

**Republic of Tunisia**

**Ministry of Education**



**The National Center for Pedagogic Innovation and Research in Education**

**Department of Evaluation**

**Participation of Tunisia in the International Assessment**

**"Trends in International Mathematics and Science Study"**

**TIMSS 2011**

**Report 2013**

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## Table of Contents

I. The General Framework of the Tunisian Participation in TIMSS 2011.....	2
1. Objectives of the Study.....	2
2. The Methodological Framework of the Comparative International Study (TIMSS 2011).....	3
II. Students Results in the TIMSS 2011 Mathematics Assessment.....	8
1. Students' Performance in the Mathematics Assessment.....	8
2. The Impact of Some Variables on the Students' Scores in Mathematics.....	17
3. Variables Related to Teachers.....	26
4. Variables Related to Students.....	30
III. Students Results in the TIMSS 2011 Science Assessment.....	37
1. Students' Results in the Science Assessment.....	37
2. The Impact of Some Variables on Students' Achievement in Science Assessment.....	<b>Error! Bookmark not defined.</b>
3. Variables Related to Teachers.....	54
4. Variables Related to Students.....	59
IV. Summary.....	64
V. Table of Figures.....	<b>Error! Bookmark not defined.</b>
VI. Table of Graphs.....	<b>Error! Bookmark not defined.</b>
VII. Table of Charts.....	<b>Error! Bookmark not defined.</b>
VIII. References.....	<b>Error! Bookmark not defined.</b>
VIII. Table of charts.....	69

# Introduction

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Building on recent educational reforms, the educational system in Tunisia has focused on the enforcement of free, compulsory public education.

In order to bridge the socio-economic gaps that exist in our society and aspiring to greater national goals, it is imperative for us to eliminate the obstacles along the path of education, and focus on improving knowledge and skills that empower young generations to keep up with the needs and challenges of modern societies.

Examining the current state of affairs is a prerequisite to any educational reform. National and international assessment studies provide real indicators for measuring levels of performance, as well as provide an understanding of relevant variables that impact performance.

Accordingly, the National Centre for Pedagogic Innovation and Research in Education, which is affiliated to the Tunisia Ministry of Education, participated in the Trends in International Mathematics and Science Study (TIMSS 2011). It is one of the most important international assessment tools, as it provides a significant qualitative and quantitative dataset used in educational policymaking and quality improvements by decision-makers, researchers, teachers, and other stakeholders in the field of education

This document provides a selection of data concerning Tunisia from the report published by the IEA concerning TIMSS 2011 session. It presents average students' results at grade 4 and 8 in mathematics and science and links it to variables related to the students (especially the percentage of repeaters students and those who dropped out of school), teachers, schools, and educational programs in a comparative approach with other participating countries and in a longitudinal perspective.

## **I- The General Framework of TIMSS 2011**

TIMSS 2011 is based on the evaluation of grade 4 and 8 students' results in mathematics and science. This research field helps in objectively comparing between the international trends in teaching basic sciences; school systems; and teaching and learning conditions. It provides key players and decision makers in the education sector with databases and results that would help them make informative informed decisions and develop improvement plans.

This study is conducted regularly every four years under the supervision the International Association for the Evaluation of Educational Achievement (IEA), which carries out most the of the study and assigns the technical part to a number of international institutions, namely:

- International Study Centre
- Statistics Canada
- Educational Testing Service
- IEA Secretariat
- Data Processing Center Hamburg

Conducted for the first time in 1995, this international assessment study currently includes 63 countries from all over the world. Tunisia has been participating in this study since 1999 for grade 8 students and since 2003 for grade 4 students.

### **1. Objectives of the Study**

The TIMSS seeks to achieve several goals and objectives, most important of which are:

- Following up on the development of the educational systems and programs, and the achievements of fourth and eighth grade students in mathematics and science.
- Learning about other educational practices applied in different parts of the world and sharing related experiences.
- Improving the process of teaching and learning science and mathematics based on accurate and scientific findings regarding students' achievements, their learning and home environment, in addition to other data related to teaching processes and programs.

## 2. The Methodological Framework of the Comparative International Study (TIMSS 2011)

### 2.1. Research Subjects

The assessment study TIMSS 2011 used 5068 fourth grade students from 222 schools and 330 mathematics and science teachers<sup>1</sup> as research subjects, in addition to 5539 eighth grade students and 633 teachers<sup>2</sup>.

### 2.2. Tools

The study is based on the following tools:

- Exercises in mathematics and science.
- Surveys targeting students, teachers, and directors of educational institutions to compile data on the process of teaching and learning mathematics and science, and other information related to families, schools, teaching and learning environment, as well as other psychological and material circumstances affecting education.

#### a) The Mathematics Assessment:

The study is organized around two main dimensions:

##### ✓ The Content Domains in Mathematics

Mathematics is divided into four main domains: numbers, algebra, geometry, and statistics, which were represented in the assessment at fixed percentages, as demonstrated in the following table:

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<sup>1</sup> - Sometimes a teacher may teach Mathematics and Science at the same time.

<sup>2</sup> - Each subject is taught by a different teacher; a teacher for Mathematics, a second for physics and a third for Life and Earth Sciences.

Table No. 1: **Classification of TIMSS 2011 Mathematics Assessment by Content Domains at Fourth and Eighth Grades**

Content Domains	Percentage	
	Fourth Grade	Eighth Grade
Numbers	50%	29%
Algebra	Not applicable	33%
Geometry	35%	19%
Data	15%	19%

✓ The Cognitive Domains in Mathematics

This comparative assessment study classifies mathematical knowledge and skills into cognitive domains that can be tested through questions represented at percentages stated in the following table:

Table No. 2: **Classification of the TIMSS 2011 Mathematics Assessment by Cognitive Domains at Fourth and Eighth Grades**

Cognitive Domains	Percentage	
	Fourth Grade	Eighth Grade
Knowing	39%	36%
Applying	41%	39%
Reasoning	20%	25%

It is worth noting that this study defines four levels of mathematics skills acquired by students. The following table shows the levels of proficiency in mathematics for fourth grade students:

Table No. 3: **The Level of Proficiency in Mathematics**

Level	Acquired skills
Advanced (625 points)	Students can apply their understanding and knowledge in a variety of relatively complex situations and explain their reasoning .They can solve a variety of multi-step word problems involving whole numbers, including proportions. Students at this level show an increasing understanding of fractions and decimals .Students can apply geometric knowledge of a range of two-and three-dimensional shapes in a variety of situations .They can draw a conclusion from data in a table and justify their conclusion.
High (550 points)	Students can apply their knowledge and understanding to solve problems .Students can solve word problems involving operations with whole numbers .They can use their understanding of place value to solve problems. Students can extend patterns to find a later specified term. Students demonstrate understanding of line symmetry and geometric properties. Students can interpret and use data in tables and graphs to solve problems. They can use information in pictographs and tally charts to complete bar graphs.
Intermediate (475 points)	Students can apply basic mathematical knowledge in simple situations. They demonstrate an understanding of whole numbers and some understanding of fractions. Students can visualize three-dimensional shapes from two- dimensional ones. They can read bar graphs, pictographs and tables to solve simple problems.
Low (400points)	Students have some basic mathematical knowledge. Students can add and subtract whole numbers .They have some recognition of parallel and perpendicular lines, familiar geometric shapes and use designs. They can read and complete simple bar graphs and tables.

## b) The Science Assessment

### ✓ The Content Domains in Science:

The subject is classified into main domains represented in the assessment at fixed percentages. At grade 4, TIMSS tests students' knowledge in three content domains, and tests eighth grade students' knowledge in four content domains, as specified in the two following tables:

Table No. 4: **Classification of the TIMSS 2011 Science Assessment by Content Domains at Fourth Grade.**

Content Domains	Percentage
Life Science	45%
Physical Science	35%
Earth Science	20%

Table No. 5: **Classification of the TIMSS 2011 Science Assessment by Content Domains at Eighth Grade**

Content Domains	Percentage
Biology	35%
Chemistry	20%
Physics	25%
Earth Science	20%

### ✓ The Cognitive Domains of Science

The cognitive domains are represented in the TIMSS science assessment at the percentages stated in the following table:



Table No. 6: **Classification of the TIMSS 2011 Science Assessment by Cognitive Domains at Fourth and Eighth Grades.**

Cognitive Domains	Percentage	
	Fourth Grade	Eighth Grade
Knowing	40%	35%
Applying	40%	35%
Reasoning	20%	30%

## II-Tunisian Participation in TIMSS 2011: Students Results in the Mathematics Assessment

### 1. Students' Performance in the Mathematics Assessment

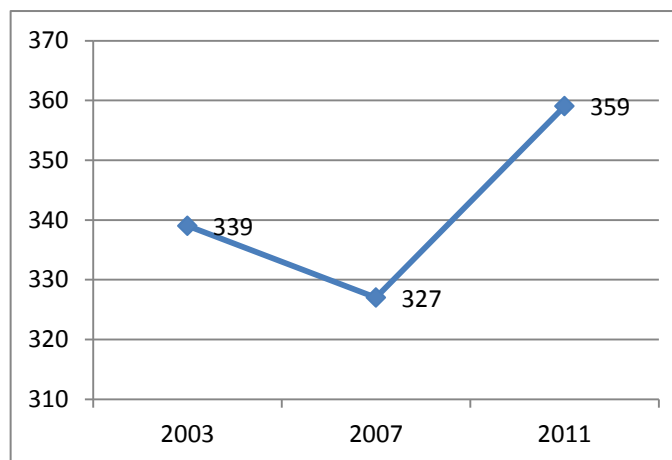
The fourth grade students' average score in the mathematics assessment was 359 points, compared to the TIMSS scale average, which is set at 500 points. As a result, Tunisia ranked low (47/50), which indicates the presence of serious problems in the early years of basic education.

Table No. 7: Country Ranking Based on Fourth Grade Students' Score in TIMSS 2011 Mathematics Assessment.

Rank	Country	Average Score
1	Singapore	606
2	Korea	605
3	Hong Kong	602
4	China	591
5	Japan	585
6	Northern Ireland	562
7	Belgium	549
8	Finland	545
9	England	542
10	Russia	542
11	The United States	541
12	Netherlands	540
13	Denmark	537
14	Lithuania	534
15	Portugal	532
16	Germany	528
17	Ireland	527
18	Serbia	516
19	Australia	516
20	Hungary	515
21	Slovenia	513

<b>Rank</b>	<b>Country</b>	<b>Average Score</b>
22	Czech Republic	511
23	Austria	508
24	Italy	508
25	Slovak Republic	507
26	Sweden	504
27	Kazakhstan	501
<b>TIMSS 2011 Scale Average</b>		<b>500</b>
28	Malta	496
29	Norway	495
30	Croatia	490
31	New Zealand	486
32	Spain	482
33	Romania	482
34	Poland	481
35	Turkey	469
36	Azerbaijan	463
37	Chile	462
38	Thailand	458
39	Armenia	452
40	Georgia	450
41	Bahrain	436
42	United Arab Emirates	434
43	Iran	431
44	Qatar	413
45	Saudi Arabia	410
46	Oman	385
47	<b>Tunisia</b>	<b>359</b>
48	Kuwait	342
49	Morocco	335
50	Yemen	248

The following graph shows the change in students' scores in the TIMSS assessments in the years 2003, 2007, and 2011.



Graph No.1: The Change in Fourth Grade Students' Score in TIMSS Mathematics Assessment

The difference in average scores of fourth grade students from 2007 to 2011 (32points) is statistically significant.

The average mathematics score increased by 32 points compared to the previous assessment and the science score went up by 27 points, which is the highest score achieved by Tunisia since its first participation in TIMSS in 2003.

This increase in the average score is reflected in all content domains, which could be explained by the implementation of the pre-school year system since 2004/2005 as part of the basic education (not compulsory) and the development of early childhood education. Around 82% of the children go to preschool, of which 30% are public schools.

Concerning the eighth grade average score in the mathematics assessment, students scored 425 points. Here Tunisia is ranked 30 out of 42 participating countries.

Table No. 8: Ranking of the Countries Based on Eighth Grade Students' Score in TIMSS 2011 Mathematics Assessment

Rank	Country	Average Score
1	Korea	613
2	Singapore	611
3	China	609
4	Hong Kong	586
5	Japan	570
6	Russia	539
7	Israel	516
8	Finland	514
9	The United States	509
10	England	507
11	Australia	505
12	Slovenia	505
13	Lithuania	502
<b>TIMSS 2011 Scale Average</b>		<b>500</b>
15	Italy	498
16	New Zealand	488
17	Kazakhstan	487
18	Sweden	484
19	Ukraine	479
20	Norway	475
21	Armenia	467
22	Romania	458
23	United Arab Emirates	456
24	Turkey	452
25	Lebanon	449
26	Malaysia	440
27	Georgia	431
28	Thailand	427
29	Macedonia	426
30	<b>Tunisia</b>	<b>425</b>

<b>Rank</b>	<b>Country</b>	<b>Average Score</b>
31	Chile	416
32	Iran	415
33	Qatar	410
34	Bahrain	409
35	Jordan	406
36	Palestine	404
37	Saudi Arabia	394
38	Indonesia	386
39	Syria	380
40	Morocco	371
41	Oman	366
42	Ghana	331

As indicated in the table, eighth grade students' average scores differ from those of fourth grade students. In fact, the students that were assessed in the fourth grade in 2007 had reached the eighth grade by 2011 and thus were assessed at the eighth grade in 2011. Nevertheless, we cannot assume that students' average scores had improved during the past 4 years, since only 64.4 % of the students of the same age group were promoted from grade 7 to grade 8 in the academic year 2010-2011<sup>3</sup> so more than 35 % of the students were not promoted to grade 8, of whom 22.8% failed and 12.7 % dropped out of school.

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<sup>3</sup>-Ministry of Education—School Statistics 2011-2012—page 129

Eighth graders' average scores decreased between 1999 and 2003, but an increase was recorded in 2011 assessments. These changes are shown in the following graph:



Graph No. 2: The Change in Eighth Graders' Score in TIMSS Mathematics Assessment

#### 1.1 . Students' Mathematics Content Domain Scores:

Fourth graders' mathematics content domains are classified as follows:

Table No. 9: Average Mathematics Content Domain Scores of Fourth Graders

Content Domains	Average Score	National Average	International Average
Numbers	390		
Geometry	329	359	500
Data	300		

As shown in the table, the average scores in the three content domains are below the international average, and the highest students' average scores was achieved in the numbers domain.

Eighth graders' mathematics content domains are classified as follows:

Table No. 10: **Average Mathematics Content Domain Scores of Eighth Graders**

Content Domains	Average Score	National Average	International Average
Numbers	431		
Geometry	426	425	500
Algebra	419		
Data	398		

As indicated in the above table, students' scores differ from one domain to the other, and the highest students' average scores were achieved in the numbers domain.

### 1.2. Students' Mathematics Cognitive Domain Scores

Fourth graders' mathematics cognitive domains scores are classified as follows:



Table No. 11: **Average Mathematics Cognitive Domain Scores of Fourth Graders**

Cognitive Domains	Average Score	National Average	International Average
Knowing	370		
Applying	346	359	500
Reasoning	335		

As shown in the table, students' average scores in the reasoning domain, which requires a higher level of skills, are lower than their average scores in the two other domains.

Eighth graders' mathematics cognitive domains scores are classified as follows:

Table No. 12: **Average Mathematics Cognitive Domain Scores of Eighth Graders**

Cognitive Domains	Average Score	National Average	International Average
Knowing	425		
Applying	421	425	500
Reasoning	423		

### 1.3. Students' Performance according to the TIMSS international benchmarks

TIMSS defines four levels of student achievement in mathematics: advanced, high, intermediate, and low. Each level describes the skills and knowledge acquired by the students.

Table No. 13: **The Classification of Fourth Graders' Scores according to the Four Levels of Achievement**

Level <sup>4</sup>	National Percentage	International Percentage
Advanced (625 scores)	0	4
High	2	28

(550 scores)		
Intermediate (475 scores)	11	69
Low (400 scores)	35	90

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<sup>4</sup> All these are accumulative. If a student reaches a level, then he/she must have reached all the preceding levels, but failed to reach a higher one

These results show that only 2 % of fourth graders reached the advanced benchmark compared to 35 % who performed low benchmark. Around 65 % of the students were outside classification which means they did not reach the low TIMSS international mathematics benchmark.

Although Tunisia is among the countries, which ranked low according to TIMSS international benchmarks, this assessment shows a decrease in the number of students who had low assessment scores and an improvement in their achievements compared to previous assessments. There is also an increase in the scores of students, who reached high benchmark (chapter 1: Trends in Mathematics Achievement page54).

Concerning the eighth graders, results show that only 5 % of the students reached high benchmark and 61 % reached low benchmark. These results were below the average international percentage for each level.

**Table No. 14: The Classification of Eighth Graders' Scores according to the Four Levels of Achievement**

<b>Level<sup>4</sup></b>	<b>National Percentage</b>	<b>International Percentage</b>
Advanced (625 scores)	0	3
High (550 scores)	5	17
Intermediate (475 scores)	25	46
Low (400 scores)	61	75

It is also worth noting that 39% of the students were not part of the classification which means they did not reach the low TIMSS international mathematics benchmark.

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<sup>4</sup>- All these are accumulative. If a student reaches a level, then he/she must have reached all the preceding levels, but failed to reach a higher one

## 2. The Impact of Some Variables on the Students' Scores in Mathematics

### 2.1. Difference in Students' Average Scores Classified by Gender

At grade 4, there was no measurable difference between the average mathematics scores of boys and girls. At grade 8, boys (433 scores) outperformed girls (417 scores) by 16 score points and this difference is considered statistically significant.

At grade 4, comparing TIMSS international average score with students' mathematics average score shows a significant difference in the average mathematics scores of boys and girls, in favor of girls, in the three content domains, as indicated in the below table.

Table No. 15: **Classification of Fourth Grade boys and girls' Mathematics Average Score by Content Domains**

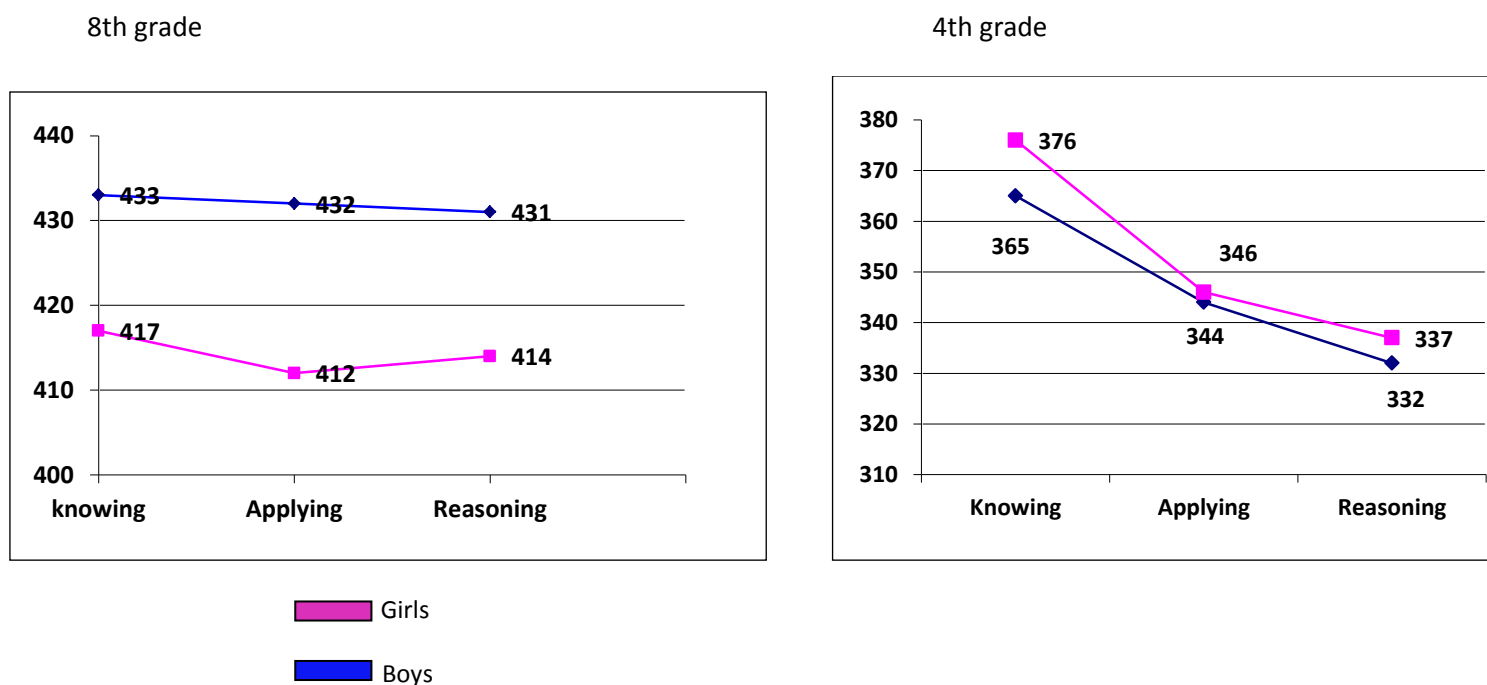
Mathematics Content Domains	Boys Average Score	Girls Average Score	National Average Score
Numbers	389	391	359
Geometry	324	336	
Data	295	305	

At grade 8, there is a significant difference in the average mathematics scores of boys and girls in numbers and geometry, in favor of boys.

Table No. 16: Classification of Eighth Grade Boys and Girls' Mathematics Average Score by Content Domains

Mathematics Content Domains	Boys Average Score	Girls Average Score	National Average Score
Numbers	444	420	425
Geometry	435	418	
Algebra	421	417	
Data	408	389	

Concerning boys and girls average score in cognitive domains, results show a statically significant difference between fourth grade boys and girls in the "knowing" domain, in favor of girls. At grade 8, boys outperformed girls in all cognitive domains as indicated in the following chart.



Graph No. 3: Boys and Girls' Average Scores in Mathematics Cognitive Domains

## 2.2. Variables Related to Students' family Surroundings

- **Home Environment:**

The study proves that achieving high mathematics scores is somehow related to the availability of some essential resources at home, such as: books, computers, and Internet connection.

The average scores of eighth graders, who answered this part of the survey, are shown in the below table.

Table No. 17: **Eighth Grade Students' Average Scores according to the Availability of Essential Home Resources**

Resources	Percentage of Students	Average Scores
Numerous Resources	3	493
Some Resources	58	436
Few Resources	38	403

- **Family Economic Status**

Fourth and eighth grade students' scores classified according to their families economic conditions as follows:

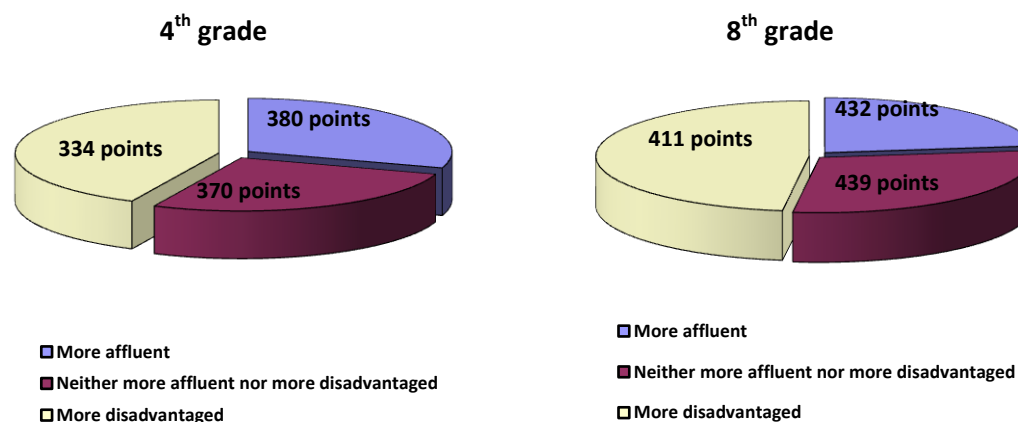


Chart No. 1: Students' Scores Classified by their Families Economic Status

According to the above pie charts, the higher the families' economic conditions are, the better students' average scores are. This difference is increasing when comparing fourth and eighth graders' scores. In fact there is a little influence of social environment; we can deduce that the whole system constitutes an important factor which explains the students' low scores.

### 2.3. Variables Related to Students' School Environment

- **School Environment**

TIMSS results proved that lack of facilities and equipment in any educational institution (such as: infrastructure, computers, and books) negatively affects students' scores in mathematics. Around 86% of sampled students at grade 4, and 94% of students at grade 8 are enrolled at schools lacking these facilities and equipment.

It is noteworthy that 51% of primary schools suffer from lack of computers, as around 6 students or more share one computer and about 18% of schools do not have computer on their premises. Around 86% of sampled preparatory schools do not have enough computers and assign one computer to every 6 students or more.

### 2.4. Variables Related to Mathematics Teaching Programs

At grade 4, the TIMSS mathematics assessment includes 18 subjects, of which 7 subjects only are taught within the Tunisian educational program. These subjects are classified according to the mathematics content domains as follows:

Table No. 18: **The Classification of TIMSS and the Fourth Grade National Education Program Subjects by Mathematics Content Domains**

	Numbers	Geometry and Measurement	Data	Total Number of Subject
TIMSS Subjects	8	7	3	18
National Program Subjects	4	2	1	7

The TIMSS mathematics assessment for grade 8 includes 19 subjects, of which 7 subjects only are taught as part of the Tunisian educational program. These subjects are classified according to the mathematics content domains as follows:

Table No. 19: **The Classification of TIMSS and the Eighth Grade National Education Program Subjects by Mathematics Content Domains**

	Numbers	Algebra	Geometry	Data	Total Number of Subjects
TIMSS Subjects	5	5	6	3	19
National Program Subjects	1	2	2	2	7

The following table is an analytical review of the TIMSS and the national educational program subjects throughout school basic education grades:

Table No. 20: **Comparing Grade 4 TIMSS Subjects to the Mathematics Formal Education Program in Tunisia**

School Grade: Content Domains in Tunisia							
TIMSS Content Domains	1	2	3	4	5	6	Remarks
<b>1. Numbers</b>							
a) The concept of whole numbers, place value, and order.	x	x	X	x			Starts at grade 1 with two-digit numbers up to six-digit numbers at grade 4.
b) Addition, subtraction, multiplication and/or division using whole numbers.	Addition	Addition and Subtraction	Addition, subtraction, and	Addition, subtraction, multiplication,	x	x	Operations are introduced to students gradually, and then taught in more detail later.

**School Grade: Content Domains in Tunisia**

<b>TIMSS Content Domains</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>	<b>6</b>	<b>Remarks</b>
			multiplication	and division			
c) Understanding fractions (fractions as part of whole numbers or group of numbers, or a place on the fraction number line)				Fractions and mental math only	Introduction	Learning	Students at grade 4 learn through mental math how to calculate half or a quarter of a number less than 100. Fractions are introduced to students at grade 5 and they learn to use fractions to solve operations at grade 6.
d) Addition and subtraction using fractions.						x	Operations with fractions are taught at grade 6.
e) Understanding decimals, including place value and ordering decimals.					x	x	Teaching decimals and operations with decimals starts at grade 5 and is continued in grade 6.
f) Addition and subtraction using decimals.					x	x	Teaching decimals and operations with decimals starts at grade 5 and is continued in grade 6.
g) Numerical expressions (finding the missing number and extending patterns to find a later specified term using numerical expressions).				x			In primary education, numerical expressions mean mixed operations of addition and subtraction without using patterns.
h) Numerical patterns (following the number pattern and finding the missing numbers).							The program teaches counting according to several steps, without introducing the concept of numerical patterns.
<b>2. Geometric Shapes and Measurement</b>							
a) Lines: measurements, line				x			Introduced at grade 4 and



**School Grade: Content Domains in Tunisia**

<b>TIMSS Content Domains</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>	<b>6</b>	<b>Remarks</b>
estimates, perpendicular and parallel lines.							taught in more detail in grades 5 and 6.
b) Drawing and comparing angles.				x			Introduced at grade 4 and taught in more detail in grades 5 and 6.
c) Using irregular coordinate systems to determine the position of a point or other geometric element.				x			Introduced at grade 4 and taught in more detail in grades 5 and 6.
d) The properties of geometric shapes.			X	x			Introduced at grades 3 and 4 and taught in more detail in grades 5 and 6.
e) Symmetry and rotation					x	x	Axial symmetry is introduced at grade 4 and taught in more detail in grades 5 and 6.
f) Relations between two and three-dimensional objects						x	Three-dimensional objects are introduced in grade 6 (cubes and cuboids)
g) Calculating and estimating area, perimeter, and volume.							Fourth graders are taught how to calculate the perimeter and they learn the concept of the area of a shape without calculating it. Volumes are not taught in primary education.
<b>3. Data Display</b>							
a) Interpreting data from tables, illustrations, bar or pie charts.							This is not included as part of the formal education program, however the school book comprises data tables and illustrations, without any bar

**School Grade: Content Domains in Tunisia**

<b>TIMSS Content Domains</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>	<b>6</b>	<b>Remarks</b>
							or pie charts.
b) Drawing conclusions from data in a table.							This is not included in the program nor in the school book.
c) Data display using drawings, illustrations, and bar graphs.							This is not included in the program, but the school book, in some cases, displays data using tables and illustrations.



 content domains which are not taught as part of the Tunisian formal education program

Table No. 21: **Comparing Grade 8 TIMSS Subjects to the Mathematics National Education Program**

	<b>School Grade</b>			<b>Remarks</b>
	<b>7</b>	<b>8</b>	<b>9</b>	
<b>1. Numbers</b>				
a) Calculations and estimations or rounding up numbers	x	x	x	
b) Fractions and calculations using fractions	x	x	x	
c) Decimals and calculations using decimals	x	x	x	
d) Representation, comparison, ordering, and calculations using whole numbers	x	x	x	
e) Solving problems using percentages and proportions	x	x	x	
<b>2. Algebra</b>				

	School Grade			Remarks
	7	8	9	
a) Patterns (or numeric, algebraic and geometric series), missing values, and generalizations.	x	x		
b) Simplifying and evaluating algebraic expressions	x	x	x	
c) Simple linear equations and inequalities	x	x	x	Inequalities are taught at grade 9.
d) Simultaneous equations (with two variables)				
e) Representation of functions, such as ordered pairs, tables, graphs, words, or equations				
<b>3. Geometry</b>				
a) Properties of angles and geometric shapes (triangles, trapezium, and other regular shapes)	x	x	x	
b) 1-Identical shapes 2-Similar triangles	1	1&2	2	
c) The relationship between two and three dimensional shapes	x	x		
d) Using proper methods for measuring perimeter, circumference, area, surface area, and volume	x	x		
e) Points on Cartesian surfaces	x	x	x	Identifying a point on Cartesian surfaces is not included in the program.
f) 1-Transition 2- symmetry 3- rotation	2	2		Transition and rotation are not included in the program.
<b>4. Data and Chance</b>				
a) Reading and presenting data using tables, illustrated graphs, bar and pie charts, and diagrams	x	x	x	
b) Interpreting data (drawing conclusions, making assumptions, estimating values between displayed data points)	x	x	x	
c) Estimating, expecting and determining the probability of potential results	x	x	x	

 TIMSS content domains which are not taught as part of the national education program

The information sources (teachers' answers and the assessment framework) are inconsistent concerning the TIMSS content domains. This could be related to the inconsistency between books and the programs on the one hand and the absence of gradual progression between educational grades on the other hand which is reflected in the vagueness of the answers.

It is worth mentioning that in spite of the discrepancies in the students' results in different mathematics content domains, the difference between taught and untaught content domains is still relative, which requires further analysis.

In addition, the average of mathematics credit hours (175 hours) is close to the international average (162 hours) for grade 4 as opposed to 131 hours and 138 hours as an international average for grade 8.

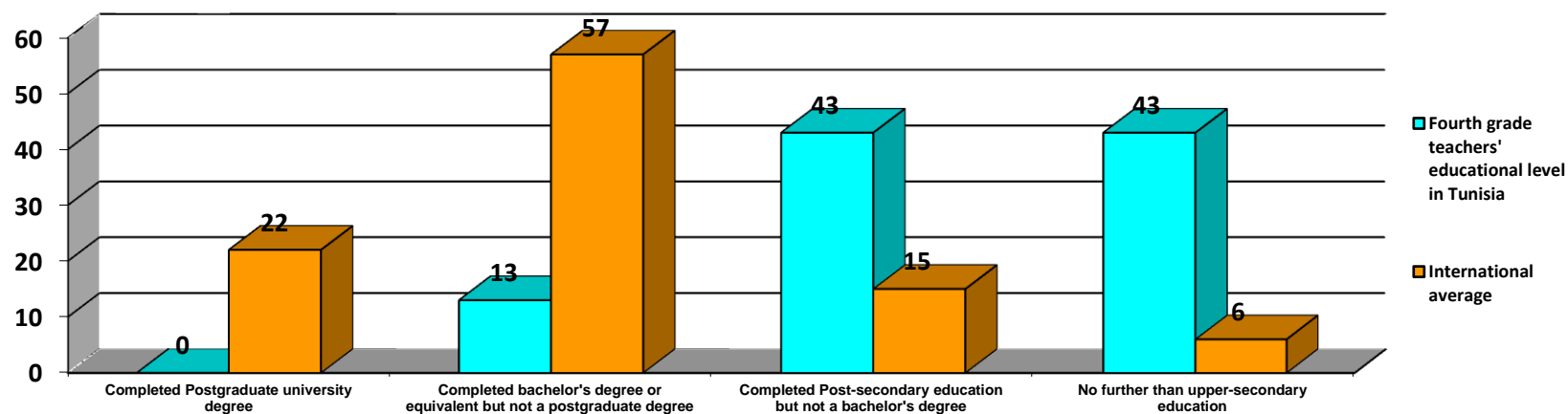
### 3. Variables Related to Teachers

The study results proved that students' performance in the assessment is linked to variables related to the teacher, such as teachers' experience and self-confidence and job satisfaction.

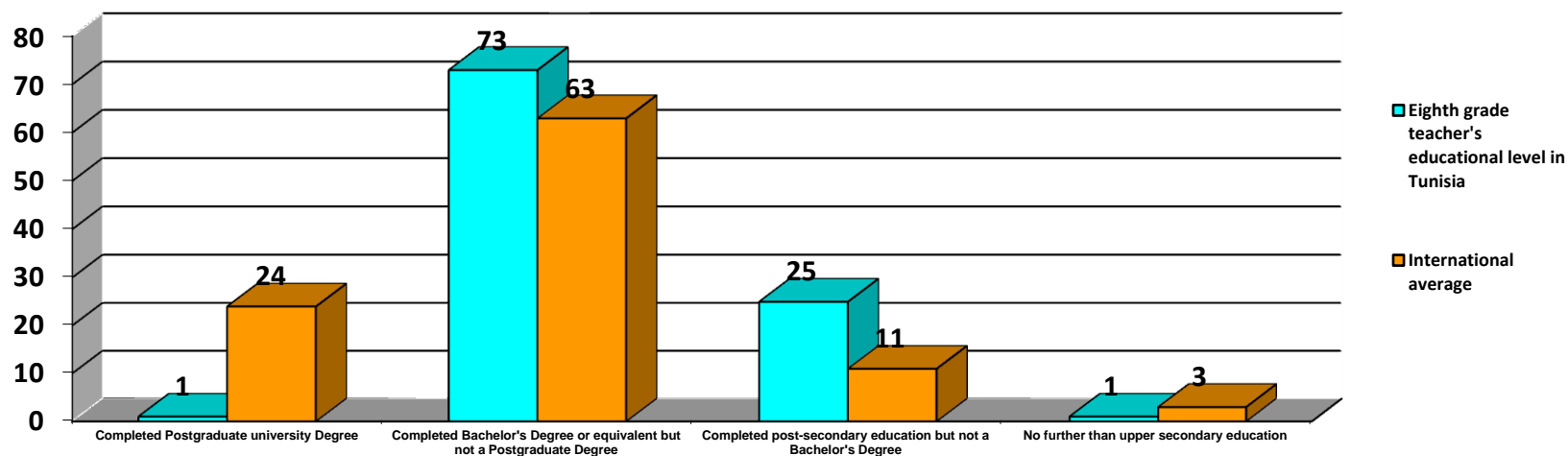
#### 3.1 .Teachers' Level of Education

The sampled fourth and eighth grade teachers are classified according to their level of education as follows:

4<sup>th</sup> grade



8<sup>th</sup> grade



Graph No. 4: Classification of Teachers according to their Level of Education.

Proven results of this study make a significant difference between the educational level of teachers in Tunisia and the global level in the first stage of basic education (primary school): 45% of them did not go beyond high school compared to 6% as a global for this category of teachers. Those with a university degree do not exceed 13% in Tunisia, while the international average is 79%. Results also show lack of cooperation between teachers in Tunisia.

### 3.2. Teaching Experience

The following table shows the results of fourth and eighth grade students in relation to their teachers' years of experience:

Table No. 22: **Classification of Students' Results according to their Teachers' Years of Experience**

	20 Years of Experience or more		From 10 to 20 Years of Experience		From 5 to 10 Years of Experience		Less than 5 Years of Experience	
	Percentage of Teachers	Students' Average Score	Percentage of Teachers	Students' Average Score	Percentage of Teachers	Students' Average Score	Percentage of Teachers	Students' Average Score
Fourth Grade Students	55	370	24	349	11	340	11	354
Eighth Grade Students	38	442	35	419	18	417	10	394

These results indicate that the more the years of teachers' experience the better the students' results. However this variable is of limited impact in several countries, such as Finland, Japan, and the United Arab Emirates.

### 3.3. Teachers' confidence in their Ability to Teach Mathematics

Around 71 % of the teachers and 61 % of the secondary school teachers showed enough self confidence in their abilities to teach mathematics. Their students achieved better results than other students, whose teachers lack self-confidence. (At the fourth grade: 362 score points compared to 353 points, at the eighth grade: 428 score points compared to 422 points).

### 3.4. Job satisfaction

Around 52 % of the teachers were satisfied with their job, while 6 % were not satisfied. Statistical analysis has proven that students taught by teachers, who are satisfied with their job achieved better results than those who are taught by unsatisfied teachers (366 points compared to 327).

In lower secondary education, around 48 % the teachers were satisfied with their job, while 5 % were not satisfied. The following table shows the students' results in mathematics assessment according to the degree of job satisfaction of their teachers.

Table No. 23: **Eighth Grade Students' Results in relation to the Degree of Job Satisfaction of their Teachers.**

	Fully Satisfied with Their Job	Relatively Satisfied	Not Satisfied at All
Percentage of Teachers	48	47	5
Students' Average Score	426	423	432

### 3.5. Cooperation for Better Education

TIMSS also evaluates the level of cooperation between the teachers to improve the quality of education, for example by evaluating how they discuss teaching a certain subject, how they prepare subject material and try different ideas and concepts. Teachers are classified into three categories according to the frequency of their meetings:

- Very cooperative: they meet once to three times weekly.
- Cooperative: they meet two or three times monthly.
- Rarely cooperative: they do not meet or they hardly meet.

The analytical review of fourth grade students' results in light of the level of cooperation between their teachers showed that students of cooperative teachers (14 % which is one of the lowest percentages in the world) achieved better results as indicated in the following table:

Table No. 24: **Fourth Grade Students' Average Results according to the Degree of Cooperation of their Teachers**

	Very Cooperative Teachers	Cooperative Teachers	Relatively Cooperative Teachers
Percentage of Students	14	57	29
The National Average Score	368	360	353

Concerning the eighth graders, the percentage of students and their average scores in mathematics are classified according to the level of cooperation of their teachers as follows:

Table No. 25: **Eighth Grade Students' Average Scores according to the Degree of Cooperation of their Teachers**

	Very Cooperative Teachers	Cooperative Teachers	Relatively Cooperative Teachers
Percentage of Students	9	52	40
The National Average Score	416	425	426

### 3.6. Using Computers to Teach Mathematics

Only 7 % of fourth grade teachers and 5 % of teachers of secondary schools use computers in their lessons, which is the lowest percentage in the world. Teachers ask their students to carry out some activities using computers, such as exploring concepts and principles of mathematics or searching for ideas and information and practicing skills and procedures.

## 4. Variables Related to Students

The study proves that the students' scores in the assessment are closely related to several variables, such as students' interest in learning mathematics, self-confidence, and class participation.

### 4.1. Students' Interest in Learning Mathematics

Most of the students expressed their interest in learning mathematics, in spite of their low score, which is below the international average.

About 69% of fourth grade students were interested in learning mathematics, which renders Tunisia the fourth among participating countries with respect to this variable. In spite of their weak results, Tunisian students are among the most interested students in learning mathematics throughout the whole participating countries.

Those students achieved 381 points, which is the highest score in mathematics assessment in Tunisia compared to the national average (359 points).

The following table details fourth grade students' results according to their interest in learning mathematics.



Table No. 26: **Fourth Grade Students' Scores according to their Interest in Mathematics**

	Interested in Learning Mathematics	Relatively Interested in Learning Mathematics	Not Interested in Learning Mathematics
Percentage of Students	69	26	5
Students' Average Score	381	320	313

The following table indicates eighth grade students' results according to their interest in learning mathematics:

Table No. 27: **Eighth Grade Students' Scores according to their Interest in Mathematics**

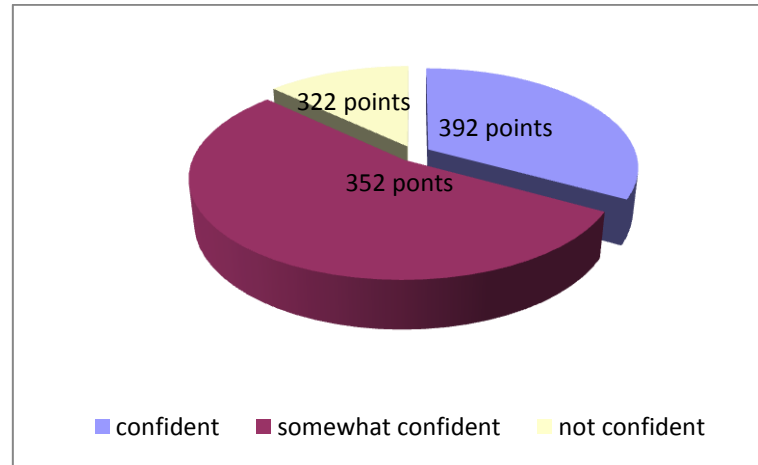
	Interested in Learning Mathematics	Relatively Interested in Learning Mathematics	Not Interested in Learning Mathematics
Percentage of Students	38	40	23
Students' Average Score	448	415	405

The table indicates that the more interested in mathematics the students are, the better results they achieve.

#### 4.2. Students' Self-Confidence in Learning Mathematics

Fourth and eighth grade students' results in mathematics according to their self confidence are indicated in the below charts.

#### 4<sup>th</sup> Grade Students



## 8<sup>th</sup> Grade Students

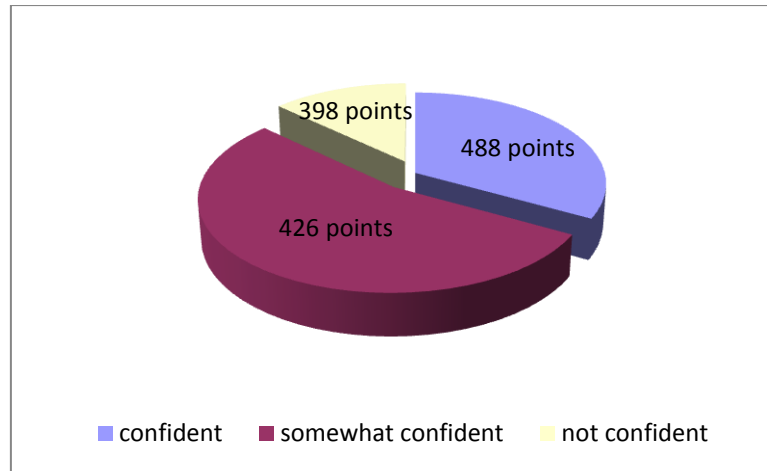


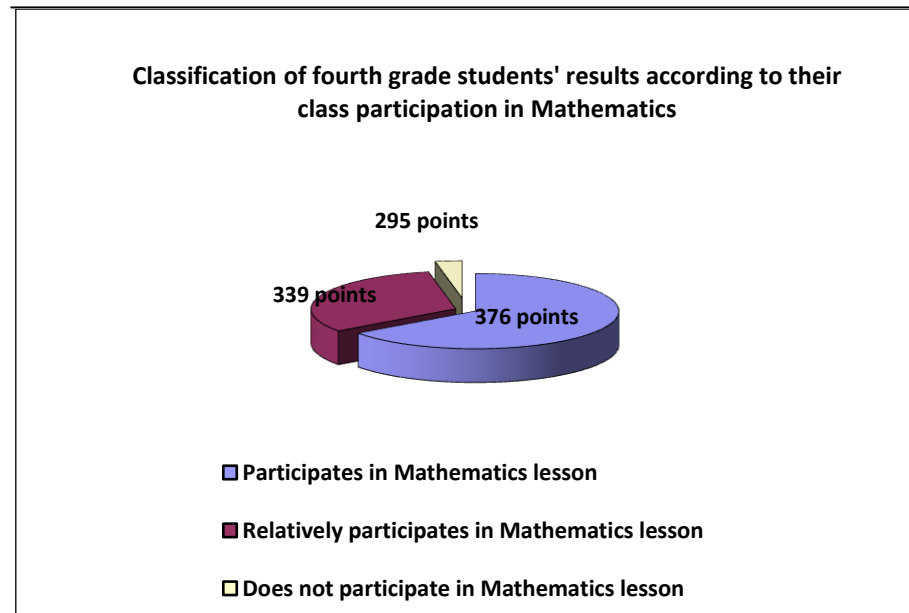
Chart No. 2: Students' Results according to their Self-Confidence in Learning Mathematics

From these results, it is proven that the more self-confident the students are, the better results they achieve.

### 4.3. Class Participation in Mathematics

Results show that students' scores in mathematics assessment are closely related to their level of class participation. Tunisia ranked the first according to this variable. Students' results in the two grades are classified as follows:

**4<sup>th</sup> grade students' results:**



#### 8<sup>th</sup> grade students' results:

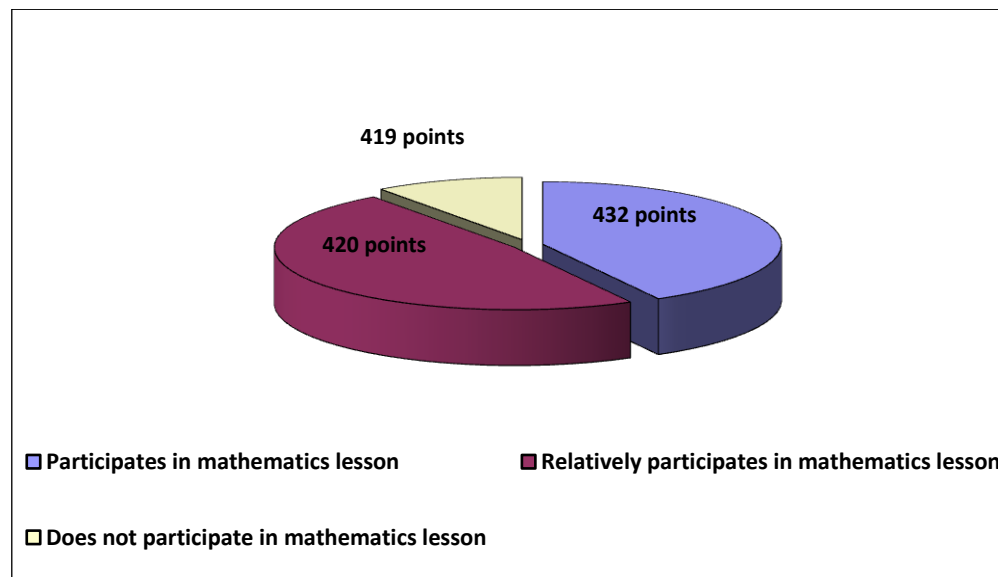


Chart No. 3: Classification of Students' Results according to their Class Participation

#### 4.4. Students 'Lack of Basic Nutrition

4<sup>th</sup> grade teachers stated that around 53 % of their students suffer from lack of basic nutrition compared to the international average of 29%. Students' malnutrition negatively affects the teacher's instruction and the student's ability to understand and learn.

Average score of students suffering from lack of basic nutrition is 348 points, which is 24 points less than the average score of students who do not suffer from this lack (372 points).

8<sup>th</sup> grade teachers stated that around 49 % of their students who suffer from lack of basic nutrition compared to the international average of 37%. Students' malnutrition negatively affects their ability to understand and learn. The average score of those students compared to their peers is indicated as follows:

Table No. 28: Eighth Grade Students' Scores according to their Nutrition

	Students who do not suffer from basic nutrition	Students who suffer from basic nutrition
National Average Score	437	412
International Average Score	477	449

#### 4.5. Students' Lack of Knowledge and Basic Skills

Fourth grade teachers stated that only 8 % of their students have enough knowledge and basic skills required for this grade. Those students achieved the highest scores in the mathematics assessment (376 points) compared to the students, who relatively have these skills (61% with average score 366 points) and those who do not have any skills (31%).

Concerning the eighth grade, teachers stated that only 5 % of the students have enough knowledge and basic skills required for this grade. Those students achieved an average score of 419 points compared to 417 points the average score of students who lack this knowledge as their teachers stated and their percentage is 40 %. The average score of students who relatively have knowledge and basic skills for learning mathematics (according to their teachers) is 431 points.

#### 4.6. Students Perception of their Academic Future

Although eighth grade students' average score in the mathematics assessment is below the international average score, they have positive perception of their future. Around 49 % of the students (average score 448 points) think they will obtain a university degree. Only 5 % of the students think they will finish the first year of university education (average score 442 points). Around 20 % of the students think they will only finish the first year of secondary school (average score 396 points). About 27 % of the students do not have any perception of their future (average score 406 points).

## II- Students Results in the TIMSS 2011 Science Assessment

### 1. Students' Results in the Science Assessment

Fourth grade students' average score in the science assessment was 346 points, compared to the TIMSS scale average, which is set at 500 points. As a result, Tunisia ranked low compared to other participating countries.

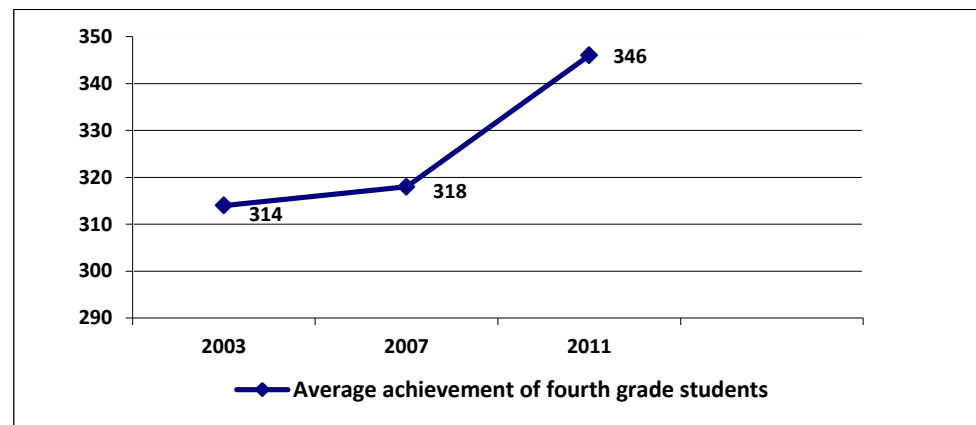
Table No. 29: **Ranking of the Countries according to Fourth Grade Students' Scores in TIMSS 2011 Science Assessment**

Rank	Country	Average Score
1	Korea	587
2	Singapore	583
3	Finland	570
4	Japan	559
5	Russia	552
6	China	552
7	The United States	544
8	The Czech Republic	536
9	Hong Kong	535
10	Hungary	534
11	Sweden	533
12	Slovak Republic	532
13	Austria	532
14	The Netherlands	531
15	England	529
16	Denmark	528
17	Germany	528
18	Italy	524
19	Portugal	522
20	Slovenia	520

<b>Rank</b>	<b>Country</b>	<b>Average Score</b>
21	Northern Ireland	517
22	Ireland	516
23	Croatia	516
24	Australia	516
25	Serbia	516
26	Lithuania	515
27	Belgium	509
28	Romania	505
29	Spain	505
30	Bologna	505
<b>TIMSS 2011 Scale Average</b>		<b>500</b>
31	New Zealand	497
32	Kazakhstan	495
33	Norway	494
34	Chile	480
35	Thailand	472
36	Turkey	463
37	Georgia	455
38	Iran	453
39	Bahrain	449
40	Malta	446
41	Azerbaijan	438
42	Saudi Arabia	429
43	United Arab Emirates	428
44	Armenia	416
45	Qatar	394
46	Oman	377
47	Kuwait	347
48	Tunisia	346
49	Morocco	264
50	Yemen	209

An increase in fourth grade students' results was recorded through different rounds of TIMSS assessments as indicated in the below graph.





Graph No. 5: The Change in Fourth Grade Students' Score in TIMSS Science Assessment

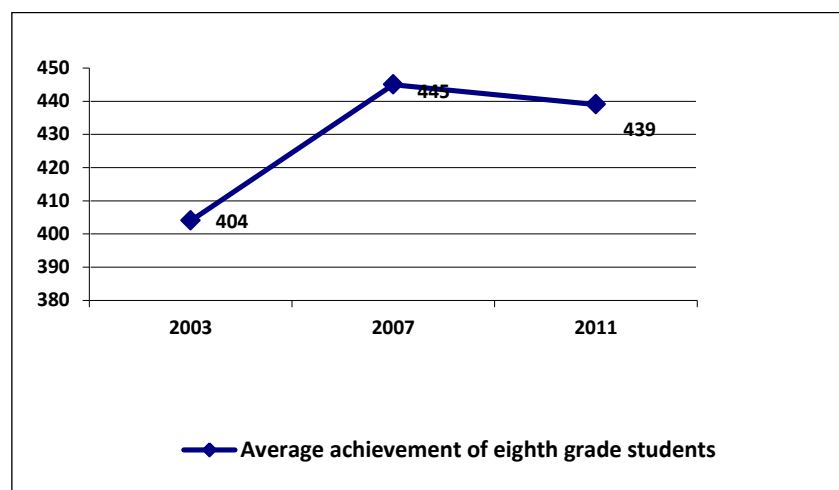
Eighth grade students' average score in science assessment is 439 points. Accordingly, Tunisia ranked 29 out of 42 participating countries.

Table No. 30: **Country Ranking according to Eighth Grade Students' Score in TIMSS 2011 Science Assessment**

Rank	Country	Average Score
1	Singapore	590
2	China	564
3	Korea	560
4	Japan	558
5	Finland	552
6	Slovenia	543
7	Russia	542
8	Hong Kong	535
9	England	533
10	The United States	525
11	Hungary	522
12	Australia	519
13	Israel	516

Rank	Country	Average Score
14	Lithuania	514
15	New Zealand	512
16	Sweden	509
17	Italy	501
18	Ukraine	501
TIMSS Average Score		500
19	Norway	494
20	Kazakhstan	490
21	Turkey	483
22	Iran	474
23	Romania	465
24	United Arab Emirates	465
25	Chile	461
26	Bahrain	452
27	Thailand	451
28	Jordan	449
29	Tunisia	439
30	Armenia	437
31	Saudi Arabia	436
32	Malaysia	426
33	Syria	426
34	Palestine	420
35	Georgia	420
36	Oman	420
37	Qatar	419
38	Macedonia	407
39	Lebanon	406
40	Indonesia	406
41	Morocco	376
42	Ghana	306

Comparing students' results in TIMSS science assessment shows a decrease in their average score by 6 points compared to the assessment of year 2007.



Graph No. 6: The Change in Eighth Graders' Score in TIMSS Science Assessment

### 1.1. Students' Average Score Classified by Science Content Domains

The following table classifies fourth grade students' average score by science content domains.

Table No. 31: The Classification of Fourth Grade Students' Average Score by Science Content Domains

Science Content Domains	Average Score	National Average Score	International Average Score
Life Science	342	346	500
Physical Science	342		
Earth Science	319		

Students' average score in all three science content domains are below the international average, however, students performed better in Life Science and Physical Science than in Earth Science which is not taught as part of the formal educational curricula.

The following table classifies eighth grade students' average score by Science Content Domains

Table No. 32: **The Classification of Eighth Grade Students' Average Score by Science Content Domains**

Science Content Domains	Average Score	National Average Score	International Average Score
Biology	449	439	500
Physics	436		
Chemistry	434		
Earth Science	414		

Students' average score varied from one domain to the other. They achieved the highest scores in biology compared to earth science.

### 1.2. Students' Average Score by Cognitive Domains

Fourth grade students' average scores in science assessment vary according to cognitive domains as indicated in the following table.

Table No. 33: **The Classification of Fourth Grade Students' Average Score by Science Cognitive Domains**

Cognitive Domains	Average Score	National Average Score	International Average Score
Knowing	336	346	500
Applying	343		
Reasoning	337		

As demonstrated in the table, students achieved low scores in the knowing and reasoning domains, which require more skills compared to the applying domain.

Concerning the eighth grade students, their average scores by cognitive domains are classified as follows:

Table No. 34: **The Classification of Eighth Grade Students' Average Score by Science Cognitive Domains**

Cognitive Domains	Average Score	National Average Score	International Average Score
Knowing	424	439	500
Applying	437		
Reasoning	446		

Students outperformed in the reasoning domain compared to their results in knowing and applying domains.

### 1.3. Students' Performance on the TIMSS International Benchmarks

The following table defines the four levels of students' achievement in science according to TIMSS International Benchmarks.

Table No. 35: **The Classification of Fourth Graders' Scores according to the Four Levels of Achievement**

Level <sup>4</sup>	National Percentage	International Percentage
Advanced (625 scores)	0	5
High (550 scores)	3	32
Intermediate (475 scores)	14	72
Low (400 scores)	35	92

These results show that only 3 % of students reached high benchmark compared to 35 % who reached the low benchmark. Around 65% of the students were outside classification which means that they did not reach the low TIMSS international benchmark.

Concerning the eighth graders, results show that only 5 % of the students reached high benchmark and 72 % reached Low benchmark. These results were below the average international percentage for each level, as indicated in the following table:

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<sup>4</sup> -All these are accumulative. If a student reaches a level, then he/she must have reached all the preceding levels, but failed to reach a higher one.

Table No. 36: **Classification of Eighth Graders' Scores according to the Four Levels of Achievement**

<b>Level<sup>4</sup></b>	<b>National Percentage</b>	<b>International Percentage</b>
Advanced (625 scores)	0	4
High (550 scores)	5	21
Intermediate (475 scores)	30	52
Low (400 scores)	72	79

Around 28 % of the students were not part of the classification which means they did not reach the lowest international benchmark.

## **2. The Impact of Some Variables on Students' Achievement in Science Assessment**

### **2.1. Difference in Students' Average Scores Classified by Gender**

Results show statistically significant difference between boys and girls at grade 4 and 8 science assessment. Fourth grade girls outperformed boys by 25 points and eighth grade boys outperformed girls by 17 points.

Table No. 37: **Classification of Students' Scores by Gender**

	<b>Boys</b>		<b>Girls</b>	
	<b>National Average Score</b>	<b>International Average Score</b>	<b>National Average Score</b>	<b>International Average Score</b>
<b>4<sup>th</sup> Grade</b>	334	485	359	487
<b>8<sup>th</sup> Grade</b>	433	465	417	469

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<sup>4</sup> -All these are accumulative. If a student reaches a level, then he/she must have reached all the preceding levels, but failed to reach a higher one.

At grade 4, comparing TIMSS international average score with students' average score in all domains shows a statistically significant difference in the average scores of boys and girls in favor of girls in the three domains, as indicated in the below table.

Table No. 38: **Fourth Grade Boys and Girls ' Science Average Score Classified by Content Domains**

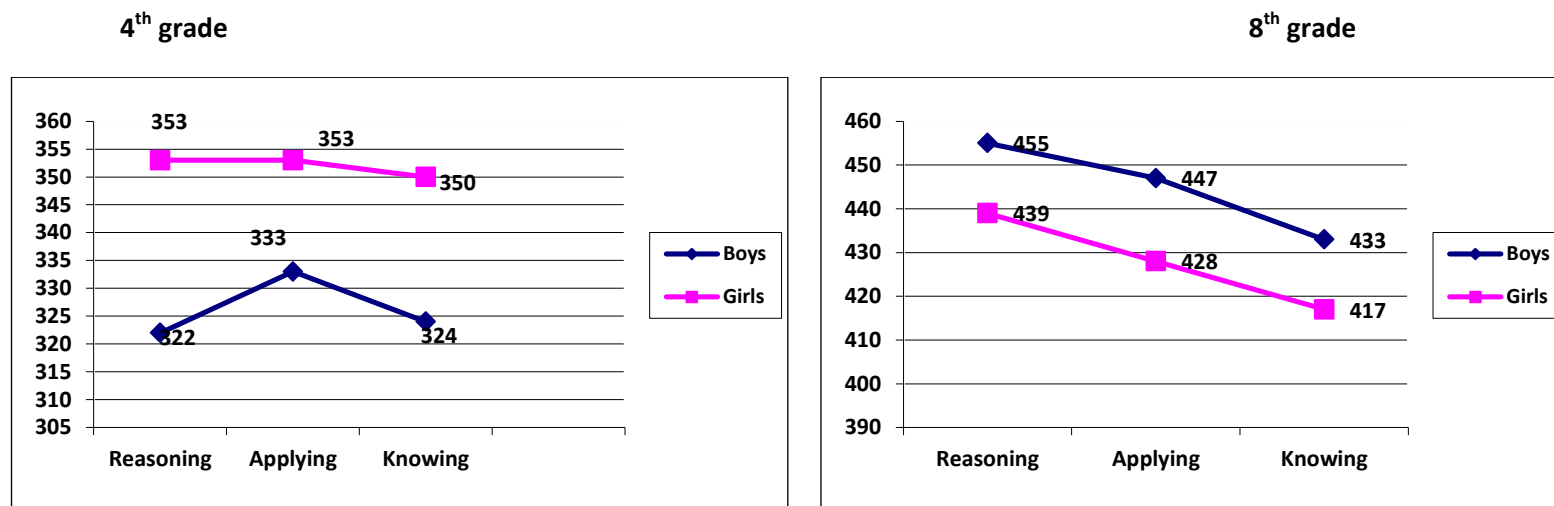
Science Content Domains	Boys Average Score	Girls Average Score	National Average Score
Life Science	330	355	346
Physical Science	331	354	
Earth Science	306	333	

At grade 8, there is a statistically significant difference in the average science scores of boys and girls in all content domains, which is in favor of boys, contrary to fourth grade students' results.

Table No. 39: **Eighth Grade Boys and Girls' Science Average Score Classified by Content Domains**

Science Content Domains	Boys Average Score	Girls Average Score	National Average Score
Biology	457	442	439
Chemistry	439	429	
Physics	447	426	
Earth Science	426	402	

Comparing boys and girls' average score in cognitive domains shows a statistically significant difference between boys and girls in all three domains: knowing, applying, and reasoning as indicated in the following charts. At grade 4, girls outperformed boys in all cognitive domains, whereas, eighth grade boys outperformed girls in these domains.



Graph No. 7: Classification of Students' Average Score by Science Cognitive Domains

## 2.2. Variables Related to Students' family Surroundings

- Home Environment**

The study proves that achieving high science scores is somehow related to the availability of some essential resources at home, such as: books, computers, and Internet connection.

The average scores of the eighth graders, who answered this part of the survey, are shown in the below table:

Table No. 40: **Eighth Grade Students' Average Scores according to the Availability of Essential Home Resources**

Resources	Percentage of Students	Average Scores
Numerous Resources	3	494
Some Resources	58	446
Few Resources	38	423



The table indicates that the more resource available for the students the better results they achieve.

- **Family Economic Status**

Fourth and eighth grade students' scores in relation to their families' economic conditions are classified as follows:

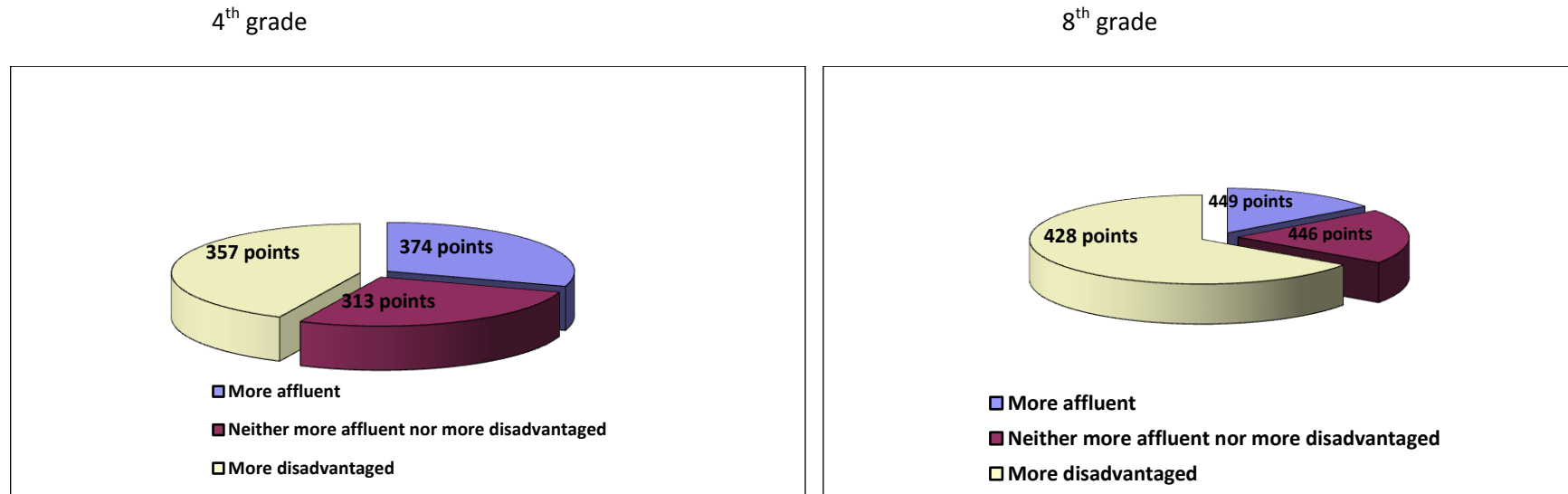


Chart No. 4: Classification of Students' Scores in Science Assessment according to their Families Economic Status

According to the above charts, the higher the families' economic conditions are, the better students' average scores are. The higher percentages of students from economically disadvantaged homes are, the lower students' average scores are.

It is worth noting that fourth grade students' scores did not reach the lowest level of achievement regardless of their economic or social conditions which raises questions about the role of schools.

### 2.3. Variables Related to School Environment

- **School Environment**

TIMSS results proves that lack of facilities and equipment in any educational institution (such as: infrastructure, computers, and books) negatively affects students' scores in science. Around 86% of sampled students at grade 4 and 94% of eighth grade students are enrolled at schools lacking these facilities and equipment.

Around 96% of the primary schools and 14% of the lower secondary schools do not have science laboratories and 11 % of lower secondary schools lack technical assistants to carry out scientific experiments.

The study also shows that 33% of the sampled lower secondary schools suffer from a shortage in the number of science teachers, which negatively affects students' scores.

#### **2.4. Variables Related to Teaching Science Programs**

TIMSS fourth grade science assessment includes 20 subjects, of which only 5 are part of the national education program. These subjects are classified by content domains as follows:

Table No. 41: **The Classification of TIMSS Assessment and Fourth Grade National Education Program Subjects by Science Content Domains**

	Life Science	Physics	Earth Science	Total Number of Subjects
TIMSS Subjects	6	8	6	20
Formal Education Program Subjects	2	3	0	5

TIMSS eighth grade science assessment includes 20 subjects, of which only 9 are part of the national education program. These subjects are classified by content domains as follows:

Table No. 42: **The Classification of TIMSS Assessment and Eighth Grade National Education Program Subjects by Science Content Domains**

	Biology	Chemistry	Physics	Earth Science	Total Number of Subjects
TIMSS Subjects	7	4	5	4	20
Formal Education Program Subjects	5	2	2	0	9

The following is a comparative analytical review on the TIMSS and the national educational program subjects in science at the level of fourth grade:

Table No. 43: **Comparing Grade 4 TIMSS Subjects to the National Education Program**

		School Grade						Remarks
		1	2	3	4	5	6	
1. Life Science								
a)	Human body organs and their main functions, as well as other living organisms (plants and animals).				x	x	x	Introduced to students at grade 4.
b)	Life cycles and plant and animal reproduction							Life cycles are not included in the program, but students are taught about vegetative reproduction as well as other types of reproduction.
c)	Physical characteristics of living things, their behavior, and living conditions.				x			Part one of the physical characteristics of living things and their behavior are introduced at grade 4.
d)	Relationships between living organisms and their							Not included in the program, however students are taught

	School Grade						Remarks
	1	2	3	4	5	6	
environment (such as food chains and the relationship between a predator and its prey).							about nutrition.
e) Environmental changes (human activity, pollution and means of prevention).				x			Students are taught how to protect their surrounding environment from pollution (preventing air and water pollution).
f) Human health (infection, prevention, disease symptoms, healthy diet, and physical exercises).				x			Students are taught means of disease prevention in human beings and animals.
<b>2. Physics</b>							
a) State of matter (solid bodies, liquids, gases, and the differences in their physical properties (shape and volume)) and changes in the state of matter by heating or cooling.			x				Students are taught the physical properties of matter starting from grade 3.
b) Classification of matter according to physical properties (weight, mass, volume, and magnetic attraction).							Not included in the program.
c) Separating the components of a mixture.							Not included in the program.
d) Changes in the state of matter (putrefaction, combustion, rusting, and cooking).							Not included in the program.
e) Different sources of energy, its types, and practical usage			x	x			Taught to students at grades 3 and 4.

	School Grade						Remarks
	1	2	3	4	5	6	
(sun, electricity, water, and wind).							
f) Light (sources and characteristics).					x		Taught to students at grade 5.
g) Electrical networks and the characteristics of magnets.						x	Electrical circuits are taught to student at grade 5 and magnets are introduced at grade 6.
h) Forces of a moving object (such as gravity, pulling and pushing).							Air pressure is introduced to students at grade 4.
<b>3. Earth Sciences</b>							
a) Water on earth (locations, types, and flow) and air (composition, proof of its existence, and its uses).							Not included in the program, but air is mentioned as a source of energy at grade 4.
b) Terrain (such as mountains, plains, rivers, and deserts) and its relationship to human activities (such as agriculture, irrigation, and land reclamation).							Not included in the program.
c) Weather conditions daily and throughout the seasons							Not included in the program.
d) Animal and plant fossils (age, location, and structure)							Not included in the program.
e) Our solar system (planets, sun, and moon)							Not included in the program.
f) Day and night, and the shadow resulting from the rotation of earth around the sun.					x		Introduced to the students at grade 5.

TIMSS content domains which are not taught as part of the national education program

Table No. 44: Comparing Grade 8 TIMSS Subjects to the Science Formal Education Program

	School Grade			Remarks
	7	8	9	
<b>1. Biology</b>	Structure	Structure (continued)	Function	
a) Human body systems and main organs, as well as other living organisms (structure/function and healthy life styles).	x	x	x	
b) Cells and their functions, such as: breathing, photosynthesis, and others).		x	x	Taught to students in detail at grade 9.
c) Sexual and asexual reproduction and genetics (inheritance and inherited and acquired traits)	Plants x	Humans x	x	Genetics was cancelled from the program.
d) The role of variation and adaptation in the survival and extinction of a species in a changing environment.	xx	x		
e) Interaction between living organisms in an ecosystem (such as energy flow, food networks, competition, and predation) and the impact of natural environment changes on the population) such as climate change and water sources.	x	x		The parts on flow of energy, competition, and predation were cancelled from the program.
f) Reasons behind the increase in world population (such as progress in medicine and hygiene) and the impact of population growth on the environment.	x		x	This phenomenon is mentioned in geography program.
g) Human health (infectious diseases, prevention means, and immunity) and the importance of following a healthy diet and exercising to maintain one's health.			x	
<b>2. Chemistry</b>				
a) Classification, formation and structure of substances (elements, compounds, mixtures, molecules, atoms, protons, electrons, and neutrons).			x	The structures of atoms and molecules are taught at the beginning of the program.
b) Solutions (solute and solvent, substance concentration, dilution, and the effect of heat on solubility).			x	
c) The properties of acidic and alkaline solutions			x	

	School Grade			Remarks
	7	8	9	
d) The chemical change (transformation of the reactant, chemical reaction, preservation of chemical substances, oxidization (such as: combustion, rusting, and pollution).			x	
<b>3. Physics</b>				
a) Physical state of the matter and its related changes (explaining the properties of matter in terms of its movement, the space between atoms, changes in the phases of substances, thermal expansion, and changes in volume and/or pressure)	x	x		Superficially taught in grades 7 and 8.
b) Types of energy, its transformation, heating, and degrees of heating.		x		
c) Characteristics of light (reflection, refraction, colors of light, and light rays) and sound (transmission of sound through several media, high sound, intensification of sound, sound frequency, and the speed of light and sound)			x	
d) Electric circuits (flow of electric current, types of circuits, series and parallel circuits, and the relationship between electric current and electric tension) properties of electromagnetism and magnetism and its usage.	x	x	x	
e) Force and motion (types of force, explanation of motion, density, and pressure).				Not included in the program of basic education.
<b>4. Earth Sciences</b>				
a) Earth's terrain and structure ( earth crust, outer core, inner core, water formation and distribution on earth, and air formation)				Cancelled from the program.
b) Evolution of earth, its cycle and history (rocks cycle, water cycle, weather, main geological events, and the formation of fossils and fossil fuels)	x			Rocks are taught to students as part of the environmental studies program.
c) Earth resources, their use and means of preservation (renewable and non-renewable resources, and the use of land, soil, and water resources).	x			
d) The earth as part of the solar system and the universe		x		

	School Grade			Remarks
	7	8	9	
(natural phenomena on earth, day and night, high tide and low tide, moon eclipse, seasons, and earth properties compared to those of the sun)				
TIMSS content domains which are not taught as part of the national education program in Tunisia				

It is worth noting that the average of science credit hours is close to the international average for grade 4, although science credit hours at grade 8 are less than the international average: 64 hours compared to an international average of 158 hours.

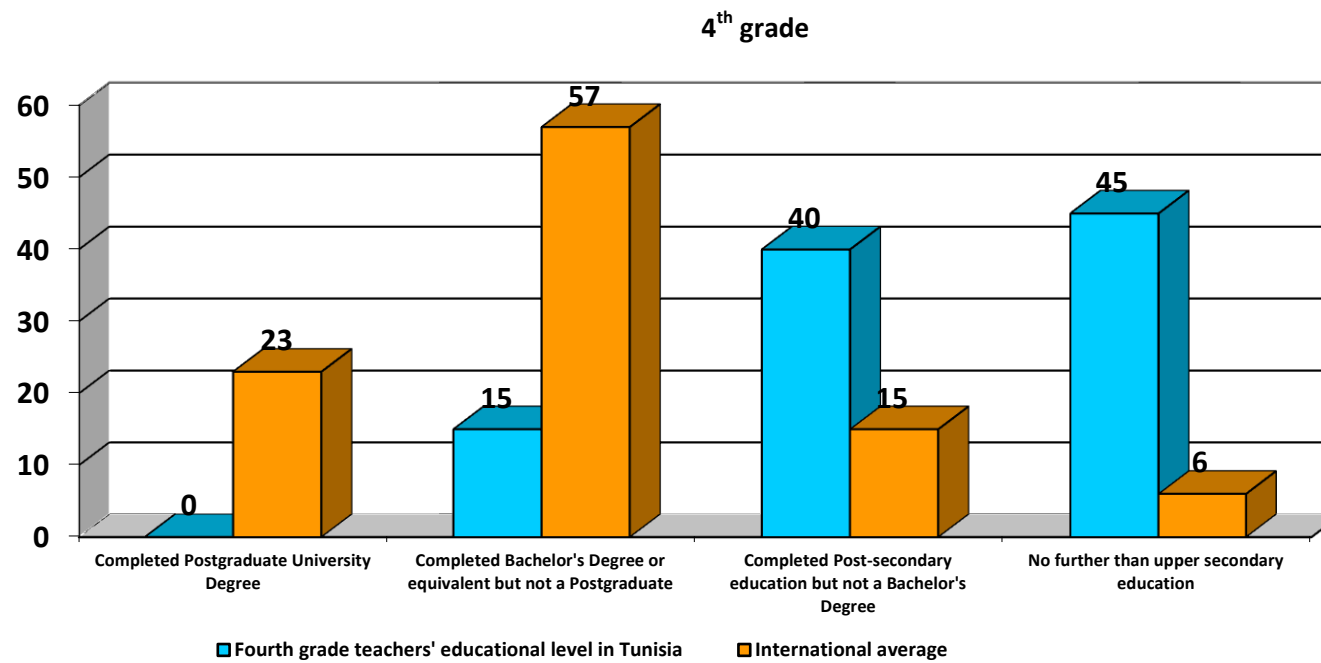
### 3. Variables Related to Teachers

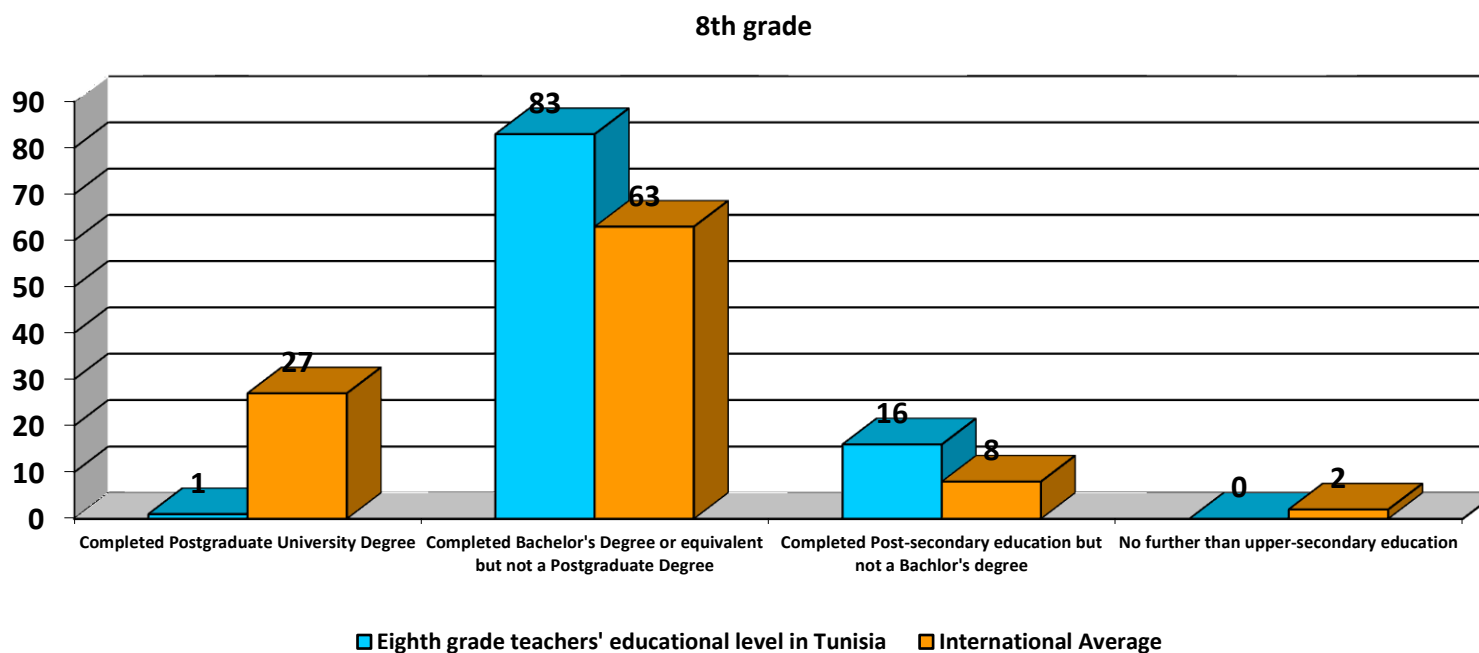
The study results prove that students' performance in the assessment is affected by variables related to the teacher, such as teachers' experience, self-confidence, and job satisfaction.

#### 3.1. Teachers' Level of Education:

Sampled fourth and eighth grade teachers classified by the level of their education:







Graph No. 8: Classification of Teachers according to their Level of Education.

### 3.2. Teaching Experience:

The following table shows the results of fourth and eighth grade students classified by their teachers' years of experience:

Table No. 45: **Classification of Students' Results according to their Teachers' Years of Experience**

	20 Years of Experience or more		From 10 to 20 Years of Experience		From 5 to 10 Years of Experience		Less than 5 Years of Experience	
	Percentage of Teachers	Students' Average Score	Percentage of Teachers	Students' Average Score	Percentage of Teachers	Students' Average Score	Percentage of Teachers	Students' Average Score
Fourth Grade Students	57	359	23	336	10	354	11	310
Eighth Grade Students	30	453	38	437	28	425	3	415

These results indicate that the more the years of teachers' experience the better the students' results. However this variable is of limited impact in several countries, such as Finland, Japan, and the United Arab Emirates which could be interpreted as a deficiency of training for teachers with less than 5 years of experience.

### 3.3. Teachers' confidence in their Ability to Teach Science :

Around 64 % of the teachers showed enough self confidence in their abilities to teach science. However, their students achieved lower results than other students, whose teachers do not have enough self-confidence. (344 score points compared to 350 points).

Around 74% of secondary school teachers showed enough self confidence in their abilities to teach science. Their students achieved better results than other students whose teachers do not have enough self –confidence (440 score points compared to 434 points).

### 3.4. Job satisfaction:

Around 54 % of the teachers were satisfied with their job, while 6 % were not satisfied. The following table shows students' results in science according to the degree of job satisfaction of their teachers.

Table No. 46: **Fourth Grade Students' Results according to the Degree of Job Satisfaction of their Teachers**

	Fully Satisfied with their Job	Relatively Satisfied	Not Satisfied at All
Percentage of Teachers	54	41	6
Students' Average Score	354	340	305

As indicated in the table, students, whose teachers were satisfied with their jobs, outperformed their peers.

Concerning the lower secondary education students, 48% of the teachers were satisfied with their job, while 5 % were not satisfied. Students' results in science assessment according to the degree of job satisfaction of their teachers are shown in the below table:

Table No. 47: **Eighth Grade Students' Results according to the Degree of Job Satisfaction of their Teachers**

	Fully Satisfied with their Job	Relatively Satisfied	Not Satisfied at All
Percentage of Teachers	49	46	5
Students' Average Score	438	441	420

### 3.5. Cooperation for Better Education:

The analytical review of fourth grade students' results in light of the level of cooperation between their teachers shows that students of cooperative teachers (13 %) achieved the best results as indicated in the following table:

Table No. 48: **Fourth Grade Students' Average Results according to the Degree of Cooperation of their Teachers**

	Very Cooperative Teachers	Cooperative Teachers	Relatively Cooperative Teachers
Percentage of Students	13	57	31
The National Average Score	350	347	340

Concerning the eighth grade, the percentage of students and their average scores in science are classified according to the level of cooperation of their teachers as follows:

Table No. 49: **Eighth grade Students' Average Score according to the Degree of Cooperation of their Teachers**

	Very Cooperative Teachers	Cooperative Teachers	Relatively Cooperative Teachers
Percentage of Students	19	63	18
The National Average Score	436	440	437

- **Using Computers to Teach Science**

Around 16 % of fourth grade teachers and 19 % of teachers of secondary schools use computers during their lessons, which is the lowest percentage in the world. Teachers ask their students to carry out some activities using computers, such as studying natural phenomena through simulations or searching for ideas and information and practicing skills and procedures.

#### **4. Variables Related to Students**

The study proves that students' scores in the assessment are closely related to several variables, such as students' interest in learning science, self-confidence and class participation.

##### **4.1. Students' Interest in Learning Science**

Most of the students expressed their interest in learning science in spite of their low scores, which are below the international average.

About 72% of fourth grade students were interested in learning science, which renders Tunisia the second country among the countries whose students participated in TIMSS 2011 with respect to this variable. In spite of their weak results, Tunisian students are among the most interested students in learning science.

The following table details fourth grade students' results according to their interest in learning science.

Table No. 50: **Fourth Grade Students' Scores according to their Interest in Science**

	Interested in Learning Science	Relatively Interested in Learning Science	Not Interested in Learning Science
Percentage of Students	72	24	4
Students' Average Score	376	278	262

The following table indicates eighth grade students' results according to their interest in learning science:

Table No. 51: **Eighth Grade Students' Scores according to their Interest in Science**

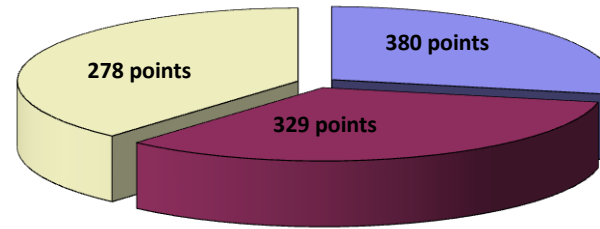
	Interested in Learning Science	Relatively Interested in Learning Science	Not Interested in Learning Science
Percentage of Students	56	37	8
Students' Average Score	450	426	422

Tunisia ranked first among countries with respect to students' interest in learning science

#### **4.2. Students' Self-Confidence in Learning Science**

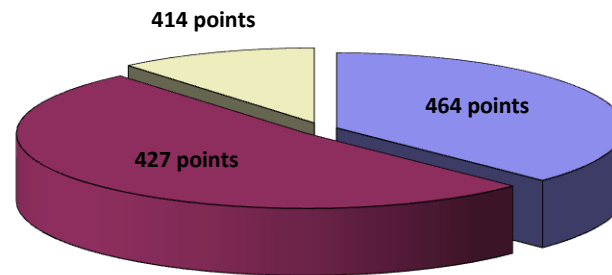
Fourth and eighth grade students' results in science classified according to their self-confidence.

**4<sup>th</sup> grade students:**



■ Confident   ■ Somewhat confident   ■ Not confident

**8<sup>th</sup> grade students:**



■ Confident   ■ Somewhat confident   ■ Not confident

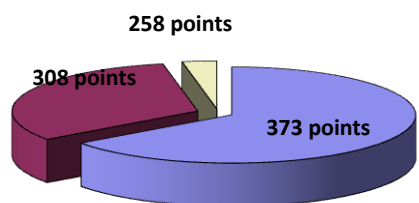
Graph No. 9: Students' Results According to their Self-Confidence in Learning Science

From the previous graphs, it is proven that the more self-confident the students are the better results they achieve.

#### 4.3. Class Participation in Science

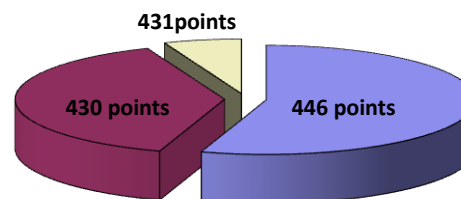
Results show that students' scores in science assessment are closely related to their level of class participation. Tunisia ranked the first according to this variable concerning the fourth and the eighth grades. Students' results in the two grades are classified as follows:

Classification of fourth grade students' results according to their class participation in science



■ Participates in Science lessons  
 ■ Relatively participates in science lessons  
 ■ Does not participate in science lessons

Classification of eighth grade students' results according to their class participation in science



■ Participates in Science lessons  
 ■ Relatively participates in science lessons  
 ■ Does not participate in science lessons

Graph No. 10: Classification of Students' Results According to their Class Participation

#### 4.4. Students' Lack of Basic Nutrition

Fourth grade teachers stated that around 51 % of their students suffer from lack of basic nutrition. Students' malnutrition negatively affects the teacher's instruction and the student's ability to understand and learn. Average score of students suffering from lack of basic nutrition is 333 points compared to the average score of students who do not suffer from this lack (359 points).



Eighth grade teachers stated that around 44 % of their students suffer from lack of basic nutrition. The average scores of those students compared to their peers are indicated as follows:

Table No. 52: **Eighth Grade Students' Scores according to their Nutrition**

	Students who do not suffer from a lack of basic nutrition	Students who suffer from a lack of basic nutrition
National Average Score	446	429
International Average Score	485	461

#### **4.5.Students' Lack of Knowledge and Basic Skills**

Fourth grade teachers stated that only 11 % of their students have the basic skills and enough knowledge required for this grade. Those students achieved the highest scores in the science assessment (358 points) compared to other students who do not have any skills (31% with average score 330 points) and those who have some of these skills (58% with average score 353 points).

Concerning the eighth grade students, their teachers stated that only 10 % of the students have enough knowledge and the basic skills required for this grade. Those students achieved an average score of 454 points compared to their peers, who lack this knowledge; representing 25% with average score 431 points. The average score of students, who have some basic skills for learning science (according to their teachers) is 439 points.

#### **4.6. Students Perception of their Academic Future**

Although eighth grade students' average scores in the science assessment are below the international average score, they have positive perception of their future. Around 49 % of the students (average scores 457 points) think they will obtain a university degree. Only 5 % of the students think they will finish the first year of university education (average scores 442 points). Around 20 % of the students think they will only finish the first year of secondary school (average scores 401 points). About 27 % of the students do not have any perception of their future (average scores 426 points).

## IV-Summary

TIMSS, "Trends in International Mathematics and Science Study" is based on the evaluation of grade 4 and 8 students' results in mathematics and science. This research field helps in objectively comparing between the international trends in teaching basic sciences; school systems; and teaching and learning conditions. This study is conducted regularly every four years under the supervision the International Association for the Evaluation of Educational Achievement (IEA). Conducted for the first time in 1995, this international assessment study currently includes 63 countries from all over the world

The fourth grade students' average score in the mathematics assessment was 359 points, compared to the TIMSS scale average, which is set at 500 points. Tunisia ranked low (47/50), which indicates the presence of serious problems in the early years of basic education. 35% of fourth grade students reached the low TIMSS International benchmark in mathematics and science assessments, whereas 65% of the students did not reach the lowest level of achievement regardless of their economic or social conditions. Although Tunisia is among the countries which ranked low, this assessment shows a decrease in the number of students who had low assessment scores and an improvement in their achievements. There is also an increase in the scores of students, who reached the advanced benchmark. In spite of their weak results, Tunisian students are among the most interested students in learning mathematics throughout the whole participating countries. At grade 4, there was no measurable difference between the average mathematics scores of males and females. At grade 8, males (433 scores) outperformed females (417 scores). Grade 8 results are far better than those of students in grade 4 in 2011 (and in 2007 : the students that were assessed in the fourth grade in 2007 reached the eighth grade by 2011 and thus were assessed at the eighth grade in 2011) : only 64.4 % of the students were promoted from grade 7 to grade 8 in the academic year 2010-2011<sup>1</sup>, and more than 35 % of the students were not promoted to grade 8, of whom 22.8% failed and 12.7 % dropped out of school. About 61% of eighth graders achieved the lowest international benchmark in the mathematics assessment compared to 72% who reached the lowest benchmark in the science assessment, and the rest of the students did not even reach the lowest level of achievement despite their interest in learning science and mathematics.

Proven results of this study make a significant difference between the educational level of teachers in Tunisia and the global level in the first stage of basic education (primary school): 45% of them did not go beyond high school compared to 6% as a global for this category of teachers. Those with a university degree do not exceed 13%, while the international average is 79%. Results also show lack of cooperation between teachers in Tunisia. TIMSS mathematics assessment for grade 4 students includes 18 subjects, of which 7 subjects only are taught as part the Tunisian educational program, and the mathematics assessment for grade 8 includes 19 subjects, of which 7 subjects only are taught as part of the national educational program; furthermore the TIMSS fourth grade science assessment includes 20 subjects, of which only 5 are part of the national education program, while the eighth grade assessment includes 20 subjects, of which only 9 subjects are taught at schools. It is worth mentioning that in spite of the discrepancies in the students' results in different mathematics content domains, the difference between taught and untaught content domains is still relative, which requires further analysis.

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## VI-Table of Figures

Table No. 1: Classification of TIMSS 2011 Mathematics Assessment by Content Domains at Fourth and Eighth Grades <i>TIMSS 2011 International Results in Mathematics. Executive summary p6.</i>	4
Table No. 2: Classification of the TIMSS 2011 Mathematics Assessment by Cognitive Domains at Fourth and Eighth Grades <i>TIMSS 2011 International Results in Mathematics. Executive summary 6.</i>	4
Table No. 3: The Level of Proficiency in Mathematics <i>TIMSS 2011 International Results in Mathematics. Executive summary p8.</i>	5
Table No. 4: Classification of the TIMSS 2011 Science Assessment by Content Domains at Fourth Grade <i>TIMSS 2011 International Results in Science. Executive summary p6.</i>	6
Table No. 5: Classification of the TIMSS 2011 Science Assessment by Content Domains at Eighth Grade <i>TIMSS 2011 International Results in Science . Executive summary p6.</i>	6
Table No. 6: Classification of the TIMSS 2011 Science Assessment by Cognitive Domains at Fourth and Eighth Grades <i>TIMSS 2011 International Results in Science. Executive summary p8.</i>	7
Table No. 7: Country Ranking Based on Fourth Grade Students' Score in TIMSS 2011 Mathematics Assessment <i>TIMSS 2011 International Results in Mathematics. Chapter 1 Exhibit 1.1 p40.</i>	7
Table No. 8: Ranking of the Countries Based on Eighth Grade Students' Score in TIMSS 2011 Mathematics Assessment <b>Error! Bookmark not defined.</b> <i>TIMSS 2011 International Results in Mathematics. Chapter 1 Exhibit 1.2 p42.</i>	
Table No. 9: Average Mathematics Content Domain Scores of Fourth Graders <i>TIMSS 2011 International Results in Mathematics . Chapter3 Exhibit 3.1 p142.</i>	13
Table No. 10: Average Mathematics Content Domain Scores of Eighth Graders <i>TIMSS 2011 International Results in Mathematics. Chapter3 Exhibit 3.2 p144.</i>	14

Table No. 11: Average Mathematics Cognitive Domain Scores of Fourth Graders	15
<i>TIMSS 2011 International Results in Mathematics. Chapter3 Exhibit 3.3 p148.</i>	
Table No. 12: Average Mathematics Cognitive Domain Scores of Eighth Graders	15
<i>TIMSS 2011 International Results in Mathematics. Chapter 3 Exhibit 3.4p 150.</i>	
Table No. 13: The Classification of Fourth Graders' Scores according to the Four Levels of Achievement	15
<i>TIMSS 2011 International Results in Mathematics. Chapter 2 Exhibit 2.2 p90.</i>	
Table No. 14: The Classification of Eighth Graders' Scores according to the Four Levels of Achievement	16
<i>TIMSS 2011 International Results in Mathematics. Chapter 2 Exhibit 2.19 p114.</i>	
Table No. 15: Classification of Fourth Grade boys and girls' Mathematics Average Score by Content Domains	16
<i>TIMSS 2011 International Results in Mathematics. Chapter 3 Exhibit 3.9 p 164.</i>	
Table No. 16: Classification of Eighth Grade boys and girls' Mathematics Average Score by Content Domains	18
<i>TIMSS 2011 International Results in Mathematics. Chapter 3 Exhibit 3.10p 166.</i>	
Table No. 17: Eighth Grade Students' Average Scores according to the Availability of Essential Home Resources	17
<i>TIMSS 2011 International Results in Mathematics. Chapter 4 Exhibit 4.3 p 182.</i>	
Table No. 18: The Classification of TIMSS and Fourth Grade National Education Program Subjects by Mathematics Content Domains	19
<i>TIMSS 2011 International Results in Mathematics. Chapter 8 Exhibit 8.10 p352.</i>	
Table No. 19: The Classification of TIMSS and Eighth Grade National Educational Program Subjects by Mathematics Content Domains	19
<i>TIMSS 2011 International Results in Mathematics. Chapter 8 Exhibit 8.11 p 354.</i>	
Table No. 20: Comparing Grade 4 TIMSS Subjects to the Mathematics Formal Education Program in Tunisia	21
<i>Table No. 21: Comparing Grade 8 TIMSS Subjects to the Mathematics National Education Program</i>	24
Table No. 22: Classification of Students' Results according to their Teachers' Years of Experience	26

<i>TIMSS 2011 International Results in Mathematics. Chapter 7 Exhibit 7.5 p 294 Exhibit 7.6 p296.</i>	
Table No. 23: Eighth Grade Students' Results in relation to the degree of job satisfaction of their teachers	27
<i>TIMSS 2011 International Results in Mathematics. Chapter 7 Exhibit 7.16 p 322.</i>	
Table No. 24: Fourth Grade Students 'Average Results according to the Degree of Cooperation of their Teachers	27
<i>TIMSS 2011 International Results in Mathematics. Chapter 8 Exhibit 8.12 p 360.</i>	
Table No. 25: Eighth grade Students' Average Scores according to the Degree of Cooperation of their Teachers	28
<i>TIMSS 2011 International Results in Mathematics. Chapter 8 Exhibit 8.13 p362.</i>	
Table No. 26: Fourth Grade Students' Scores according to their Interest in Mathematics	29
<i>TIMSS 2011International Results in Mathematics. Chapter 8 Exhibit 8.1p 330.</i>	
Table No. 27: Eighth Grade Students' Scores according to their Interest in Mathematics	29
<i>TIMSS 2011 International Results in Mathematics. Chapter 8 Exhibit 8.2p 332.</i>	
Table No. 28: Eighth Grade Students' Scores according to their Nutrition	36
<i>TIMSS 2011 International Results in Mathematics. Chapter 8 Exhibit 8.22 p 384.</i>	
Table No. 29: Ranking of the Countries according to Fourth Grade Students' Scores in TIMSS 2011 Science Assessment	37
<i>TIMSS 2011 International Results in Science. Chapter 1 Exhibit 1.1 p38.</i>	
Table No. 30: Country Ranking according to Eighth Grade Students' Score in TIMSS 2011 Science Assessment	36
<i>TIMSS 2011 International Results in Science. Chapter 1 Exhibit 1.2 p40.</i>	
Table No. 31: The Classification of Fourth Grade Students' Average Score by Science Content Domains	38
<i>TIMSS 2011 International Results in Science. Chapter 3 Exhibit 3.1 p 144.</i>	
Table No. 32: The Classification of Eighth Grade Students' Average Score by Science Content Domains	39
<i>TIMSS 2011 International Results in Science. Chapter 3 Exhibit 3.2 p146.</i>	

Table No. 33: The Classification of Fourth Grade Students' Average Score by Science Cognitive Domains	39
<i>TIMSS 2011 International Results in Science. Chapter 3 Exhibit 3.3 p150.</i>	
Table No. 34: The Classification of Eighth Grade Students' Average Score by Science Cognitive Domains	39
<i>TIMSS 2011 International Results in Science. Chapter 3 Exhibit 3.4 p 152.</i>	
Table No. 35: The Classification of Fourth Graders' Scores according to the Four Levels of Achievement	43
<i>TIMSS 2011 International Results in Science. Chapter 2 Exhibit 2.2 p86.</i>	
Table No. 36: Classification of Eighth Graders' Scores according to the Four Levels of Achievement	44
<i>TIMSS 2011 International Results in Science. Chapter 2 Exhibit 2.18 p114.</i>	
Table No. 37: Classification of Students' Scores by Gender	<b>Error! Bookmark not defined.</b>
<i>TIMSS 2011 International Results in Science. Chapter 1 Exhibit 1.10 p 66 Exhibit 1.11 p68.</i>	
Table No. 38: Fourth Grade boys and girls' Science Average Score Classified by Content Domains	45
<i>TIMSS 2011 International Results in Science. Chapter 3 Exhibit 3.9 p 168.</i>	
Table No. 39: Eighth Grade boys and girls' Science Average Score Classified by Content Domains	45
<i>TIMSS 2011 International Results in Science. Chapter 3 Exhibit 3.10 p 170.</i>	
Table No. 40: Eighth Grade Students ' Average Scores according to the Availability of Essential Home Resources	46
<i>TIMSS 2011 International Results in Science. Chapter 4 Exhibit 4.3 p 186.</i>	
Table No. 41: The classification of TIMSS and fourth Grade National Education Program Subjects by Science Content Domains	45
<i>TIMSS 2011 International Results in Science. Chapter 8 Exhibit 8.8 p 356.</i>	
Table No. 42: The classification of TIMSS and Eighth Grade National Educational Program Subjects by Science Content Domains	46
<i>TIMSS 2011 International Results in Science. Chapter 8 Exhibit 8.9 p 358.</i>	
Table No. 43: Comparing Grade 4 TIMSS Subjects to the National Education Program	46

Table No. 44: Comparing Grade 8 TIMSS Subjects to the Science Formal Education Program	49
Table No. 45: Classification of Students' Results according to their Teachers' Years of Experience	54
<i>TIMSS 2011 International Results in Science. Chapter 7 Exhibit 7.5 p 298 Exhibit 7.6 p 300.</i>	
Table No. 46: Fourth Grade Students' Results according to the Degree of Job Satisfaction of their Teachers	54
<i>TIMSS 2011 International Results in Science. Chapter 7 Exhibit 7.15 p 324.</i>	
Table No. 47: Eighth Grade Students' Results according to the Degree of Job Satisfaction of their Teachers	55
<i>TIMSS 2011 International Results in Science. Chapter 7 Exhibit 7.16 p 326.</i>	
Table No. 48: Fourth Grade Students' Average Results according to the Degree of Cooperation of their Teachers	55
<i>TIMSS 2011 International Results in Science. Chapter 8 Exhibit 8.12 p 366.</i>	
Table No. 49: Eighth grade Students' Average Score according to the Degree of Cooperation of their Teachers	56
<i>TIMSS 2011 International Results in Science. Chapter 8 Exhibit 8.13 p 368.</i>	
Table No. 50: Fourth Grade Students' Scores according to their Interest in Science	57
<i>TIMSS 2011 International Results in Science. Chapter 8 Exhibit 8.1 p 322.</i>	
Table No. 51: Eighth Grade Students' Scores according to their Interest in Science	57
<i>TIMSS 2011 International Results in Science. Chapter 8 Exhibit 8.2 p 335.</i>	
Table No. 52: Eighth Grade Students' Scores according to their Nutrition	60
<i>TIMSS 2011 International Results in Science. Chapter 8 Exhibit 8.22 p 394.</i>	



## VII-Table of Graphs

<i>Graph No. 1: The Change in Fourth Grade Students' Score in TIMSS Mathematics Assessment</i>	9
<a href="#">TIMSS 2011 International Results in Mathematics. Chapter 1 Exhibit 1.5 p 52.</a>	
<i>Graph No. 2: The Change in Eighth Graders' Score in TIMSS Mathematics Assessment</i>	13
<a href="#">TIMSS 2011 International Results in Mathematics. Chapter 1 Exhibit 1.6 p 56.</a>	
<i>Graph No.3: Boys and Girls' Average Scores in Mathematics Cognitive Domains</i>	17
<a href="#">TIMSS 2011 International Results in Mathematics. Chapter 3 Exhibit 3.10 p 168 Exhibit 3.9 p 170.</a>	
<i>Graph No.4: Classification of Teachers according to their Level of Education</i>	25
<a href="#">TIMSS 2011 International Results in Mathematics. Chapter 7 Exhibit 7.1 p 284 Exhibit 7.2 p 286.</a>	
<i>Graph No.5: The Change in Fourth Grade Students' Score in TIMSS Science Assessment.</i>	36
<a href="#">TIMSS 2011 International Results in Science. Chapter 1 Exhibit 1.5 p 52.</a>	
<i>Graph No.6: The Change in Eighth Graders' Score in TIMSS Science Assessment</i>	46
<a href="#">TIMSS 2011 International Results in Science. Chapter 1 Exhibit 1.6 p56.</a>	
<i>Graph No.7: Classification of Students' Average Score by Science Cognitive Domains</i>	43
<a href="#">TIMSS 2011 International Results in Science. Chapter 3 Exhibit 3.1 p 144 Chapter 3 Exhibit 3.2 p146.</a>	
<i>Graph No.8: Classification of Teachers according to their level of Education</i>	53
<a href="#">TIMSS 2011 International Results in Science. Chapter 7 Exhibit 7.1p 288 Exhibit 7.2 p 290.</a>	
<i>Graph No.9: Students' Results according to their Self-Confidence in Learning Science</i>	58
<a href="#">TIMSS 2011 International Results in Science. Chapter 8 Exhibit 8.4 p 344 Exhibit 8.5 p 346.</a>	
<i>Graph No.10: Classification of Students ' Results according to their Class Participation</i>	59

[TIMSS 2011 International Results in Science. Chapter 8 Exhibit 8.17 p 380 Exhibit 8.18 p 382](#)

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## **VIII-Table of Charts**

*Chart No. 1: Students' Scores Classified by their Families Economic Status* 18

[TIMSS 2011 International Results in Mathematics. Chapter 5 Exhibit 5.3 p 214 Exhibit 5.4 p 216.](#)

*Chart No. 2: Students' Results According to their Self-Confidence in Learning Mathematics* 33

[TIMSS 2011 International Results in Mathematics. Chapter 8 Exhibit 8.4 p 336 Exhibit 8.5 p 338.](#)

*Chart No. 3: Classification of Students' Results according to their Class Participation* 32

[TIMSS 2011 International Results in Mathematics. Chapter 8 Exhibit 8.17 p 370 Exhibit 8.18 p 372.](#)

*Chart No. 4: Classification of Students' Scores in Science Assessment according to their Families Economic Status* 44

[TIMSS 2011 International Results in Science. Chapter 5 Exhibit 5.3 p 212 Exhibit 5.4 p 214.](#)

The National Centre for Pedagogic Innovation and Research in Education

**Assessment Section**

Participation of Tunisia in the International Assessment Entitled

"Trends in International Mathematics and Science Study"

**TIMSS 2011**

Report

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