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AN ANALYSIS OF TEACHING STRATEGIES EMPLOYED IN THE ELEMENTARY SCHOOL MATHEMATICS TEACHING IN TERMS OF MULTIPLE INTELLIGENCE THEORY

(İLKÖĞRETİM MATEMATİK ÖĞRETİMİNDE KULLANILAN ÖĞRETİM STRATEJİLERİNİN ÇOKLU ZEKA KURAMI AÇISINDAN ANALİZİ)

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ABSTRACT

The purpose of this study is to define teaching strategies that the teacher use through the teaching process of Mathematic courses in elementary schools and to find out which intelligence areas these strategies refer in line with the teachers' point of views. This is a descriptive survey study. The study was conducted with 215 elementary school and mathematics teachers, teaching in the central administrative districts of Adana. The data were collected through the questionnaire developed by the researchers in line with the eight intelligence areas. As for the data analysis, frequency, percentage, indepedent samples t-test and one way variance analysis were computed. The results of this study showed that both elementary school teachers and mathematics teachers used teaching strategies addressing eight intelligence areas in definite frequencies in their classes –though not in every class. Also, it was seen that elementary school teachers tried to refer to more intelligence areas and they significantly differed from mathematics teachers in that respect. Finally, it was found that variety in teaching increased parallel to teachers' teaching experience.

Keywords: Multiple Intelligence Theory, Elementary School, Elementary School Mathematics Teaching Programme

ÖZ

Bu araştırmanın genel amacı, ilköğretim matematik öğretiminde kullanılan öğretim stratejilerinin hangi zeka alanlarına hitap ettiklerini belirlemektir. Araştırma tarama modelinde betimsel bir çalışmadır. Araştırma Adana ili merkez ilçelerinde çalışan 215 ilköğretim matematik branş ve sınıf öğretmeni ile gerçekleştirilmiştir. Araştırmada veriler araştırmacılar tarafından geliştirilen ve sekiz zeka alanına yönelik öğretim stratejilerinin yer aldığı anket form ile toplanmıştır. Araştırma verilerinin analizinde frekans, yüzde, bağımsız gruplar t-testi ve tek yönlü varyans analizi kullanılmıştır. Araştırma sonuçları hem ilköğretim matematik branş hem de sınıf öğretmenlerinin matematik derslerinde sekiz zeka alanına yönelik öğretim stratejilerinin çoğuna her derste olmasa da belirli sıklıklarda yer verdiklerini ortaya koymuştur. Sınıf öğretmenlerinin derslerinde daha fazla zeka alanına hitap etmeye çalıştıkları ve bu yönüyle branş öğretmenlerinden anlamlı bir şekilde farklılaştıkları görülmüştür. Araştırmada ayrıca kıdem arttıkça öğretimde çeşitliliğin de arttığı belirlenmiştir.

Anahtar Sözcükler: Çoklu Zeka Kuramı, İlköğretim, İlköğretim Matematik Öğretimi.

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INTRODUCTION

Today, many psychologists and academicians claim that children make up of their own knowledge as long as they interact with their environment (Brooks and Brooks, 1999a, 1999b; Von Glaserafeld, 1995). Educational environments, however, do not generally reflect this idea. In this context, some teachers still follow learning and teaching methods that they took over from the past. That some educators claim that their past experiences and knowledge offer the best is quite natural. If the children are supposed to generate their own knowledge, some opportunities that are physically and mentally allowing them to move around should be provided for them. Thus, it can be provided for the children to use learning methods that are meaningful for them and to acquire problem-solving skills on this kind of problems by becoming aware of their own problems (Althouse, 1994; Boyd, 2000; Gough, 1999; Sani, 2000; Smerdon, Burkam & Lee, 1999). Therefore; in this context, the students should be directed to be more qualified learners, not only as passive and knowledge receivers. That means that they need to be active individuals who construct knowledge, think, do research, question and produce (Ercanlı, 1997; Gültekin, 2004; İşman, Baytekin, Balkan, Horzum & Kıyıcı, 2002).

NCTM (2000) stated that "equality" is the most important principle that should be based on regarding mathematics teaching. The vision of primary education mathematics teaching curriculum of 2005 is based on the principle that"every child can learn mathematics". In other words, teaching should be carried out by considering the individual characteristics of each student. Besides, according to Reys, Suydam, Linquist and Smith (1998), the learning processes of children should be considered for an effective mathematics teaching. While primary school-age children are going through the abstract process period from concrete process period, improving the children's skills about establishing logical links contributes much to their development and learning processes. In this context, following facts should be taken into consideration for the development of children's mathematical logic:

1- Children should always be communicated.
2- Learning should be supported with the children's previous learning.
3- It should not be forgotten that learning is a developmental process.
4- Learning should be facilitated by meaningful questions.
5- Teachers should always express positive attitudes. (Negative experiences might cause mathematical concerns.)
6- Children should actively participate in the learning process (Reys, Suydam, Linquist and Smith, 1998, 22-30).

Improving the facts mentioned above is only possible with the strategies, methods and techniques that will make every student learn mathematics and with the teachers who can implement these in their classes. These requirements make obligatory to make use of various theories and approaches in mathematics teaching. The multiple intelligence theory which has become one of the basic principles of the planning, implementation and evaluation processes of the educational progression in our country in line with the changes in the elementary school curriculum in 2005 can be assessed from this perspective. Gardner (1983, 1993) identified eight intelligence areas in the scope of the multiple intelligence theory. Individuals might have the abilities to create a product or to solve a problem defined in the framework of one or more cultures by using these intelligence areas as they have a structure which makes many combinations such as talent, competence and skill possible. Therefore, both intelligence and intelligence areas can be improved. Students can construct the information and use it in their real-lives through the activities addressing to all aspects of the individuals and the regulations done in accordance with the principles which the multiple intelligence theory suggests in the educational progress. It can be said that the teachers have to create a supportive atmosphere which allows the students to use these skills during their lives.

According to Akarsu (2001), a lot of research findings indicate that the formations in the brain go through the interaction of genetic characteristics which are specific for species and individual and the characteristics of close environment at critical times. In this situation, parents, teachers and educators carry great responsibilities. If the environment we provide for our children designates their brain functions to some extent, what can we do for this? What we need to do is to provide them experiences that form the ground for children's intelligence areas of and their development. The richness and the diversity of the experiences facilitate and accelerate the development of the intelligence areas and improve the individuals' meaningful learning by making all intelligence areas active in certain ratios.

As a result of the literature review, it was seen that the research that studies could be reached and that are carried out by taking the multiple intelligence theory as the basis were generally about the effect of the multiple intelligence theory on the students' success (Greenhawk, 1997; Coşkungönüllü, 1998; Temur, 2001; İflazoğlu, 2003; Kuloğlu, 2005; Akamca and Hamurcu, 2005; Aydoğan, 2006; Yıldırım, 2006; Yıldırım, Tarım and İflazoğlu, 2006; Işık, 2007; Ercan, 2008; Torun, 2009); the effect of the multiple intelligence theory on the students' attitudes (Akamca and Hamurcu, 2005; Coşkungönüllü, 1998; Kuloğlu, 2005; Şengül and Öz, 2008); the determination of the distribution of students' intelligence areas (Rammstedt and Rammsayer, 2000; Gürçay and Eryılmaz, 2002; Kuloğlu, 2005; Saraç, 2007; Sarıcaoğlu and Arıkan, 2009); the reflection of the multiple intelligence

theory on the education (Talu, 1999; Tarman, 1999) and teachers' and students' point of views about the implementation of the multiple intelligence theory (Aydoğan, 2006; Kutluca, Çatlıalp, Birgin, Aydın and Butakın, 2009). When these research studies were investigated, it was determined that the research carried out by Aydoğan, (2006) investigated the teachers' and students' point of views about the teaching activities implemented on the basis of the multiple intelligence theory, the research carried out by Kutluca, Çatlıalp, Birgin, Aydın and Butakın, (2009) investigated the teachers' point of views about the teaching activities implemented on the basis of the multiple intelligence theory. In both of these studies, teachers' point of views about the studies done in line with the principles of the multiple intelligence theory in the scope of only experimental research were mentioned. However, the multiple intelligence theory is one of the basis of the curriculum together with the amendment made in the elementary school curriculum in 2005 and teachers are supposed to use activities suitable for all intelligence areas according to principles envisaged by the multiple intelligence theory in the learning-teaching process. For this reason, it is important to reveal which teaching strategies elementary school and mathematics teachers use during maths teaching and the distribution of these strategies to the intelligence areas. The problem statements of this research are what teaching strategies the teachers use during maths teaching in classes and to what intelligence areas these strategies address?

The Purpose of the Research

The general purpose of this research is to define the distribution of the teaching strategies that elementary school teachers and mathematics teachers at elementary schools use during maths teaching process according to the intelligence areas. The research questions of this study are as follows:

1. What is the distribution of the teaching strategies that elementary school teachers and mathematics teachers use in their maths classes according to verbal/linguistic, mathematical/logical, musical/rhythmic, visual/spatial, bodily/kinaesthetic, personal/intrapersonal, intrapersonal/social and naturalist intelligence areas?
2. Is there a significant difference between the branches according to the distribution of the teaching strategies that the teachers use to the intelligence areas?
3. Is there a significant difference between the seniority groups of the teachers according to the distribution of the teaching strategies that the teachers use to the intelligence areas?

METHOD

This research is descriptive survey study, aiming to define the distribution of the teaching strategies that teachers use in line with the intelligence areas. The population of the study is 215 elementary school and mathematics teachers working in the central administrative districts of Adana and selected randomly in the academic year of 2007-2008. The sample of the study consisted of 97 mathematics teachers, 54 of whom were females and 43 of whom were males, 113 elementary school teachers, 56 of whom were females and 57 of whom were males. 5 of the teachers in the sample group did not mention their specialization field.

Data Collection Tools

In the study, "An Inventory of Teaching Strategies in Mathematics Teaching" developed by the researchers was used as a data collection tool. The process of developing the data collection tool was presented below.

An Inventory of Teaching Strategies in Mathematics Teaching*:* The inventory was developed by the researchers so as to identify mathematics and elementary school teachers' teaching strategies in the mathematics course. While developing it, some statements were written for the strategies giving direction to the teaching process and expressing the system implemented in directing the interaction between the students and teaching resources during the course. The principles and the eight intelligence areas of the multiple intelligence theory developed by Gardner (1983, 1993) were taken as the basis while writing these statements. These statements were written by the researchers with the help of the resources related with the topic (Armstrong, 1994; Bümen, 2001, 2005; Campbell, 1997; Çakmak, 1999; Çavuş, 2004; Demirel, 2005; Ekici, 2003; Iyer, 2006; Saban, 2004; Tertemiz and Doğan, 2003).

The inventory consists of two parts. In the first part, there were questions, defining the grade levels that the teachers teach, their genders, branches, seniorities and the schools that they graduated from. In the second part, there were statements, expressing the system implemented in directing the teacher-student-teaching resources during the course by associating with eight intelligence areas. There were 5 personal information questions and 75 questions about the activity, totally 80 questions in the inventory prepared as a draft. In the second part of the inventory, the statements were scaled according to the options "never", "once or twice a semester", "once or twice a month", "once or twice in fifteen days" and "in every lesson" across them.

The draft version of the inventory was examined by 3 lecturers giving the mathematics teaching in the Elementary School Teaching Department in the Faculty of Education and 4 lecturers working in the Curriculum and Instruction Department. The group of experts gave feedback on some points about the statements in the second part of the inventory. In line with the

suggestions of the group of experts, 75 statements in the second part were reduced to 72 statements. This form of the inventory was implemented to 20 teachers of 4th and 5th grade class teachers and mathematics teachers and their suggestions were considered. Four statements were excluded from the second part after the teachers' feedback. The final version of the inventory consisted of totally 73 statements, 5 of which were about personal information and 68 of which were about strategy - 3 negative and 65 positive. The inventory was administered by the researchers to 215 teachers who volunteered answer the questionnaire and who were teaching in 28 different elementary schools in the central administrative districts of Adana. After the implementation, the positive statements in the second part of the inventory were scored from 1 to 5 and the negative statements were scored from 5 to 1.

The principal component analysis was computed in order to reveal the factor structure of the questionnaire. Eventually, it was seen that 16 factors eigenvalue of which was 1.00 or above explained the 69.770 % of the variance. After the analysis, 48 items and 8 factors that cover these items were found in the inventory. 20 items which could not be loaded to any of the factors and which were in the questionnaire were excluded. The remaining 48 items were examined in terms of content validity and checked for suitability. 11 of the remaining items were loaded to the first factor, 7 of them were loaded to the second factor, 7 of them were loaded to the third factor, 5 of them were loaded to the fourth factor, 5 of them were loaded to the fifth factor, 4 of them were loaded to the sixth factor, 5 of them were loaded to the seventh factor and 4 of them were loaded to the eighth factor. It was observed that the value of the load factor of the remaining 48 items was between 0.42 and 0.81. It was seen that eight factors explained the 59.198 % of the variance.

The factors were named as appropriate to the items that were loaded to each of the factors by being examined in terms of content. The names of the factors were "studies referring to the mathematical-logical intelligence area (M/M)", "studies referring to the musical-rhythmic intelligence area (M/R)", "studies referring to the personal-intrapersonal intelligence area (K/İ)", "studies referring to the visual-spatial intelligence area (G/U)", "studies referring to the naturalist intelligence area (Doğa)" "studies referring to the bodily-kinaesthetic intelligence area (B/K)", "studies referring to the interpersonal-social intelligence area (K/S)" and "studies referring to the verbal-linguistic intelligence area (S/D)", respectively. Cronbach's alpha was calculated as 0.92 for the total score and M/M= 0.83; M/R= 0.86; K/İ= 0.84; G/U= 0.79; Doğa= 0.84; B/K= 0.88; K/S= 0.84 and S/D= 0.74 for the sub-scales; respectively.

Kaiser-Meyer-Olkin measure of sampling adequacy was found as 0.84 for this solution. Common variance values of the items varied from .35 to .79 and item total correlations varied from .58 to .86. Arithmetic mean values of

the items were between 2.14 and 4.46 and standard deviation values were between 0.81 and 1.53.

The Collection and Analysis of the data

The data collection tool used in this study was administrated to elementary school and mathematics teachers working in the central administrative districts of Adana in the academic year of 2007-2008 by the researchers. The data obtained from the research was analyzed through SPSS statistical package. Independent group t-test and one-way analysis of variance (ANOVA) technigues were used in addition to the descriptive statistics in analysis of the data.

FINDINGS

The distribution of the verbal-linguistic intelligence area oriented teaching strategies that the teachers used and the results about the frequencies of use were shown in Table 1. When Table 1 was considered, it was seen that the teachers used all of the strategies for the verbal-linguistic intelligence area "once or twice a semester". It was found that the teachers used the strategies of *"*I identify some key words about the topic*",* *"*I utilize verbal expressions for making them remember the topic more easily *",* *"*I make them write down the explanations facilitating their understanding the topics from different sources*",* *"*I make them prepare a written report", most in every lesson.

Table 1. The Distribution of the Strategies the Elementary School and Mathematics Teachers Use in terms of the Verbal-Linguistic Intelligence Area

The studies referring to the verbal/linguistic intelligence area	Never		Once or twice a semester		Once or twice a week		Once or twice in fifteen days		In every lesson		TOTAL	
	f	%	f	%	f	%	f	%	f	%	f	%
1. I utilize verbal expressions for making them remember the topic more easily.	8	3.8	12	5.7	24	11.4	47	22.3	120	56.9	211	100
2. I make them prepare a written report.	29	13.9	54	26.0	49	23.6	49	23.6	27	13.0	208	100
3. I make them write down the explanations facilitating their understanding the topics from different sources.	30	14.1	36	16.9	30	14.1	47	22.1	70	32.9	213	100
4. I identify some key words about the topic.	6	2.8	14	6.6	28	13.1	37	17.4	128	60.1	213	100

The distribution of the strategies the elementary school and mathematics teachers use referring to the mathematical-logical intelligence area and the results about the frequencies of use were given in Table 2. When Table 2 was considered, it was seen that the teachers used all of the strategies for the mathematical-logical intelligence area "once or twice a semester". It was found that the teachers used the strategies of *"asking questions for using the thinking skills", "using different ways in solving a problem", "making the students solve the problems by using different ways", "revealing different problem states", "revealing the similarities and differences to explain the topic", "making the students find the solutions on their own"* and *"solving problems that make the students explore the mathematical rules and basic concepts"* most in every lesson.

Table 2. The Distribution of the Strategies the Elementary School and Mathematics Teachers Use in terms of the Mathematical-Logical Intelligence Area

The studies referring to the mathematical/logical intelligence area	Never		Once or twice a semester		Once or twice a week		Once or twice in fifteen days		In every lesson		TOTAL	
	f	%	f	%	f	%	f	%	f	%	f	%
1. I associate some topics with the other courses.	3	1.4	11	5.3	32	15.3	74	35.4	89	42.6	209	100
2. I convey the learned information by a mathematical formula.	10	4.7	18	8.5	33	15.5	78	36.6	74	34.7	213	100
3. I develop a strategy game (building relationship) related with the topic.	9	4.3	18	8.6	44	21	61	29	78	37.1	210	100
4. I expose similarities and differences to explain the topic.	4	1.9	14	6.6	20	9.4	57	26.8	118	55.4	213	100
5. I present different problem states.	3	1.4	9	4.2	24	11.3	52	24.4	125	58.7	213	100
6. I ask questions intended for using the thinking skills.	-	-	9	4.3	18	8.6	51	24.3	132	62.9	210	100
7. I make students solve problems by using various ways.	7	3.3	12	5.7	23	10.8	38	17.9	132	62.3	212	100
8. I solve problems which make students explore mathematical rules and basic concepts.	4	1.9	10	4.7	25	11.6	61	28.4	115	53.5	215	100
9. I ask problems that could be solved by using more than one strategy.	5	2.3	8	3.7	26	12.1	75	34.9	101	47.0	215	100
10. I make students find the solutions by themselves.	3	1.4	1	5.1	25	11.6	59	27.4	117	54.4	215	100
11. I use different ways to solve a problem.	5	2.3	7	3.3	23	10.8	45	21.1	133	62.4	213	100

The distribution of the strategies the elementary school and mathematics teachers use referring to the musical-rhythmic intelligence area and the results about the frequencies of use were given in Table 3.

Table 3. The Distribution of the Strategies the Elementary School and Mathematics Teachers Use in terms of the Musical-Rhythmic Intelligence Area

The studies referring to the musical/rhythmic intelligence area	Never		Once or twice a semester		Once or twice a week		Once or twice in fifteen days		In every lesson		TOTAL	
	f	%	f	%	f	%	f	%	f	%	f	%
1. I find some tongue twisters related with the topic and use them in class.	17	7.9	31	14.5	40	18.7	64	29.9	62	29.0	214	100
2. I use some rhythm patterns while teaching some formulas and concepts.	27	12.7	38	17.9	36	17.0	64	30.2	47	22.2	212	100
3. I associate some lyrics with the topics I cover.	64	29.8	37	17.2	28	13.0	44	20.5	42	19.5	215	100
4. I collect the songs about the topic and use them.	82	38.1	32	14.9	30	14.0	35	16.3	36	16.7	215	100
5. I start the lesson with music.	91	43.3	41	19.5	40	19.0	33	15.7	5	2.4	210	100
6. I want students to tell the explanations related with the topic by defining a rhythm.	57	27.7	63	30.6	43	20.9	33	16.0	10	4.9	206	100
7. I change the lyrics with the ones related with the topic.	73	35.4	49	23.8	53	25.7	20	9.7	11	5.3	206	100

When Table 3 was taken into account, it was seen that the 40 % of the teachers (80 teachers) did not use the strategies of *"starting the lesson with music (43.3 %)"* and *"collecting and using the songs related with the topic (38.1 %)"* for the musical-rhythmic intelligence area. It was determined that the teachers used the strategies of *"I find and use tongue twisters related with the topic (29.0 %)", "I use some rhythm patterns in teaching some formulas and concepts (22.2 %)"* and *"I associate some lyrics with the topics I cover*

(19.5 %)" for the musical-rhythmic intelligence area. In addition, it was found that 70 % of the teachers (140 teachers) used strategies for this intelligence area "once or twice a semester", "once or twice a month", "once or twice in fifteen days" even if not every lesson.

The distribution of the strategies the elementary school and mathematics teachers use referring to the visual-spatial intelligence area and the results about the frequencies of use were given in Table 4.

Table 4. The Distribution of the Strategies the Elementary School and Mathematics Teachers Use Referring to the Visual-Spatial Intelligence Area

The studies referring to the visual/spatial intelligence area	Never		Once or twice a semester		Once or twice a week		Once or twice in fifteen days		In every lesson		TOTAL	
	f	%	f	%	f	%	f	%	f	%	f	%
1. I draw tables/clusters/graphics/diagrams/ figures appropriate for the topic.	16	7.6	21	10	38	18.1	42	20.0	93	44.3	210	100
2. I explain the topic with pictures.	27	13.0	39	18.8	43	20.7	54	26.0	45	21.6	208	100
3. I present the topic by using one of the projection /overhead projector/slides/video instruments.	31	15.0	40	19.4	39	18.9	58	28.2	38	18.4	206	100
4. I make students prepare posters, notice boards, advertisements and wall papers.	25	12.1	46	22.2	50	24.2	53	25.6	33	15.9	207	100
5. I use the board in my classes.	4	1.9	10	4.7	21	9.9	26	12.3	151	71.2	212	100

According to Table 4, it was seen that the teachers used all visual-spatial intelligence area oriented strategies at least "once or twice a semester" and 71.2 % of the teachers used especially "using the board in the classes" strategy in every lesson. However, it was found that 1.9 % and 15 % of the teachers "never" used the visual/spatial intelligence area oriented strategies in their classes.

The distribution of the strategies the elementary school and mathematics teachers use referring to the bodily-kinaesthetic intelligence area and the results about the frequencies of use were given in Table 5.

Table 5. The Distribution of the Strategies the Elementary School and Mathematics Teachers Use in terms of the Bodily-Kinaesthetic Intelligence Area

The studies referring to the bodily/kinaesthetic intelligence area	Never		Once or twice a semester		Once or twice a week		Once or twice in fifteen days		In every lesson		TOTAL	
	f	%	f	%	f	%	f	%	f	%	f	%
1. I use the drama method.	25	12.0	33	15.8	49	23.4	52	24.9	50	23.9	209	100
2. I make students prepare materials related with the course.	10	4.8	34	16.2	47	22.4	61	29.0	58	27.6	210	100
3. I make students prepare models of the figures related with the topic.	13	6.3	43	20.7	52	25.0	53	25.5	47	22.6	208	100
4. I make students prepare cards (game, puzzles etc.) related with the topic which will be covered.	20	9.6	36	17.2	43	20.6	69	33.0	41	19.6	209	100

Table 5 showed that the teachers used all bodily/kinaesthetic intelligence area oriented strategies at least "once or twice a semester", 4.8 % and 12 % of the teachers, however, "never" used these strategies in their classes and 2.32 % and 3.25 % of them did not answer the item.

The distribution of the strategies the elementary school and mathematics teachers use referring to the personal-intrapersonal intelligence area and the results about the frequencies of use were given in Table 6. Table 6 illustrated that nearly all teachers used all personal/intrapersonal intelligence area oriented strategies at least "once or twice a semester". It was found that 65 % of the teachers were tending to use especially *"creating a supportive educational environment for the students who think in a different way and who offer different ways to solve the problems"* in every lesson.

Table 6. The Distribution Of The Strategies The Elementary School And Mathematics Teachers Use In Terms Of The Personal-Intrapersonal Intelligence Area

The studies referring to the personal/intrapersonal intelligence area	Never		Once or twice a semester		Once or twice a week		Once or twice in fifteen days		In every lesson		TOTAL	
	f	%	f	%	f	%	f	%	f	%	f	%
1. I assign homework that the students need to do on their own.	5	2.4	12	5.7	31	14.8	64	30.5	98	46.7	210	100
2. I want students to explain their feelings/ opinions related with the topics.	6	2.9	21	10	27	12.9	54	25.8	101	48.3	209	100
3. I create opportunities for the students to assess their own works.	5	2.4	16	7.7	34	16.3	65	31.3	88	42.3	208	100
4. I provide alternatives for the students while determining the annual assignment or project topics.	6	2.9	30	14.3	45	21.4	45	21.4	84	40.0	210	100
5. I make the students work individually in the class.	3	1.4	25	11.8	39	18.4	58	27.4	87	41.0	212	100
6. I encourage the students about different thinking styles.	2	0.9	10	4.7	27	12.7	40	18.9	133	62.7	212	100
7. I create a supportive educational environment for the students who offer different ways to solve the problems.	3	1.4	14	6.6	20	9.5	32	15.2	142	67.3	211	100

The distribution of the strategies the elementary school and mathematics teachers use referring to the interpersonal-social intelligence area and the results about the frequencies of use were given in Table 7.

Table 7. The Distribution of the strategies the Elementary School and Mathematics Teachers use in terms of the Interpersonal-social Intelligence Area

The studies referring to the interpersonal/social intelligence area	Never		Once or twice a semester		Once or twice a week		Once or twice in fifteen days		In every lesson		TOTAL	
	f	%	f	%	f	%	f	%	f	%	f	%
1. I use different activities which are based on group work in my classes.	5	2.4	28	13.3	48	22.9	68	32.4	61	29.0	210	100
2. The students generally work in small groups in my class.	16	7.7	38	18.2	46	22	68	32.5	41	19.6	209	100
3. I use thinking aloud problem solving method.	17	8.1	25	11.8	41	19.4	55	26.1	73	34.6	211	100
4. I make the students teach the topic each other.	12	5.8	18	8.7	40	19.2	56	26.9	82	39.4	208	100
5. I give homework/project assignments that need to be done in groups.	10	4.7	52	24.6	41	19.4	59	28	49	23.2	211	100

When Table 7 was regarded, it was seen that 0.9 % and 8.1 % of the teachers "never" used interpersonal/social intelligence area oriented strategies in their classes and 1.86 % and 3.25 % of them did not answer the item. It was found that most of the teachers used these strategies at least "once or twice a semester". The strategies that the teachers use "in every lesson" were *"I make students teach the topic to each other", "I use thinking aloud problem solving method in the class", "I use different activities which are based on group work in my classes", "I give homework/project assignments that need to be done in groups"* and *"The students generally work in small groups in my classes"*, respectively.

The distribution of the strategies the elementary school and mathematics teachers use in terms of the naturalist intelligence area and the results about the frequencies of use were given in Table 8. When Table 8 was addressed, it was seen that the teachers used all bodily/kinaesthetic intelligence area oriented strategies at least "once or twice a semester", 1.9 % and 7.2 % of the teachers, however, "never" used these strategies in their classes. It was found that 40 % of the teachers used the strategies of *"helping the students explore the mathematics existing in the universe", "assigning*

some observation tasks about field calculations, geometric shapes etc.", and *"associating the nature with the mathematics topics"* "in every lesson.

Table 8. The Distribution of the Strategies the Elementary School and Mathematics Teachers Use in terms of the Naturalist Intelligence Area

The studies referring to the naturalist intelligence area	Never		Once or twice a semester		Once or twice a week		Once or twice in fifteen days		In every lesson		TOTAL	
	f	%	f	%	f	%	f	%	f	%	f	%
1. I make use of the nature to teach the topics.	4	1.9	39	18.5	50	23.7	44	20.9	74	35.1	211	100
2. I associate the nature with the mathematics topics.	4	1.9	26	12.3	47	22.3	58	27.5	76	36.0	211	100
3. I assign some observation tasks about field calculations, geometric shapes etc.	6	2.8	31	14.7	36	17.1	66	31.3	72	34.1	211	100
4. I help them explore the mathematics exisiting in the universe.	5	2.4	31	14.8	38	18.2	51	24.4	84	40.2	209	100
5. I make the students form some problems by utilizing their real-life situations.	15	7.2	31	15.0	42	20.3	53	25.6	66	31.9	207	100

Indepedent samples t-test was done to find out whether the average scores according to the teaching strategies that the elementary school and mathematics teachers use differentiate or not. The results of the analysis were shown in Table 9.

Table 9. The Comparison of the Scores of the Teaching Strategies that the Elementary School And Mathematics Teachers Use, T-Test Results

Intelligence Areas	Teacher Groups	N	$\overline{X}$	SS	t	p
Verbal/Linguistic	Classroom teachers	113	3.78	.76	3.724	.0001
	Mathematics teachers	97	3.36	.91		
Mathematical/Logical	Classroom teachers	113	4.31	.54	2.691	.008
	Mathematics teachers	97	4.09	.65		
Musical/Rhythmic	Classroom teachers	113	3.21	.87	8.618	.0001
	Mathematics teachers	97	2.21	.80		
Visual/Spatial	Classroom teachers	113	3.91	.87	6.458	.0001
	Mathematics teachers	97	3.17	.80		
Bodily/Kinaesthetic	Classroom teachers	113	3.85	.84	7.021	.0001
	Mathematics teachers	97	2.93	.87		
Personal/Intrapersonal	Classroom teachers	113	4.29	.65	3.849	.0001
	Mathematics teachers	97	3.90	.82		
Interpersonal/Social	Classroom teachers	113	3.78	.79	3.055	.003
	Mathematics teachers	97	3.42	.89		
Naturalist	Classroom teachers	113	3.90	.89	2.657	.008
	Mathematics teachers	97	3.57	.91		

When Table 9 was taken into account, it was seen that the average scores of the teaching strategies concerning all intelligence areas that the elementary school and mathematics teachers use differed from each other. According to the results of independent samples t-test, it was found that there was a significant difference in terms of the average scores of the teaching strategies that the elementary school and mathematics teachers use intended for the intelligence areas of verbal/linguistic [t(208)=3.724, p=.0001], mathematical/logical [t(208)= 2.691, p=.008], musical/rhythmic [t(208)= 8.618, p=.0001], visual/spatial [t(208)=6.458, p=.0001], bodily/kinaesthetic [t(208)=7.021, p=.0001], personal/intrapersonal [t(208)=3.849, p=.0001], interpersonal/social [t(208)=3.055, p=.001] and naturalist [t(208)=2.657, p=.008] and it was revealed that this difference was in favor of the elementary school teachers when the mean scores of this difference were studied.

The seniority of the teachers, mean and standard deviations of the scores of the teaching strategies according to the intelligence areas and the results of one-way variance analysis were given in Table 10.

Table 10. The Comparison of the Seniority of the Teachers and the Scores of the Teaching Strategies that the Teachers Use towards the Intelligence Areas, the Results of One-Way Variance Analysis

Intelligence Areas	Seniority	N	$\overline{X}$	SS	F	p	Scheffe-F
Verbal/Linguistic	1-10 years	84	3.23	.98	17.774	.0001	11-20 years>1-10 years 21 or more years >1-10 years 21 or more years >11-20 years
	11-20 years	66	3.65	.68			
	21 or more years	65	4.00	.59			
Mathematical/Logical	1-10 years	84	3.91	.64	25.034	.0001	11-20 years>1-10 years 21 or more years>1-10 years 21 or more years >11-20 years
	11-20 years	66	4.29	.53			
	21 or more years	65	4.53	.40			
Musical/Rhythmic	1-10 years	84	2.22	.80	25.575	.0001	11-20 years>1-10 years 21 or more years>1-10 years
	11-20 years	66	2.87	.91			
	21 or more years	65	3.23	.95			
Visual/Spatial	1-10 years	84	3.18	.84	15.693	.0001	11-20 years>1-10 years 21 or more years>1-10 years
	11-20 years	66	3.66	.89			
	21 or more years	65	3.94	.82			
Bodily/Kinaesthetic	1-10 years	84	3.15	.92	7.096	.001	21 or more years>1-10 years
	11-20 years	66	3.37	.90			
	21 or more years	65	3.78	.98			
Personal/Intrapersonal	1-10 years	84	3.87	.81	11.897	.0001	21 or more years>1-10 years 21 or more years >11-20 years
	11-20 years	66	4.08	.75			
	21 or more years	65	4.44	.52			
Interpersonal/Social	1-10 years	84	3.54	.92	6.747	.001	21 or more years>1-10 years 21 or more years >11-20 years
	11-20 years	66	3.39	.79			
	21 or more years	65	3.91	.72			
Naturalist	1-10 years	84	3.52	.86	7.452	.001	21 or more years>1-10 years
	11-20 years	66	3.72	.93			
	21 or more years	65	4.08	.84			

When Table 10 was taken into consideration, it was seen that the mean scores of the teaching strategies that the teachers according to their seniorities used were different from each other. One-way variance analysis was done so as to find out whether this difference between the mean scores was significant or not. The results of the one-way variance analysis revealed that there were

significant differences, "verbal/linguistic [F(2,212)=17.774; p<.01]", "mathematical/logical [F (2,212) = 25.034; p<.01]", musical/rhythmic [F (2,212) = 25.575; p<.01]", visual/spatial [F (2,212) = 15.693; p<.01]", bodily/kinaesthetic [F (2,212) = 7.096; p<.01]", personal/intrapersonal [F (2,212) = 11.897; p<.01]", interpersonal/social [F (2,212) = 6.747; p<.01]", and naturalist [F (2,212) = 7.452; p<.01]". Scheffe-F test was applied in order to determine to which teachers according to their seniorities this difference was in favour of. The results of Scheffe-F test found a significant difference between teachers with 11-20 year-experience and 1-10 year-experience in favour of the teachers with seniority of 11-20 year-experience in the intelligence areas of verbal/linguistic, musical/rhythmic and visual/spatial and a a significant difference between teachers with 20 year and more experience and 1-10 year-experience in favor of teachers with seniority of 20 year and more experience. In the mathematical/logical intelligence, a significant difference was found in favor of teachers with 11-20 years of experience and teachers with more than 20 years of experience. In addition to that, in personal/intrapersonal, interpersonal/social, bodily/kinaesthetic, naturalist intelligence areas, a significant difference was seen in favor of 21 and more year-experienced teachers.

RESULTS, DISCUSSION AND SUGGESTIONS

The results of the research reveal that both elementary school teachers and mathematics teachers mostly use activities addressing the verbal/linguistic, mathematical/logical, interpersonal/social, personal/intrapersonal and naturalist intelligence areas in maths classes and mathematics teachers used the strategies of "I start the lesson with music" and "I collect songs related with the topic" referring to the musical/rhythmic intelligence area less than the elementary school teachers. Besides, it was seen that the elementary school teachers used the strategies of *"I present the topic by using one of the projection/overhead projector/slides/video instruments and I make students prepare posters, notice boards, advertisements and wall papers"* referring to the visual/spatial intelligence area and the strategies of *"using the drama method, making the students prepare materials related with the lesson, making the students build models related with the topic"* referring to the boidly/kinaesthetic intelligence. This result can imply that both elementary school teachers and mathematics teachers arrange the teaching process in a way that addresses to different intelligence areas. It can be said about this finding that it is convenient for the objective aiming to train individuals who can find new solutions to every kind of problem, can adapt themselves to the constantly changing society conditions, and to teach individuals where and how they can gain the information and skills they need

along with providing information and skills for them and preparing the child to the adult society (Razon, 1997).

Campbell, (1997); Goodlad, (2004); Kornhaber, Fierros, and Veenema, (2004) also stated that the teachers in the field of the multiple intelligence theory underlined the importance of awareness about the necessity of using teaching strategies for the all intelligence areas. When both the mathematics teachers and elementary school teachers use teaching strategies referring to different intelligence areas in the learning-teaching process, it is more probable to come across with the individuals who question and can come up with ideas about the reasons while learning mathematics and who can think about the solutions of their own problems and make decisions about them.

It was seen that the teachers used some of the strategies referring to the visual/spatial, musical/rhythmic and bodily/kinaesthetic intelligence areas less in the learning/teaching processes. However, it is important to use teaching strategies referring to the visual/spatial, musical/rhythmic and bodily/kinaesthetic intelligence areas in terms of visualizing and concretizing the topic, forming the abstract mathematical concepts in the students' minds. The findings of the study carried out by Gardner and Hatch (1989) are in line with the ones obtained in this study. Gardner and Hatch (1989) stated in their study that the teachers used only two symbol forms (language and logic-mathematics) in the learning-teaching process and leave the usages of the other symbols out of school.

It was observed that elementary school mathematics teachers and elementary school teachers differ from each other in terms of using the teaching strategies referring to the intelligence areas and this difference was in favour of the elementary school teachers. This may have derived from the idea that elementary school teachers focused on the process of teaching mathematics more due to their training they attended. However; elementary school mathematics teachers may have dealt with teaching the actual mathematics knowledge, instead of focusing on how to teach. Altun (2005) defined mathematics as a science which is based on abstraction that the mind-itself- produces and he added that high level mathematics which is not in need of the environmental support is self-productive in line with its on dynamics. This may have derived from the fact that mathematics has been regarded as an operational science, not a conceptual one in our country (Baki and Bell, 1997).

It was found that the teachers' teaching strategies through intelligence areas differed according to their experience period and this difference was in favor of experienced teachers. Therefore, it can be said that the teachers' experience and their use of teaching strategies addressing the intelligence areas are in line with each other. In other words; as the year of experience increases, the variety of using teaching strategies increases. In the same manner; Baki and Bell (1997) mentioned that mathematics are taught operationally, not conceptually at the level of faculty education, so novice

teachers avoid using different teaching strategies in their first years. However; as they become experienced, they start to use various techniques.

What is crucial in education is the establishment of learning permanence. When teachers employ different teaching strategies in their classes, the courses will become more enjoyable, so we can provide long-term retention in learning. Also, if we arrange our courses by taking into account students' individual differences, our students will make the most of this system and will be able to contribute students' learning. Whatever the level of the class is, individual differences among students should be considered. Therefore; teachers ought to organize their courses in line with multiple intelligence areas because a good education includes teaching students how they learn and how they provide motivation. In this context, teachers should be able to arrange teaching strategies in line with the multiple intelligence theory. To do this, teachers should learn about multiple intelligences and should be aware of their students' interests and abilities. In addition, necessary precautions ought to be taken in order to make teachers develop themselves in a way that they keep other variables affecting the teaching process (family, school facilities etc.) under control (Cambell, 1997).

Within the limitations of this research, the study aimed to investigate to what extent the principles of the multiple intelligence theory which formed one of the basis of the elementary school programme completely restructured in the academic year of 2005 could be achieved in the application stage by the teachers. According to Gardner (1999), a teacher who thinks there is only one method on teaching mathematics takes the risks about facing with many failures just at the beginning of the teaching process. If the teacher, however, thinks that there are a great number of methods on teaching mathematics, she or he will be more successful without any doubt. It is important to understand students and be aware of how they think, instead of evaluating whether they solve the maths problems or not. In this context, teachers should attend in-service teacher training programs that help teachers become aware of their own intelligence areas and develop themselves. They should be guided to teach their students not at an operational level, but at a comprehension level through various approaches. In that way, conceptual learning can be achieved. Novice teachers should be encouraged to make use of new approaches in their classes and necessary precautions should be taken about that.

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