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Challenges to learning mathematical concepts among sixth-grade students in primary education: A teachers' perspective

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ABSTRACT

The aim of this study was to identify the main challenges faced by sixth-grade students in grasping mathematical concepts at elementary levels in Northern Tunis as perceived by teachers. It also examined how teacher-related variables like teacher's gender, age, and qualifications influence these perceptions. Using a descriptive-analytical approach, this study conducted a survey that served as the primary instrument for data collection. The sample consisted of 200 teachers: 127 females and 73 males. Findings revealed challenges like overcrowded classrooms, lack of specialized mathematics laboratories, inadequate reward and discipline systems, minimal focus on modern teaching methods in teacher training programs, and insufficient parental involvement in their children's education. The data also suggested a relationship between these challenges and the teacher-related variables of gender and age, indicating that these variables influence the perceptions of challenges. Recommendations were made to address these issues, highlighting the importance of taking these challenges seriously.

Keywords: challenges, learning, mathematical concepts, elementary levels

INTRODUCTION

Mathematics stands as a crucial domain of knowledge, distinguished by its distinctive character, structured complexity, and its educational and learning methods that are progressive and cumulative. From an intellectual and cognitive perspective, Abu Zeina (2010) affirmed that the importance of teaching mathematics in school curricula can be viewed through two comprehensive and integrated lenses:

The first perspective considers mathematics as a practical instrument. This involves mathematical abilities essential for managing personal affairs and tasks. Additionally, it includes skills necessary for functioning within a society shaped by its cultural, social, and economic aspects. The second perspective identifies mathematics as an independent cognitive entity, characterized by its unique structure and organization.

In the field of education, mathematics emerges not only as a critical academic discipline but also as a significant obstacle for many students, spanning from primary education to university levels.

The importance of this study stems from the issue it addresses, which is to understand the challenges to learning mathematics among sixth-grade students. The problem of learning mathematics is a general problem for all students at all stages and in universities. Therefore, understanding these problems provides Tunisian educational decision-makers with mechanisms to establish policies and solutions to solve this problem. This study also sheds light on an important axis in the educational process, aiming to increase awareness among teachers about this problem and its resolution mechanisms, as well as increasing awareness among educational policymakers.

By exploring the specific challenges faced by sixth-grade students in Northern Tunis, this study aims to reveal the multifaceted challenges to effective mathematics education from a teachers' perspective. Through a comprehensive analysis, we seek not only to enrich the academic dialogue around mathematics education in Tunisia but also to offer tangible insights for educational policy and teaching strategy reforms. Transitioning from this broad scope to a focused inquiry, our approach is methodologically robust and oriented towards practical outcomes.

This study focuses on identifying and addressing the challenges sixth graders in Northern Tunis face in learning mathematical concepts from the teacher's perspective, using a descriptive-analytical approach and survey method analyzed through SPSS. The significance level was set at $p < 0.05$ to ensure reliability, verified by Cronbach's alpha at ≥ 0.70, and to explore the influence of teacher variables such as gender, age, and academic qualification on perceptions of learning challenges. It aims to propose

innovative solutions, incorporating insights from literature reviews, previous studies, and interviews with teachers, to enhance mathematical learning by implementing effective strategies based on teacher perspectives.

Study Objectives

Mathematics is one of the fundamental sciences that many other sciences rely on. Mathematics as a discipline is involved in engineering, administrative and humanities sciences, and other fields. It is also important for the ordinary person in simple calculations for buying and selling, among others. Mathematics has developed like other sciences from its inception to the present day, which is a world of rapid change due to the scientific boom in the field of information and communication technology. Despite the importance of mathematics, many students have difficulties in learning this science for various reasons; some are due to the student themselves; others may be a result of the educational process itself, and it could also be due to the teacher.

There are many problems that students face in the field of learning mathematics, including difficulties in addition, subtraction, multiplication, and division operations. There are also difficulties related to transforming written content into mathematical operations to solve them, or the reverse, where students are unable to convert mathematical equations and values into written content.

Numerous researchers have explored the challenges that students encounter in achieving academic success, especially in the field of mathematics. It has been noted that students often underperform in a way that does not correlate with their mental age. This is particularly evident in their pronounced difficulties with arithmetic operations and number comprehension, signaling deeper struggles in mastering mathematical concepts (Cross et al., 2009).

The objective of this study is to gain a deeper understanding of the challenges students face in learning mathematics. Furthermore, the study aims to explore the feasibility of developing mechanisms and solutions to address these challenges, which are prevalent among students at all educational stages.

Research Questions

This study seeks to clarify the following questions.

First research question

What are the most significant challenges to learning mathematical concepts for sixth-grade students in the primary schools of Northern Tunis from the teachers' perspective?

This leads to the following sub-questions:

1. *What are the main challenges associated with the students themselves?*
2. *What are the main challenges associated with the teachers?*
3. *What are the main challenges associated with school administration and inspection?*
4. *What are the main challenges associated with the designated textbook?*
5. *What are the main challenges associated with the methods of teaching?*
6. *What are the main challenges associated with the local community?*

Second research question

Are there statistically significant differences at the significance level ($\alpha \leq 0.05$) in the assessment averages of the study sample of teachers regarding the challenges to learning mathematical concepts among sixth-grade students in Northern Tunis schools, attributed to the following teachers' variables: gender, age, and academic qualification?

Principal Hypothesis

There are no statistically significant differences at the significance level ($\alpha \leq 0.05$) in the assessment averages of the study sample of teachers regarding the challenges to learning mathematical concepts among sixth-grade students in Northern Tunis schools, attributed to the following teachers' variables: gender, age, and academic qualification?

This leads to the following specific sub-hypotheses:

1. **Gender-related null hypothesis ($H0_1$).** *There are no statistically significant differences at the significance level ($\alpha \leq 0.05$) in the assessment averages from the teachers' sample of the study concerning learning challenges to learning mathematical concepts among sixth-grade students in Northern Tunis schools from the teachers' perspective, attributed to the gender variable*.
2. **Age-related null hypothesis ($H0_2$).** *There are no statistically significant differences at the significance level ($\alpha \leq 0.05$) in the assessment averages from the teachers' sample of the study concerning learning challenges to learning mathematical concepts among sixth-grade students in Northern Tunis schools from the teachers' perspective, attributed to the age variable.*
3. **Academic qualification-related null hypothesis ($H0_3$).** *There are no statistically significant differences at the significance level ($\alpha \leq 0.05$) in the assessment averages from the teachers' sample of the study concerning learning challenges to learning mathematical concepts among sixth-grade students in Northern Tunis schools from the teachers' perspective, attributed to the academic qualification variable.*

LITERATURE REVIEW

Mathematics education faces diverse challenges, deeply influencing how students understand and engage with mathematical concepts. These challenges, as explored in various studies, shed light on the complexities of teaching and learning mathematics across different educational levels and contexts. To better understand these challenges, literature can be organized into several key themes.

Cognitive Challenges in Learning Mathematics

Kashefi et al. (2010) explore the difficulties students face in grasping two-variable functions within multivariable calculus. This study illuminates the struggles students encounter when transitioning from simpler mathematical concepts to more complex, abstract ideas, especially in representing functions in three-dimensional space. It underscores the cognitive challenges inherent in visualizing and conceptualizing mathematical phenomena.

Integrating Sustainability into Mathematics Education

In the realm of primary education, Vásquez et al. (2022) delve into the crucial task of integrating sustainability competencies into mathematics curricula. Moreno-Pino et al. (2021) found a low presence of these competencies in the syllabi of mathematics education programs. Serow (2015) and Petocz and Reid (2003) both highlight the need for a deeper understanding of mathematical concepts and the potential for integrating sustainability issues into the curriculum. Fuertes-Camacho et al. (2019) further underscores the value of a global learning strategy, such as the project method, in developing sustainability competencies in higher education.

Graham (2023) identifies a negative correlation between overcrowded classrooms and grade 9 mathematics achievement in South Africa, attributing decreased performance to challenges in personal interaction, instructional neglect, and time management. The study underscores the urgent need for interventions to address classroom overcrowding and enhance educational outcomes.

Challenges in Science and Mathematics Teacher Education

Luft et al. (2020) address the challenges faced in science education, particularly the assignment of teachers to subjects outside their areas of expertise due to teacher shortages and inconsistencies in certification standards. They emphasize the urgent need for policy reforms, targeted research, and comprehensive professional development programs.

Hobbs and Porsch (2021) emphasize the need for enhanced teacher education to address the teaching out-of-field phenomenon, advocating for specialized training and ongoing professional development to mitigate teacher shortages and improve instructional efficacy.

Drews (2007) analyzes the impact of resources in primary mathematics, highlighting the importance of using various materials, from manipulatives to technology, to bridge concrete and abstract mathematical concepts, urging clarity and purpose in their application by teachers.

Problem-Based Learning and Learning Difficulties

Building upon these primary education challenges, Nurlaily et al. (2019) examine the hurdles encountered by teachers implementing problem-based learning in mathematics. Febriyanti et al. (2021) investigate the strategies employed by Indonesian teachers to diagnose and address learning difficulties in mathematics among elementary students.

Challenges in Understanding Specific Mathematical Concepts

Transitioning to junior high school, Noto et al. (2020) delve into the learning challenges Indonesian students face in understanding algebra. Cesaria and Herman (2019) focus on the learning challenges junior high school students in Indonesia face in understanding geometry, specifically polyhedron.

The Role of Educational Resources in Mathematics Learning

Mangwende and Maharaj (2019) present the challenges faced by mathematics teachers in Zimbabwe including limited opportunities for in-service teacher training. Mbofana and Banda (2022) and Tachie and Chireshe (2013) investigate challenges in mathematics education in Zimbabwe and South Africa, respectively. Mbofana and Banda (2022) focus on large class sizes in Zimbabwean schools, highlighting issues like reduced teacher-student interaction, and suggest digital and e-learning technologies to improve outcomes. Tachie and Chireshe (2013) analyze high failure rates in mathematics in rural South African schools, attributing these to external factors such as resource shortages, poor teaching, and overcrowded classrooms, as well as internal factors like student laziness, lack of interest and absenteeism. They recommend enhancing teaching quality and student motivation to improve mathematics performance. Rameli and Kosnin (2016) uncover factors impeding effective mathematics learning among secondary students in Malaysia, such as negative self-perceptions, unengaging teaching methodologies, and a lack of stimulating educational materials. Yuliani (2016) discusses the application of the theory of didactical situations in overcoming learning barriers. Yang et al. (2022) and Livy et al. (2023) investigate the integration of children's literature in mathematics. Kaushik Das (2019) and Okigbo and Osuafor (2008) both underscore the importance of mathematics laboratories. Fan et al. (2021) explore secondary mathematics teachers' perceptions of textbooks in Shanghai, China. Teachers generally view textbooks as facilitators in their teaching practice, especially teacher manuals, which are more helpful in the comprehension and transformation of mathematical concepts.

Table 1. Matrix of reliability coefficients for survey axes according to Cronbach's alpha equation

Axes	Number of items	Reliability coefficient value
Challenges related to the student	10	0.909
Challenges related to the teacher	10	0.945
Challenges related to administration and inspection	10	0.873
Challenges related to the designated textbook	10	0.903
Challenges related to teaching methods	10	0.948
Challenges related to the local community	9	0.978

Table 2. Challenges related to the student

No	Items of student axis	AM	SD	RW	DMA	R
1	Overcrowding of the classrooms with students.	4.24	1.35	84.8%	SA	2
2	The general weakness of the students in understanding mathematics.	4.02	1.02	80.4%	A	4
3	Low motivation among some students for learning mathematics due to their low academic achievement.	4.05	1.06	81.0%	A	3
4	Lack of interest of students in prior preparation and participation in the math class.	3.74	1.16	74.8%	A	7
5	Students' weakness in executing skills and algorithms related to the intended objectives.	3.92	0.92	78.4%	A	5
6	Students' weakness in basic mathematical concepts and operations learned in earlier stages.	3.90	1.04	78.0%	A	6
7	Some students' low belief in the importance of mathematics in their lives.	3.50	0.91	70.0%	A	8
8	Students' concern with grades rather than developing their mental skills.	4.29	0.86	85.8%	SA	1
9	Negative attitudes of some students towards the mathematics teacher.	2.98	1.15	59.6%	N	10
10	Students being preoccupied with other interests such as activities and competitions.	3.43	1.25	68.6%	A	9
All items combined		3.81	0.74	76.14%	A	

Note. AM: Arithmetic mean; SD: Standard deviation; RW: Relative weight; DMA: Degree of measured attitude; R: Ranking; A: Agree; N: Neutral; & SA: Strongly agree

Acharya (2017) examines a range of factors contributing to difficulties in learning mathematics in Nepal. These include ineffective linking of new mathematical concepts with previously learned structures, mathematics anxiety, students' negative feelings towards mathematics, economic conditions, educational backgrounds, and the school management systemTambychik et al. (2010) investigate students' difficulties in mathematics problem-solving. Caviola et al. (2021) conducted a meta-analysis to investigate the relationship between academic anxiety and mathematics performance.

Building on the varied challenges identified in mathematics education, our research uniquely focuses on six specific axes within the context of Northern Tunis, Tunisia, marking a novel contribution to the field. It is distinct in its comprehensive exploration of these challenges, exclusively from teachers' perspectives, and employs a widely recognized descriptive analytical approach.

METHODOLOGY

In our study, we employed a descriptive methodology to comprehensively explore the challenges of learning mathematical concepts, featuring a unique questionnaire with six axes, extending beyond the scope of previous studies. This approach involved surveying 887 primary school mathematics teachers across Northern Tunis. The reliability and validity of our questionnaire were rigorously tested on a pilot sample of 20 teachers, resulting in a Cronbach's alpha coefficient of 90.8%. Our actual study sample consisted of 200 randomly selected teachers, ensuring a broad representation of the population. The questionnaire, comprising 59 items distributed over six axes, utilized a five-point Likert scale ranging from "strongly agree" to "strongly disagree" to assess teachers' perceptions of the challenges to learning mathematical concepts. This methodological framework not only underscores the study's commitment to depth and accuracy but also its alignment with validated research practices.

The reliability of the study tool (questionnaire) was confirmed by finding the Cronbach-alpha reliability coefficient, which reached a value of 0.978 for the total score of all 59 questionnaire items. This value indicates a high stability in the study data, thus these data can be relied upon, analyzed, and generalized to the study population, as shown in **Table 1**.

RESULTS

To answer the first research question of the study, which states: *What are the most significant challenges to learning mathematical concepts for sixth-grade students in the primary schools of Northern Tunis from the teachers' perspective?*

To address this question, we calculated the arithmetic means, standard deviations, relative weights, the degree of measured attitude and ranking of each item within the various axes of our questionnaire. We then identified and clarified the most important challenges, expressed our opinion, and outlined findings consistent with previous studies. The details are evident in the following:

The First Axis: Challenges Related to the Student

Significant challenges include students' concern with grades rather than developing their mental skills, overcrowding in classrooms and low motivation, among others, as detailed in **Table 2**.

Table 3. Challenges related to the teacher

No	Teacher-related item	AM	SD	RW	DMA	R
1	Weak preparation of mathematics teachers in universities.	3.58	1.32	71.6%	A	3
2	The teacher's focus on the cognitive aspects of the student more than other aspects.	3.24	1.23	64.8%	N	5
3	The teacher's focus on rote learning without mastery.	3.09	1.31	61.8%	N	9
4	Poor coordination among mathematics teachers at different grades and stages.	3.47	1.12	69.4%	A	4
5	Lack of teacher's interest in research, reading, and abstraction.	3.20	1.41	64.0%	N	8
6	Focus on theoretical content without concern for practical applications.	3.21	1.17	64.2%	N	7
7	lack of diversity in the assessment tools used by the teacher in student learning.	3.06	1.18	61.2%	N	10
8	The teacher's concern with completing the syllabus in the allotted time more than mastery.	3.22	1.45	64.4%	N	6
9	Not assigning teachers with scientific specializations to teach mathematics.	3.63	1.18	72.6%	A	2
10	Lack of a dedicated laboratory for teaching mathematics.	4.22	1.07	84.4%	SA	1
All items combined		3.39	0.51	67.6%	N	

Note. AM: Arithmetic mean; SD: Standard deviation; RW: Relative weight; DMA: Degree of measured attitude; R: Ranking; A: Agree; N: Neutral; & SA: Strongly agree

Table 4. Challenges related to the administration and inspection

No	Items for administration and inspection category	AM	SD	RW	DMA	R
1	The abundance of work and responsibilities assigned to the teacher by the principal and inspector.	3.90	1.27	78.0%	A	4
2	The abundance of laws and official instructions that limit the teacher's freedom to be creative.	4.07	1.06	81.4%	A	3
3	The lack of implementation of reward and punishment systems for students in a way that preserves the teacher's status and dignity.	4.26	1.05	85.2%	SA	1
4	Administrative and inspection instructions limit the teacher's authority to make decisions related to teaching mathematics.	3.52	1.27	70.4%	A	8
5	Lack of diversity in tools and methods for evaluating the teacher's work.	3.70	1.07	74.0%	A	7
6	Few training days for the development of the teacher's capabilities.	4.15	0.98	83.0%	A	2
7	Lack of focus on how to teach the contents of the designated textbook.	3.75	1.20	75.0%	A	6
8	The teacher being occupied with tasks and work considered secondary to teaching mathematics.	2.94	1.18	58.8%	N	9
9	Frequent absence of the teacher from mathematics classes in the school.	2.05	1.27	41.0%	D	10
10	The inspector focuses on evaluating the teacher's work more than developing their performance.	3.80	1.33	76.0%	A	5
All items combined		3.61	0.52	74.2%	A	

Note. AM: Arithmetic mean; SD: Standard deviation; RW: Relative weight; DMA: Degree of measured attitude; R: Ranking; A: Agree; N: Neutral; SA: Strongly agree; & D: Disagree

Table 5. Challenges related to the designated textbook

No	Items for the designated textbook axis	AM	SD	RW	DMA	R
1	The length of the topics in the designated textbook and the insufficiency of time available for teaching them.	4.31	0.89	86.2%	SA	1
2	Lack of coherent and sequential presentation of the textbook's topics.	4.01	1.11	80.2%	A	3
3	Few exercises in the book that help develop students' thinking.	3.77	1.15	75.4%	A	5
4	Lack of connection of the book's topics with the students' daily life.	3.92	1.20	78.4%	A	4
5	Presence of scientific and typographical errors in the book.	3.29	1.21	65.8%	N	10
6	Lack of logical sequence in the presentation of some topics in the designated textbook.	3.65	1.04	73.0%	A	8
7	Lack of variety in the book with the examples provided.	3.57	1.28	71.4%	A	9
8	Lack of renewal of problems that do not match the content of the lessons.	4.03	1.02	80.6%	A	2
9	Lack of sequencing elements of a single topic from easy to difficult.	3.71	1.30	74.2%	A	7
10	Difficulty of some topics in the designated textbook and not considering the students' developmental stages.	3.73	1.26	76.6%	A	6
All items combined		3.78	0.70	75.6%	A	

Note. AM: Arithmetic mean; SD: Standard deviation; RW: Relative weight; DMA: Degree of measured attitude; R: Ranking; A: Agree; N: Neutral; & SA: Strongly agree

The Second Axis: Challenges Related to the Teacher

Notable challenges involve lack of a dedicated laboratory for teaching mathematics, not assigning teachers with scientific specializations to teach mathematics and weak preparation of mathematics teachers in universities, as illustrated in **Table 3**.

The Third Axis: Challenges Related to Administration and Inspection

This axis emphasized issues like lack of implementation of reward and punishment systems for students in a way that preserves the teacher's status and dignity, few training days for the development of the teacher's capabilities and the abundance of laws and official instructions that limit the teacher's freedom to be creative, as detailed in **Table 4**.

The Fourth Axis: Challenges Related to the Designated Textbook

Challenges here include the length of topics in the textbook, lack of renewal of problems that do not match the content of the lessons and lack of coherent and sequential presentation of the textbook's topics, as detailed in **Table 5**.

Table 6. Challenges related to the teaching methods

No	Items for teaching methods category	AM	SD	RW	DMA	R
1	The teacher's inability to choose the appropriate teaching method.	3.00	1.20	60.0%	N	6
2	The teacher's weak ability to use modern technologies in teaching.	3.22	1.44	64.4%	N	3
3	Lack of attention in training programs to train teachers on modern teaching methods.	3.71	1.27	74.2%	A	1
4	Weakness of university plans in qualifying teachers for teaching mathematics.	2.93	1.56	58.6%	N	8
5	Some teachers' lack of ability to produce and employ appropriate teaching materials.	2.95	1.22	59.0%	N	7
6	The belief that traditional methods maintain order and calm in the classroom.	3.32	1.33	66.4%	N	2
7	The teacher's lack of understanding of the goals of teaching mathematics to choose the appropriate method.	2.84	1.48	56.8%	N	9
8	Lack of teacher's interest in transferring skills from books to practical application in daily life.	3.02	1.19	60.4%	N	5
9	The inspector's focus on completing the syllabus rather than on the method of teaching.	3.19	1.44	63.8%	N	4
10	The teacher's disbelief in the effectiveness of modern teaching methods.	2.56	1.38	51.2%	D	10
All items combined		3.07	0.75	61.4%	N	

Note. AM: Arithmetic mean; SD: Standard deviation; RW: Relative weight; DMA: Degree of measured attitude; R: Ranking; A: Agree; N: Neutral; & D: Disagree

Table 7. Challenges related to the local community

No	Items for local community axis	AM	SD	RW	DMA	R
1	The family's perception of mathematics as a difficult subject.	4.25	0.92	85.0%	SA	3
2	Parents scaring the child about mathematics.	3.85	1.33	77.0%	A	5
3	Weak monitoring by parents of their children at school.	4.39	0.99	87.8%	SA	2
4	Weak follow-up by the family on their children's performance of school assignments.	4.52	0.73	90.4%	SA	1
5	The family's inability to help their children in mathematics.	4.15	0.85	83.0%	A	4
6	The family's view that mathematics is not useful in practical life.	2.79	1.37	55.8%	N	9
7	Weak relationship between the mathematics teacher and the local community, reflecting on students' performance.	3.03	1.23	60.6%	N	8
8	Poor communication between the local community and the school.	3.74	1.03	74.8%	A	6
9	The local community's focus on financial support for the school at the expense of technical support for students' learning.	3.49	1.25	69.8%	A	7
All items combined		3.80	0.49	72.8%	A	

Note. AM: Arithmetic mean; SD: Standard deviation; RW: Relative weight; DMA: Degree of measured attitude; R: Ranking; A: Agree; N: Neutral; & SA: Strongly agree

Table 8. Arithmetic means, standard deviations, and rankings for the axes of the study tool

No	Axis	Arithmetic mean	Standard deviation	Relative weight	Degree of measured attitude	Ranking
1	Student	3.81	0.74	76.0%	Agree	1
2	Teacher	3.39	0.51	67.6%	Neutral	5
3	Administration and inspection	3.61	0.52	74.2%	Agree	3
4	Designated textbook	3.78	0.70	75.6%	Agree	2
5	Teaching methods	3.07	0.75	61.4%	Neutral	6
6	Local community	3.80	0.49	Agree	Agree	4
Overall score		3.58	0.33	71.0%	Agree	

The Fifth Axis: Challenges Related to Teaching Methods

Identified challenges include lack of attention in training programs to train teachers on modern teaching methods and the belief that traditional methods maintain order and calm in the classroom, summarized in **Table 6**.

The Sixth Axis: Challenges Related to the Local Community

Significant issues noted are weak follow-up by the family on their children's performance of school assignments and weak monitoring by parents of their children's academic engagement, as detailed in **Table 7**.

After analyzing the results of each item in all the axes, we return to the question initially posed: *What are the most significant challenges to learning mathematical concepts for sixth-grade students in the primary schools of Northern Tunis from the teachers' perspective?*

To summarize the results, we calculated the averages, relative wight, and rankings for each axis of the questionnaire (**Table 8**).

After calculating the means, standard deviations, and their rankings for all the questionnaire items, we can identify the top ten challenges in learning mathematical concepts at the primary stage from the perspective of teachers in Northern Tunis schools as outlined in **Table 9**.

It is clear from **Table 9** that most of the items come from the student, teacher, and local community aspects.

After presenting the study results by answering the first research question and reviewing the most prominent survey results, we move on to address the second research question regarding statistically significant differences in the assessment averages of the study sample of teachers on the challenges to learning mathematical concepts among sixth-grade students in Northern Tunis schools, specially investigating if these perceived challenges vary based on the teaches' gender, age, and academic qualification.

Table 9. Arithmetic means, standard deviations, and degree of measured attitude for the top-10 challenges ranked in descending order

No	Item statement	C	AM	SD	DMA	R
54	Weakness in family follow-up of children's performance of school homework.	LC	4.52	0.73	SA	1
53	Weakness in parental follow-up of their children in school.	LC	4.39	0.99	SA	2
31	Length of the subjects in the designated book and the insufficiency of the available time to teach them.	AI	4.31	0.89	SA	3
8	Student's concern with grades without developing their mental skills.	S	4.29	0.86	SA	4
23	Lack of activation of reward and punishment systems for students in a way that preserves the teacher's status and dignity.	T	4.26	1.05	SA	5
51	Family's perception of mathematics as a difficult subject.	TM	4.25	0.92	SA	6
1	Overcrowding of classrooms with students.	S	4.24	1.35	SA	7
20	Lack of a specialized laboratory for teaching mathematics.	T	4.22	1.07	SA	8
26	Few training days for developing teachers' abilities.	T	4.15	0.98	A	9
3	Low motivation of some students to learn mathematics due to their low academic achievement.	S	4.05	1.06	A	10
54	Weakness in family follow-up of children's performance of school homework.	LC	4.52	0.73	SA	1

Note. C: Category; AM: Arithmetic mean; SD: Standard deviation; DMA: Degree of measured attitude; R: Ranking; A: Agree; SA: Strongly agree; LC: Local community; S: Student; T: Teacher; TM: Teaching methods; & AI: Administration and inspection

Table 10. Results of the independent t-test for the first null hypothesis

Gender	Number	Arithmetic mean	Standard deviation	Degrees of freedom	Calculated t	Calculated significance level
Males	73	3.59	0.26	198	4.269	0.040
Females	127	3.56	0.35			

Table 11. Arithmetic means and standard deviations for the age variable

Age	Number	Arithmetic mean	Standard deviation
20-30 years	25	3.4949	0.38607
31-40 years	74	3.5383	0.30286
41-50 years	48	3.5606	0.23678
51 years and above	53	3.6780	0.37770
Total	200	3.5752	0.32607

Table 12. Results of the one-way ANOVA test for the age variable

Source of variation	Sum of squares	Degrees of freedom	Mean square	Calculated F value	Calculated significance level
Between groups	0.832	3	0.277	2.675	0.048
Within groups	20.326	196	0.104		
Total	21.158	199			

To systematically explore this inquiry, we established the following null hypotheses, each focusing on one of the variables of the teachers:

1. **First null hypothesis ($H0_1$).** There are no statistically significant differences in the assessment averages related to the challenges of learning mathematical concepts, as perceived by teachers, due to their gender.
2. **Second null hypothesis ($H0_2$).** There are no statistically significant differences in the assessment averages related to the challenges of learning mathematical concepts, as perceived by teachers, due to their age.
3. **Third null hypothesis ($H0_3$).** There are no statistically significant differences in the assessment averages related to the challenges of learning mathematical concepts, as perceived by teachers, due to their academic qualification.

To test the first null hypothesis, the independent t-test was used, a single-sample t-test to determine whether the response rate exceeded the neutrality rate or not, as shown in **Table 10**.

To test the second null hypothesis, arithmetic means and standard deviations for the challenges in learning mathematical concepts among sixth-grade students in primary schools in Northern Tunis from the teachers' perspective, attributed to the age variable, were calculated, as shown in **Table 11**.

It is apparent from **Table 11** that there are apparent differences between the arithmetic means of the challenges to learning mathematical concepts among sixth-grade students in primary schools in Northern Tunis from the teachers' perspective, attributed to the age variable. To determine if these differences are statistically significant, a one-way analysis of variance (ANOVA) test was used to test comparisons between three or more groups, as clarified in **Table 12**.

To determine in whose favor these differences are, advanced statistical analysis (post-hoc) was used. This is employed after the one-way ANOVA test to elucidate the least significant difference (post-hoc) and the arithmetic means for differences in challenges in learning mathematical concepts among sixth-grade students in Northern Tunis primary schools from the teachers' perspective, attributed to the age variable, as **Table 13** explains.

To test the third null hypothesis, the arithmetic means and standard deviations for the challenges in learning mathematical concepts among sixth-grade students in Northern Tunis schools from the teachers' perspective were calculated, attributed to the educational qualification variable, as shown in **Table 14**.

Table 13. Advanced statistical analysis of dimensional differences and dimensional arithmetic means (post-hoc)

Age group	20-30 years	31-40 years	41-50 years	51 years and above
20-30 years		0.04333	0.06569	*0.18305
31-40 years	0.04333		0.02236	*0.13972
41-50 years	0.06569	0.02236		0.11736
51 years and above	*0.18305	*0.13972	0.11736	

Note. *Statistically significant

Table 14. Arithmetic means and standard deviations for the educational qualification variable

Educational qualification	Number	Arithmetic mean	Standard deviation
Doctorate	4	3.9492	0.767030
Master's	11	3.5606	0.28826
Bachelor's degree	105	3.5869	0.318650
Diploma	21	3.5012	0.193070
High school diploma	59	3.5714	0.367990
Total	200	3.5752	0.326070

FooterWillBeHere

Table 15. Results of the one-way ANOVA test for educational qualification variable

Source of variation	Sum of squares	Degrees of freedom	Mean square	Calculated F value	Calculated significance level
Between groups	0.413	4	0.103	0.969	0.425
Within groups	20.745	195	0.106		
Total	21.158	199			

Table 14 shows apparent differences between the arithmetic means for challenges in learning mathematical concepts among sixth-grade students in primary schools in Northern Tunis from the teachers' perspective, attributed to the variable of educational qualification. To determine if these differences are statistically significant, the one-way ANOVA test was used for comparisons between three or more groups, as illustrated in **Table 15**.

DISCUSSION

In the first axis, focusing on student-related challenges, arithmetic means of the items ranged between 2.98 and 4.29, with relative weights from 59.6% to 85.8%, and an average overall of 3.81. This indicates that the items in the first axis were considered significant challenges to a degree of agreement. Notably, the highest relative weight was attributed to item 8, "The students' concern with grades rather than developing their mental skills." This highlights a significant gap perceived by teachers in learning mathematical concepts, largely due to a lack of awareness among students and their families about the importance of comprehending and mastering mathematical concepts. Such a focus on academic achievement is without sufficient motivational programs for students, aligning with findings from Acharya (2017) and Caviola et al. (2021), who pointed out students' emphasis on grades over cognitive and skill aspects of learning mathematics.

Item 1, "Overcrowding of classrooms with students," in the first axis, indicates a shortage of resources and budgets for educational process development. This condition underscores the limitations in public educational facilities and the absence of modern teaching methods. This observation is in line with studies by Mbofana and Banda (2022), Tachie and Chireshe (2013), and Graham (2023), which noted that overcrowding in classrooms significantly impedes the learning of mathematics and its concepts.

Item 9, "Negative attitudes of some students towards the mathematics teacher," had the lowest relative weight (59.6%) in the first axis. This reflects the perceived value of mathematics among students and its association with notions of brilliance, intelligence, and excellence.

In the second axis, the challenges related to the teacher showed arithmetic means ranging between 3.06 and 4.22, with relative weights from 61.2% to 84.4%. The average overall for the second axis was 3.39, indicating these items were viewed as challenges to a neutral degree. particularly, item 10, "Lack of a dedicated laboratory for teaching mathematics," received the highest relative weight 84.4% with a strong agreement. This underscores the critical need for practical aspects of mathematical sciences, as evidenced by the essential role of specialized labs in developing students' scientific imagination and understanding. This finding aligns with Das (2019) and Okigbo and Osuafor (2008), who stressed the importance of providing such facilities.

Item 9, "Not assigning teachers with scientific specializations to teach mathematics," highlighted the necessity of specialized qualifications for mathematics educators. This observation agrees with Vásquez et al. (2022) and Luft et al. (2020), emphasizing the significant impact of teacher competence on student learning.

Moreover, the least emphasized challenge in the second axis was item 7, "Lack of diversity in the assessment tools used by the teacher in student learning," receiving the lowest relative weight 61.2%. This implies a need for broader assessment methodologies beyond those provided by the educational curriculum, suggesting a potential area for improvement in teacher training and curriculum development.

In The third axis, the examination of challenges related to administration and inspection revealed arithmetic means spanning from 2.05 to 4.26, with relative weights between 41.0% and 85.2%, resulting in an overall category average of 3.61. These results

indicate these challenges are agreed upon to a significant degree. Item 3, addressing the "lack of implementation of reward and punishment systems for students," emerged as the most significant challenge with a strong agreement at an 85.2% relative weight. Similarly, item 6, pointing to "Few training days for the development of the teacher's capabilities," also received an 83% agreement.

Furthermore, item 6's emphasis on the lack of developmental opportunities for teachers signifies a pressing need for enhanced pedagogical strategies and modern teaching methodologies. This necessity underscores the critical importance of ongoing professional development to equip educators with innovative instructional techniques, as emphasized by studies by Vazquez et al. (2022) and Hobbs and Porsch (2021) which stress the imperative of comprehensive teacher training and development programs.

Conversely, item 9's lower relative weight 41.0% suggests a commendable level of teacher commitment and adherence to educational mandates, reflecting a strong professional ethic among primary school educators. This commitment is bolstered by stringent absenteeism policies enforced by the ministry of education, ensuring consistent teacher presence and engagement in the classroom, thus mitigating the impact of this challenge on the overall educational experience.

In the fourth axis, challenges concerning the designated textbook were closely examined, revealing arithmetic means between 3.29 and 4.31, and relative weights spanning from 65.8% to 86.2%. This examination culminated in an axis average of (3.78, indicating these challenges were recognized to a considerable degree of agreement among respondents. Notably, item 1, highlighting "The length of topics in the designated textbook and the insufficiency of time available for teaching them," was identified as the most significant challenge, achieving the highest relative weight of 86.2% and a strong level of agreement. This was closely Followed by item 8, "Lack of renewal of problems that do not match the content of the lessons," with an 80.6% agreement, highlighting issues with curriculum alignment and problem relevance.

The critical nature of item 1 reflects a significant oversight in curriculum design, notably the failure to balance lesson content with available teaching time. This imbalance is attributed to the varied pace at which students grasp mathematical concepts, necessitating more nuanced and time-intensive instruction. Such challenges echo research by Vásquez et al. (2022) and Graham (2023), who stress the importance of curriculum developers considering the practical constraints of teaching time and lesson volume.

Item (8)'s prominence signals a misalignment in curriculum development and the selection of textbook problems, highlighting a disconnect between theoretical content and its practical application in students' lives. This misstep not only hampers student engagement but also impedes the seamless integration of mathematical concepts into their everyday experiences. This is corroborated by Tambychik et al. (2010), who advocate for curriculum and textbook designs that resonate more closely with real-world contexts.

Conversely, item 5, addressing "Presence of scientific and typographical errors in the book," received the lowest relative weight of 65.8%, indicating a degree of oversight in the quality control processes of textbook production. Nonetheless, this issue, while ranked lowest among the textbook-related challenges, underscores the ongoing need for meticulous revision and correction by curriculum authorities to uphold the integrity and reliability of educational materials.

In examining the fifth axis, challenges concerning teaching methods were thoroughly analyzed, revealing arithmetic means ranging from 2.56 to 3.71 and relative weights between 51.2% and 74.2%, leading to an overall axis average of 3.07. This analysis indicates a general neutrality among respondents regarding these challenges. The significant challenge, item 3, "Lack of attention in training programs to train teachers on modern teaching methods," garnered the highest relative weight of 74.2% and an agreement level, pointing to significant gaps in current teacher training programs.

The prominence of item 3 underscores the substantial underinvestment in educational programs that fail to adapt to the evolving landscape of teaching methodologies. Despite Tunisia allocating 16.3% of its general state budget to education in 2021, this allocation falls short when compared to the investment levels in developed countries. The challenge of modernizing teaching methods due to budgetary constraints, resource limitations, and a shortage of expertise is a pivotal challenge, necessitating comprehensive and continuous training for teachers on the application of modern educational technologies and methodologies.

Conversely, item 10, "The teacher's disbelief in the effectiveness of modern teaching methods," emerged as the least significant challenge with the lowest relative weight of 51.2%, indicating a degree of skepticism among educators regarding the utility of contemporary teaching approaches. However, this skepticism contrasts with the broader recognition of the need to embrace technological advancements in education, which have the potential to enhance teaching efficacy, engage students more effectively, and ultimately elevate the learning experience.

These findings are consistent with insights from Luft et al. (2020), Nurlaily et al. (2019), and Drews (2007), all of whom highlight the critical importance of investing in teacher training and embracing innovative teaching methods to mitigate educational challenges and improve student outcomes. The disparity between the need for modern teaching approaches and the current state of teacher training and resource allocation underscores a crucial area for policy intervention and educational reform.

The investigation into the sixth axis reveals several challenges arising from the local community's influence on the educational environment, characterized by arithmetic means ranging between 2.79 and 4.52, and relative weights from 55.8% to 90.4%, resulting in an axis average of 3.80. This consensus indicates that challenges related to the local community are acknowledged to a significant extent. The predominant challenge, item 4, "Weak follow-up by the family on their children's performance of school assignments," and item 3, "Weak monitoring by parents of their children at school," emphasize a considerable gap in parental engagement and supervision in the educational process of their children, receiving the highest levels of agreement.

The strong agreement on item 4 underscores the pervasive issue of insufficient parental involvement in their children's academic lives, largely attributable to the demanding nature of parental work schedules and subsequent exhaustion. This lack of

involvment leads to a diminished capacity for parental oversight of school assignments and overall academic progress. Conversely, item 6, “The family’s view that mathematics is not useful in practical life,” represents the least acknowledged challenge, suggesting a nuanced understanding among families regarding the utility of mathematics in daily life and its role in fostering intellectual development.

These insights are corroborated by feedback obtained through interviews with teachers, highlighting a widespread acknowledgment among parents regarding the significance of mathematics, albeit overshadowed by challenges in direct involvement due to lifestyle constraints. The emphasis on strong parental support for academic endeavors, albeit challenged by logistical and perceptual barriers, delineates a critical area for intervention, aiming to bridge the gap between educational institutions and the local community to foster a more conducive learning environment for students.

Overall, the collective assessment of the questionnaire reveals an overall agreement among teachers on the challenges faced in the educational context, with an average score of 3.58 indicating a consensus towards “agree”. This consensus underscores the perceived challenges across different axes, from student-related issues to the integration of teaching methods, each contributing to the overall educational landscape in Northern Tunis schools.

The focus on the student axis emerges as the highest-ranked challenge, emphasizes the pivotal role of the student in the educational process. This focus reflects the myriad challenges students face, including socio-economic and familial factors, underscoring the complexity of learning environments. The findings resonate with the research by Vásquez et al. (2022), Nurlaily et al. (2019), and Rameli and Kosnin (2016), highlighting the significant impact of the student axis on the learning process.

The teaching methods axis, ranked lowest, highlights the need for innovation in educational strategies. Despite the neutrality in the degree of agreement, it suggests a critical area for improvement, especially in adopting modern teaching methodologies and integrating technology into the classroom. This urgency for modernization in teaching methods aligns with the recommendations of Luft et al. (2020), Nurlaily et al. (2019), advocating for enhanced training programs and the adoption of new educational technologies to address contemporary educational challenges.

This comprehensive summary not only provides a snapshot of the current challenges but also aligns with findings from previous research, underscoring the multifaceted nature of educational hurdles. Prioritization on the student axis as a central pillar in the educational system resonates with the literature, advocating for a holistic approach that considers all stakeholders in the education sector. Moreover, the analysis shed light on the necessity for continuous development and support for teachers, particularly in the areas of professional training and resource allocation, to enhance the overall quality of education.

Through this evaluative process, we are able to delineate the top ten challenges confronting the educational realm in Northern Tunis, offering a foundation for targeted interventions and policy formulations aimed at mitigating these barriers and fostering a more conducive learning environment, supported by the insights from previous studies cited throughout the discussion.

Regarding the statistical analysis, **Table 10** illustrates the results of the t-test for independent samples (independent t-test) for the challenges in learning mathematical concepts among sixth-grade students in primary schools in Northern Tunis from the teachers’ perspective, attributed to the gender variable. It is revealed that the calculated significance level is (0.04), which is less than the statistical significance level ($\alpha \leq 0.05$). hence, the null hypothesis ($H0_1$) is rejected, and the alternative hypothesis is accepted, indicating statistically significant differences at the significance level ($\alpha \leq 0.05$) for the challenges in learning mathematical concepts among sixth-grade students in primary schools in Northern Tunis from the teachers’ perspective, attributed to the gender variable.

From this analysis, it is clear that the arithmetic mean for males is 3.59 with a standard deviation of 0.26, and the arithmetic mean for females is 3.56 with a standard deviation of 0.35. Therefore, the arithmetic mean for males is higher than that for females, indicating the differences are in favor of males.

Subsequently, it is evident from **Table 12** that the calculated significance level, valued at 0.048, is less than the statistical significance level ($\alpha \leq 0.05$). Consequently, the null hypothesis suggesting no statistically significant differences in the arithmetic means is rejected. The alternative hypothesis, indicating the presence of statistically significant differences at the statistical significance level ($\alpha \leq 0.05$) for challenges in learning mathematical concepts among sixth-grade students in Northern Tunis primary schools from the teachers’ perspective attributed to the age variable, is accepted.

This difference in the arithmetic mean of the age variable between 20-30 years and 51 and above shows the advantage was for 51 and above, with an arithmetic mean value of 0.18305. Similarly, when comparing the arithmetic mean of the age variable between 31-40 years and 51 and above, it was in favor of 51 and above, with an arithmetic mean value of 0.13972.

These findings suggest that teachers, as they get older, tend to have less experience with technology and less motivation towards innovating in the teaching methods they follow. This contrasts with newly appointed teachers who are enthusiastic and driven, and open to interacting with modern and technological methods that can contribute to reducing the challenges faced by teachers in the educational process.

Finally, the calculated significance level from **Table 15**, valued at $p = 0.425$, is higher than the statistical significance level ($\alpha \leq 0.05$). Therefore, the null hypothesis is accepted, indicating no statistically significant differences at the statistical significance level ($\alpha \leq 0.05$) for the challenges to learning mathematical concepts among sixth-grade students in Northern Tunis schools from the teachers’ perspective, attributed to the educational qualification variable.

This outcome indicates that the teachers’ academic qualifications, ranging from doctorate to high school diploma, do not significantly impact the perceived challenges in teaching mathematical concepts. Despite the apparent differences in the arithmetic means among different educational qualifications, these differences are not statistically significant, implying that factors other than academic qualifications might play a more substantial role in the challenges faced by teachers in learning

environments. This finding calls for a broader examination of teacher training, professional development, and the effectiveness of teaching methods beyond academic qualifications alone.

CONCLUSIONS

This study highlights significant challenges faced by sixth-grade students in Northern Tunis when learning mathematical concepts. These challenges include issues such as weakness in family follow-up of children's performance on school homework and in school generally, the perceived difficulty of mathematics by families, lengthy subjects in textbooks relative to the available instructional time, and a student focus on grades without developing mental skills. Other challenges encompass inadequate reward and discipline systems, limited instructional time, overcrowded classrooms, lack of specialized laboratories for teaching mathematics, and insufficient focus on innovative teaching methods. Teacher variables, such as gender and age, can influence their perceptions of these challenges, highlighting the complexity of the educational environment. Addressing these issues requires collaborative efforts from all educational stakeholders to improve mathematics education. Future research should explore these challenges across different educational levels and regions to gain a more comprehensive understanding.

Recommendations

To address the challenges of learning, it is recommended to optimize class sizes to reduce overcrowding, focus on developing students' mental skills across grades, and use rewards to encourage participation. Additionally, it is recommended to use teaching methods that relate mathematical concepts to everyday life and to use relevant and up-to-date textbooks that support these methods. Increasing funding for specialized mathematics facilities and assigning subjects to teachers with relevant expertise is important. Effective coordination among teachers, targeted professional development, updated curricula, and improved communication between home and school are essential. Additionally, motivating teachers to adopt and explore modern teaching methods will further support an improved learning environment

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