

What Can We Learn from a Study?¹

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Abstract:

The purpose of this study is to investigate the effect of spatial intelligence covered in Multiple Intelligence Theory on the academic success of 6th grade students for the unit “What Constitutes Earth’s Surface” covered in Science and Technology course, and propose suggestions with respect to data obtained. Pre-test, post-test and control group experimental design method is used for the study. 16 boys and 22 girls, 38 in total involved in experiment group, 17 boys, 21 girls, 38 in total involved in control group. Lessons are carried out with traditional method for the control group. Spatial intelligence designed lessons are carried out with experiment group. After the study, statistical analyses done to investigate the effect both for instructional methods which are traditional method and Visual Intelligence Designed instructional methods. Statistical analyses are also done for gender differences on academic success for both groups.

¹ This study is derived from a master thesis

No significant effect of both gender and spatial intelligence designed instructional method is found on increasing students' academic achievement. Yet the most important acquisition of the study is its finding on science education studies. This study is a classical study done to investigate of a new approach and aims to help researchers to be guide line on designing an experimental study which is in fact to emphasize the assessment and evaluation relationship.

Key words: Multiple intelligence, Visual intelligence, Assessment, Evaluation, Science education

INTRODUCTION

Due to increasing demand of qualified workers in every area made governments focus on their educational systems since qualified workers could be obtained through education. Thus universities, which are seen as the main chief actor in establishing countries' future prosperity, focused on this issue. As a result of this, researchers tried to find better ways for a qualified education. Increasing number of the researches done on the educational area is generally accepted as the proof of this argument. Researches done on education have been increasing and are focusing especially on effective instructional methods and learning since 19th century. This trend also made researches to focus on individual's experiences and their characteristics. Individuals are the main source of education systems and hence individual characteristics and their behaviors in education environment became one of the main concerns for the researchers. For example Miller (2010) indicates students' attitudes towards science are related with their motivation. Doymuş (2007) introduced a new technique, Subject Jigsaw, as an addition to Jigsaw Technique which is known for its success on both social and academic achievement. Dimick (2012), on the other hand, points that lessons along with individual experiences can be used for moral education.

Due to variety of the researches and their implications some terms are brought up to occupy more space and definitions to themselves in educational world. As a natural fact, some terms are redefined and possessed their value in educational researches. Intelligence is one the terms which is being redefined and hence occupy a new dimension in educational world (Akkuş, 2009; Hübner, 2012).

Intelligence generally described as individual's ability of understanding situations, establishing relationships between concepts and events, reading comprehension, learning capacity, intellectualism, making inferences, abstract reasoning and performance shown at school lessons (i.e. getting high grades). Thus it was believed that intelligence could be measured by simple tests like Intelligence Quotient (IQ) tests. Yet recent developments let researchers to establish new theories and describe intelligence in different ways. One of these theories is Multiple Intelligence Theory (MIT) which describes intelligence other than its common definitions (Gardner, 1993; Başbay, 2000; Almeida, 2011).

Gardner, who introduced Multiple Intelligence Theory (MIT), defines intelligence as ability of an individual to solve problems encountered in society and intellectual capacity of producing product. Gardner argues that all the human beings have equal intelligence and intelligence is shaped by the culture that an individual lives in or comes from. For that reason Gardner claims intelligence itself cannot be defined in singular form but in multiple, and he criticizes the use of Intelligence Quotient (IQ) tests and argues capacity of IQ tests for defining intelligence itself in all aspects. According to Gardner IQ tests are specialized for the people who use verbal and mathematical intelligences effectively. Gardner criticizes that and gives an example of two men who lost their ways. One man asks another person to find his way while the other man looks to a map to find his way. According to Gardner these two men are intelligent since they find their way and hence

producing a product but their way of finding is just related with how they use the different part of their intelligences. Gardner criticizes general view on intelligence , by previous example, and points out that assuming intelligences of these two men works in the same way is same for a psychologist who assumes that his/her two different patients have same characteristics and hence same problems. If these two people, given in Gardner’s example, were asked to fill an IQ test then it would be possible for them to take low scores on the tests, however Gardner describe intelligence as “finding a solution to a problem”. MIT suggests that all the individuals use all the type of intelligence but personal characteristics or culture of the person let one or more intelligences work more efficiently (Robin and James, 1995; Sahli et al, 2011).

Multiple Intelligence Theory (MIT) assumes intelligence is composed of nine different intelligence. These intelligences are;

- 1) Verbal - Linguistic
- 2) Logical - Mathematical
- 3) Musical - Rhythmic
- 4) Bodily - Kinesthetic
- 5) Interpersonal
- 6) Intrapersonal
- 7) Naturalist
- 8) Existential
- 9) Visual – Spatial Intelligence

Gardner indicates that known intelligence tests are suitable for the people who use verbal and mathematical intelligence mostly. That’s why he criticizes those intelligence tests and points out those tests are not sufficient enough for assessing other intelligences (Kurt, Gümüş and Temelli, 2013; Robin and James, 1995).

Visual Spatial Intelligence

Individuals who use this intelligence more than other intelligences like to collect their ideas in the pictures. They enjoy drawing their feelings, emotions and ideas in pictures. Individuals who use the visual spatial intelligence (VSI) effectively can animate happenings in their minds. Moving the chess stones in the mind, drawings in a cave, drawing of maps are the examples of visual spatial intelligence (VSI). Thus VSI people are tend to be a sculptor, artist, architect, designer, photographer, decorator, captain, surgeon, mathematician, carpet maker, coach, mechanic and image maker (Susan, 2005; Campell, Campell and Dickenson, 1999; Allstrom, 1970).

VSI people can easily find their way and can read graphics, diagrams, maps, drawings and models easily. They create imaginary objects and pictures from what they hear. They use those imaginary objects during recalling the information. They are skillful people to understand spatial world and transfer it to real life. They can easily present abstract information, for this reason VSI people are assumed as analytical thinkers. Observation and visibility are important for them. They can easily remember faces, shapes, colors, details and scenes. But it would be a mistake to assume all the VSI people have same characteristics or tendencies. Some may be good at drawings while some other may be good at 3 dimensional modeling (Campell, Campell, and Dickenson, 1999; Allstrom, 1970; Quispel and Maes, 2012).

Students who uses VSI more effectively learn through seeing and observations. For this reason pictures, photographs, diagrams, colored papers, cameras, computers and videos should be used in a VSI designed classroom. Classrooms may be decorated with posters, pictures, cartoons and these materials may contain information related with lesson. Mind maps, circle method, flow charts may be used as instructional

materials (Kagan and Kagan, 1998; Campell, Campell, and Dickenson, 1999; Allstrom, 1970).

RESEARCH METHOD

Research Design

This study is carried out during 2008-2009 education and instruction year. Since Turkish Ministry of Education decided to apply a new approach (constructivist teacher practice) to the country's educational policy starting with 2005-2006 education and instruction year, modern theories and approaches are popular in Turkey (Acat, Anılan and Anagun, 2010). As a result of this MIT is selected as the research topic and VSI as the main topic. To apply VSI in classroom environment first, researchers decided to choose the unit in which the visual materials could be used efficiently. For that purpose the unit "What Constitutes Earth's Surface?" was chosen. Reasons for selection of this unit are; more visual material were included in the text book, picture and video documents could be easily retrieved related with the unit. After choosing the unit, study design and sub-problems were determined.

Problem statement:

What is the effect of spatial intelligence on the academic success of 6th grade students for the topic "What Constitutes Earth's Surface?"

Sub-problems:

- 1) Is there any significant difference between the experiment and control groups with respect to pre-test (PT)?
- 2) Is there any significant difference between the experiment and control groups with respect to achievement test (AT)?
- 3) Is there any significant difference between the boys and girls with respect to PT and AT?

Pre-test, post-test and quasi experimental design is used for the study. Sample of the study consists of 76 (seventy six) 6th grade students. For quasi experimental design students were given a science test as pre-test (PT) whose questions were selected from test questions prepared by the test centers for high school entrance exam done in Turkey. After that students were divided into two groups by using s-shaped distribution to make the groups equal with respect to their academic level, half (38) involved in experiment and half (38) involved in control group.

Application of the material (study phase)

Study is carried out with 6th grade students (n=76) who are separated into two groups as experiment (n=38) and control (n=38) groups. Lessons are carried out with traditional method with control group. This method includes classical instruction, solving problems and using Socratic Method (question and answer). Teacher reviewed previous lesson during each lesson session to review students' previous learning and to decide whether students achieved previous lesson objectives or not. If students achieved previous lesson objectives then teacher started to new lesson. Also teacher made students to take notes and to write information on the blackboard to their notebooks. During the lesson teacher also asked questions to check students learning on the topics covered for the lesson. If the teacher decided that students did not learn well then s/he made a summary on the topics and made sure students learned well, if necessary homework assignments were also given to students.

Lessons with experiment group were carried out with "spatial-visual intelligence designed lessons". For that purpose teacher brought newspapers and magazines related with lesson topics which might be interesting for the students for engagement. Videos related with topic were watched by the students and after watching the videos teacher asked questions about the video related with the topic. To make lesson fun and

enhance learning students were asked to prepare card games, charts, posters, create photo albums and write compositions with pictures. Visual instruments like power point presentations are also used as instruction materials.

FINDINGS AND DATA ANALYSIS

Before Study

Gender and number of students in the groups are given in

Table 1 Descriptive values of the groups are given in

Table 2 Control group's PT mean value is higher than experiment group mean value (1,37 points). To determine whether this difference is statistically significant in favor of control group or not, independent t-test analysis is also done and test results indicated that there is no significant difference between the groups ($p=0,101 > 0,05$ as shown in Table 3). For determining academic level difference between the genders within the groups (students involving in both experiment and control group), chi-square test was run and test results indicated that there is no significant effect of gender within the group on academic achievement level. ($p=0,769 > 0,05$ as shown in

Table 4 for control group; $p=0,280 > 0,05$ as shown in Table 5 for experiment group).

Table 1 Descriptive values of the groups

	Groups			
	Experiment		Control	
	n	%	n	%
Girls	22	57,9	21	55,2
Boys	16	42,1	17	44,8
Total	38	100	38	100

Table 2 Descriptive values of the groups after PT

Group	Number (N)	Mean (X)	Standard Deviation (S)
Experiment	38	7,71	3,35
Control	38	9,08	3,81

According to Table 2 control group's test score mean is higher than experiment group. To determine whether this difference is statistically significant or not independent samples t-test was run and results are shown in Table 3 After that Chi-square analysis was run to determine difference between the boys and girls for both experiment and control group (Table 4 and Table 5).

Table 3 Independent samples t-test

		t-test for Equality of Means		
		t	df	Sig. (2-tailed)
PT	Equal variances assumed	1,663	74	,101
	Equal variances not assumed	1,663	72,826	,101

Table 3 implies although there is difference between the groups with respect to mean scores, this difference is not significant statistically.

Table 4 Chi-square test for determining effect of the gender for the control group students

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	10,765 ^a	15	,769
Likelihood Ratio	14,523	15	,486
Linear-by-Linear Association	,295	1	,587
N of Valid Cases	38		

Table 4 Chi-square analysis shows there is no significant difference between boys and girls for control group.

Table 5 Chi-square test for determining effect of the gender for the experiment group students

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	13,201 ^a	11	,280
Likelihood Ratio	16,847	11	,112
Linear-by-Linear Association	,206	1	,650
N of Valid Cases	38		

Table 5 Chi-square analysis shows there is no significant difference between boys and girls for experiment group.

After Study

For reliability of the AT, Cronbach's Alpha reliability test run and items decreasing the reliability omitted from the AT which left AT with 20 questions with a reliability of 0,689. This value pointed out that AT was reliable to assess the students' scores (Kalaycı, 2010). After the study, it was found that control group's AT mean result was 1,66 point was higher than experiment group's mean score (Table 6). To determine whether this difference is significant or not and the effect of VSI on increasing academic achievement independent samples t-test analysis was done (Table 7). Independent samples t-test analysis result showed mean difference was not statistically significant since $p = 0,118 > 0,05$ Table 7 . This result showed VSI applied in the classroom had no effect on academic achievement. Then further statistical analysis (chi-square tests) was done to determine whether "spatial-visual designed lessons" have significant effect on gender or not within the experiment group

Table 8 Chi-square test was run for that purpose and p value found as $0,427 > 0,05$. That p value showed that VSI applied for the experiment group had no effect on academic achievement on gender.

Achievement Test Results (AT)

Table 6 Descriptive value of experiment and control groups

Group	Number (N)	Mean (X)	Standard Deviation (S)
Experiment	38	9,55	3,52
Control	38	11,21	5,41

According to Table 6 control group's test score mean is higher than experiment group. To determine whether this difference is significant statistically or not independent samples t-test run and results are shown in Table 7.

Table 7 Independent samples t-test

		t-test for Equality of Means		
		t	df	Sig. (2-tailed)
AT	Equal variances assumed	1,583	74	,118
	Equal variances not assumed	1,583	63,500	,118

Table 7 implies although there is difference between the groups with respect to mean scores, this difference is not significant statistically.

Table 8 Chi-square test for determining effect of the gender for the experiment group students

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	12,234 ^a	12	,427
Likelihood Ratio	15,018	12	,240
Linear-by-Linear Association	,000	1	,988
N of Valid Cases	38		

DISCUSSION AND CONCLUSION

It is important to choose right instruction technique to use in the classroom environment since some science topics are abstract, but the topics may be concrete if examples are given from daily life. By doing this way it is also possible to make lessons fun. For that purpose it is important for the teachers to select instruction methods wisely and adapt the methods and lesson within each other which will make classroom a fun environment for the kids. Using MIT in the classroom may be hard at first since lesson plan should be prepared carefully. Teachers should focus on all the intelligences not only on one of the intelligences. Of course it is important to determine which type of intelligence is used mostly by the students for effective instruction but that does not mean only one intelligence should be used in the education environment. All the types of

intelligences should be used for educational purposes. This will be helpful for instruction and learning (Allstrom, 1970; Bowkett, 2006). This study is done as Master Thesis in Turkey and is still the only Master Thesis especially focused on VSI, and also there is no Doctorate Thesis done on VSI in Turkey. Uniqueness of the study also makes it as a start guide for the researchers who will study on especially VSI. Efforts and mistakes will be discussed in this section and it is also hoped that researchers who will study on VSI will avoid same or similar mistakes and will be able to increase quality of the researches done in the future. One of the important aspects of the study is that the study itself also shows focusing only on one intelligence which is criticized by MIT itself. Study shows that focusing on one intelligence does not bring success, yet it shows that education system needs all the instruments used together and carefully. By doing that it is likely to create a fun classroom environment and that may help students feel secure in the classroom. Security feeling in the classroom helps to children to reach their potential faster. It also helps students to have positive attitude towards classroom thus towards lessons, other students in the classroom, teacher and to school (Pol, Volman and Beishuizen, 2012; Pollit, 2012; Warin, Kolski and Sagar, 2011).

Although there is no significant effect has been found in this research this does not mean visual-spatial designed lessons are not effective. It may be concluded that visual-spatial designed lessons are not designed good enough. For the study researchers tried to use maximum number of visuals and that may seem right thing to do. The real case might be different than what is assumed, in fact supporting formal instruction with spatial content may not increase academic achievement but it may cause an opposite effect. Studies point out that supporting formal instruction with Visual-spatial content may impede full participation of students and may reduce

differences of the students who are from different socioeconomic status and gender (Newcombe and Frick, 2010).

Another problem should be mentioned is although study aimed to determine effectiveness of a modern approach, assessment and evaluation done with traditional methods such as classical (pre and post) tests which are prepared with respect to traditional assessment. This might be a problem because assessment may not be good enough to assess the outcome such as experience. In some cases, there might be developments but since assessment instruments are not good enough or not specialized to assess the outcome, researches may not prove effectiveness of the method. Teachers may recognize developments, may appreciate students' developments and progress but because of the assessment system they may not give proper rewards (grades) to students since grading is defined by traditional system. So students' encourage to study or development may not be encouraged, in fact it may have negative effect which might make students not study anymore or having negative attitudes towards course and study. This situation is pointed out by Wollman by "*if we bring our old thinking to a new practice, the rationales may not fit*" (as cited in Fountas and Pinnel, 2012). Malekian, Pour and Pour (2012) pointed out if the post-tests are designed proper to VSI then statistical analysis could give significant difference between the groups. In their research they prepared a post-test (Achievement Test) designed for VSI and hence they were able to show out the difference between control and experiment groups. Traditional educational system is appropriate for verbal and mathematical intelligence assessment which makes hard to assess other intelligences and hence learning, yet for this research achievement test used is appropriate for traditional education. Purpose of the assessment is to output what has been learned. Other assessment instruments could be designed and prepared for assessment. Assessing students' progress and

their efforts could be done with different instruments such as using portfolio, giving some portion of grading to progress, development and effort of students (Prokysek and Rambousek, 2012). Another problem is the starting point of research. MIT does not suggest that an individual uses only one type of intelligence. In fact MIT claims that an individual use all the type of intelligences with varying proportions, yet this researched focused on only VSI (just like traditional educational system focuses on mathematical and verbal intelligence). Focusing on one or two specific intelligences is the main problem emphasized by MIT also Seifoori and Zarei (2011) indicated that students do not only use VSI alone but they use VSI with other type of intelligence. That gives a clue on why this research failed to show a significant difference between the groups and maybe genders. MIT suggest a new look to education to increase quality of the education yet this research tried to apply a modern approach with traditional approach.

Teachers have crucial importance in education progress since they are responsible about using these suggestions. If that is the case then teachers should be encouraged to use new methods and techniques to increase the quality. Seminars, workshops should be done for teachers on effective teaching methods. Recent studies points out although teachers are eager to use new methods, instructional techniques, computer technologies in the classroom yet they do lack on recent developments and modern methods. Teachers may have academic knowledge on recent developments but they still have problems about using the information and knowledge. Reason for that could be mentioned as lack of experience on using techniques or having some misconceptions on these methods while using. Helping teachers to learn new academic knowledge through paper work might be right at first, but to be really good teachers they are still in need of experiences, even sometimes should act or take scenarios as students. Teachers' training as

students will help them to understand how students learn and how they feel during the lessons. By doing that teachers' awareness towards lessons and learning will increase and hence students' awareness too (Garderen, Hanuscin and Lee, 2012; Bayrakçeken, Doymuş, Doğan, Akar and Dikel, 2012; Misra, Grimes and Rogers, 2012; Doymus, Akkus and Bayrakceken, 2012). Cohen-Vogel (2011) indicates that a qualified teacher who knows when and how to apply his/her educational methods may have positive effects on students, yet in the same research it is also pointed out if the teacher lacks on quality then effect is in reverse direction and hence students' learning and attitudes towards course, teacher and school may be affected negatively.

Also using a new technique itself may cause negative attitude during applying. Some researches indicate if students do not understand the meaning of classroom, lesson, instruction and materials used then aim of the education fails. This situation may let students to have negative attitude towards lesson or instruction. Same researches indicate to prevent this kind of problem; lesson plans and instruction should be carefully designed (Doymus, Akkus and Bayrakceken, 2012; Bozdoğan and Yalçın, 2004).

Another reason might be mentioned as the physical conditions of the schools which were not appropriate for the desired lesson activities. Audio and visual equipments (school did not have a technology class) were not adequate and which may also cause negative attitude towards lessons. Akpınar (2003) supports this idea with his research and indicates that natural and social surrounding may have negative impact on education.

Socio-economic status of the families whose children involved in study also should be mentioned. Children involved in the study were coming from mostly low level socio-economic families. Families coming from low socio-economic status are not interested in their children progress at school. This

situation affects students' attitudes towards course, school, teachers, school manager and even their friends at schools. Gil-Flores (2011) determines that coming from low level socio-economic families have negative effects on students, especially on elementary level students. Caner and Okten (2013) determine that socio-economic level of the families even affects students' success on entering universities. Martlew and others (2010) in their study indicate similar problem and point out that instruction time schedule may need to be extended in most cases.

Last thing should be mentioned is time of the research. Some researches done in Turkey mention importance of the time of the studies. Students who want to go better high schools have to get high scores from the High School Entrance Exam (SBS previously OKS). This exam is done at the end of the second semester. Due to that students go to private after school courses (offered at the weekend), in some cases schools also offer this kind of service for a low fee or students take private lessons from private teachers. This causes students to have stress and their stress level increases gradually as the time for the exam gets closer. Increasing level of stress decreases students' success on the courses, in fact in most cases stress may even make students to have negative attitudes towards instruction technique, course, school and teacher (Oksal, Durmaz and Akın, 2013; Argon and Soysal, 2012; Gündoğdu, Kızıldaş, and Çimen, 2010; Şahin, Baş, Sucuoğlu and Fırat, 2012). This argument is also researched by the Turkish National Education Ministry (MEB). According to MEB's research SBS exams (previously OKS) increases stress level of the students and thus has negative effect on educational progress (Eğitimi Araştırma ve Geliştirme Dairesi Başkanlığı, 2010).

We highly hope that this study will help other researchers and teachers who are interested in applying new methods to increase education quality. In the light of this

research, it is also believed introducing new approaches, methods and techniques should also be discussed with assessment methods.

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