the document makes us question the idea of concepts about teaching mathematics through memorisation, repetition and association, or with frivolous activities, as well as making us think about the mathematical skills to be contemplated in teaching young children.

There are three main objectives, according to RCNEI (p.215), to be developed in the area of mathematics for pre-school children:

- Recognise and value numbers, numerical operations, oral counts and spatial notions as necessary tools in their daily lives;
- Communicate mathematical ideas, hypotheses, processes used and results found in problem situations regarding quantities, physical space and measurement, using oral language and mathematical language;
- Have confidence in your own strategies and ability to handle new mathematical situations using your prior knowledge.

In the document, mathematical skills are organised into three blocks: “Numbers and Numbering System” (1), “Greatness and Measures” (2) and “Space and Shape” (3). Block 1 involves: oral counting in the games or when children feel the need to explore them; simple situations of mental calculation for solving small problems; communication of quantities through oral language, numerical notation and unconventional records (for example, drawings); comparisons of numeric writing identifying irregularities; position of an object or number, with notions of predecessor and successor; identification of numbers in different contexts.

Regarding the notions of numerical writing, the RCNEI uses the term numerical notation, which is the ability to read, compare and order numbers, making use of everyday resources to provide these notions. The operations are, on the other hand, worked with notions of adding, aggregating, segregating and repeating. The calculation is learned along with the notion of number, in games and plays through situations-problems.

Block 2 covers the exploration of different procedures for comparing quantities; the notion of measures, weight, volume, length, time; time stamps (calendar); experience with

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<sup>1</sup> In this article, all quotations made from RCNEI refer to the same bibliographic source (Brasil, 1998). Because of their recurrence, the bibliographic source was suppressed throughout the text.

play money. The concept of measurement is broad, and it can refer to distance, surface, space, mass, heat (temperature), movement (velocity) and duration (time) (Lorenzato, 2008).

The greatness to be developed is time, monetary system, and length. Time is a measurable quantity, which uses landmarks and comparisons. Money articulates knowledge of numbers and measures: making operations, exchanging, comparing values, solving problems, encouraging counting, mental calculation, and estimating. The length includes the observation and sensory and perceptive comparison of the objects, that is, the capacity of the child to use their senses and their assimilation with the object in order to be able to quantify this greatness.

Block 3 comprises position statement; exploration and identification of geometric properties, shapes, contours, bi and three-dimensional representations, flat faces; identification of reference points and displacement; description of small courses and routes. It is considered that the experiences of children in this age range occur through the structuring of space and not in relation to geometry. Therefore, the usual relations with space present significant situations that stimulate it the same. The most significant spatial notions are those involving closeness, interiority and direction.

To develop geometric thinking, notions of shape must establish the characteristics of the attributes of the object (Carvalho, 2014). In this way, it is considered essential to present the drawing in different plane angles, as well as its three-dimensional shape, through constructions with objects, blocks, panels, models and the planning of solid objects.

Although the curriculum of Mathematics of Infant Education is known and the primary skills to be worked, it is not a sufficient condition to only take into account the learning in informal processes, individual or collective. It is necessary to continue the learning with intentionality and planning, encouraging the elaboration of this knowledge, and taking into account the evaluation process of this learning.

## EVALUATION IN CHILD EDUCATION

Thinking about the multiple faces of evaluation, it is essential to reflect on their specificities in Early Childhood Education. Barbosa and Horn (2008) affirm that the evaluations of the children reveal the conceptions about learning, childhood and education, exposing in some way the theoretical models supported by the teachers. Bassedas, Huguet and Solé (1999, p.173, author's italics) define the evaluation: "serve to intervene, *to make educational decisions*, to observe the evolution and progress of the child and to plan if it is necessary to intervene or modify certain situations or activities in class".

Hoffmann understands evaluation as "a set of didactic procedures that extend over a long time and in various school spaces" (2014, p.13), thus carrying out a process of follow-up of the child's development, using instruments such as: descriptive evaluation

documents, evaluation sheets, portfolio, reports, dossiers or any other form of records or notes that are tools that assist in the evaluation process. In addition, teachers who perform this assessment are often grounded in feelings and perceptions and interpret what is observed in children. These looks magnify the way to evaluate, not only being linked to the look on what the children represent, but also as a way of reflecting on the practice itself and the macro system of the school, because everything will in some way affect the children and the actions that they have.

In a unique look, we turn to the Municipal Pedagogical Proposal<sup>2</sup> for Early Childhood Education that guides the school investigated (2015). According to the proposal, the school understands that the evaluation process “refers to the internal follow-up that occurs in the institutions, whose focus is the child and their learning” (p.35), proposing to evaluate the child, the work of the teacher and developed by the school, being “a PROCESS, above all” (p.36, author’s italics).

Thus, this document indicates three instruments for assessing: observation, recording and documentation. Observation can be carried out through learning situations, in which the teacher is able to carry out a continuous observation of this process and thus record it in the form of photographs, drawings, evaluation of the day by the children, daily and general reports. Documentation is a way of systematising the evaluation, being carried out in the form of descriptive evaluation documents, so that some teachers still use the portfolios. These opinions are, in general, constructed semi-annually and cover our elements of analysis.

## **METHODOLOGICAL PROCEDURES**

The study falls within the scope of qualitative research, having as its outline the Case Study, which can be understood as “empirical research that investigates a contemporary phenomenon within its real-life context, especially when the boundaries between the phenomenon and the context are not defined” (Yin, 2001, 32). For Bogdan and Biklen (1994, p.89) the Case Study consists of “detailed observation of a context, or individual, of a single source of documents or a specific event”. Based on this, we set forth assumptions based on these authors to serve as a point of reference for the design of our particular study.

The delimitation of the case began with the choice of the School of Early Childhood Education, with the criterion being that which had the highest number of students enrolled, and thus could provide a more comprehensive number of subjects. It is a municipal public school in a medium-sized city in the southernmost state of Rio Grande do Sul.<sup>3</sup> The chosen stage was preschool, which includes children from four to five years. In addition to the first year of elementary school, it is the moment when students and teachers begin

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<sup>2</sup> Municipal School of Early Childhood Education Fraternidade.

<sup>3</sup> Municipal School of Early Childhood Education Fraternidade.

a greater search for the skills to be developed and the fulfilment of a curriculum that is more explicitly linked to Mathematics.

The study collaborators were exclusively female teachers who followed the following inclusion criteria in the study: being a pre-school teacher at the institution; be in an effective exercise of teaching with regular class; be graduated with a degree in Pedagogy – *Licenciatura* (Teacher training); have agreed to participate in the study; and have signed a Free and Informed Consent Form. Based on these criteria and the desired profile, we found a group of eight teachers who taught at this level in 2017, with 105 students.

Data collection was done through the provision by the teachers of a copy of the individual evaluation instrument of the school – descriptive evaluation documents – that are provided to the parents containing aspects of the child’s pedagogical development in the semester. The data processing was done through documentary analysis, so we base our study on the references of Ludke and André (2013), who recommend an initial reading of the document and the understanding of the main points of prominence, “identifying factual information in the documents from questions or hypotheses of interest” (p.38). Thus, we read the documents in order to (a) map the fields of mathematical knowledge and the competencies that are prioritised and emphasised, as well as (b) observe the methodological references that appear in the evaluation records.

After reading all the documents, we selected only those in which it was possible to find some reference to the area of mathematics, which resulted in 52 opinions as the final corpus of analysis. The detailed analysis was then started making a narrower selection to identify information involving only Mathematics, which resulted in 117 units of analysis. These units were grouped and analysed according to the block of contents to which they referred.

Ethical care has been taken since the beginning of the research engagement. At the first contact with the school, a formal authorisation was requested to conduct the research, clarifying the instruments used, filling out the Consent Form with the school’s management and with each participant. Care was taken not to identify neither teachers nor children mentioned in the opinions.

## **DATA ANALYSIS**

It is important to note that of the 105 descriptive evaluation documents provided, only 52 mentioned mathematical skills. In another perspective, a little more than half, 53 documents, did not allude an evaluation of the learning of Mathematics. It may be assumed that mathematics is somewhat neglected in the assessment record of a quite significant portion of the students. The descriptive report is intended to provide an evaluation of the child’s development (Bassedas, Huguet & Solé, 1999; Hoffman, 2014). In this sense, this significant gap makes us believe that teachers do not treat mathematical skills as an essential indicator in the development and learning of children. Regarding

the mathematical skills identified, the first treatment we gave the data was to group them by content blocks to then check the frequency of each skill and compare them with the curriculum suggested by the RCNEI.

## NUMBER AND NUMBERING SYSTEM

According to the RCNEI, the block “Number and Numbering Systems” aims to approach skills that involve notions of numeric counting, notation and writing and mathematical operations, addressing them in six objectives, as shown in Table 1:

Table 1

*Objectives for the block Number and Numbering Systems. Source: RCNEI (Brasil, 1998).*

1. Use of oral counting in games and situations in which children recognise their need;
2. Use of simple notions of mental calculation as a tool to solve problems;
3. Communication of quantities using oral language, numerical notation and/or unconventional records;
4. Identification of the position of an object or number in a series, explaining the notion of successor and predecessor;
5. Identification of numbers in the different contexts in which they are;
6. Comparison of numeric writing, identifying some regularities.

The skills present in the extracts of the opinions elaborated by the teachers related to this block are shown in Table 2. From the previous analysis, it was verified that it would be possible to organise the data in three subgroups: a) number and numeral; b) count and c) mental calculation, as presented in the Table 2 below:

Table 2

*Excerpts from the descriptive evaluation documents on the block Number and Numbering Systems.*

Extracts according to subgroups	Number of units
<b>2.a Number and numeral</b>	
Difference / differs number from letters	10
Write and relate the numbers to their respective number up to ten	9
Properly doing the relationship between number and numeral	6
Struggling to write and relate the numbers to their respective number up to ten	6
Understand the notion of quantity and recognise the numerals	4
Recognises some numbers from 1 to 10	2
Understand the notion of quantity of numerals and recognises up to number 10	2
Understand the notion of the number of numerals up to five	2
Differentiates writing from numbers	1
Recognise up to 10	1

<b>Extracts according to subgroups</b>	<b>Number of units</b>
Differentiates letters of numbers but does not yet recognise them and has no idea of quantity	1
Identifies some numerals	1
<b>2.b Count</b>	
Count from 1 to 10	6
There is some difficulty when counting the numbers from one to ten.	1
<b>2.c Mental Calculation</b>	
Recognises the numbers and makes some mental additions	1
<b>Total</b>	<b>53</b>

(a) The subgroup number and numeral contains fragments that show worked items referring to the idea of number and its written representations in the form of a numeral. In Mathematics, the concept of number refers to the idea of quantity that comes to mind when counting, ordering, or measuring. The numeral is any representation of a number, whether written, spoken or typed. In Table 2, we find abilities related to differentiating, recognising, relating, identifying and perception (notion).

According to these units, it is perceived that the term most approached is the concept of differentiation from letters and numbers. The act of differentiating implies distinguishing one element from another. The term “number”, which refers to quantity, was used in the writings of the teachers in a context with symbol differentiation: numbers of letters.

The segments presented in this axis approach objective 5 “Identification of numbers in the different contexts in which they are”, addressed in the Reference. However, in observing the description “differentiates letters of numbers”, one does not identify in what type of situation the differentiation process occurs. The RCNEI suggests differentiation of the numbers in their different contexts (numeral, digit, cardinal, ordinal...).

The differentiation between numbers, as well as the process of reading, comparing and associating them, is indispensable for understanding the meaning of numerical notation. When faced with these various facets of numbers, the child is challenged to develop his or her own thinking and produce knowledge about it (Brasil, 1998). This competence is described when the student is “adequately making the relation between number and numeral”, being possible to verify the relationship with the objective “comparison between number and quantity” proposed by the Reference.

In relation to this objective, other notes are observed, such as: “recognises some numbers from 1 to 10”, “has a notion of quantity and recognises numerals” and “differentiates letters of numbers but does not yet recognise them and has no notion of quantity“. It is observed that there is great appreciation by the part of the teachers regarding the relation of number and numeral, as well as the identification of the commitment of



the student when it addresses: “It is striving to write and to relate the numbers to their respective amount up to ten”. In relation to the items discussed, we can highlight in the section “adequately making the relation between number and numeral”, that although we do not know how the teacher develops this relation, from his writing, we are supposed to work with goal 3 of the document, which refers to the communication of quantities, using oral language, numerical notation and/or unconventional records.

(b) Subgroup 2.b is composed of units of analysis that represent the use of the students’ day-to-day counting. From these segments and the ideas of Nogueira (2011), we realise that counting is one of the first steps in comparison and quantification of collections, and from the family environment the child is induced to perform counts and, in contact with the environment and emphasised by the school, this ability becomes easier. These fragments fit into objective 1 of the RCNEI, using and recognising the oral counting of numerals. However, the document makes clear that, although the use of oral recitation of numbers is essential for the approximation with the numerical system, it is necessary to avoid the mechanisation of this act.

For such purpose, we can see that there is a distinct difference between the level of learning among students who already know how to do, and others who still find difficulties, as the passage explains: “when counting the numbers from one to ten, finds some difficulty. “ Thus, it can be seen that the teacher, through her goal validation strategies, can identify the difficulties of the students and realise that they are progressing towards the proposed goal.

(c) Subgroup 2.c addresses the student’s use of mental calculus. It is understood, through these units, that the child can, besides recognising the numbers present in different contexts, make some mental additions, thus contemplating objective 2 of the Reference.

The RCNEI addresses the calculation as an acquisition along with the notion of number and from its use in games and problem situations. In this perspective, the calculation is an open problem that can be solved in several ways and degrees of difficulty, varying according to the types of questions presented. However, it is not known how the student came to the development of doing additions mentally, but it is recognised that children experience situations in which it becomes necessary to use notions such as joining, separating, withdrawing and adding.

From the groups formed with the competencies evidenced in the opinions, it is verified that objectives 4 and 6 of the block “Numbers and Numbering Systems” were not explored in the opinions. The whole process of re-knowing the numbers is complex and challenges the child to learn, thus developing a unique thought, which makes it capable of producing new knowledge, and reaching the resolution of problems. In the same way, it is essential to emphasise that the absence of reference to these objectives does not mean that they are not developed.

## GREATNESS AND MEASURES

According to RCNEI (p.219), the “Greatness and Measures” block aims to approach competencies “involving different sizes, weights, volumes, temperatures” so that children informally establish contact, “making comparisons of sizes, establishing relationships, constructing some representations in this field, assigning meaning and making use of the expressions they usually hear. “ Considering these competencies, the RCNEI addresses four objectives:

Table 3

*Objectives for the block Quantities and Measures. Source: RCNEI (Brasil, 1998).*

1. Exploration of different procedures to compare quantities.
2. Introduction to the notions of measurement of length, weight, volume and time, by the use of conventional and unconventional units.
3. Marking time through calendars.
4. Experiences with money in play or situations of interest to children.

From the analysis of the descriptive documents, it was verified that the fragments produced by the teachers contemplate, in a certain way, the objectives 1, 2 and 3 of the Reference. In the data produced it can be observed that some of them were contemplated, organising them into two subgroups: (a) time and (b) measures.

Table 4

*Excerpts from the descriptive evaluation documents on the block Quantities and Measures.*

Extracts according to subgroups	Number of units
<b>4.a Time</b>	
Presents good notions of temporality by adequately using the terms: day/night, yesterday, today and tomorrow	15
Developing the notions of temporality to properly use the terms day/night, yesterday, today, and tomorrow	1
Properly use the terms before, after, morning, afternoon, night, yesterday.	1
<b>4.b Measures</b>	
Expanding the knowledge regarding measurement concepts such as: large/small, major/minor, high/low, longer / shorter, less long / shorter, thicker / thinner	13
Identify [...] the same and different, simple antonyms: high / low, near / far, large / small, hard / soft. Have a notion of day / night, cold / hot	1
<b>Total</b>	<b>36</b>

(a) Subgroup 4.a has notions of time. According to this passage, we understand that children have a notion of differentiating the regularities of time as the past, the present and

the future, as well as recognise different situations of their day, such as the differentiation between day and night. It can be seen that this segment falls under RCNEI objective 3 (p.222), referring to time as “a measurable quantity that requires more than the comparison between two objects and requires relations of another nature”. Thus, reference points of temporal relations are used, for example, day and night; morning, afternoon and night; days of the week; the months; the year; present, past and future; before, now, and after.

For the development of temporality, it is crucial that we start the closest notions of time to the most distant ones of the child. This contributes to the establishment of new relationships, such as order and time duration. From what is observed, the emphasis is placed on temporal ordering, making possible the understanding of linear time, such as morning, afternoon and night. In the opinions, we also find the notion of temporal duration, situating the child in relation to short, medium and long temporal durations.

The construction of these temporal notions has a correspondence with the daily life of the students, such as the sequence of the routine that is lived in the school, at home, before or after lunch, dinner, among others (Bassedas, Huguet, & Solé, 1999). Even if the child has not built it in conventional terms, the nursery school routine plays a fundamental role, offering events to mark the passage of time, such as snack time, play, rest, time to leave.

(b) Block 4.b addresses the notions of measurement. In analysing this extract, it is noticed that the child already has the notions not only in relation to their position in the environment but also in comparison with other objects. It is able to recognise different positions as inside, outside, open, closed, among others. Thus, what is evident here is close to objective 2 of the RCNEI, regarding the introduction of measures of magnitude, more precisely to the design of measurement.

In the small section under analysis, one can see that broad, and often succinct, concepts are broadened, since at first, we have the opposite characteristics of the quantities: far / near, front / back, side (we suppose left and right), inside / outside, open/closed. The teacher mentions size measures, using adjectives to express relationships built by children, such as high/low, near / far, large/small. The density measurement is quoted from the hard/soft ratio, and analogously, the temperature measurement is evidenced by the cold/hot ratio. In the stratum, the day/night relation is quoted, which allows the interpretation of time measurement.

In no opinion, we find reports about the use of objects to measure, such as ruler, scale, thermometer or other non-conventional object constructed with the class. Nothing was observed on the quantification of quantities such as weight, length or temperature. Although it is not explicitly stated in the opinions, objective 1 – exploring different procedures for comparing quantities – is the basis for the other two objectives developed.

Given the fragments presented, it was noticed that the fourth objective was not mentioned, which refers to the use of money in games that arouse the interest of the children. Depending on the social context in which the child finds himself, he does not have experience and, consequently, an easy understanding about the notion of money,

being an important skill to be developed in the preschool. The purpose of the monetary system objective is for children to articulate ideas about numbers and measures (Muniz, Batista, & Silva, 2008). The action of making exchanges, comparing values, performing operations and solving problems helps in visualising and establishing characteristics of the representation of natural numbers and decimals. For Curi (2015), the mathematical knowledge to be prioritised in this school stage is what society considers valid and necessary for an adequate social insertion of children. Therefore, using money is an opportunity and construction of a basic repertoire, which in itself encourages counting, mental calculation and estimation.

## SPACE AND SHAPE

According to the RCNEI, the “Space and Shape” block comprises geometric thinking, which deals with the relationships and spatial references that children develop. It is recommended that these skills be developed with representations built from the sensory exploration, the actions developed on an object, the movement in the environment, besides the problem-solving.

In relation to the objectives of the block, it is expected that children can acquire “an increasing control over their actions and can solve problems of a spatial nature and potentiate the development of their geometric thinking” (p.230). RCNEI addresses five objectives for this block:

Table 5

*Objectives for the block Space and Shape. Source: RCNEI (Brasil, 1998).*

- |   |
|---|
| <ol style="list-style-type: none"><li>1. Explanation and/or representation of the position of people and objects, using relevant vocabulary in games and in the various situations in which children deem this action necessary.</li><li>2. Exploration and identification of geometric properties of objects and figures, such as shapes, contour types, two-dimensionality, three-dimensionality, flat faces, straight sides, etc.</li><li>3. Two-dimensional and three-dimensional representations of objects.</li><li>4. Identification of landmarks to locate and move in space.</li><li>5. Description and representation of small routes and routes, observing reference points.</li></ol> |
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From the analysis of the competencies related to space and form, data were organised into two subgroups: a) spatial location and b) geometric properties. The competencies present in the extracts related to these objectives are shown in the following table:

Table 6

*Excerpts from the descriptive evaluation documents on the block Space and Shape.*

<b>Extracts according to subgroups</b>	<b>Number of units</b>
<b>6.a Spatial Location</b>	
Features basics notions of from far and near, ahead, behind, next, in, out, open, closed, closer to you and objects	6
In the drawing, already presents a concern in the space, with the forms, more structured forms and looks for symbols that represent its environment	5
In the activities proposed in class, it demonstrates knowledge of colours, a good spatial notion, besides the proper use of glue and scissors, carries out activities with enthusiasm and carefully, as well as helps colleagues who have difficulties	1
Draw the human figure by placing all the body parts, including drawing a floor for them, demonstrating good spatial notion	1
Paint their drawings with notions of space and with colour distribution harmoniously	1
Knows how to tell about his person, where he lives and describes the parts of his body very well. their expressive language is very clear	1
<b>6.b Geometric Properties</b>	
Recognises colours and geometric figures	12
Remembers geometric shapes	2
Likes situations that involve logical challenges, colours, geometric shapes, puzzles, games	1
In the first semester, he excelled in activities involving colours, geometric shapes, trimming /gluing and modelling	1
Identifies [...] geometric shapes	1
<b>Total</b>	<b>32</b>

(a) The subgroup spatial location brings units of analysis that show items worked by the teachers related to space exploration, and can be seen in three perspectives: spatial relations contained in objects, which can be perceived through contact and manipulation; spatial relations between objects, which involve notions of orientation, such as proximity, interiority and directionality; spatial relations in the displacements, involving the observation of the points of reference that the children adopt.

Based on the extracts, it was found that they fit within the objectives 1, 4, and 5 recommended by the RCNEI for the block of contents of table 5. It can be seen in the excerpt: “It presents basic notions from far and near, behind, inside, outside, open, closed, closer to oneself and objects “that the child presents a” spatial notion between objects involving notions of orientation, such as closeness, interiority and directionality” (p.230). In this way, it determines the position of a person in space, using a reference point of another object, which can be stopped or in motion.

The section “Knows how to say data about yourself, where you live” was addressed in a single opinion. This does not mean that the others can not represent this location, depending on how the teacher values what they record about each student. From observations of points of reference, in this case, being able to identify where he/she lives

allows the child to know the stretch by which he/she moves daily. These competencies are identified in objectives 4 and 5 of the document.

In other excerpts we identify the evaluation of spatial notions in painting activities “Paints his drawings with notions of space and with distribution of colours in a harmonious way”, and drawing “In the drawing already presents a preoccupation in the space, with the forms, more structured forms and demand symbols that represent their environment. “ It is also observed that when the spatial notion is associated with the drawing that represents the position of the body in space, “Draw the human figure by placing all the parts of the body, including drawing a floor for them, demonstrating a good spatial notion”, the child is evaluated successfully by drawing a floor for the doll, which seems to us a rather incipient indicator. From the fragments, we can question that the first perception of the teachers is the representation, obeying orders and limits, based on painting and drawing. In general, this concept is superficial, since children develop geometric thinking, which refers to spatial relationships and representations, very early and in various actions of movement-relation.

(b) The second subgroup 6.b represents the use and recognition of geometric properties. It is observed how a variability in terms used to define the student’s level of development in relation to the geometric form is used, such as: “Recognizes colours and geometric figures” and “Remember geometric shapes”.

Objective 2 of the Referential explains that students in preschool explore and identify the geometric properties of objects. This means that in addition to recognising a square, circle, rectangle or differentiating them, it also addresses issues such as the identification of contour types, bi and three-dimensionality, flat faces, straight sides, and so on.

Another critical point is that the forms are linked to the games “Likes situations that involve logical challenges, colours, geometric shapes, puzzles, games” and activities “excelled in activities involving colours, geometric shapes, clipping/gluing and modelling “. These reports show a promising and adequate approach to the level of education, which favours the learning of spatial notions, but it is not enough.

After the analysis of the extracts, it was verified that the objective 3, which approaches bi and three-dimensional representations of objects, was not explored in the evaluations. A similar result was found by Muniz (2013), where he emphasises that geometric activities are mostly absent in practices in Early Childhood Education. According to the author, the neglect of geometric work has several origins, such as the fact that throughout history, Geometry was predominantly absent in Brazilian school curricula.

Note the concern of the teachers in presenting the geometric figures to the children in order that they learn to name them. The three-dimensional representation is an important objective. However, we can assume that its neglect can occur for two reasons: (1) the teachers understand that the essential teaching of geometry is linked to the representations of flat figures or (2) consider that the relationships between bi and three-dimensional objects are complex for children. It is understood that thinking about geometry is to get the child to take notice and feel belonging to the space experienced and thought, which

would foster a very consistent approach to questions of tridimensionality. Thus, the fact of not addressing three-dimensional objects makes us suppose that the teaching of forms is more directed to drawings and formal representations than to everyday situations.

## FINAL CONSIDERATIONS

This study on communication documents of the assessment of pre-school children sought to highlight which mathematical skills were considered outstanding in the evaluative processes of teachers. However, it is essential to emphasise that the absence of mention of particular objectives in the opinions does not mean that they are not developed. Often, teachers can approach skills but choose not to mention them in their opinions, which leads to the possibility that they do not consider these references important in the information about the student's learning process.

At the outset, it may be noted that just over 50% of the documents analysed did not have any mention of the skills that involve knowledge in the field of Mathematics. It is noted that there is a relative consensus about the importance of mathematics in school life so that a total absence of mention of the area shows a very significant gap. This is a relevant fact in that it ratifies the need to emphasise the importance of teaching Mathematics, even at earlier levels of education, and in the processes of initial and continuing teacher training.

Among those opinions that listed mathematical references, the first of our objectives was to identify the skills that are highlighted in preschool. We understand that what the teachers present in the descriptive evaluation documents are the skills considered important. In general, there is a varied distribution of the presence of the three blocks of contents indicated by the official curricular reference.

In the "Number and Numbering System" block, the most mentioned skills are those that refer to the distinction of numbers of letters, the relation between numbers and letters, the written representation of numerals and the count. In all situations, the explicit quantity is up to 10. It was noticed that there are no skills in the opinions that involve two objectives recommended in the curricular referent: the idea of predecessor and successor, and comparisons of numerical writing in order to identify some regularities. It is noted that these are more complex skills that are linked to differentiated methodological approaches. Understanding the notion of successor and predecessor, for example, requires counting teaching to overcome number recitation and sequence memorisation techniques. We may assume that this is one of the possible reasons why these skills are not highlighted in the descriptive evaluation documents.

In the block "Greatness and Measures", time is highlighted. Note is given to very suitable expectations for the learning of children in Early Childhood Education, such as understanding the notions of before and after, day and night, yesterday, today and tomorrow. The other magnitudes appear comparatively between their antithetic measures (big and small, far and near, large and small, cold and hot, etc.). The gaps in this block

refer to the objective that addresses the monetary system. This is a conspicuous absence since there is no mention of this greatness, which presents a significant relation with the daily life and the social interactions of the children.

In the block that deals with “Space and Shape” the elementary spatial notions, such as far and near, open and closed, etc. are highlighted. It is noted that the teachers assume the quality of the children’s drawing as an essential indicator of the idea of space, understanding that the painting and the pictorial representations are a reference to evaluate the spatial notion. In the field of forms, the emphasis is on identifying and correctly naming flat figures. It was possible to identify that there is no highlight in the opinions for three-dimensional figures or relations with the forms in everyday situations of the students. It can be assumed that the group of participating teachers appreciates flat geometry and its symbolic representations as more significant skills at this level. It is perceived that there is an implicit understanding that the representations of the figures and the construction of formal school knowledge seem more important to be reported in the evaluation than those in which there is interaction with the reality and the knowledge coming from the children’s daily lives.

Our next analysed objective goes back to the methodological references that are mentioned or deductible in the descriptive evaluation documents. Although this type of document intends to report only the performance and routine of children in their activities, it is possible to perceive some methodological approaches that are implicit. In the analysed corpus, we identified **a concern with formal mathematical knowledge, which evidences methodological approaches less connected with everyday situations and with students’ previous and social knowledge.** One can illustrate this idea with the priority given in the opinions to the writing of numerals and their different representations (with no more concern with ideas of approximate quantity and quantification), the proper and formal appointment of flat figures (without further exploration of their properties and presence in everyday life) and counting based on memorization (without construction of meanings or activities of classification and serial number construction). In the same sense, the absence of skills strongly linked to daily situations, such as the monetary system or the three-dimensional figures, corroborates this idea that there is a concern for a more formalised teaching of Mathematics in Early Childhood Education. Thus, it is understood that there is still a tendency for traditional mathematics teaching and that it also has few openings for more diversified methodological approaches.

## **AUTHORS’ CONTRIBUTIONS STATEMENTS**

J.A.S. oversaw the project. C.A.R. conceived for the idea presented. C.A.R., C.C.B. and J.A.S. developed the theory. C.A.R. adapted the methodology to this context, created the models, performed the activities and collected the data. C.A.R. and C.C.B. analysed the data. All authors discussed the results and contributed to the final version of the manuscript.



## DATA AVAILABILITY STATEMENT

Data supporting the results of this study will be made available by the corresponding author, C.C.B, upon reasonable request.

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