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Mathematics Teachers' Comments on PISA Math Questions and Our Country's Students' Low Achievement Levels

Matematik Öğretmenlerinin PISA Matematik Soruları ve Ülkemiz Öğrencilerinin Düşük Başarı Düzeyleri Üzerine Yorumları

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ABSTRACT: Our country's having underachieved repeatedly in the international examinations such as PISA, TIMSS etc., has made us consider that there are some problems related to our education system. The lowness of achievement levels might be affected by many factors such as the student, the program, and the teacher being in the first place. Of these factors, it is the teacher who is of great importance both because of being the person implementing this program and being the factor on the performance of whom measures can be taken easily. Starting from this point on, in the present study, the opinions of teachers about the lowness of students' achievement levels on these exams were examined. To achieve depth in the investigation, first the questions having addressed to students in PISA implementations were asked to the teachers in written form and answers were received and then they were asked for their opinions. The study revealed that the teachers regarded **the insufficiency of the contents of the program and that of the teachers' accumulation of knowledge** as the main reasons for students' low achievement levels. It has been concluded that working on these two factors and including such kinds of questions within the exams carried out nationally are necessary to increase students' achievement levels.

Keywords: Mathematics education, mathematics literacy, mathematics teachers, PISA, mathematics program, mathematics teacher education

ÖZ:Ülkemizin son yıllarda PISA, TIMMS gibi uluslararası sınavlarda üst üste düşük dereceler elde etmesi, eğitim öğretim sisteminde bazı sorunlar olduğunu düşündürmektedir. Başarı düzeyinin düşüklüğü öğrenci, program, öğretmen başta olmak üzere birçok faktörden etkilenebilir. Bu faktörler arasında öğretmen, hem programı uygulayan kişi hem de performansı üzerinde kolayca tedbir alınabilecek bir faktör olması bakımından önem arz etmektedir. Bu noktadan hareketle bu çalışmada öğretmenlerin bu sınavlarda elde edilen öğrenci başarısının düşük oluşuna ilişkin görüşleri incelenmiştir. İncelemede derinlik sağlamak için öğrencilerin PISA uygulamalarında muhatap olduğu sorular önce öğretmenlere yazılı olarak sorulmuş, cevapları alınmış ve sonra görüşlerine başvurulmuştur. Araştırma, öğretmenlerin, öğrencilerinin başarı düşüklüğünün başlıca nedenleri olarak **programın içeriğinin** ve **öğretmenlerin birikiminin yetersizliğ**ini gördüklerini ortaya koymuştur. Başarıyı artırmak için bu iki faktör üzerinde çalışılması ve ayrıca ülke içinde yapılan sınavların bu tür soruları içermesi gerektiği sonucuna ulaşılmıştır.

Anahtar sözcükler: Matematik eğitimi, matematiksel okuryazarlık, matematik öğretmeni, PISA, matematik programı, matematik öğretmeni eğitimi.

1. INTRODUCTION

The fact that the achievement levels of our country obtained from PISA 2003 assessment (Program For International Student Assessment) which our country attended for the first time and TIMSS-R 1999 (Third International Mathematics and Science Study-Repeat) and PIRLS 2001 (The Progress in International Reading Literacy Study) (İş, 2003) did not satisfy the educational community has leaded to change of direction in the studies on program development which started in 1985 and continued since that time and the attention has been shifted from content to methodology. Since 2004, a series of studies on program development regarding mainly program methodology have been conducted. The behavioural approach which the elementary educational program was based on has been abandoned; instead of it, a program based on mainly constructivist approach has been designed and put into practice. This basic change has required also a change in the course materials and classroom learning environment and resulted in designing learning environments as student-centred (MEB, 2005). In the last assessment carried

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out in 2009, the expected improvement level wasn't obtained (www.pisa.oecd.org. 2010). This situation put forwards the necessity to do more detailed researches concerning the subject.

Providing the opportunity for the comparison of educational levels of countries, PISA is a project for international student assessment. Due to its academic content, PISA project performs studies which assess the **reading skills, physical sciences and mathematics** and is applied to 15-year-old students. The objective of this project is not to find out how much the young people are specialized in certain content but to define what they can achieve with what they learn from school.

Math questions of PISA are mainly related with **mathematical literacy**. *Mathematical literacy is defined as the capacity to perceive how mathematics can be used in real life and hence how it can be utilized to meet the needs* (MEB, 2005). The mathematical literacy in PISA is measured in four fields. These include (1) Geometry, (2) Algebra, (3) Arithmetic and (4) Probability. The evaluations in these fields are carried out by means of giving students an opportunity to use the mathematical competence they need via the problems presented in the context of real life. These problems necessitate the use of such skills as **reasoning, communication**, **modelling, problem posing and solving, using symbolic, formal and technical language and operations.** The skills on these fields show differences in terms of difficulty level and the questions can be divided into three categories according to the skills to be measured. These involve reproduction, connection and reflection skills. **The reproduction skills** include identification of mathematical processes and problem types and application of routine operations. The solutions of the easiest problems presented to students in PISA require the use of such skills. **The connection skills** emerge when students are required to go beyond the routine problems, interpret different situations and establish connections between them. The problems necessitating such skills are generally mid-difficult. Finally, **the reflection skills** require students' creativity when identifying the mathematical elements in the problem and establishing connection. The problems measuring these skills are usually complex and the questions oriented towards this objective are more difficult than others (MEB, 2005).

Since 2004 when the studies on program development started in our country, some researches on the PISA achievement level of our country have been conducted.

Of these researches, İş (2003) has analysed the factors affecting math success and determined such four factors as (i) student development level, (ii) self-confidence level, (iii) positive classroom environment and (iv) avoiding memorizing. A similar study has been performed by Yıldırım (2009). He has talked to 160 school heads and nearly 5000 student's parents from various cities by using PISA 2006 data and examined the factors determining the quality of education in Turkey. He has identified these factors as (i) Home and parental characteristics, (ii) Student characteristics, (iii) Teaching method and (iv) Environment.

Savran (2004) focused on the question structure of PISA and analysed whether PISA questions are suitable for Turkish student profile or not. He has concluded that the high school entrance exams (LGS) are based on memorized knowledge and hence PISA questions are different from this aspect. Regarding the questions, another study has been carried out by Okur (2008). He has examined students' behaviours while solving 10 problems chosen from PISA practices and tried to identify the deficiencies of our educational system. He has come to the conclusion that the questions which require different problem solving strategies should be included in the teaching program and students should be given a chance to discuss their achievement status.

Berberoğlu and Kalender (2005) have investigated the effects of region and school types on the result and concluded that the school types are more influential on success rather than regional differences.

These summarized researches present the description of mathematics education in our country from the perspective of PISA but any studies regarding teachers' comments on this subject and their suggestions to improve success haven't been carried out. Although there are few studies including directly teachers' comments on program development as the study of Duru and Korkmaz (2010), a research involving teachers' comments on PISA assessments which trigger these program changes haven't been found out. However, we can find many studies which point out that teachers play the most significant role in the success of program development studies. Howson, Keitel and Kilpatric (1981) have expressed that teacher is one of the strongest factors influential on program changes; Sosniak, Ethington and Varelas (1991) and Koehler and Grouws (1992) have stated that math teachers' comments and beliefs on program make it easy or difficult to implement the program; Knapp and Peterson (1995) have pointed out that teachers' comments on program should be taken into account in order that programs can be applied successfully.

Being directly related with PISA and including the elementary mathematics teachers' ideas on achievement level of the 8th grade students in PISA questions and improvement of it, this study aims at filling this gap. Concerning the level of our country's 8th grade students to solve the questions correctly selected from PISA applications, the mathematics teachers were asked the following;

(i) their predictions about the level of students to solve these questions correctly,
(ii) their comments on the degree of questions to assess mathematics achievement of students,
(iii) their ideas on the low achievement level of students in PISA questions,their opinions on the changes and arrangements to be made in the education system in order to improve the students' success in mathematics.

2. METHOD

Since this study analyses a present situation under its own conditions without any outside effects, it is designed in screening model (Karasar, 2000). It is a qualitative study as the data has been obtained by examining the written comments of the participants through the content analysis. In qualitative studies the basic objective is not to reach a general result via numbers but to present a descriptive and realistic picture regarding the examined subject. As this study does not have a concern for generalization, the obtained findings are limited with only elementary mathematics teachers who have participated in the research.

2.1. Analysis Unit

The research was performed with 140 elementary mathematics teachers working in Bursa. One of the researchers gave the teachers who attended the research a seminar for a week. In that seminar, the participants were given information on PISA examination, Turkey's achievement level in PISA and mathematical questions in PISA and they were asked to solve some of those problems. Upon the completion of seminar, the research questions stated above were addressed to the teachers in written.

2.2. Data Collection Tool

The elementary mathematics teachers' comments on PISA mathematical questions and our country's mathematics success in PISA were collected by using "Semi-Structured Interview Form". This form consists of totally four questions including one multiple-choice and three open-ended questions.

2.3. Data Analysis

The data obtained from the interview forms was firstly recorded in a Word document and analysed via content analysis. The objective of content analysis is to gather the similar

information in the framework of certain concepts and themes and interpret them as comprehensibly for readers (Yıldırım and Şimşek, 2006; 227). In the analysis process, the words, sentences and paragraphs were conceptualized and coded with the aim of identifying the opinion desired to be expressed in the answers given by the elementary mathematics teachers to the questions. Then, the data obtained from interviews was analysed through Nvivo 8 qualitative data analysis programme. In the programme, the codes were formed as free codes and gathered under certain groups and the themes were defined. The codes and themes were determined by the researchers and arranged in a way to provide an opportunity to define and interpret. The frequencies of each theme and sub-theme were expressed as percentage. These percentage values achieved were used for ranking and suggestion by the nature of qualitative studies. The figures have been utilized for the presentation of the codes and themes formed after the data analysis. Following each figure, the examples of the elementary mathematics teachers' expressions have been presented by quotations from the opinions on this code or theme.

3. FINDINGS

The findings of research are given on the basis of question below:

The first question addressed to the teachers was *"at what range do you think that the percentage (%) of the 15-year-old students who answer these questions correctly is?"*

A) 0 - 25 *B) 26 - 50* *C) 51 - 75* *D) 76 - 100*

The frequency and percentage distribution of the teachers' answers for this question are given in Table 1.

Table 1: The Frequency and Percentage Distribution of the Elementary Mathematics Teachers' Answers for the 1st Question

0-25	26-50	51-75	76-100
66 (%47)	64 (%46)	10 (%7)	-

Of the teachers, 93% (130 teachers) stated that students' achievement level would be between 0%-50% and 7% (10 teachers) stated it would be between 51% and 75%. None of them estimated that the percentage of correct answers would be between 76% and 100%. The teachers' comments confirm our country's results received in PISA 2003, PISA 2006 and PISA 2009.

The second question addressed to the teachers was *"do you think that these questions measure mathematics success of the 15-year-old students? Write your opinion clearly. Is it suitable to apply these questions to the 15-year-old students?"*

Of the teachers, 53% (75 teachers) stated that the questions were suitable; 17% (24 teachers) stated they were partially suitable and 29% (41 teachers) pointed out that they were not suitable. These numerical results show that the teachers find the PISA questions involved in the study appropriate for students' capacity. The first and second question is interrelated. Considering that more detailed results can be obtained, those two questions are assessed together below. To that end, the answer of the first question formed as **"suitability of questions for students' level"** is given in the line and the answer of the second question, **"the expected achievement level of students"** is given in the column in the same table (Table 2).

Table 2: Teachers' Comments on the Expectation Level for Students' Success and Suitability of Questions

		Suitability of Questions for Students' Level (N)			
		Unsuitable	Partially Suitable	Suitable	Total
Expected Achievement level (%)	0 - 25	17	8	41	66
	26 - 50	21	16	27	64
	51 - 75	3	0	7	10
Total		41	24	75	140

Providing an opportunity to compare the answers given by the teachers for the 1st and 2nd question, Table 2 puts forward some interesting results. The total number obtained in the columns of this table shows that the answers of teachers are concentrated on the *suitable* option out of the options of *unsuitable, partially suitable* and *suitable*; the total number obtained in the columns represent that the achievement level is mostly between the range of 0%- 25% and then 26%-50%. When these two results are reviewed together, the teachers have expected the achievement level would be under the mid-range although most of them have found the questions as partially suitable or suitable.

Assessing the results in a more detailed way, of 41 teachers included in the first column of Table 2, 17 teachers expressed that students' achievement levels would be between the range of 0% and 25%; for 21 teachers, it would be between 26% and 50% and 3 teachers stated that it would be between 51% and 75%. The fact that those 41 teachers expressed the unsuitability of questions for the students' level is compatible with their prediction that the students' success would be under 50%. On the other hand, most of 99 teachers who found the questions suitable and partially suitable stated that the achievement level would be under 50%. In other words, the expected achievement level and suitability of questions haven't shown parallelism; on the contrary, the achievement level has shared similarity with the expectation level of the ones who haven't considered the questions as suitable. This situation indicates that the teachers regard the questions efficient and the education system inefficient.

Through the analysis of lines in Table 2, some interesting results have also been obtained. Most of 66 teachers included in the first line expected an achievement level under 25% although they considered the questions suitable (8) or partially suitable (41). Most of 64 teachers included in the second line expected an achievement level between 26%-75%, namely under the medium range, although they regarded the questions partially suitable (16) and suitable (27). The fact that 7 of 10 teachers in the third line found the questions suitable is compatible with their expectation for 50%-75% rated achievement level. However, the ones involved in this group constitute a small part in 140 teachers. It is an interesting result in this research that the forth line hasn't been formed. None of 75 teachers who considered the questions suitable expected an achievement level rated between 75% and 100%. The information available in these two lines has represented the teachers' opinion that "the questions are suitable but our students can't answer them."

The third question addressed to the teachers was "*what do you think about the reasons why the failed students couldn't answer the questions involved in this practice correctly? Please make an assessment regarding the difficulty level of questions, the content of teaching programs, teachers' teaching capability and knowledge, school infrastructure and classroom equipment, cultural suitability of questions etc."*

The teachers' comments on why the students couldn't give correct answers to the questions addressed in the study are coded under 6 basic themes and 18 sub-themes. These themes are grouped via Nvivo 8 program and the result is given in Figure 1.

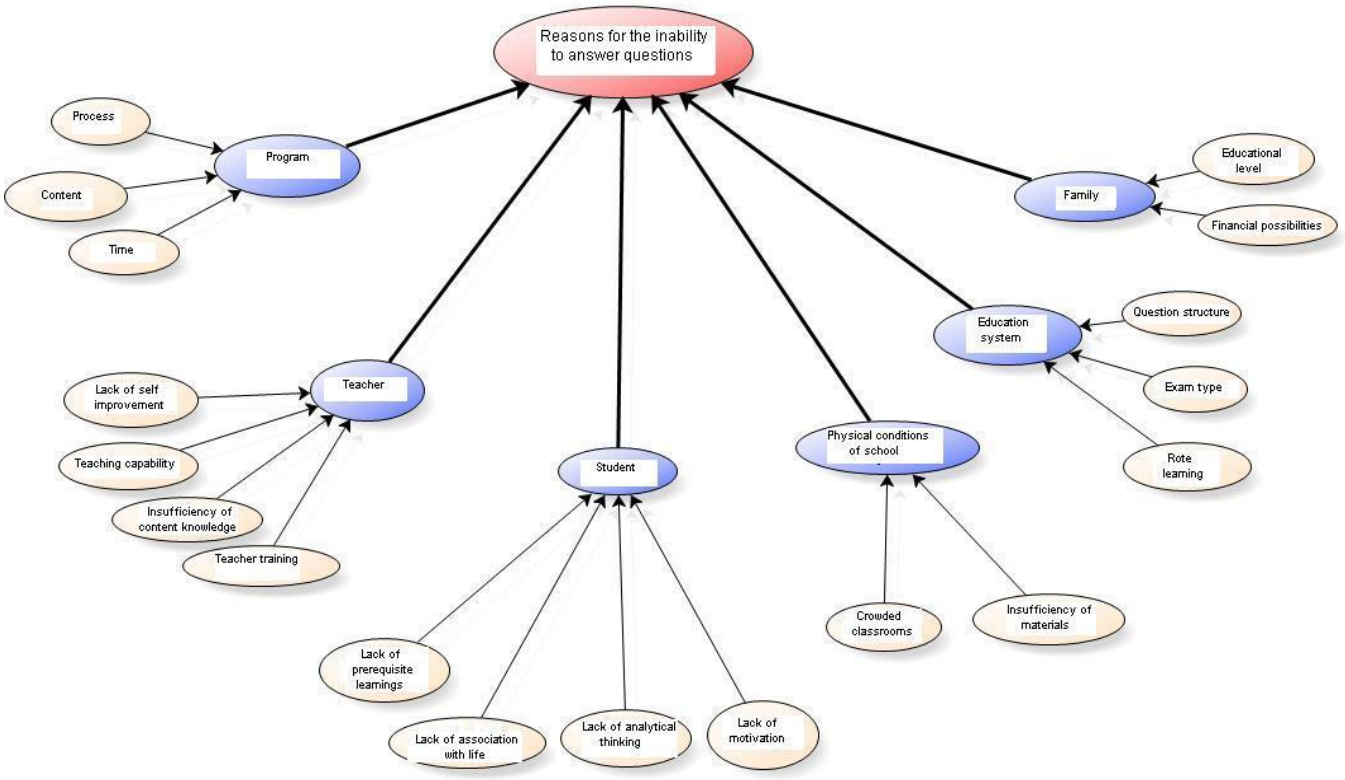


Figure 1. The teachers' comments on why the students couldn't give correct answers to the questions

According the variable number of teachers, the factors which they consider as influential on students' achievement levels are listed as the education system and exams (71), curriculum (60), student (53), physical conditions (51), teacher (50) and family (8).

Table 3: Teachers on Students' Achievement Levels of Their Answers Formed the theme of the Frequency and Percentage Distribution

	Frequency (f)	Percent (%)
Education system and exams	71	25,27
Curriculum	60	21,47
Student	53	18,48
Physical conditions	51	17,50
Teacher	50	17,25
Family	8	0,03
Total	293	100

Those teachers pointed out that the students couldn't answer those questions due to **our education system based on rote learning**, **the used exam type, the question structure**

(multiple-choice questions) used both in those questions and courses. We can see same examples of the teachers' comments on this matter below:

> *"I think the students couldn't answer the questions correctly because our education system is based on rote learning and not built on real information and it is not associated with current life"*
>
> *"As the teachers who instructed us, we (I'm talking about my period) prepare students for the exams executed by the Ministry of National Education, load them with knowledge as if they are machines and students do not know how and where to use knowledge."*
>
> *"The content of our teaching system is based on reaching solution by the direct use of knowledge without interpreting the problem."*
>
> *"Since our education system is generally based on multiple-choice tests, our students fail in classic exams. The inability to give correct answers results from the fact that our education system is built on multiple-choice tests."*
>
> *"Since the admission to high school has the logic of SBS (Placement Test) in the system, I think the logic of such questions is not introduced to students in the elementary education."*
>
> *"The reason is the requirement to teach lessons as SBS-oriented."*
>
> *"In my opinion, the reason why students are not able to answer such questions is the frequent application of test techniques."*
>
> *"The students couldn't answer the questions involved in this practice because they are highly occupied with test books due to SBS anxiety during 6^{th}, 7^{th} and 8^{th} grades. Students have become afraid of thinking, interpreting the questions and content with only what is explained in the courses."*
>
> *"What is done and aimed to be done and the obtained result is not corresponding. Discussing the net average of mathematics due to the reality of SBS in each meeting leads to a change in the dimension of activities to be performed in classrooms. In other words, tests are done instead of activities."*
>
> *The second factor which the teachers regarded as a reason why the students were unable to give answers for PISA questions is **mathematics curriculum**. Sixty teachers discussed this subject and associated the reasons of the inability to answer with the **content, process and application time** of mathematics curriculum. Some examples of the teachers' explanations regarding this matter are given below:*
>
> *"The curricular intensity hampers students' possibility to speak in the classroom sufficiently and students do not have enough time to make comments in class."*
>
> *"The reason is that our curriculum consists of knowledge loading not real life."*
>
> *"The curricular intensity and lack of activities due to keeping up with the curriculum are among the reasons."*
>
> *"Since the education given in schools has been mostly abstract and disconnected from real life for years, students are not able to use what they have learnt for similar problems they are faced with."*
>
> *"The fixed course hours can hinder advanced learning (analysis, synthesis)."*
>
> *"The reason is the insufficiency of time spared for mathematics course."*

The teachers have attributed students' inability to answer questions to some **student-related matters**. Of the teachers, 53 discussed this subject and considered **lack of motivation, association with life and prerequisite learnings** as the reasons for the inability to answer. Some examples of teachers' opinions on this subject are given below:

"I think the cause of the inability to find the correct answers is 'the taught mathematics fear' the students experience."

"The students failed because they are uninterested in the course and they do not desire to learn."

"Students firstly have a great prejudice. They do not go beyond the operations they know."

"Students are not able to transfer what they learn at school to current life."

"I associate the reasons of the incapability to answer the questions with the lack of connection between courses and life."

"Since thinking skill of students in the cause and effect process is not developed, students couldn't answer the questions."

"The basic reason why the students failed to answer the questions was the lack of reasoning, prediction and interpretation and motivation to use these strategies."

"The fact that the learned math subjects usually stay at the concept and knowledge level and do not get to the analysis and synthesis phase is the reason of the incapability to answer the questions."

"The principal reason why the students were unable to answer the questions is that they do not understand what they read and there are deficiencies in their basic math knowledge."

"As the courses lack activities in the first grade education, students are prompted to memorize."

As the forth reason for the students' inability to answer the questions involved in this study sufficiently, the teachers drew attention to the physical conditions of schools. 51 teachers expressed their opinions and stated that students couldn't answer such questions due to mostly **crowded classrooms** and **insufficiency of materials** among the physical conditions. We can find the expressions of several teachers regarding the subject below:

"The school infrastructure and classroom equipment are not adequate enough to give such education."

"Among the causes of failure, we can mention excessive number of students and physical structure of schools."

"The infrastructure of schools is not suitable for this system; the total number of students is high and the classrooms do not have the required properties."

"The crowded classrooms, the incapability to deal with students personally and technological insufficiencies are the causes of failure."

The teachers considered **teachers** as another factor within the reasons of students' inability to answer PISA questions. Fifty teachers addressed this matter and gathered the insufficiencies regarding themselves under four sub-themes. These include **lack of self-improvement, teaching capability, insufficiency of content knowledge and teacher training.** Some examples of the teachers' expressions are stated below:

"What is important is to be a maestro in practises. We lack it."

"Taking into account the Turkish general situation, there are teachers who teach courses in the old style in line with their competence and knowledge that is why students will not be highly competent in such questions."

"Most of the teachers on duty do not have the necessary background to implement the new curriculum."

"I believe that teachers teach courses via old-fashioned knowledge, they don't have enough information about progressive educational philosophy and hence teachers should receive in-service training."

"Teachers have insufficient information or they lack skills to apply these new methods."

"In my opinion, math teachers are educated with theoretical knowledge and they don't know applied mathematics and there is not a suitable environment for self-improvement in our country."

"The reason of failure is that teachers are still educated through the old system and education and training is given via the new system."

"The fact that teachers are generally educated via teacher-centred system not student-centred is the reason for failure."

The teachers stated that the last factor for the failure of students was **students' families.** 8 teachers addressed the family factor and this number is much lower compared to the numbers obtained in other factors. The theme of family is discussed under two sub-themes including financial possibilities and educational level. We can see the examples of teachers' comments on the subject below.

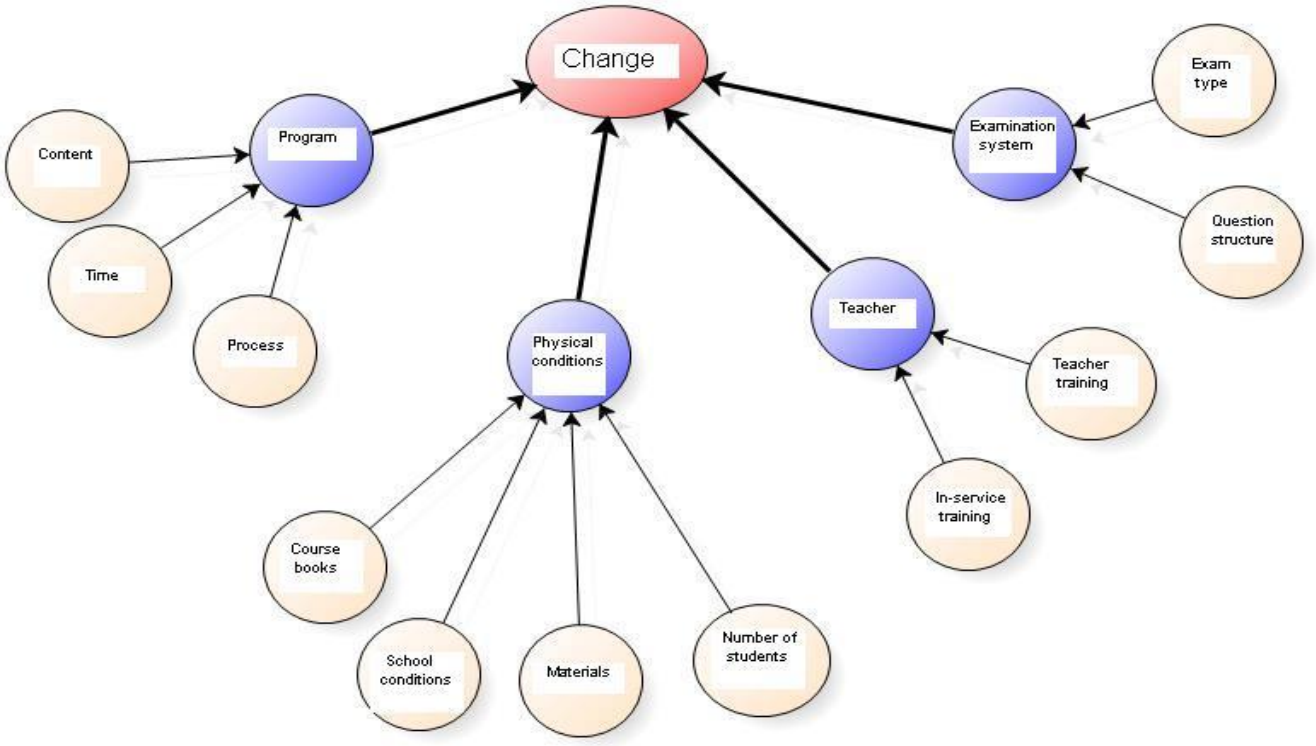
"Indifference of students' parents"

"... the educational level of family."

"Indifference of families. Economic and social insufficiencies."

Lastly, the teachers were asked the question, *"do you think that a change is necessary in our education system to improve the success in order to answer these questions? What direction should this change be?"*

The teachers' opinions on how the change in our education system should be to improve success are coded under 4 themes and 11 sub-themes. The result obtained regarding these themes and sub-themes are given in Figure 2.



Four teachers didn't give an answer to this question and two teachers pointed out that there was no need for a change to improve success. Other teachers stated that some changes regarding the factors of **mathematics curriculum (185), physical conditions (80), examination system (45) and teacher (26)** should be made in order to increase success.

Concerning the need of change, the most addressed factor was the program and 68 teachers discussed this matter. The teachers especially stated that there were excessive subjects in the content of program, the course time was not enough to teach the subjects and hence the subjects involved in the program should be decreased and associated with real life. The teachers' comments on this matter are presented below:

Table 4: According to the Opinion of the Teachers in Our Education System Necessary Change the Frequency and Percentage Distributions

	Frequency(f)	Percent (%)
Curriculum	185	55,05
Physical conditions	80	23,80
Examination system	45	13,40
Teacher	26	7,75
Total	336	100

"The number of subjects should be decreased. Adequate time should be spared for the subjects in order to be reinforced and internalized by students."

"We should make the course curriculums less intensive."

"This change should ensure that the children under the age of 15 are taught the mathematical fields used in the daily life rather than theoretical knowledge. The curriculum should be simplified in order to create the required time and carry out activities. And the appropriate time and opportunities should be provided."

"I think that it will be possible to allocate more time via less-extensive curriculum and the students' success will increase."

"If it is primarily desired to comprehend the basic mathematical knowledge, the number of subjects should be reduced or the course hours should be increased."

"The expression, 'Everyone has their own peculiar style" should be taken into account and we should educate children according to it."

"It is required to let students discover themselves with applied methods in courses."

"The curriculum should be organized to promote researching, thinking, interpreting and creating solutions not memorizing."

"It is necessary to turn mathematics into a necessity, ask questions and carry out activities which develop thinking system (the solution shouldn't be told by the teacher and time should be given to let students find the result.)

"It is essential to pay more attention to process than result. Students and teachers should be given practical education rather than theoretical."

"More time is to be allocated for practices in courses. Students should discover knowledge by experiencing and doing themselves."

"The time given for the subjects involved in the curriculum is not enough. It is necessary to increase time in order to let students use problem solving and reasoning methods."

Another field for which teachers require change with the aim of improving success is **physical conditions.** Forty six teachers addressed this matter and pointed out that **the number of**

students in classrooms should be reduced, the **course books** should be more based on analysis and synthesis, **the school infrastructure** should be improved and appropriate **materials** should be provided in classrooms. We can find examples of the teachers' comments on the theme of physical conditions and its sub-themes:

> *"In order to find a solution, firstly the course books are required to get rid of test logic and be built on mainly interpretation and acquisition and teachers should fulfil this properly."*
>
> *"Our books are inefficient. The course hours are inadequate to teach a subject. The number of students should be between 15 and 20."*
>
> *"It is essential to provide that school properties are complete. The number of students should be suitable for one-to-one education."*
>
> *"The physical properties of schools must be improved. More importance should be paid to visual education."*
>
> *"The infrastructure of schools and classroom equipment should be improved. More equipment and instruments and mathematical materials must be used."*
>
> *"I think that education and training will be efficient in 15-student classes accompanied by well-educated teachers (who love their jobs) and sufficient equipment and materials."*

With a view to improving success, the teachers stated that the **examination system** should be changed. Thirty teachers discussed this subject and expressed that the exam type used in our country and the multiple-choice structures of these questions asked in such exams are required to be changed. The teachers think that the current examination system prompts students to memorize and an examination-centred education is given. Some examples of the teachers' opinions on this theme and its sub-themes are presented below:

> *"Children shouldn't be put in a race. Education should be learning-centred without grade anxiety."*
>
> *"We must assess students via process not exams."*
>
> *"Sure, the exams which children and young people will attend play a significant role. Should the examination system be abandoned? This is a risk because whether a fair conduct can be secured is to be questioned… However, the examination format can be changed and hence the knowledge and practices can be successful."*
>
> *"It is necessary to get rid of SBS and OSS logic and oral-written exams like this exam and practices are required to be included instead of exams. The subjects encompassed in the first grade are to be reduced. The change of OSS logic can be advantageous in this respect."*
>
> *"SBS should be abandoned. It is essential to pay great effort to better comprehension of subjects instead of solving many questions. In this way, the stress over students, parents and teachers will be removed."*
>
> *"When we are doing an activity, we are confronted with such a reaction from children as "Let's solve questions. We are studying for SBS etc." As long as an exam is available or unless the questions asked in exams measure whether the concept is comprehended or not, the situation can't be improved."*

Stating that they should keep up with the change themselves in order to increase success, the teachers pointed out the **in-service trainings** must be more efficient and **the teacher training system** should be compatible with the philosophy of mathematics curriculum in order to implement the new program better. We can see the examples of 19 teachers' comments on this subject:

"In our education system, teachers must be adequately instructed and all opportunities must be provided."

"Our education system should firstly begin from teacher training. The teachers who do not know how to teach, namely, who haven't absorbed mathematical theories completely can only make children memorize. A teacher who has comprehensive knowledge and knows how to discover can turn it to behaviour."

"It is important to teach teachers "why knowledge is taught, for what use, where to use" rather than how to teach students knowledge. If teachers change, then students also change."

"The quality of teaching faculties should be improved."

"Teachers must be given efficient education."

"Initially teachers need to be educated and adapted to this system."

4. DISCUSSION and RESULTS

Of four questions used in this study, the first two were interrelated and the last two were related to one another. In the first question, teachers were asked "how successful their students would be" and in the second question they were asked "the suitability of questions for the 8th grade" and hence "how successful they should be" was questioned. Upon reporting the low achievement level, the third and forth question asked the reasons of failure and the measures to be taken.

The first two questions pointed out the general conclusion that PISA questions were suitable for the level of the students to whom that exam was applied but the students in our country wouldn't be successful at such suitability level and would get lower success. The fact that the achievement level of the 8th grade students was expected mainly between the rate of 0-25% and 26-50% put forward the teachers' opinion that the education-training system didn't enable students to acquire the skills required by those questions. In other words, the results obtained in 2003, 2006 and 2009 PISA practises weren't surprising for teachers. This situation at least lets us think that teachers are highly aware of it and they can make contribution to improvement works. Table 4 which was obtained from the answers of the second question of the same problem and provided the possibility to compare the suitability of the questions and achievement expectation presented some interesting results.

The close relationship between the third and forth question enables us in a sense to get an idea about the reliability of the given answers. If the number of teachers who address a subject is considered as a sign for the significance of the subject, the reasons of the low success in PISA mathematics exams are listed respectively according the order of importance: education system (exams and education), mathematics curriculum, student, physical conditions, teacher, family, concerning the proposals about the changes to be made, program, physical conditions, examination system, teacher. Taking into account that the availability of teacher factor is self-criticism and it is difficult to criticize yourself, the factors can be set forth as teaching system and exams, program, teacher and physical environment. The expressions involved in the answers given to the third and forth questions were regarded as compatible and there were found as sincere answers.

Of the six basic themes under which the teachers' statements regarding the third question about the reasons of the low level of success or the expectation of low success were gathered, many teachers (71) addressed education system. This situation can be perceived as a sign for the need to start improvement studies from this point. Within this theme, three sub-themes included question structure, exam type and rote learning and **the average success of the multiple-choice questions in this study was higher than open-ended questions**. When these two situations are

taken into account together, it can be understood that students should be given a chance to arrange and organize their opinions.

While listing the reasons of failure, the teachers mentioned about the dominant character of multiple-choice exams in the system and test technique. They pointed out that this situation prompted students to use knowledge directly and resulted in teaching the courses as exam-centred, which presents the need to redesign the learning environments via process and result-centred assessment. The concepts which were significant under the title of content, learning and implementation process were program, teaching process and implementation process within the **program** theme which was the second to have been discussed most. The teachers stated that the intensity of programs was tiring for students and teachers, there was no enough time in order to give students a chance to express themselves and the content of teaching was disconnected from real life. The third subject which the teachers discussed most under the student theme was the quality of education the students received until the 8^{th} grade. The insufficiency of pre-learning, lack of motivation, lack of association with life and analytical thinking etc. can each be acquired and removed by an efficient learning environment.

The teachers put forward that the negative impacts of physical conditions of schools on the learning success were related with crowded classrooms and technological insufficiencies. This situation revealed that those deficiencies continued despite the improvement works.

Concerning the reasons which they presented for themselves, the teachers stated that the number of mathematics teachers was not adequate, they couldn't adapt themselves to the new teaching practices discussed lately and they taught courses as compatible with the system in which they were educated and the education system was still teacher-based. Also, they pointed out that the theoretical knowledge was more dominant in teacher training and practices were not involved sufficiently. All these issues prompt us to think that teachers should be educated well during pre-service and in-service education.

68 teachers presented their opinions on the program among the four basic themes under which the answers given by the teachers regarding the question of what changes can be made in the education system in order to improve the mathematic success in PISA exams. Concerning the program, the teachers emphasized the excessive number of subjects and underlined the necessity that the content should give students a chance to discover themselves, the teaching practices should be carried out by paying more importance to process than result and the number of searching assignments should be increased. Teachers' those expressions are corresponding to their statements about the reasons of failure in PISA applications.

The teachers put the physical conditions in the second rank among the changes to be made. In this context, they emphasized that the course books should pay attention to concept knowledge and abandon being test-based materials. They also underlined that the number of students in classrooms should be limited enough to ensure that teachers could deal with students personally. They also emphasized that the class environments should be adequate in terms of books, equipment-instruments and materials.

Thirdly, the teachers discussed the examination system. They underlined the necessity of exams but stated that the grade anxiety, competition, sense of rivalry should be avoided. The focal point is the necessity to use the exams involving oral and written expression instead of multiple-choice exams. Another proposal made within the scope of that question is related with teacher training. Although fewer teachers discussed this subject, the ones who expressed their opinions clearly emphasized that the changes to be made should start from teacher training and teacher initially should keep up with innovations. They have also stated that unless teachers change, teaching and students couldn't change, either. In both questions, it was reached the

conclusion that the answers given to the student and family variables were coherent and the questions were answered seriously.

Compared to the other variables discussed in this study, it is more difficult to take measures on the variables of family and student. Being prominent in the study, teaching and exams, program, teacher training and physical conditions are the variables which can be improved in shorter time. The continuity of the researches in this field and the systematic follow-up of the effects of the measures on the results are considered as a need in order to improve success.

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Uzun Özet

Ülkemizin uluslararası düzeyde uygulanan ve ülkelerin eğitim düzeylerinin birbirleriyle karşılaştırılmasına imkân veren Program for International Student Assesment (PISA), Third International Mathematics and Science Study Repeat (TIMSS-R) ve The Progress in Internaltional Reading Literacy Study (PIRSL) gibi değerlendirme sınavlarındaki başarı düzeyinin düşük olması eğitim sistemimizde bir takım sorunların olduğunun ve bir değişime ihtiyacın işaretcisi olmuştur. Bu durumdan dolayı eğitim programlarının metodolojisi ile ilgili bir dizi program geliştirme çalışması yapılmıştır. Bu çalışmalar ile birlikte ilköğretim programının dayandığı davranışçı yaklaşım terkedilmiş, yerine ağırlıklı olarak yapılandırmacı yaklaşımı esas alan bir program tasarlanmış ve uygulamaya konulmuştur. Bu değişim sınıf içi öğrenme ortamının ve ders materyallerinin değişmesine yol açmıştır. Son yapılan uluslararası

değerlendirme sınavlarının sonuçları dikkate alındığında program değişikliğiyle istenilen düzeyde yükselme olmamıştır. Bu durum konu ile ilgili daha ayrıntılı araştırılmaların yapılması ihtiyacını ortaya koymaktadır.

Ülkelerin eğitim düzeylerinin birbirleriyle karşılaştırılmasına imkân veren PISA uluslararası bir öğrenci değerlendirme projesidir. PISA projesi akademik içeriği itibari ile okuma becerileri, fen bilimleri ve matematik alanlarını değerlendiren çalışmalar yapmaktadır ve 15 yaş grubundaki öğrencilere uygulanmaktadır. Hedefi, gençlerin belirli bir içerik hakkında ne ölçüde uzmanlaştıklarını değil onların, okulda öğrendikleri ile, neler yapabileceklerini belirlemektir.Ülkemizin PISA başarı düzeyi üzerine birtakım araştırmalar yapılmıştır (İş, 2003; Savran, 2004. Berberoğlu ve Kalender, 2005; Okur, 2008; Yıldırım, 2009). Belirtilen çalışmalar ülkemizdeki matematik eğitiminin PISA perspektifinden bir tasvirini ortaya koymakla birlikte, öğretmenlerin bu konu ile ilgili olarak ne düşündüklerine, başarı artırmak için ne önerdiklerine yer veren bir çalışma yapılmamıştır. Doğrudan program geliştirme çalışmaları hakkında öğretmen görüşlerine yer veren Duru ve Korkmaz (2010) gibi az sayıda çalışma olmasına rağmen, bu program değişikliklerini tetikleyen PISA değerlendirmelerine ilişkin öğretmenlerin görüşlerine yer veren bir çalışmaya rastlanamamıştır.

Bu çalışma ilköğretim matematik öğretmenlerinin, 8.sınıf öğrencilerinin PISA soruları ile ilgili başarı düzeyi ve bu başarıyı artırmayla ilgili düşüncelerine yer vermesi ve doğrudan PISA ile ilgili olması ile bu boşluğu doldurmayı amaçlamaktadır. Bu amaçla öğretmenlerin bu sınavlarda elde edilen öğrenci başarısının düşük oluşuna ilişkin görüşleri incelenmiştir. Çalışmaya 140 ilköğretim matematik öğretmeni katılmıştır. Ilköğretim matematik öğretmenlerinin PISA matematik soruları ve ülkemizin PISA matematik başarısı ile ilgili görüşleri yarı yapılandırılmış görüşme formu kullanılarak toplanmıştır. Veri toplama sürecinde öğrencilerin PISA uygulamalarında muhatap olduğu sorular önce öğretmenlere yazılı olarak sorulmuş, cevapları alınmış ve sonra görüşlerine başvurulmuştur. Görüşme formlarından elde edilen veriler öncelikle Word belgesi olarak kayıt edilmiş ve içerik analiziyle çözümlenmiştir. Analiz sürecinde ilköğretim matematik öğretmenlerinin sorulara verdiği cevaplarda anlatılmak istenen düşüncenin tespit edilmesi amacı ile kelime, cümle ve pragraflar kavramlaştırılarak kodlar belirlenmiştir. Daha sonra görüşme verileri Nvivo 8 nitel veri analizi programı aracılığıyla gerçekleştirilmiştir. Programda kodlar serbest kodlar şeklinde oluşturulmuş ve özelliklerine göre belirli gruplar altında toplanarak temalar belirlenmiştir. Kodlar ve temalar, araştırmacılar tarafından belirlenmiş ve tanımlamaya ve yorumlamaya imkan sağlayacak bir biçimde düzenlenmiştir. Her tema ve alt temaların frekansları yüzde olarak ifade edilmiştir. Elde edilen bu yüzdelik değerler nitel araştırmaların doğası gereği sıralama ve fikir verme amacına yönelik olarak kullanılmıştır. Verilerin analiziedilmesinden sonra oluşturulan kodların ve temaların sunulmasında, şekillerden yararlanılmış ve her bir şekilden sonra o kod veya temaya ait görüşlerden bire bir alıntılar yapılarak ilköğretim matematik öğretmenlerinin ifadelerinden örnekler sunulmuştur.

Çalışmanın verilerine göre ilk iki sorunun ortaya koyduğu genel sonuç, öğretmenlerin PISA sorularının bu sınavın uygulandığı öğrenci grubunun düzeyine uygun olduğunu ancak ülkemizdeki öğrencilerin, bu uygunluk düzeyinde başarılı olamayacağı, daha düşük bir başarı elde edeceklerini belirtmişlerdir. İlk soruya verilen cevaplarda, 8. sınıf öğrencilerinin başarı düzeyinin ağırlıklı olarak % 0-25 ve %26-50 oranında beklenmesi öğretmenlerin eğitim-öğretim sisteminin bu soruların gerektirdiği becerileri yeterli düzeyde kazandırmadığı düşüncesinde olduklarını ortaya koymuştur. Yani 2003, 2006 ve 2009 PISA uygulamalarından elde edilen sonuçlar öğretmenler için sürpriz olmamıştır. Bu durum en azından öğretmenlerin farkındalık düzeylerinin yüksek olduğunu ve iyileştirme çalışmalarına katkı verebileceklerini düşündürmektedir.

Öğretmenlerin üçüncü ve dördüncü sorulara verdikleri cevaplar incelendiğinde PISA matematik sınavlarında başarı düşüklüğünün nedenleri önem sırasıyla sırayla; eğitim sistemi (sınavlar ve öğretim) (71), matematik öğretimi programı (60), öğrenci (53), fiziksel koşullar (51), öğretmen (50), aile (8); yapılması gereken değişiklikler için yapılan öneriler de; program (72), fiziki koşullar (46), sınav sistemi (30), öğretmen (19) şeklinde olmuştur. Öğretmen faktöründen söz etmenin bir özeleştiri yapmak olması ve özeleştiri yapmanın güçlüğü dikkate alındığında faktörleri öğretim sistemi ve sınavlar, program, öğretmen ve fiziksel ortam olarak ifade edilebilir.

Öğretmenler başarısızlığın nedenlerini sıralarken öğretim sistemimizde çoktan seçmeli sınavların sistemdeki baskın karakterlerinden, test tekniğinden söz etmişlerdir. İkinci olarak çok değinilen program teması altında içerik, öğrenme ve uygulama süreci başlığı altında öne çıkan kavramlar program, öğretim

süreci ve uygulama sürecidir. Öğretmenlerin üçüncü olarak çokça değindikleri öğrenci teması altında değindikleri husus, sekizinci sınıfa gelinceye kadar aldıkları eğitimin niteliği ile ilgilidir. Ön öğrenmelerinin yetersizliği, motivasyon eksikliği, yaşamla ilişkilendirilmeden yoksunluk, analitik düşünme v.s. her biri nitelikli bir öğrenme ortamının zaman içinde kazandıracağı ve ortadan kaldırabileceği hususlardır.

Öğretmenler PISA sınavlarındaki matematik başarısını arttırmak için öğretim programı, fiziki koşullar, sınav sistemi ve öğretmen yetiştirme politikalarında değişikliğe gidilmesi yönünde görüş bildirmişleridir. Öğretmenler programla ilgili olarak konuların fazlalığına, içeriğin öğrencinin kendisini keşfetmesine imkân vermesine, sonuçtan çok sürece önem verecek öğretim uygulamaları yapılmasına, araştırma ödevlerinin artırılmasının gerekliliğine vurgu yapmışlardır. Öğretmenler yapılabilecek değişikliklerde ikinci sıraya fiziki koşulların düzeltilmesini koymuşlardır. Bu bağlamda ders kitaplarının test ağırlıklı materyaller olmaktan çıkıp kavram bilgisine önem vermesinin, sınıf mevcutlarının öğretmenin öğrencilerle bireysel olarak ilgilenmesine fırsat verebilecek ölçüde az tutulmasının, sınıf ortamlarının kitap, araç-gereç materyal bakımından yeterli hale getirilmesinin gerekliliği üzerinde durmuşlardır. Öğretmenler üçüncü olarak sınav sistemine değinmişler; sınavların gerekliliğini belirtmişler ancak not kaygısı, yarışma, rekabet duygularının önüne geçilmesi gerektiğini ifade etmişlerdir. Bu noktadaki vurgu çoktan seçmeli sınavların yerine sözlü, yazılı anlatıma yer veren sınavların kullanılması gerektiği noktasında olmuştur. Bu soru kapsamında yapılan önerilerden bir diğeri de öğretmen yetiştirme ile ilgilidir. Daha az sayıda öğretmen bu konuya değinmiş olmasına rağmen, fikirlerini açıkça bildirenler yapılacak değişikliklere öğretmen eğitiminden başlanması gerektiğine, öğretmenlerin öncelikle yeniliklere ayak uydurmasına, öğretmen değişmedikçe öğretimin ve öğrencinin değişemeyeceğine vurgu yapmışlardır.

Citation Information

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