



The Effects of Teaching Activities Prepared According to the Multiple Intelligence Theory on Mathematics Achievements and Permanence of Information Learned by 4th Grade Students

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Аннотация

The aim of this research is to reveal that to teaching activities which are designed according to the Multiple Intelligence Theory have effects on the students success in mathematics and on the permanence of the knowledge learned. This research has been carried out the fourth graders at Gazi University Foundation Private Primary school. Among all the classes, two of them were selected, 4-A was selected as an experimental group and 4B as a control group considering their pre-test points. The groups attending to the research were applied a permanence test which examines the behaviors that have to be gained before the subject to be taught, after the subject and the month after the completion of the subject. The points acquired from pre-test were used in order to balance the groups and final test points were used in order to determine the success points and permanence test was used in order to bring up the level of oblivion. It is found out that the average of the final test's points of the experimental group who studied in accordance with Multiple Intelligence Theory was 18.08, were as the average of the final test's points of the control group was 15.95. The t point was determined as 2.55 in the analysis of t test. Because of the fact that the table t point in the level 0.5 was 2.06 it is understood that the result is to the advantage of the experimental group.

Ключевые слова: Mathematics, Teaching mathematics, Multiple Intelligence



INTRODUCTION

People have some characteristics that distinguish them from others. One of these characteristics is intelligence. Studies conducted to define the features of intelligence date back to ancient times. Studies in a scientific sense started to be conducted after 1900's; however, these efforts have not been sufficient enough to turn intelligence into a concept explained by one single definition (Bajaran, 1992:82). A few explanations defining intelligence are as follows:

Intelligence is a concept explaining all intellectual powers people have (Stoddard, 1956:5). "Intelligence is the power of adaptation to environment in new and surprising conditions, the power of abstraction and problem solving (Selyuk, 1999: 63). Binet defines intelligence as the capacity of reasoning, decision making and self-criticism (Toker et al., 1968:64). Thorndike defines intelligence as the ability to react positively in terms of the reality or phenomena (Toker et al., 1968:64).

When we look at it from an educational perspective, we see that the quality rather than the definition of intelligence comes into prominence. Since there is no consensus on "What is intelligence?" and "How can it be measured?", many theories have been developed (Bajaran, 1992:82). Spearman's Two Factors Theory, Thorndike's Multiple Factors Theory, Thurstone's Group Factor Theory, Piaget's Theory of Equilibrium and Gardner's Multiple Intelligence Theory can be listed as examples in this scope. In this study, Gardner's Multiple Intelligence Theory will be discussed and the effects of teaching activities based on this theory on mathematic achievements and the permanence of information learned by students will be tested.

Gardner suggests that there are eight intelligence domains relatively independent from each other. Moreover, he suggests that experiences gained also affect intelligence types. In the light of this assumption, Gardner suggests that intelligence domains of an individual should be profiled taking into consideration the culturally-valued behaviors within a specific environment, rather than applying a single test to detect the intelligence of the individual. The most important development on the issue of "What is intelligence?" is the agreement reached by nearly all researchers that at least some aspects of our intellectual skills are related with our past experiences (Yekovich, 1994:2).



Multiple Intelligence Theory represents the pluralist appearance of intelligence domains and the diversity of the ways of expressing the skillfulness and skills of the individual in the scope of their own culture (Allen, 1997).

Gardner suggests that all people have many intelligence domains, although, everything that makes life interesting is not equally distributed to each intelligence domain and that everyone is not provided with the same intelligence composition. Each classroom in a school is an intelligence garden. While plants look the same from a distance, each grows in a different way and produces a different fruit. A teacher should detect the superiorities of logical-mathematical, musicalrhythmic, visual-spatial, bodily-kinesthetic, naturalist, intrapersonal, interpersonal intelligence domains of their students just as a gardener who distinguishes how healthy and well-developed his plants are. Only in this way, can a teacher help their students to be successful (Sweet, 1998:50). Multiple Intelligence Theory goes beyond being an intelligence theory; rather it is an education philosophy showing how students learn and how teachers should teach (Hoerr, 1997:43). Education programs should be enriched with this approach in mind. Educational conditions can benefit with the implementation of Multiple Intelligence Theory.

Use of Multiple Intelligence Theory in Classroom Settings

According to the statements quoted by Jenkins (1997), Dr. Deming, who reminds us that all children should be seen to be bom "as motivated" rather than believing that students should be "motivated", suggests that trainers do not need to know how to motivate students, rather they should know what decreases students' motivation. When a teacher always uses the method s/he finds the easiest and fails to meet students' needs, the students' motivation is affected negatively. There are many possible methods which can be applied in a classroom setting. What is important is to select methods and techniques which are appropriate for the subject and which enable active participation of the students. Thus, motivation and discipline problems will be eliminated and more permanent learning behaviors will be ensured.

The use of Multiple Intelligence Theory in a classroom setting can solve possible motivation and discipline problems. However, Gardner always suggests that Multiple Intelligence Theory is not an education prescription; that this theory can always be applied in



education; that it is the trainers who will detect the areas to which this theory will be applied; and that the teaching activity to be performed according to this theory does not have one specific way. He underlines the need to handle nearly all issues (in the application phase) by using different methods from storytelling to regular discussions and artistic research (Vickers,1995:130-131).

An important result is obtained when looked at from a different perspective. Since all children do not learn with the same method, it will be possible to reach more children using this approach. Gardner calls this attractive approach, figuratively speaking "different windows into the same room". When students observe that a teacher can explain a piece of information using a number of different ways, they understand what it means to be an expert and also discover that they can also explain a specific subject in more than one way (Vickers,1995: 131-132).

Individuals acquire these eight intelligence types at birth. However, each student comes to a classroom as an individual who has developed a different type of intelligence. This means that each student has their own intelligence superiorities and weaknesses. These intelligence domains determine how easily or difficultly a student can learn through a specific teaching method. This is called a "learning style". There can be more than one learning style in a classroom. Therefore, it is not impossible for a teacher to teach every lesson according to each learning style present in the classroom. However, a teacher should show students how to understand a subject which indeed addresses one of their weak intelligence domains by applying their most developed intelligence domain. For instance; a student who has a highly-developed musical intelligence can be asked to learn about a war and what happened during that war by making up a song about it (Brualdi, 1996).

The aim of this study is to observe the effects of the activities developed by taking into consideration the learning styles of students according to Multiple Intelligence Theory on the achievements of students in mathematic lessons. Mathematics has always been a lesson deemed difficult among students. Situations arising from mathematics which make it a concern include: students being asked to tell a mathematical answer while the whole class waits silently for the expected answer; asking a student to do something on the board although the student does not want to do so; awarding correct answers in an exaggerated way and exhibiting disappointment when a wrong answer is given; attaching importance to speed and time limitations during lessons and examinations;



deeming an oral answer completely wrong without listening to the correct parts of the answer; shaming a student when s/he is alone or in a group due to a poorly-produced piece of work; giving attention and compliments to only successful and fast students; giving mathematics homework as a punishment; and shaming a student when s/he is alone or in a group labelling her/him as "slow" or "unsuccessful"; etc.

Situations to have been generally defined as problems for years by teachers and parents result from learning differences (Wahl, 1999:48). Studies point out that when learning opportunities are combined in the curriculum through eight intelligence domains, students can be academically more successful, notice their own learning strategies and be more self-confident (Allen, 1997).

When we look at our surroundings, we can see many buildings that could not have been constructed without the use of huge mathematical knowledge. As adults, we generally ignore the communication that can be established between children and the natural mathematic world around them. Today's world is full of activities for solving mathematical problems. We can be quite successful if we are more aware of the channels and situations around us and use this information in teaching our students (Krongh, 1995).

Mathematic education should be given in an orderly, planned and integrated manner to ensure that children establish a connection with the surrounding mathematical world. Mathematic curriculum should be prepared so as to serve these principles and planned to serve expected behavioral changes.

A curriculum developed according to Multiple Intelligence Theory, on the other hand, will focus not only on the skills used within a school setting but also more importantly, on skills and abilities to be used in daily life. A curriculum to be prepared on the basis of this theory will also include objectives, content, educational status and evaluation parts. However, education status will be filled with activities and tools - materials based on the eight intelligence domains. Evaluation will not be composed of a few questions; rather, it will be composed of observation reports kept by the teacher during the year, student projects and many check-lists prepared for the students. Since students will play an active role in the preparation of student files and experience the evaluation process individually, they will develop pride in themselves and will have the opportunity to monitor their own improvement.



Teaching activity conducted via Multiple Intelligence Theory will automatically decrease the concern for mathematics as an activity addressing the well-developed perception channel of the student which will be conducted during the lesson. Turning the teaching process into intrapersonal intelligence and informing each student on her/his past concerns and fears (regardless of the well-developed intelligence domains of the student), will decrease the concern for mathematics. A student can get rid of her/his concerns with the help of a simple and sympathetic speech (Wahl, 1998: 48).

Multiple Intelligence Theory and Evaluation

In the scope of the classical education system we use, monitoring and achievement tests are deemed enough for learning evaluation. The evaluation process is completed by applying written examinations and multiple choice tests. Such kinds of evaluation methods aim at measuring verbal-linguistic and mathematical-logical intelligence.

Some researchers suggest that the limits of a child's abilities can never be defined clearly; thus, test results should not be fully trusted. They think tests can reveal only a small part of the whole (Güven, 1997: 71).

With the introduction of Multiple Intelligence Theory, there is a shift from the well-known evaluation and assessment made at the end of each chapter to a learning which is much more comprehensive. In other words, teachers will have the opportunity to observe and assess their students throughout the learning-teaching process.

According to Gardner and Hatch, performance- based tools should be improved so as to measure all intelligence domains successfully. For instance, a test aimed at measuring a concept including the kinesthetic ability of an individual should not be a kind of written test. On the contrary, it should be a physical activity (Allen,1997).

Another way of making an evaluation based on Multiple Intelligence Theory is to observe children. Since students with highly-developed linguistic intelligence can be observed while speaking, students with highly-developed visual-spatial intelligence can be observed drawing or dreaming; students with highly-developed interpersonal intelligence while in discussion with other students; and students with highly-developed bodily intelligence can be observed while running. Another method is to observe students in their free time. By way of these observations, it will be possible to learn how students master skills more effectively. In addition to such



kinds of observations, a marking list including the characteristics of each intelligence domain can be prepared. Information and documents can be collected by recording students' work, by taking photos of student drawings and by recording students' voices when singing. By looking at school reports and by examining different grades students' achieve in lessons, we can predict student types (Armstrong, 1994b: 128,129).

Education activities conducted on the basis of Multiple Intelligence Theory has a project-oriented approach. Guidance must be given to a student to ensure that s/he produces an outcome about the issue that will be taught. Students should be set free in deciding their own subject within the scope of class projects. Project activities teach an individual the ability to control one's learning. For this reason, before participating in a classroom activity, students should know that they have to do the following

- Set their objectives
- Present their objectives in the form of questions
- Write down at least three sources to be applied for information
- Define the steps to be taken to achieve the objectives
- Prepare a study program (Campbell,1997:17) .

A record book can be kept for the assessment to be made on the basis of Multiple Intelligence Theory. By recording each chapter of this book, one can understand the course of the lesson and whether or not the teacher has ignored any intelligence domain. The number of students using each intelligence domain should be recorded in this book and some small observations can be entered in the "comments" section (Emig, 1997:48)

The effectiveness of sole standard tests will decrease and a more reliable and effective assessment system will start to be implemented with the introduction of Multiple Intelligence Theory.

Accordingly, Multiple Intelligence Theory is an important factor for effective a high-quality teachinglearning process and the success to be achieved from this (Mayer: 1997). The subject of this study is the effects of the activities prepared according to Multiple Intelligence Theory on the mathematic achievements of 4th grade students.



Purpose

The purpose of this study is to detect the effects of the training activities developed according to Multiple Intelligence Theory on student achievement and permanency.

Answers will be sought for the following questions for this purpose:

1. Are there any differences between the final test scores of the experimental group subjected to teaching activities prepared according to Multiple Intelligence Theory and the control group subjected to a traditional method?
2. Are there any differences between the achievement scores of the experimental group subjected to teaching activities prepared according to Multiple Intelligence Theory and the control group subjected to a traditional method?
3. Are there any meaningful differences between the final test and permanency test scores of the experimental group subjected to teaching activities prepared according to Multiple Intelligence Theory?
4. Are there any differences between the final test and permanency test scores of the control group subjected to training activities prepared according to a traditional method?
5. Are there any meaningful differences between the permanency test scores of the experimental group subjected to teaching activities prepared according to Multiple Intelligence Theory and the control group subjected to a traditional method?

Scope and Limitations:

- The research is limited to two 4th grade classrooms in Private Primary School of Gazi University Foundation.
- It is also limited with eleven comprehension behaviors related with the aim of comprehending "Time measurement units" under the "Times" Chapter included in the 4th grade Mathematic curriculum.
- The universal study scope is composed of 4th grade students attending at Private Primary School of Gazi University Foundation.



RESEARCH DESIGN

An experimental pattern has been used in the study as the research design. For this purpose, pre-post test design with a control group has been applied.

Data Analysis

T-test has been applied in data analysis to reveal any differences between the group averages. Statistical calculations have been made using SPSS. The meaningfulness of the data obtained has been evaluated at the level of .05.

FINDINGS AND COMMENTS

Sub-problem 1 - Are there any differences between the final test scores of the experimental group and control group?

The average of the final test scores of experimental group has been calculated as 18.08 and the average of the control group as 15.95. A t-test has been applied to see if there is a meaningful difference between the averages of the two groups. The t value has been calculated as 2.55. The t value corresponding to .05 level in t table is 2.06. Since the calculated t value is higher than the t value in the Table (Table 1) ($2.55 > 2.06$), a meaningful difference has been recorded between the final test scores of the groups. In other words, there is a meaningful difference in favor of the experimental group. It can be concluded that this result proves that the activities planned and implemented according to Multiple Intelligence Theory are more effective than a traditional method.



Table 1.Experimental group and control group on the basis of final test scores

<i>Groups</i>	<i>N</i>	\bar{X}	<i>S</i>	<i>t</i>	<i>Table t</i>
<i>Experimental Group</i>	24	18.08	2.56	2.55*	2.06
<i>Control Group</i>	24	15.95	3.15		

* at .05 level

Table 2. Experimental Group and Control Group On The Basis Of Achievement Scores

<i>Groups</i>	<i>N</i>	\bar{X}	<i>S</i>	<i>t</i>	<i>Table t</i>
<i>Experimental Group</i>	24	3.20	1.97	2.34*	2.06
<i>Control Group</i>	24	1.91	1.83		

* at .05 level

Table 3.Experimental Group and Control Group On The Basis Of Permanency Test Scores

<i>Groups</i>	<i>N</i>	\bar{X}	<i>S</i>	<i>t</i>	<i>Table t</i>
<i>Experimental Group</i>	24	18.04	2.38	7.46*	2.06
<i>Control Group</i>	24	14.01	2.91		

* at.05 level

Table 4. Experimental Group On The Basis Of Final Test and Permanency Test Scores

<i>Experimental Group</i>	<i>N</i>	\bar{X}_{10}	<i>S</i>	<i>t</i>	<i>Table t</i>
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Sub-problem 2 - Are there any differences between the achievement scores of the experimental group and control group?

The average achievement scores of the experimental group have been calculated as 3.20 and the average of the control group as 1.91. A t-test has been applied to see if there is a meaningful difference between the averages of the two groups. The t value has been calculated as 2.34. The t value corresponding to .05 level in t table is 2.06. Since the calculated t value is higher than the t value in the Table (Table 2) ($2.34 > 2.06$), a meaningful difference has been recorded in the achievement scores of the groups. In other words, there is a meaningful difference in favor of the experimental group.

Sub-problem 3: Are there any meaningful differences between the permanency test scores of the experimental group and control group?

The average of the permanence scores of the experimental group has been calculated as 18.04 and the average of the control group as 14.01. A t-test has been applied to see if there is a meaningful difference between the averages of the two groups. The t value has been calculated as 7.46. The t value corresponding to .05 level in t table is 2.06. Since the calculated t value is higher than the t value in the Table (Table 3) ($7.46 > 2.06$), a meaningful difference has been recorded in the permanency scores of the groups. In other words, there is a meaningful difference in favor of the experimental group. It can be concluded that these results prove that the information learned using Multiple Intelligence Theory is more permanent than the information learned through a traditional method.

Sub-problem 4: Are there any meaningful differences between the final test and permanency test scores of the experimental group?

The average of the final test scores of the experimental group has been calculated as 18.08 and the average of permanency test scores as 18.04. A t-test has been applied to see if there is a meaningful difference between the averages. The t value has been calculated as 0.2. The t value corresponding to .05 level in t table is 2.06. Since the calculated t value is lower than the t value in the Table (Table 4) ($0.2 < 2.06$), a meaningful difference has not been recorded between the final test scores and permanency scores of the experimental group. From these results it is concluded that the information gained from Multiple Intelligence Theory is not forgotten in a short time and is quite permanent.

Sub-problem 5: Are there any differences between the final test and permanency test scores of the control group?



The average of the final test scores of the control group has been calculated as 15.95 and the average of the permanency test scores as 14.01. A t-test has been applied to see if there is a meaningful difference between the averages. The t value has been calculated as 3.18. The t value corresponding to .05 level in t table is 2.06. Since the calculated t value is higher than the t value in the Table (Table 5) ($3.18 > 2.06$), a meaningful difference has been recorded between the final test scores and permanency scores of the control group. From the results it concluded that the information learned through a traditional method is less permanent.

CONCLUSION

According to the data obtained in the study, teaching of "time measurement" behaviors to students by taking Multiple Intelligence Theory as a basis has had positive effects on the mathematic achievement of primary school 4th grade students. In the education given on the basis of traditional methods, on the other hand, no meaningful change has been recorded in terms of students' mathematical achievements.

A meaningful difference has been detected between student achievement scores, in favor of the experimental group. In other words, activities performed in the framework of Multiple Intelligence Theory have positively affected the achievement scores of the students in the experimental group.

On the basis of Multiple Intelligence Theory it has been observed during the teaching activities performed that students actively participate in lessons; their interest level rise with the rich activities performed; and they are more aware of their abilities. During the project activity made in relation with the subject, students have participated in the activities willingly; they have participated in any of the activities they have preferred among all activities (each of which has been developed for each intelligence domain); and have produced creative outputs. At the end of this lesson, students stated that they could not really understand when the lesson started and ended and that they comprehended the lesson well, thanks to the tools and materials used.

According to the data obtained, a meaningful difference has been detected between the averages of student permanence test scores, in favor of the experimental group. In other words, it can be stated that the activities performed on the basis of Multiple Intelligence



Theory have positively affected the permanence test scores of experimental group students.

At the end of this study, it has been observed that students are quite willing to participate in the study, they can do some activities independently and their leadership skills have improved. The observations made at the end of the semester by teachers have shown that students can easily remember the issues they had learned at the beginning of the semester.

REFERENCES

1. Allen, D. (1997). The Effectiveness of Multiple Intelligence Approach In A Gifted Social Studies Classroom: Georgia College öc State University
2. Armstrong, Thomas (1994) Multiple Intelligences In The Classroom. ASCD. Virginia
3. Bajaran, I. E. (1992). Egifim Psikolojisi (Education Psychology). Ankara: Kadioglu Matbaasi
4. Brualdi, A. C. (1996) Multiple Intelligences: Gardners Theory <http://www.ed.gov/databases/ERICDiGEST/ed.410226.html>.
5. Bruetsh, A. (1995). Multiple Intelligences Lesson Plan Book. J.D
6. Campbell, L. (1997). How Teachers Interpret MI Theory. Educational Leadership. (55), 14-19.
7. Demirel, Ö. (1999). Planlamadan Degerlendirmeye Öğretme Sanati (Teaching Art From Planning to Assesment). Ankara: Pegem Yayincihk
8. Edwards, A. (1999). The Eight Intelligence http://education.canberra.edu.au/postgard/ss/stu_dents/franc.es/FRANCES.HTM
9. Emig, V. B. (1992). A Multiple Intelligences Inventory. Educational Leadership, September:48
10. Güven, Y. (1997). Erken Matematik Testi — 2'nin Geyerlilik, Güvenirlik, Norm Qalijmasi ve Sosyo- Kültürel Faktörlerin Matematik Yetenegine Etkisinin Incelenmesi (Study on the Effects of Validity, Reliability Norm Analysis and Socia- Cultural Factors of Early Mathematics Test-2 on Mathematics Ability), Istanbul: Marmara Universitesi(Yayinlanmamij Doktora Tezi)
11. Hoerr, T. (1997). Frag Ballets And Muzical Fractions. Educational Leadership, September:45 — 46



12. Jenkins, L. (1998). Simflarda Ogrenmenin lyilejtirilmesi (Improvement of Learning in Classroom Settings). Gönül Yenersoy (Qev). Istanbul: Rota Yayin Yapim Tanitim Ticaret Ltd. Şti
13. Krongh, S. L. (1995) . The Entegrated Early Childhood Curriculum. MC Gram — Hill, Inc.
14. Meyer, M. (1997). The Greening of Learning: LTsingThe Eight Intelligence. Educational Leadership, September: 32 — 33
15. Saban, A. (1998). Ogrenme Ogretme Süreci (Teaching and Learning Process). Ankara: Nobel Yayin Dagitim
16. Selyuk, Z. (1999) . Gelisjim ve Ogrenme (Development and Learning). Ankara: Nobel Yayin Dagitim
17. Sweet, S. S. (1998). A Lesson Learned About Multiple Intelligences. Educational Leadership, November: 50 - 51
18. Toker, E, Kuzgun. Y, Gebe. N, Kaya B.U. (1968). Zeka Kuramlan (Intelligence Theories) Ankara: Milli Egitim Bakanhgi Talim ve Terbiye Dairesi Arajtirma ve Degerlendirme Bürosu.
19. Vickers, C. j. (1995). Qoklu Zeka: Görü^meler ve Makaleler (Multiple Intelligence: Interviews and Articles). (Qev. Meral Tüzel), Istanbul: Enka Okullan
20. Wahl, M. (1999). Math For Humans Teaching Math Trough 8 Intelligences. Langly, Washington: Lun Learn Prees