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A New and Realistic Approach to Contextualize the Mathematical Learning

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Abstract

The school textbook was always considered as a fundamental component in teaching and learning mathematics (Reys et al., 2004; Fan et al. 2013), but also as an indicator of the quality of building up a student's knowledge. Several studies (Delcroix et al., 2013; Tang et al., 2010) justify the lack of motivation of students to learn mathematics by the absence of contextualization in the didactic situations proposed by these manuals: this absence leads to poor understanding of the practical significance of the mathematical knowledge offered by these textbooks. It is therefore necessary to write textbooks using approaches that promote active and interactive learning, as well as creativity and critical thinking among students, in other words helping students to develop different mathematical thinking. In this paper, we are mainly interested in the contribution of school textbooks to the development of the algebraic thinking among students, especially when that books use a new and realistic approach to contextualize the mathematical learning, the so-called "Realistic Mathematics Education" (RME).

Keywords: *school textbooks, contextualization, algebraic thinking, "Realistic Mathematics Education" (RME).*

I. Introduction

Moonof's approach is the "Realistic Mathematics Education" (RME), developed towards the end of the 1990s by the Freudenthal Institute in the Netherlands (Gravemeijer, 1994; Van den Heuvel-Panhuizen, 1996) to allow each educational system to adapt the learning it offers to its local culture, its practices, its policies and its educational objectives. The principle is to offer "imaginable" contexts to help students develop their algebraic thoughts in mathematics, with a strong emphasis on didactic situations that "give meaning" to the subject. This is called "reverse contextualization". These situations serve to initiate the development of mathematical concepts, tools and procedures (Gravemeijer et al., 1999; Laurens et al., 2017), but also of mathematical thinking (Sitorus, 2016) through

contextualized learning. This is the starting point of our study with the aim of understanding how we can innovate using RME theory to contextualize Moroccan mathematics textbooks? especially in the algebra chapters.

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Indeed, our problem is to try to understand the correlation between the teaching process introduced in school textbooks by an RME approach and the development of algebraic thinking among Moroccan secondary school students. We will first focus on

measuring the degree of awareness with the authors of school textbooks as well as secondary school teachers of the importance of the utilization of contexts in relation to RME theory in mathematics textbooks at the secondary level (middle and high school) in algebra chapters. Our study is also quantitative (measure the rate of presence of contexts in the school textbook at the secondary education level) than qualitative (what mode of expression of contextualized problems is used in the activities offered by the Moroccan school textbook: text, illustration, or combination between the two). For this we used textbooks approved by the Moroccan Ministry of National Education (MEN).

Our article is divided as follows. The first part (theoretical framework of the article) deals with the importance of school textbooks in learning, the notion of contextualization of didactic situations proposed by textbooks, as well as the RME approach: its originality, its fundamental principles and its relationship with the contextualization of learning in school textbooks. The second part is dedicated to action research carried out to try to understand the raised problem. Finally, a section dedicated to the discussion of the results and conclusions is proposed at the end of the article.

II. Theoretical Frame

1. Contextualization and its Importance in Learning Mathematics

The school textbook is a subject of research which continues to fascinate didacticians and still arouse much researches (Reys et al., 2004; Fan et al., 2013; Chang et al., 2017; Schubring et al., 2018). The school textbook (in paper or digital format) is considered a didactic tool necessary for the teacher to implement the programs. It plays a very important role in structuring mathematical knowledge among students, hence the need for the didactic situations proposed by a school textbook to be based on a well-considered didactic approach (Flanders, 1987; Glasnovic, 2018). In this sense, textbooks can be considered important indicators of the quality of teaching in a given educational system (Tarr, 2006). Manuals allow teachers to create didactic learning situations by offering avenues for reflection presented in the form of "problem situations" or sometimes "complex situations"

According to Tonget al. (2022) and Zulkardi et al. (2020), learning activities should be designed and organized in a way that challenges learners, makes them more independent and able to think more critically and therefore better solve problems as "mathematicians" (Marja Van et al., 2021). As the textbook is the set of activities for teaching and learning mathematics, so it should focus on the basic concepts of mathematics which are the keys to solving mathematics problems. Contextualizing these problems by relating them to student's daily lives will allow students to easily adapt to other problems whose difficulty level has been changed by the teacher.

Despite their different angles of approach (psychological and methodological approach, (Johnson, 2002), theory (Verbitsky, 1991), conceptual (Berns, Erickson, 2001), educational (Rogers, Weinbaum, 1995), the mentioned authors agree that teaching and contextualized learning mainly involve the connection between the content taught and the learning with the context in which to use this content, which supposes the integration of educational and practical activities of students and the need to overcome the separation between theoretical and practical knowledge. Therefore, they view the teaching process as an education process in which the main goal should be to teach students to identify the meaning of the content they are learning by making connections between that content and the social context , cultural, professional and daily life (Dragica Milinković et al 2017).

Johnson (2002) and Dragica (2017) provide the most comprehensive demonstration of the practical benefits of contextualized learning. They emphasize interdependence, differentiation and self-organization as scientific principles on which teaching is based. Among these advantages, they cite for example the facts of:

- Establish meaningful connections between learning content and the real world;
- Promote self-regulated learning;
- Encourage cooperation that allows you to detect your own potential strengths and weaknesses;
- Develop critical and creative thinking;
- Achieve high levels and achievements in the teaching process.

To take full advantage of these advantages cited above, it is therefore necessary to adopt a contextualization approach graduated according to the age of the students, epistemology of the concept to be addressed, Dee Lang (1987), while emphasizing the role and the impact of context in the learning and teaching of mathematics, he then specifies three levels of contextualization in the teaching of mathematics:

- Use context to solve "simple" problems (easily transfer the original problem into a math problem) while performing the math operations built into it (often found in textbooks);
- Use context in creating relevant mathematical situations;
- Use context to develop mathematical models and concepts.

2. Realist Mathematics Education (RME) Approach

As previously noted, different angles of approach have addressed the notion of contextualization of learning: the psychological and methodological approach (Johnson, 2002), the theoretical one (Verbitsky, 1991), the conceptual one (Berns, Erickson, 2001), and finally the educational one (Rogers, Weinbaum, 1995). In this work, we will focus on another approach, described as being "realistic": Realist Mathematics Education (RME). The history dates back to 1960s, when teaching Mathematics in the Netherlands was dominated by a formal teaching approach where mathematics was taught in an atomized manner. This approach was initiated in 1968 by the Wiskobas foundation ("primary mathematics") which argued for "realistic" contextualized learning of mathematics, meaning that children learn mathematics through solving real-world problems in meaningful contexts (Searle and Barmby, 2012). This gave rise to a new school of mathematics education called "realistic mathematics education" (Wittmann, 2020).

According to Daryanto and Tasrial (2012), the RME approach is similar in principle to the constructivism of contextual teaching and learning. However, RME is an approach specifically developed for learning mathematics. which combines the vision of what mathematics is (1971, Freudhental), how students learn mathematics (Daryanto and Tasrial, 2012) and how mathematics should be taught (Riyan Hidayat,et all.2015). Indeed, Freudenthal (1971) considers mathematics as a human activity which should not be learned in a way closed to the system but rather as an activity of mathematization of reality, where learning Mathematics refers to the student's daily life which can improve their mathematical abilities in various aspects. Treffers

(1987a) insists on the distinction between horizontal and vertical mathematization. In horizontal mathematization, students use mathematical tools to organize and solve problems located in real situations. It's about moving from the world of real life to that of mathematical symbols. Vertical mathematization refers to the process of reorganization within the mathematical system resulting in shortcuts using connections between concepts and strategies. It's about moving into the abstract world of symbols. The two forms of mathematization are closely related and are considered of equal value by the RME.

Treffers (1978) summarized RME in six fundamental principles in the RME approach

- The "activity principle", which means that students are seen as active participants in the learning process. He also emphasizes that mathematics is best learned by doing mathematics, which is strongly reflected in Freudenthal's interpretation of mathematics as a human activity;
- The "reality principle" which can be recognized in RME in two ways.

First, it expresses the importance attached to the goal of mathematics education, including student's ability to apply mathematics to solve "real-life" problems. Second, it means that mathematics teaching should begin with problem situations that are meaningful to students, which provide them with the opportunity to make sense of the mathematical constructs they develop while solving problems.

- The "level principle" emphasizes that learning mathematics must pass through different levels: from informal context-related solutions, creating different levels of shortcuts and schematizations, to acquiring a deep understanding of how concepts and strategies are linked. For example, for the teaching of operations with numbers, this level principle is reflected in the didactic method of "progressive schematization" suggested by Treffers (1987b) where transparent methods in integers gradually evolve towards algorithms based on numbers.
- The "interweaving principle" which means that the mathematical content area such as number geometry, measurement and data processing should not be considered as isolated but also strongly integrated chapters where students are presented with rich problems in which they can use various mathematical tools and knowledge.
- The "principle of interactivity" which means that learning mathematics is not only an individual activity but also a social activity. Consequently, RME favors class discussions and group work, which offer students the opportunity to share their strategies and inventions with others. This way, students can come up with ideas to improve their strategies. Additionally, the interaction provokes thinking, allowing students to reach a higher level of understanding.
- The "guiding principle" refers to the Freudenthalian principle of "guided reinvention" of mathematics. This implies that in RME teachers must play a proactive role in student learning and that educational programs must contain scenarios that have the potential to act as a lever to achieve changes in student understanding. And to achieve this, teaching and programs must be based on consistent long-term teaching in the learning process. (Marja V. and Paul D., 2021)

Finally, let us point out that on the basis of these six general principles of teaching, a number of local theories of instruction and paradigmatic teaching sequences focused on specific mathematical subjects have been developed over time. For example, the RME-based textbook series "Mathematics in Context" Wisconsin Center for Educational Research & Freudenthal Institute (2006) has a considerable market share in the Asian United States and some countries in Europe.

III. The Experimentation

As previously noted, our work is mainly interested in the contextualization of algebra learning in secondary school. Indeed, algebra remains an important element in the academic curriculum of middle school students and is often used to filter them for scientific fields. Several studies have largely addressed student's difficulties in mathematical reasoning in algebra (Bednarz and Janvier, 1996; Carraher, Martinez, and Schliemann, 2007; Filloy and Rojano, 1989; Kieran 1989, 1990; Radford 2003; Radford and Puig, 2007). As well as to promote success in algebra in secondary school, Squalli, et all, (2020) propose developing algebraic thinking from primary school. We have also clarified in the theoretical framework the notion of contextualization in relation to the RME theory and the role they play in the learning of mathematics through Moroccan school textbooks. We used among the textbooks approved by the Ministry of National Education (MEN) those most used in Moroccan establishments (see table below).

College	Manual	High school	Manual
1st year college	Universe more	Scientific common swap	Al Mofid
2nd year college	Universe more	1st year baccalaureate	Fi Rihab
3rd year college	Universe more	2nd year baccalaureate	Fi Rihab

The objective of our analysis is to respond adequately to our problem on the correlation between the teaching process according to the RME approach in the school textbook and the mathematical skills among students. We will also be interested in measuring the degree of awareness among textbook authors of the importance of using contexts in relation to RME theory in mathematics textbooks at secondary level (middle and high school) in the chapters of algebra. This study will allow us to quantify the presence of tasks contextualized in these manuals, but also to qualify the mode of expression of the problems contextualized in the activities proposed by these manuals.

Our study, based on the descriptive analytical method, used as a research technique, and according to two criteria:

- the representation of contextualized problems in relation to other types of non-contextualized tasks;
- the representation of problems contextualized according to the mode of expression.

The unit of analysis is the "task" whether in the form of activities or exercises. According to the first criterion, contextual and practical problems whose plot emerges from the nature and social environment of the students. The data was collected as a set of activities only in the algebra chapters for the middle and high school levels. The table below gives the distribution of the algebra chapters in each textbook.

	1st year	2nd year	3rd year
Algebra chapter	-Positive decimal numbers, operations-Fraction and operations-Relative numbers, comparison, operations-power of a number	-Relative numbers, comparison and operations-Rational number introduction and comparison and operation-Power of a number-Literal calculation	-numerical calculation: remarkable identity, power-order and operation-equations and inequalities

Level: College.

	Common core	1st year baccalaureate	2nd year baccalaureate
Algebra chapter	-set of natural integers and arithmetic notion -sets -order in R-polynomials	-notion of logic -trigonometric calculation (calculation and transformation)	-Complex number-Differential equations

Level: High School.

To achieve objectives we cited before, all the problems in the school textbook as a set of tasks such as course activities and exercises (application exercise, reinforcement exercises, in-depth exercises and synthesis exercises).

These problems according to the first criterion are contextual problems that come out of the nature and social environment of the students are identified, because they attract more or less the reality of their lives. The second criterion concerns all modes of expression of contextualized problems, whether in the form of text, illustrated (images) or a combination of text and the illustrated.

1. Distribution of Data according to Chapters

In order to facilitate data collection we have first used data collection grids to determine contextualized problems and other task types in percentages through a descriptive method that was used as a research technique. We obtained the following statistics

Level	Chapter	Contextualized problem	Other type of task
1st year college	Positive decimal numbers, operations	33.3%	66.7%
	Fraction and operations	25.7%	74.3%
	Relative numbers, comparisons, operations	28.6%	71.4%
	Power of a number	10.9%	89.1%
2nd middle school year	Relative numbers, comparison and operations	10%	90%
	Rational number introduction and comparison and operation	13.4%	86.6%
	Power of a number	12.2%	87.8%
	Literal calculation	14.3%	85.7%
3rd year college	Numerical calculation: remarkable identity, power	7.3%	92.7%
	Order and operation	5%	95%
	Equations and inequalities	17.5%	82.4%
Scientific common core	Set of natural integers and arithmetic concept	20%	80%
	Sets	3.3%	96.7%
	Order in R	1.4%	98.6%
	Polynomials	2.3%	97.7%
1st year baccalaureate	Concept of logic	1.7%	98.3%
	Trigonometric calculation (calculation and transformation)	0%	100%
2nd year bac	Complex number	0%	100%
	Differential equations	22.2%	77.8%

The results show that the studied textbooks include contextualized problems in different chapters and teaching levels. However, there are variations in the percentages of contextualized tasks compared to other task types. The most contextualized math chapters are positive decimals, fractions, and relative numbers for middle school levels. For the common scientific core, there is a contextualized chapter which is all natural integers and arithmetic notions with a percentage of 20% compared to other chapters which varies between 1.4% and 3.3% of contextualized chapters, the other two high school levels 1st and 2nd baccalaureate, the most contextualized chapters are differential equations and logic. There are also chapters where contextualized tasks are rarer, such as trigonometry and complex numbers for baccalaureate levels. It is interesting to note that the school core chapters also have higher percentages of contextualized tasks than the baccalaureate chapters.

Level	**Chapter**	**Mode of expression**		
		Text	Illustrated	Combined
1st middle school year	Positive decimal numbers, operations	75%	12.5%	12.5%
	Fraction and operations	44.4%	11.2%	44.4%
	Relative numbers, comparisons, operations	62.5%	12.5%	25%
	power of a number	100%	0%	0%
2nd middle school year	Relative numbers, comparison and operations	66.7%	33.3%	0%
	Rational number introduction and comparison and operation	72.7%	0%	27.3%
	Power of a number	80%	0%	20%
	Literal calculation	20%	0%	80%
3rd middle school year	digital calculation: remarkable identity, power	0%	0%	100%
	order and operation	100%	0%	0%
	equations and inequalities	50%	16.7%	33.3%
Scientific common core	set of natural integers and arithmetic concept	100%	0%	0%
	sets	66.7%	0%	33.3%
	order in R	100%	0%	0%
	Polynomials	0%	0%	100%
1st year baccalaureate	concept of logic	100%	0%	0%
	trigonometric calculation (calculation and transformation)	0%	0%	0%
2nd year bac	Complex number	0%	0%	0%
	Differential equations	66.7%	0%	33.3%

It seems that different chapters of the textbooks use different modes of expression for contextualized problems. It is interesting to note that the middle school level chapters shift between different modes of expression, while the high school level chapters mainly use texts. It is also interesting to note that certain chapters, such as numerical calculations in 3rd year of college and polynomials in common core science, use exclusively illustrations to express the problems.

2. Distribution of Results according to a Sample Chapter

Level	**Contextualized problem**	**Other type of task**
1st year college	33.3%	66.7%
2nd year of college	10%	90%
3rd year college	7.3%	92.7%
Common core	20%	80%
1st year baccalaureate	1.7%	98.3%
2nd year baccalaureate	0%	100%

These results indicate that contextualized problems are less common in mathematics textbooks than other types of tasks. In particular, they represent only 33.3% of the problems of the first year of college, 10% of the second year of college, 7.3% of the third year of college, 20% of the common core and 1.7% of the first year of the baccalaureate.

On the other hand, other types of non-contextualized tasks are more frequent, with 66.7% of problems in the first year of college, 90% in the second year of college, 92.7% in the third year of college, 80% of the common core and 98.3% of the first year of the baccalaureate. It is interesting to note that in the second year of the baccalaureate, there is no problems contextualized in school textbooks.

Level	**Contextualized problem**		
	Illustrate	Combine	Textual
1st year college	33.3%	0%	66.7%
2nd year of college	33.3%	0%	66.7%
3rd year college	0%	100%	0%
Common core	0%	0%	100%
1st year baccalaureate	0%	0%	100%
2nd year baccalaureate	0%	0%	0%

These results indicate that contextualized problems are expressed in different ways depending on grade levels. In particular, they show that "illustrate" and "text" type problems are used mainly in the first and second year of college. However, they are not used in other grade levels. "Combined" type problems are used only in the third year of college with a percentage of 100%. But the textual mode of expression is used in all levels except that in 2nd year and 3rd year college.

3. Distribution of Data according to Each Level

1st Year College

Chapter	**Contextualized problem**	**Other type of task**
Decimal numbers, operations	33.3%	66.7%
Fractions, operations	25.7%	74.3%
Relative numbers	28.6%	71.4%
Powers	10.9%	89.1%

It seems that the contextualized problems for the first year of college are distributed according to the chapters in the following way: 33.3% for decimal numbers and operations, 25.7% for fractions and operations, 28.6% for relative numbers and 10.9% for powers. However, it is important to note that this distribution may vary depending on the school program used.

Chapter	**Mode of expression**		
	Text	Illustrated	Combined
Decimal numbers, operations	75%	12.5%	12.5%
Fractions, operations	44.4%	11.2%	44.4%
Relative numbers	62.5%	12.5%	25%
Powers	100%	0%	0%

The percentages given indicate that for the Decimals and Operations chapter, most of the tasks are expressed in text form (75%), which may indicate that the concepts in this chapter are mainly based on calculations and mathematical rules to follow. However, there is also part of the task expressed in pictorial (12.5%) and combined (12.5%) forms, which may indicate that illustrations and worked examples are used to help students understand the concepts in this chapter.

For the fractions, operations and relative numbers chapters, part of the task is expressed in text form (44.4%,62.5%), which may indicate that the concepts in this chapter include calculations and mathematical rules. However, there is also a significant portion of the task expressed in pictorial (11.2%,12.5%) and combined (44.4%,25%) form, which may indicate that illustrations and concrete examples are used to help students to understand the concepts of this chapter. For the Powers chapter, all tasks are expressed in text form (100%).

2nd Middle School Year

Chapter	Contextualized problem	Other type of task
Relative numbers	10%	90%
Rational numbers	13.4%	86.6%
Powers of a rational number	12.2%	87.8%
Literal calculation	14.3%	85.7%

The results indicate that most tasks for the second year of college are not contextualized. For the chapters on relative numbers, rational numbers and powers of a rational number, less than 15% of the tasks are contextualized. For the literal calculus chapter, it's a bit higher, but still less than 20%. These results may indicate that the emphasis is on acquiring basic mathematical skills rather than applying these skills in purely mathematical contexts. It is possible that this is done to give students a solid mathematical foundation but it does not help the student to develop these mathematical skills in relation to their real life.

Chapter	Mode of expression		
	Text	Illustrated	Combined
Relative numbers	66.7%	33.3%	0%
Rational numbers	72.7%	0%	27.3%
Powers of a rational number	80%	0%	20%
Literal calculation	20%	0%	80%

These results indicate that contextualized problems in 2nd middle school year are mainly presented in text form for the chapters on relative numbers, rational numbers and powers of a rational number. We notice that for the literal calculation chapter, it is the opposite, the majority of the problems are presented in the combined form of text and illustration.

This may indicate that literal calculation problems are more complex and require a visual explanation to be better understood by students. Regarding the other types of tasks, we see that they represent a significant proportion in all chapters, which shows that it is important to vary the types of exercises by the authors of the manuals for better understanding and better mastery of concepts for students.

3th Year College

Chapter	Contextualized problem	Other type of task
Numerical calculation	7.3%	92.7%
Order and operation	5%	95%
Equation and inequality	17.6%	82.4%

The results indicate that for the 3rd year of middle school, most of the tasks are non-contextualized and focus mainly on numerical calculations, order and operations, and equations and inequalities. It is interesting to note that only 7.3% of the tasks are contextualized for the numerical calculation chapter, while 17.6% are for equations and inequalities. This may suggest that equations and inequalities are considered more important or more complex than numerical calculations, and that they require contextualization for better understanding.

Chapter	Mode of expression		
	Text	Illustrated	Combined
Numerical calculation	0%	0%	100%
Order and operation	100%	0%	0%
Equation and inequality	50%	16.7%	33.3%

The results indicate that in the numerical calculation chapter, all problems are expressed in combined text form, which may include numerical calculations and written explanations. In the order and operation chapter, all problems are expressed in text form only. Finally, for the equations and inequalities chapter, half of the problems are expressed in text form only, while the others are expressed in combined and illustrated form.

Scientific Common Core

Chapter	Contextualized problem	Other type of task
Sets of natural integers, arithmetic concept	20%	80%
Sets	3.3%	96.7%
Order in IR	1.4%	98.6%
Polynomials	2.3%	97.7%

The results show that there is a small percentage of contextualized tasks in the different chapters of the common science textbook. For example, in the chapter on natural numbers, only 20% of the tasks are contextualized, while 80% are not. This is similar for chapters sets, order in IR and polynomials, where the percentages of contextualized tasks are 3.3%, 1.4% and 2.3% respectively.

Importantly, contextualized tasks allow students to practice the concepts they have learned in real-world situations, which can help them better understand and retain these concepts. It is why the authors of these textbooks must make an effort in this direction in textbooks to reinforce student learning.

Chapter	Mode of expression		
	Text	Illustrated	Combined
Sets of natural integers, arithmetic concept	100%	0%	0%
Sets	66.7%	0%	33.3%
Order in IR	100%	0%	0%
Polynomials	0%	0%	100%

For the chapter of natural numbers and order in IR, it seems that the expression used exclusively of type "text". There is no use of illustrations or a combination of text and illustrations. For the "sets" chapter, it seems that the expression used mainly is text, with 66.7% usage. So as the use of the combination of texts and illustrations. For the polynomials chapter, it seems that there is no use of texts or illustrations, but exclusively a combination of texts and illustrations.

1st Year Baccalaureate

Chapter	Contextualized problem	Other type of task
Concept of logic	1.7%	98.3%
Trigonometric calculation	0%	100%

For the notion of logic, it seems that there is very little use of contextualized problems, with only 1.7%. While most of the tasks used are not contextualized. It is important to emphasize that contextualized tasks are an effective means of learning because it allows students to see the applications of a mathematical concept in truly real situations. It is therefore important to have a balance between contextualized tasks and other types of tasks for better understanding and effective application of concepts.

Chapter	Mode of expression		
	Text	Illustrated	Combined
Concept of logic	100%	0%	0%
Trigonometric calculation	0%	0%	0%

The results indicate that for the chapter of "concept of logic" the mode of expression exclusively in text form is used. But in the trigonometric calculation chapter there is no mode of expression because the authors of this manual do not contextualize the tasks of this chapter. It is important to note that different modes of expression can be used to reinforce the understanding of concepts. Using illustrations or combinations of text and illustrations can help students visualize concepts and relate them to real-world situations. It is helpful to consider why these modes of expression are not used in these chapters and to think about ways to incorporate illustrations or combinations of text and illustrations to reinforce learning.

2nd Year Baccalaureate

Chapter	Contextualized problem	Other type of task
Complex numbers	0%	100%
Differential equation	22.2%	77.8%

The results indicate that for the complex numbers chapter, contextualized problems are not used, while for the differential equations chapter, they represent only a small part of the contextualized tasks used, just 22.2% in the differential equations chapter.

Chapter	**Mode of expression**		
	Text	Illustrated	Combined
Complex numbers	0%	0%	0%
Differential equation	66.7%	0%	33.3%

The results indicate that for the differential equations chapter, the modes of expression are exclusively in text form (66.7% text and 33.3% combination). There is no use of illustrations alone.

IV. General Conclusion

According to the three distributions that we made in the practical part, we see that the contextualized chapters are higher in middle school (1st and 2nd year) than in high school. This represents a significant share, but generally less than half of the contextualized. However, this variation depends on each specific chapter. Furthermore, the mode of expression in which these problems are presented differs between the text and the illustration. For example, concrete illustrations are used to help students better understand math concepts, but this does not necessarily promote the development of real-life math skills.

Textbook authors at these levels should place emphasis on fostering a solid mathematical foundation, but primarily in a contextualizing context.

However, the percentage of contextualized tasks decreases considerably from the 3rd year until high school; it is important to note that this year plays an essential role in the future orientation of students.

In high school, the use of contextualized tasks is very limited, not exceeding 20% in the algebra chapters in the scientific core curriculum. This deprives students of the opportunity to apply mathematical concepts in real-world situations, which can be detrimental to their learning and understanding of mathematics throughout the student's education.

It is strongly important that textbook authors strive to balance contextualized tasks with other types of tasks for in-depth understanding and effective application of concepts.

The different modes of expression of contextualized tasks, such as the use of illustrations or combinations of text and illustrations, are used in high school with a very small percentage to reinforce the understanding of concepts. This helps students visualize concepts and relate them to real-life situations. It is essential that textbook authors consider ways to incorporate such illustrations or combinations of text and illustrations to enhance learning, whether in middle school or high school.

We can conclude, at the end of this detailed analysis, that the authors of the textbooks make an effort for the lower levels because the students, especially in middle school, know symbolization in mathematics for the first time but this remains insufficient to develop algebraic thinking among students and give mathematical notions in a contextualized context, because, when students are placed in front of a task that promotes mathematical reasoning, they are able to implement ways of approaching mathematics typical of algebraic thinking also, on the one hand and on the other hand the textbooks at the college universe plus level are new editions (2020) It should be noted that the age of the school textbooks compared to those of the college could partly explain these unsatisfactory results.

which shows that the authors make an effort in the short story compared to the old high school editions which are very weak in contextualized problems, therefore It is important to integrate RME theory into textbooks to improve mathematics teaching.

A study also a similar analysis was done in 2017 on the elements of the contextual approach to the teaching process from the first to the fifth grades of primary school different modes of contextual problems are mainly identified with regard to different forms of expression and presentation

The results of their number also indicate the unsatisfactory support of standard textbooks to the process of contextualization of learning and teaching of mathematics in the first years of primary education.

The number of publications related to RME in the Scorpus database between 1972 and 2020 is 282 documents distributed in various countries in Europe, America, Africa, Asia (Indonesia 164, USA 37, Netherlands 28 , Greece 11, UK 6 and documents between 6-1 in other countries) (Tinh Thi Phan et al., 2022) and it remains low at the level of research in mathematics teaching and especially in Morocco, and However, this reflects the ranking of our country in the last position according to the international TIMSS survey with a score of 388 in 2019 far from the average in the TIMSS scale (500).

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Annex

Data collection grid

Level: Chapter

Number of activities

Contextualized problem	Number Total	%	Other type of stain	NumberTotal	%

Mode of expression	Text	Illustrated	Combined
Total number			
%			