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Didactic Knowledge of Mathematics Teachers about Their Teaching: From the Perspective of the Use of Manipulative Materials

Venâncio Lopes*, Marcelino da Costa Ribeiro, Alfredo Pinto
Universidade Nacional Timor Lorosa'e, Timor-leste
Email: loccordada@gmail.com*

Abstract
The main objective of this research was to explore the opinions of primary and secondary school teachers in the municipality of Manatuto regarding the teaching of Mathematics using manipulative materials. A quantitative methodology was employed, and the opinions of 30 teachers were gathered through a closed questionnaire. Data analysis was conducted using Microsoft Excel. The results indicated that primary and secondary school teachers in the municipality of Manatuto are familiar with and use the following manipulative materials in their teaching practice: Geoboards, tangram, geometric solids boxes, abacus, rulers, compasses, protractors, blackboards, logical blocks, number dice, coins, and playing cards. These materials were used for specific topics but not across all contents outlined in the mathematics curriculum. Teachers stated that manipulative materials help students touch, feel, and move objects, making abstract concepts more concrete and understandable, which aids in student comprehension and motivation. These materials serve as symbolic representations, help contextualize learning, and promote skill development, but they require careful planning and teacher guidance to be effective. Regarding curricular guidelines, the findings suggest that mathematics programs should incorporate the use of manipulative materials to enhance the learning experience.
Keywords: Knowledge; Manipulative materials; Primary and Secondary School Teachers

INTRODUCTION

In fact, in Timor-Leste, all students, whether in primary and secondary education or university students, share the same opinion (Beck, 2022; Butcher, Bastian, Beck, d'Arbon, & Taouk, 2015): they recognize the complexity of Mathematics content, given that the learning results of this subject at the end of the school year speak for themselves and need no introduction, because they are far below expectations; they are very weak indeed. These perspectives are supported by some authors, namely Freitas and Moita, who state that, *a matemática é uma ciência muito rigorosa e bastante complexa. Grande parte dos alunos não gostam de estudá-la, por considerar esta matéria de difícil compreensão e acabam não tendo sucesso na escola. Este pensamento, obviamente desmotiva a maioria dos alunos no aprendizado dos conteúdos desta disciplina que, sendo uma área do conhecimento que pertence às ciências exatas é importante não só como conhecimento básico para outras disciplinas como de extrema importância para a vida*," (Boaler, 2025; Demartini, 2023).

On the other hand, Resende and Mesquita add that, *"muitas vezes, ouvem-se declarações de que os estudantes não gostam de matemática, de que a temem e de que a consideram uma disciplina complexa"* (p. 200) (SOUSA, 2023). Regarding mathematics tests, Magalhães and Martinho reveal that, *"os alunos em todos os níveis de ensino continuam a revelar muita dificuldade no processo de prova matemática e na procura de possíveis caminhos para a resolução de situações problema"* (p. 104) (Mendes, 2023; Pontes, 2018).

In summary, mathematics content is considered by all students to be very difficult, and most of them do not like to learn it (Akhter & Akhter, 2018; Guner, 2020). On the other hand, teachers have an important and complex role in changing this situation (Becirović & Akbarov, 2015). In addition to teaching mathematics, they must be able to encourage students to learn

using different means (Abd Alganı, 2019; Abramovich, Grinshpan, & Milligan, 2019). Thus, it is imperative to mention that teaching practices combined with the knowledge that teachers have are crucial, essential, and fundamental for learning (Alemu, 2015).

Teachers must master the content they have to teach so that students can clearly understand it (Banner & Cannon, 2017). At the same time, the teacher must be able to select appropriate and relevant manipulative materials to support educational activities in schools, both at the primary and secondary levels, in order to achieve the desired learning outcomes. Therefore, professional knowledge, particularly concerning the teaching practices of Mathematics teachers, constitutes one of the factors that strongly influence the quality of teaching and student learning (Yang & Kaiser, 2022). It is thus of great importance to understand the teaching practices of primary and secondary school mathematics teachers, and whether these practices follow new social conditions and respond to the characteristics and interests of students (Goos, Stillman, Herbert, & Geiger, 2020).

Starting from the above description, we will seek to answer the following research questions: 1) What manipulative materials do teachers use in the teaching and learning of Mathematics in the classroom? 2) What knowledge do primary and secondary school teachers have regarding the use of manipulative materials in Mathematics class? 3) What knowledge do mathematics teachers have regarding the curricular guidelines on the use of manipulative materials?

We note that a study on the teaching practice of teachers, especially focused on the use of manipulative materials in classrooms, has important repercussions on the teaching and learning of mathematics, namely: 1) Because primary and secondary school mathematics teachers can improve their skills to educate and teach by using appropriate manipulative materials; by improving their practices, they create conditions for students to learn and improve study results; 2) This research is a very important source of information for teachers who teach Mathematics subjects, with regard to the selection/elaboration of manipulative materials suitable to support teaching and learning activities in primary and secondary education classrooms in Timor-Leste; 3) As a source of information for the Government of the Democratic Republic of Timor-Leste, specifically the Ministry of Mathematics, with a view to carrying out retraining to improve the training of Mathematics teachers; 4) As information that will allow the Government, through the Ministry of Education, to make decisions on equipping schools with appropriate didactic resources based on the reality of Timor-Leste.

Previous studies show that Freitas and Moita investigated the use of digital games and simulations in mathematics teaching among teachers in Timor-Leste, emphasizing that such digital tools can improve student motivation and classroom engagement (Moruk & de Fatima Noronha, 2025). However, their study primarily focused on digital media rather than the pedagogical use of manipulative materials as concrete teaching aids in mathematical understanding (Chiu & Churchill, 2015). Meanwhile, Yazdani (2025) evaluated a supplementary mathematics and STEAM professional development program in Timor-Leste, demonstrating that teacher training significantly improved student learning outcomes. Nonetheless, this research did not explore how teachers utilize or understand manipulative materials within classroom instruction, nor did it assess teachers' alignment with curriculum guidelines (Gareis & Grant, 2015; Tekir & Akar, 2019).

The main objective of this study is: 1) To identify which manipulative materials are used

by teachers in the teaching-learning process of Mathematics in classrooms. 2) To understand the knowledge that primary and secondary school teachers have about the use of manipulative materials in Mathematics class. 3) To know the knowledge that mathematics teachers have in relation to curricular guidelines on manipulative materials. Moreover, the findings are expected to benefit teachers by offering practical insights to improve teaching effectiveness, assist educational institutions and policymakers in designing targeted training programs, and contribute to more engaging and meaningful mathematics learning experiences for students in Timor-Leste.

RESEARCH METHODS

In this study, a mixed methodology was chosen, composed of three key components. The first component referred to the general methodological approach, the second highlighted the study participants, and the third focused on data treatment and analysis.

The main objective was to understand teachers' knowledge about the use of manipulative materials in classrooms and to quantify the knowledge primary and secondary school mathematics teachers in Timor-Leste had about their use in the teaching-learning process. The study was conducted during the 2025 school year using a closed questionnaire and interviews to collect information on various aspects of manipulative materials from the knowledge and teaching experience of Mathematics teachers. The goal was to collect concise information regarding the use of manipulative materials by these teachers.

A group of thirty primary and secondary school teachers from two municipalities in Timor-Leste was selected for the study.

Table 1. Study Participant

Municipalities	Number of teachers		Total
	Primary education	Secondary education	
Manatuto	7 teachers	8 teachers	15 teachers
Liqu	7 teachers	8 teachers	15 teachers
Total	**14 teachers**	**16 teachers**	**30 teachers**

The questionnaire was used as a method of data collection applied during the 2025 school year to primary and secondary school teachers in Timor-Leste who participated in the study.

The questionnaire consisted of two parts: the first asked respondents about personal and professional data; the second presented two to six response alternatives, using Likert and Guttman scales. The Likert scale included five options: Strongly Disagree (DT), Disagree (D), No Opinion (SO), Agree (C), and Totally Agree (CT). Another Likert scale had six options: Never (N), Almost Never (QN), Few Times (PV), Many Times (MV), Almost Always (QS), and Always (S). The Guttman scale offered two options: exists/does not exist or knows/does not know.

Participants answered the questionnaire based on their teaching experiences, especially concerning the use of manipulative materials in primary and secondary education in Timor-Leste. The questionnaire was presented in Portuguese and distributed to 30 teachers as indicated in Table 1.

For data treatment and analysis, all questions were classified and tabulated according to the questionnaire categories. Answers about knowledge and existence of manipulative

materials were coded from 1 to 2 (does not exist/exist or does not know/know). Agreement levels were coded from 1 to 5, from Strongly Disagree (DT) to Totally Agree (CT). Frequency of use responses were coded from 1 to 6, from Never (N) to Always (S).

From these numerical values, frequencies, means, and standard deviations were calculated. All statistical analyses were conducted using Microsoft Excel.

RESULTS AND DISCUSSION

Personal and professional data of teachers

The personal and professional data of the thirty teachers included in this study who belong to primary and secondary schools in the municipality of Manatuto in Timor-Leste, according to these data, are made from the following variants: age, gender, academic qualifications, length of service and the type of school that the teachers teach.

Regarding age, the teachers involved in the study are between 34 and 59 years old, with an average of 47, 40 years old. Thus, it is possible to see that the primary and secondary school teachers who teach mathematics in the municipality of Manatuto and Liquiçá, in Timor-Leste, are relatively young, as can be seen in figure 1.

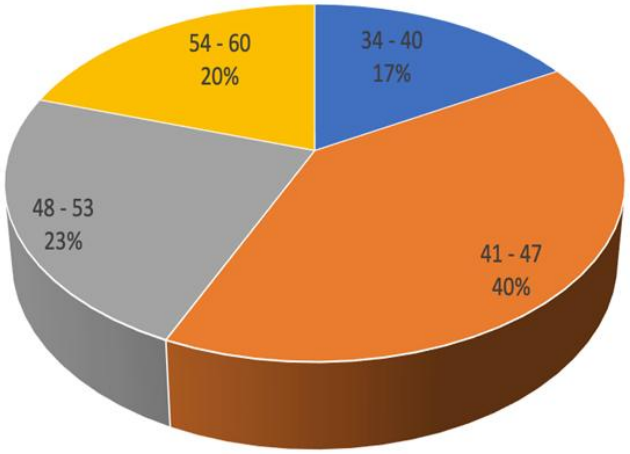

Figure 1. Percentages of teachers according to age
Source: Research result (2025)

From the graph presented in figure 12, it can be seen that most teachers are in the age group between 41 and 47 years old (40%). While in second place occupied by teachers aged between 48 and 53 years old (23%), in third place occupied by teachers aged between 54 and 60 years old (20%) and finally the ages of teachers between 34 and 40 years old who occupy last place with a percentage of 17%.

Regarding the gender of those who assume the responsibility of being teachers in the area of mathematics, according to the data collected, there is an unbalanced. Of the 30 teachers in the sample, 63% are male and 37% female.

While the academic qualification of teachers who assume responsibility as teachers in the area of Mathematics involved in the study was verified, 57% of teachers with the academic qualification level is a bachelor's degree and the rest of 43% with the academic qualification level of bachelor's degree.

In relation to the length of service of mathematics teachers in primary and secondary education in the municipalities of Manatuto and Liquiçá, they are involved in the study, as

shown in the figure below.

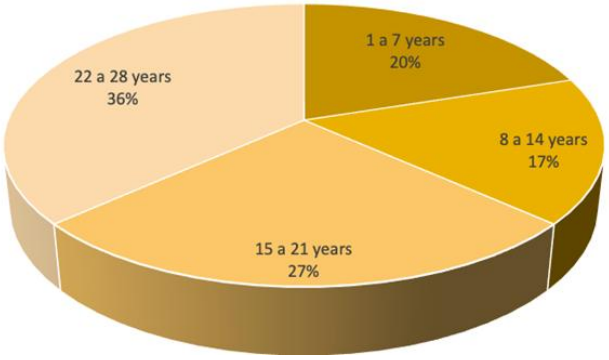

Figure 2. Percentages of teachers according to length of service
Source: Research result (2025)

According to data presented in figure 2, mentioned above, it can be seen that most teachers have up to 28 years of teaching service (36%), in this case, we can justify that teachers who work in the area of Mathematics, from the occupation of Indonesia to the present date.

Finally, the number of teachers according to the level of education they teach is presented, as shown in figure 3.

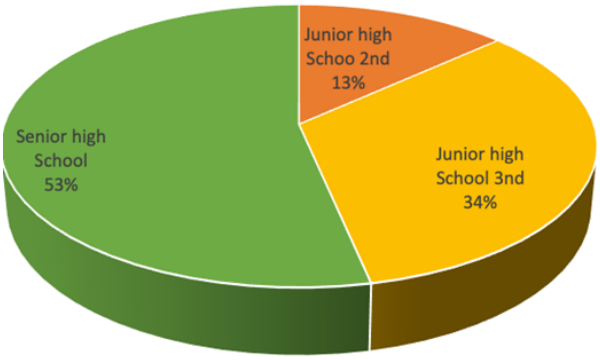

Figure 3. Percentages of teachers according to levels of education they teach
Source: Research result (2024)

According to the result of the analysis shown in figure 3, we can justify that the vast majority of teachers involved in the study come from the senior high school level with the percentage reaching 53%, while from junior high School only 47% is composed of 13% of the junior high school teachers of the 2nd cycle and 34% of the junior high school teachers of the 3rd cycle.

Manipulative materials in the Mathematics class

Teaching materials in school

Table 2 shows the results obtained in question 7 of the questionnaire, related to the various didactic materials. In general, teachers respond based on the materials that exist, especially the materials from their school.

Table 2. Teachers' opinions about manipulative materials existing in the school (n = 30)

Manipulative materials	Frequency and percentage of response			
	Exists		There is no	
	f	%	f	%
Geoboards	19	63,3	11	36,7
Tangram	9	30,0	21	70,0
Geometric Solids Boxes	24	80,0	6	20,0
Abacus	10	33,3	20	66,7
Rules	29	100,0	0	0,0
Bars	30	100	0	0,0
Protractors	24	80,0	6	20,0
Math games	8	26,7	22	73,3
Blackboard	30	100	0	0,0
Paper folds	30	100	0	0,0
Logic blocks	8	26,7	22	73,3
Tower of Hanoi	6	20,0	24	80,0
Number dice	9	30,0	21	70,0
Coins	30	100	0	0,0
Shuffle of cards	18	60,0	12	40,00%

Source: Research data analysis result (2025) by Microsoft Excel

By observing the data presented in table 2, we can verify that all teachers (100%) declare that the following teaching materials exist and are always available in their schools: rulers, compasses, blackboard, folding paper and coins. Likewise, it is verified that most respondents refer to the existence of some other teaching materials in their schools. Thus, in descending order, they refer to the existence of the following materials: geometric solids boxes (80.00%); protractors (80.00%); Geoboards (63.33%); and shuffle of cards (60.00%). In an assessment of these answers, the teaching materials that gather more conviction regarding their existence in schools seem to correspond to the materials that are frequently used by primary and secondary school mathematics teachers in their classes.

Other manipulative materials are also pointed out, in a minority way, as existing in schools. Thus, in descending order, the materials mentioned by some teachers are indicated: Abacus (33.33%), tangram and numerical dice (30.00%), mathematical games and logic blocks (26.67%), and the Tower of Hanoi (20.00%).

Teaching materials known to teachers

Table 3 presents the results obtained in question 8 of the questionnaire, related to the various didactic materials. In general, teachers respond based on the materials they know, especially the materials in their school.

Table 3. Teaching materials that teachers know (n = 30)

Manipulative materials	Frequency and percentage of response			
	Know		Don't know	
	f	%	f	%
Geoboards	24	80	6	20,0
Tangram	25	83,3	5	16,7
Geometric Solids Boxes	30	100	0	0,0
Abacus	30	100	0	0,0
Rules	30	100	0	0,0
Bars	30	100	0	0,0
Protractors	30	100	0	0,0
Math games	18	60,0	12	40,0
Blackboard	30	100	0	0,0

Manipulative materials	Frequency and percentage of response			
	Know		Don't know	
	f	%	f	%
Paper folds	25	83,3	5	16,7
Logic blocks	12	40,0	18	60,0
Tower of Hanoi	10	33,3	20	66,7
Number dice	30	100	0	0,0
Coins	30	100	0	0,0
Shuffle of cards	30	100	0	0,0

Source: Research data analysis result (2025) by Microsoft Excel

From the results of data analysis presented in table 3, it is possible to verify that all teachers (100%) know some of the teaching materials, such as: Geometric solid boxes, abacus, rulers, compasses, protractors, blackboard, Number dice, coins and shuffle of cards. It is also verified that most of the respondents know some of the other teaching materials: Tangram and paper folding (83.33%), Geoboards (80.00%), and math games (60.00%). Even so, two manipulative materials that he presents in question 8, which are mentioned by the lesser-known teachers, such as: Logic blocks (40.00%) and Tower of Hanoi (33.33%). In the case of some of the materials that gathered a high percentage of teachers who are unaware of them, this may be related to the lack of knowledge of their name, such as logical blocks and tower of Hanoi. In general, this result demonstrates that almost everyone, that is, the majority of mathematics teachers in primary and secondary education in the municipality of Manatuto, know manipulative materials that were presented in table 3.

Frequency of use of manipulative materials

In this part, the results obtained by questionnaire regarding the frequency of use of different manipulative materials in mathematics classes of primary and secondary education in the municipality of Manatuto are presented. In this question, the Likert scale was applied including six frequency options: Never (N), Almost Never (QN), Few Times (PV), Many Times (MV), Almost Always (QS) and Always (S), which were coded by assigning the numerical values 1, 2, 3, 4, 5 and 6, respectively. The full result as follows in table 4.

Table 4. Frequency of use of manipulative materials in mathematics class (n=30)

How often do you use the following manipulative materials:	% response						
	N	QN	(N+QN)	PV	QS	S	(QS+S)
Geoboards	0,0	46,7	46,7	53,3	0,0	0,0	0,0
Tangram	0,0	0,0	0,0	**100**	0,0	0,0	0,0
Geometric Solids Boxes	0,0	0,0	0,0	**100**	0,0	0,0	0,0
Abacus	0,0	46,7	46,7	53,3	0,0	0,0	0,0
Rules	0,0	0,0	0,0	0,0	100	0,0	**100**
Bars	0,0	0,0	0,0	**100**	0,0	0,0	0,0
Protractors	0,0	0,0	0,0	**100**	0,0	0,0	0,0
Math games	43,3	46,7	90,0	10,0	0,0	0,0	0,0
Blackboard	0,0	0,0	0,0	0,0	0,0	100	**100**
Paper folds	0,0	0,0	0,0	**100**	0,0	0,0	0,0
Logic blocks	36,7	46,7	83,3	16,7	0,0	0,0	0,0
Tower of Hanoi	100	0,0	100	0,0	0,0	0,0	0,0
Number dice	0,0	43,3	43,3	56,7	0,0	0,0	0,0
Coins	0,0	0,0	0,0	**100**	0,0	0,0	0,0
Shuffle of cards	0,0	0,0	0,0	**100%**	0,0	0,0%	0,0

Source: Research data analysis result (2025) by Microsoft Excel

From the results of the analysis of the data obtained, in terms of percentages presented in table 4, it can be seen that all teachers declare that they use "always or almost always" some of the manipulative materials indicated in question 9 of the questionnaire. They are: the ruler and the blackboard. In addition, there are also some of the manipulative materials that are used frequently by all teachers. These materials were as follows: Geometric solid boxes, tangram, compasses, protractors, paper folding, coins and playing card. From the same result, it can also be seen that more than half of the teachers surveyed rarely use some of the manipulative materials, namely: Number dice (56.7%), geoplane (53.3%) and abacus (53.3%). This result shows that these materials are rarely used in mathematics classes, but it can be considered that, in terms of the level of uses, they are positive, because they are used only for certain mathematics contents.

Table 4 also shows some manipulative materials that were highlighted by the teachers surveyed as being used with little or no frequency: Tower of Hanoi (100%), mathematicians' games (90.0%), geoplane and abacus of the same percentages (46.7%). These results show that these materials are less used by teachers in their teaching practices, in this case, due to the insufficient number of materials in their schools.

Teachers' knowledge about the use of manipulative materials

The teachers' knowledge about the use of manipulative materials in Mathematics classes is composed of characteristics and functions of manipulative materials, the result of analysis as follows.

Manipulative Material Characteristics

The result of the analysis regarding the opinions of primary and secondary school mathematics teachers in the municipality of Manatuto about the characteristics of the manipulative materials to be used in the mathematics class, contemplated in the closed items of the questionnaire, is shown in table 06. In this question, the Likert scale was used, which included five options of agreement or disagreement: Strongly Disagree (DT), Disagree (D), No Opinion (SO), Agree (C) and Totally Agree (CT), which were coded by assigning the numerical values 1, 2, 3, 4 and 5, respectively.

Table 5. Material characteristics that can be manipulated for the mathematics class (n=30)

Statement	% response						
	DT	D	DT+D	OS	C	CT	C+CT
Manipulative material is everything that leads to learning	0,0	0,0	0,0	36,7	50,0	50,0	100
Manipulative material is a set of objects or things that the student is able to feel, manipulate and move	0,0	0,0	0,0	0,0	63,3	36,7	100
Manipulative material corresponds to real everyday objects	0,0	0,0	0,0	0,0	56,7	43,3	100
Manipulative material corresponds to objects used to represent an idea	0,0	0,0	0,0	0,0	50,00	50,0	100
Manipulative material corresponds to resources that enable the teacher to develop student-centered teaching	0,0	0,0	0,0	0,0	80,0	20,0	100
Manipulative material corresponds to resources that help learning, developing in	0,0	0,0	0,0	0,0	10,0	90,0	100

Statement	% response						
	DT	D	DT+D	OS	C	CT	C+CT
students a positive attitude towards Mathematics							
Manipulative material corresponds to an object configured in order to materialize mathematical structures	0,0	0,0	0,0	0,00%	40,0	60,0	100

Source: Research data analysis result (2025) by Microsoft Excel

As can be seen in table 5, all teachers (100%) "agree" or "totally agree" with most of the items related to the characteristics of the didactic materials for the mathematics class.

The teachers revealed that they see manipulative materials in a comprehensive way in terms of their use and that they contribute to the learning of Mathematics. The conviction regarding the importance of the material as a way to focus teaching on the student and to develop a positive attitude towards mathematics loses some strength, as the percentages between "agree" and "totally agree" are reversed. Regarding the last item, the large percentage of teachers "without an opinion" may reveal some misunderstanding regarding what is meant by "materializing mathematical structures".

In conclusion, teachers recognize that didactic material corresponds to all material that can help learning, whether it is designed specifically for this purpose or an object of common use. Teachers also consider that teaching materials are useful to develop a positive attitude in the student towards mathematics and their learning.

Teaching material functions in the Mathematics classroom

The result of the analysis regarding the opinions of primary and secondary school mathematics teachers in the municipality of Manatuto on the functions of manipulative materials to be used in mathematics class, contemplated in the closed items of the questionnaire, is shown in Table 6. In this question, the Likert scale was used, which included five options of agreement or disagreement: Strongly Disagree (DT), Disagree (D), No Opinion (SO), Agree (C) and Totally Agree (CT), which were coded by assigning the numerical values 1, 2, 3, 4 and 5, respectively.

Table 6. Functions of manipulative materials in mathematics class (n = 30)

Statements	% response						
	DT	D	DT+D	OS	C	CT	C+CT
Students learn math better when they use manipulative materials	0,0	0,0	0,0	0,0	53,3	46,7	100
The use of manipulative material helps to develop students' skills	0,0	0,0	0,0	0,0	50,0	50,0	100
The use of manipulative material makes the class more attractive	0,0	0,0	0,0	0,0	36,7	63,3	100
The use of manipulative material increases the students' motivation in carrying out the proposed tasks	0,0	0,0	0,0	0,0	43,3	56,7	100
Manipulative Material allows students to work on abstract concepts in a more concrete way	0,0	0,0	0,0	0,0	43,3	56,7	100
The use of manipulative materials makes it easier for students to discover mathematical concepts	0,0	0,0	0,0	0,0	70,0	30,0	100
Manipulative materials help the teacher to explain certain subjects	0,0	0,0	0,0	0,0	36,7	63,3	100
Students with more difficulties need to resort to manipulative materials to learn Mathematics	0,0	0,0	0,0	0,0	43,3	56,7	100

Statements	% response						
	DT	D	DT+D	OS	C	CT	C+CT
Manipulative material can help in understanding and solving a problem	0,0	0,0	0,0	0,0	66,7	33,3	100
Manipulative materials help students explain how they thought or solved a problem	0,0	0,0	0,0	26,7	50,0	23,3	73,3

Source: Research data analysis result (2025) by Microsoft Excel

In this theme, the opinions of teachers are presented on various aspects (in percentage) related to the functions of manipulative materials for the mathematics class, contemplated in the closed items of question 11 of the questionnaire. It can be seen in table 6 that all teachers (100%) declare "I agree" or "totally agree" with most of the statements related to the functions of the manipulative materials for the mathematics class, in this case, they consider that the manipulative material facilitates the students to learn mathematics better, helps develop competence, makes the class more attractive, increases motivation to develop the mathematics task, work on abstract concepts in a concrete way, relevant to the most difficult students, and facilitates better explanation of mathematical contents. Respondents' confidence in other statements regarding the functions of manipulative materials that focus on supporting problem solving loses some strength, as the percentages between "agree" and "strongly agree" are reversed.

In summary, we conclude that, according to the teachers, the functions of teaching materials in mathematics classes involve the following important aspects: facilitating the explanation of the contents; help build students' knowledge and skills; to enable work with abstract concepts in a simpler and more concrete way; and contribute to the understanding of problem solving. This perspective is reinforced by the ideas of Botas and Moreira regarding the functions that teaching materials can play in teaching, in particular in contributing to providing information, providing training and the exercise of skills, captivating interest and motivating the student, evaluating and developing skills and knowledge, providing simulations in problem solving.

Curricular guidelines on the use of manipulative materials

This section presents the results of the analysis regarding the opinions of primary and secondary school mathematics teachers in the municipality of Manatuto on the curricular guidelines on the use of manipulative materials in mathematics classes, contemplated in the closed items of the questionnaire. In this question, the Likert scale was used, which included five options of agreement or disagreement: Strongly Disagree (DT), Disagree (D), No Opinion (SO), Agree (C) and Totally Agree (CT), which were coded by assigning the numerical values 1, 2, 3, 4 and 5, respectively. Table 7 presents the opinions of the respondents about the agreement or disagreement (in percentage) regarding the curricular guidelines on the use of manipulative materials, contemplated in the closed items.

Table 7. Curricular guidelines on the use of manipulative materials (n = 30)

	% response						
	DT	**D**	**DT+D**	**OS**	**C**	**CT**	C+CT
The current curriculum recommends the use of manipulative materials	0,0	3,3	3,3	23,3	66,7	6,7	73,3
Current mathematics programs present the proposal to use manipulative materials in all content	0,0	20,0	20,0	13,3	63,3	3,3	66,7
The proposals of the mathematics program on the use of manipulative materials are diverse and interesting	0,0	0,0	0,0	30,0	53,3	16,7	70,0
The mathematics program encourages the use of manipulative materials	0,0	0,0	0,0	0,0	66,7	26,7	93,3
The mathematics program encourages the use of manipulative materials in the resolution of the most abstract contents	0,0	13,3	13,3	23,3	56,7	6,7	63,3

Source: Research data analysis result (2025) by Microsoft Excel

As can be seen in table 7, it is understood that most of the respondents "agree" or "totally agree" with all of the items related to the curricular guidelines on the use of manipulative materials, and it was verified, in ascending order, that: about 93.3% of the teachers consider that "the mathematics program encourages the use of manipulative materials" (66.7% agree and 26.7% totally agree); 73.3% of respondents underline that "the current curriculum recommends the use of manipulative materials", with 66.7% agreeing and 6.7% totally agreeing; 70.0% of respondents highlight that "the proposals of the mathematics program on the use of manipulative materials are diversified and interesting" (53.3% agree and 16.7% totally agree). About 66.7% of teachers consider "Current mathematics programs present the proposal to use manipulative materials in all contents", with 63.3% agreeing and 3.3% totally agreeing. And finally, about 63.3% of the informants report that "The mathematics program encourages the use of manipulative materials in the resolution of the most abstract contents", in this case, 56.7% agree and 6.7% totally agree.

According to this result, we can conclude that teachers recognize that the curricular guidelines on the use of manipulative materials emphasize that they should promote the integral development of students, aligning with the principles of equity in the rights of teaching and learning to students.

CONCLUSION

Mathematics teachers in Manatuto's Basic and Secondary Education levels used a variety of manipulative materials, such as geoboards, tangrams, geometric solids, and abacuses, but applied them selectively rather than consistently across topics. They viewed these materials as tangible tools that help transform abstract concepts into concrete learning experiences, enhancing understanding, motivation, knowledge retention, and inclusivity, especially for students with learning difficulties. The current curriculum supports the use of manipulative materials to foster logical reasoning and real-world connections in mathematics. Future research could explore strategies to promote more systematic and comprehensive use of manipulative materials across all mathematical content areas to maximize their educational impact.

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