

An Investigation the Effect of Quantum Learning Approach on Primary School 7th Grade Students' Science Achievement, Retention and Attitude

(Kuantum Öğrenme Yaklaşımının İlköğretim 7. Sınıf Öğrencilerinin Fen Başarısı, Kalıcılık ve Tutumlarına Etkisinin İncelenmesi)

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Abstract

Aim of the study is examining the effect of Quantum Learning Approach on primary school 7th grade students' achievement, retention and their attitude towards the science course. The study was carried out on totally 40 grade students and performed with pretest – posttest control group semi experimental design. Achievement test and attitude scale were used for data collection. Quantum learning was applied in the treatment group and the current program was applied in the control group during the study. As a result of the study; Quantum Learning Approach affected students' academic achievement, retention and attitude marks in a positive way.

Keywords: Quantum learning, science education, achievement, attitude

Özet

Araştırmanın amacı; Kuantum Öğrenme Yaklaşımının 7. Sınıf öğrencilerinin fen dersinde başarı, kalıcılık ve tutumlarına etkisinin incelenmesidir. Araştırma toplamda 40 öğrenci ile yürütülmüş ve ön test - son test kontrol gruplu yarı deneysel modelde gerçekleştirilmiştir. Veri toplamak amacıyla başarı ve tutum ölçekleri kullanılmıştır. Deneysel araştırma sürecinde deney grubunda Kuantum öğrenme kullanılırken kontrol grubunda mevcut program kullanılmıştır. Araştırmanın sonuçlarına göre; Kuantum Öğrenme Yaklaşımı öğrencilerin başarı, kalıcılık ve tutum **puanlarını olumlu etkilemiştir.**

Anahtar kelimeler: Kuantum öğrenme, fen eğitimi, başarı, tutum

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Introduction

One of the aims of science education is to help individuals accommodate the changing and developing environment (Kaptan and Korkmaz, 1997). Learning science depends on the experience of learning concrete thoughts initially, and then making those thoughts more complex and more applicable. Thus, teaching approaches should provide students favorable environment and help them live more experiences to understand making science process. It is generally accepted that traditional teacher centered instructions are inadequate to educate new human model, as in all social systems, they are not explanatory enough in education system (Acat, 2010). Therefore, there is a kind of searching about nonlinear approaches in education. In this regard one of the approaches presented is Quantum Learning.

Quantum physics, assumes that new properties come out when ordinary existence combine or get in touch. Accordingly, the whole is more than total of the parts. Every Quantum piece has the multiple potential of being elastic about time and ground, and the capacity to effect the world. According to uncertainty principle, acquiring certain data is almost impossible. Relationships are non-linear and there is a mutual causality. In Quantum, systems show variation, clearness, complexity, mutual causality and uncertainty, reflecting qualitative changings more than quantitative changings (Demirel, Arseven, Konaş, Yurtluk, Yalın, Turan and Ayvaz, 2004).

As for Quantum physics, events cannot happen apart, all events happen at the same time and interactively. Holistic thought came out from this point, evaluates the structures in a three dimensional world, and according to this notion a fact evaluated linearly is absolute. An effect we give to the one point of quantum field, effects the whole, but consequences may be contrary to each other (Penrose, 2004). The coming out of the Quantum theory required changing in paradigms. Changing paradigm emphasizes that scientific process which takes into account world's relativity, not a practical process of producing knowledge. Social facts can be understood by separating typical dimensions, not by producing general laws determining the social conduct. These developments revealed quantum philosophy and quantum frame of mind. The changing which Quantum paradigm caused in frame of mind also caused developments in process of understanding and using the knowledge. Unstable paradigm affected education and opened the way of multiple cause-effects, a process constantly interactive, in spite of usual casual- effect, action and reaction.

The educational programs which use the principles of Newton as base, and show a positivist manner are criticized. According to Şişman (1999), considering the mind is the reason of that. A program based on a perception which considers unexamined and invalidated thoughts ideological and nonscientific, will not give the chance to educate creative and original individuals. Producing solution to this matter, Quantum paradigm, mentions the proved and unproved yet together. It tries to handle these two conditions together in a multi-dimension environment. Creativity in education is a fact which can be gained as an insight (ref.: Akpınar and Aydın, 2009). A program based on quantum paradigm, must be built on a balance correlated between mind and experiment. It supports mental, emotional, and intuitional function and multi- intelligence specifications.

Accordingly, this program includes emotion, comment, thought, imagination, intuition and creativity besides intelligence (Puk, 2003; Demir, 2006; Türer, 2006).

Quantum Learning Model

When we look at definitions of Quantum Learning; 'Quantum Learning, is keeping all together structures specially and privately in order to construct meaningful information, using all of the neural networks in brain' (Vella, 2002).

Quantum Learning is model based on the years of 1980's when scientific developments gained acceleration. The basic of this model relies on accelerated learning techniques presented by Dr. Georgi Lazanov, and the usage of the learning techniques and strategies compatible with brain. Moreover; it is based on approaches using the differences of brain functions as twosome and threesome brain theory, and it includes the principles of multiple intelligence theory looking from the perspective of mankind has different types of intelligences and the philosophy of the factor of success is not one type of sense. Also; it is supported with the approach giving heed to the learners' both physical and mental development equally as holistic education, included and synthesized modern approaches as NLP (DePorter and Hernacki, 1992; Vella, 2002). It is developed by Bobbi DePorter and there are existing applications applied by 'Learning Forum' in America. In our country, it has been put into practice in recent years as 'Supercamp Turkey'.

Quantum Learning Theory gives the learners the chance of practicing in education helping them gain the perspectives below.

- There are a lot of reasons of natural and social facts, not one reason. As there is a constant changing, facts and information about these are changing also. Therefore; information about facts cannot be accurate totally. (Uncertainty Principle)
- The same method cannot be applied for all features. There are much more methods.
- Cause-effect relationship between facts, are not accurate and unchangeable. There is mutual causality between relationships.
- Everything is related to each other.
- The existence of one thing depends on its whole environment.(conceptuality)
- There is no objectivity, but there is aspect. Every event must be evaluated according to its venue.
- When ordinary existences unite, new features come out.
- We can find the truths by eliminating the mistakes. We can't be sure that we find the truth anytime. Skepticism lie behind the science.
- Probabilities may be understood; but the accurate results can't be estimated.

It can be said that the main aim of this learning theory is to provide individuals self-actualization as a whole. In order to reach that aim, it is necessary that the perspectives of quantum learning must be gained by the learners (Hanbay,2009,s.19). Quantum learning, requires more than the process of brain's understanding, running, the information coming from the outer world and exercising it according to certain rules. The profit of the theory is that it objects to the thought of the independence of the perceived world from the observer. Zohar and Marshall (2004), say that the best thing that can be done for the education is to get information and extend our perspectives in order to see the whole which means more and more different points of view.

Quantum Learning is based on five main principles. Some of them provide a basis while setting the basic learning system (DePorter, Reardon and Nourie, 1999; Usta, 2006).

- 1) Classroom environment, body language, the planning of the lecture notes and the other all exist in the learning environment. Ideal learning environment includes proper light, carefully selected colors, plants, props and music.
- 2) Everything is done according to its aim. Because lessons are thought in a careful way as an orchestra.
- 3) Our brain can be more successful if it is stimulated by the complex stimulants. If new ideas are related to the things that gained without learning, the learning may be more effective.
- 4) Learning includes risks. But if learning environment is set enjoyably, learning may be easier. If learner follows this step, he considers it safe and may be successful.
- 5) If something is worth learning it is also worth being celebrated, because, feedback makes positive emotional relations with learning.

Quantum Learning Process, Techniques and EEL Dr.C Circle

Quantum learning is configured on theoretical foundations, atmosphere, design and environment. Theoretical foundations are relevant with believes, agreements and instructions. Whereas, honesty, trust and individual feelings compose the atmosphere. While design qualifies dynamic and interesting education programme, environment is the structure which will increase and support learning (Ayvaz and others, 2007).

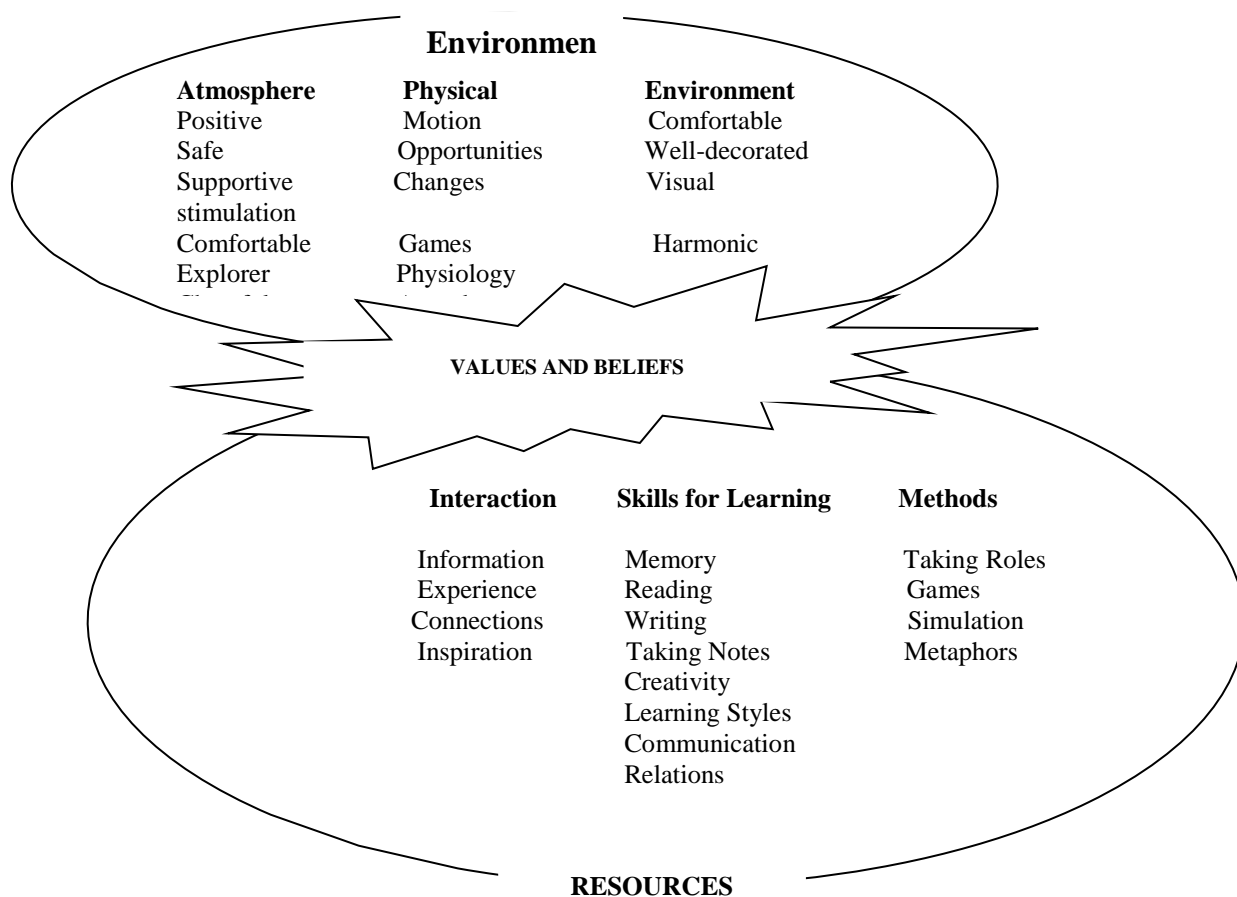


Figure. 1. Quantum Learning Design

The skills that are going to be taught to the students in quantum learning are separated into two categories. The first one is quantum working strategies, quantum note-taking, memory, mind maps, quantum writing and reading techniques that are known as academic skills. The second one is described as lifelong learning skills. And these consist of creative problem solving techniques, eight keys of excellence, leadership skills, self-confidence feeling, responsibility, motivation and effective communication skills (Yurdakul, B. and others, 2007).

The students take active role in quantum learning. Quantum reading (quick and effective reading) enables students to get information in a short period of time. The brain focuses on the topic better in quick reading. Reading affects considering speed, too. Quick reading is a technique that can frequently be used in exams, homeworks and resource scanning by students. Quantum reading process consists of five stages which are preparation, focusing, superb scanning, reading and reviewing (DePorter, Reardon and Nourie, 1999).

Another technique that is frequently used in quantum learning is quantum writing. The characteristic which makes quantum writing different from classical writing is that it is handled as an activity in which whole brain is effective rather than left-brain activity and thus, it is created as systematic. The most important factors causing classical writing to be ineffective are rules limiting the capacity of brain in the process of creating writing such as planning, main lines, grammar and punctuation. The brain can't allow visuality and emotional flow during this process. The right brain should be prior in real writing. Function of the right brain in writing is expand comprehension by including innovation, feelings, colour and excitement into writing. Moreover, it has a triggering role in the beginning stage. It functions as locomotive in writing. Ideas that can be filtered and the ones remaining on sieve generate writing. Quantum writing is handled as two processes which are clustering and quick writing (Demir, 2006).

Quantum memory techniques consist of association, classification, animation, basic memory systems, note AY and mind map techniques.

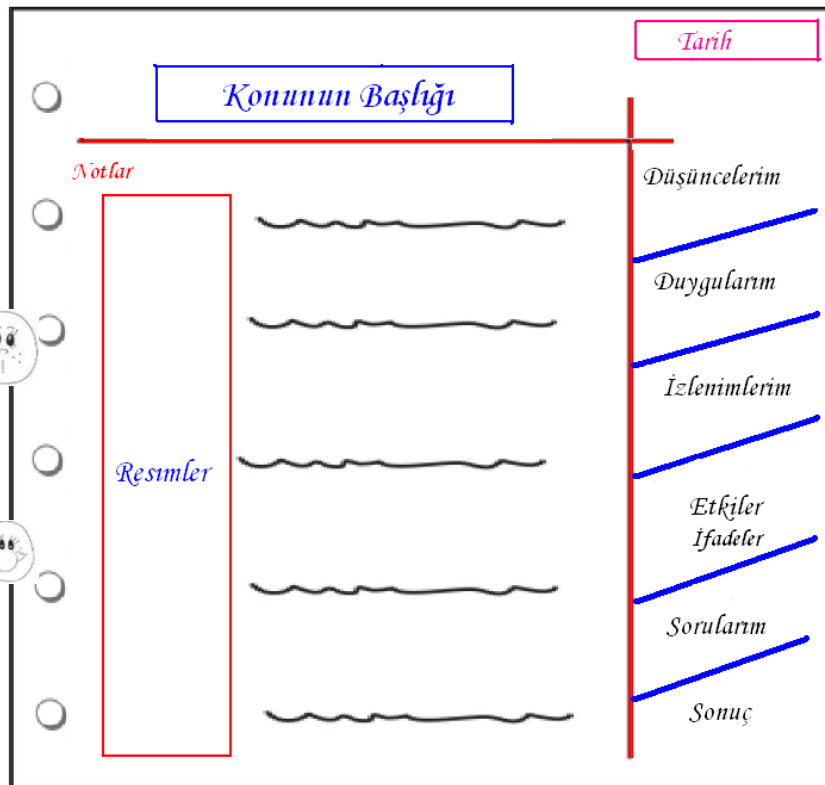


Figure. 2. Note AY Technique (adapted from DePorter, Reardon and Nourie, 1999)

Quantum learning design should be taken into consideration while a learning-teaching process is planned. This design will enable an effective learning process.

The learning design consisting of six stages is bound to correlative and mutual complementarity principle. The design called EEL Dr.C took its name from the first letters of the stages and each stage displays part - whole relationship in learning and teaching process. This design consisting of enrolling, experiencing, labeling, demonstrating, reviewing and celebrating phases should cover academic and lifelong learning skills effectively (DePorter, Reardon and Nourie, 1999; Demir 2006).

1st Stage: Enrolling: It's an important stage from the respect of self-learning skills, the phenomenon of students' needs for pre-editing and learning should be made gained. It's aimed that the students should take the control of the situation by presenting their own solutions for the problems they face and wonder (Usta, 2006; Demir, 2006).

2nd Stage: Experience: An experience or an activity introducing them the class is mentioned for enabling them to find relations which check their prior knowledge about the subject and for creating a knowledge need that provides meaning and interest to the content. At the stage of experiencing, mnemotechnik (a memory developing technique by benefitting from exercises with team and group activities and associations), simulations, mind maps, metaphors can be used (DePorter, Reardon and Nourie, 1999).

3rd Stage: Label: According to Dr. Georgi Lazanov discuss students' relevance with life after providing relevance with topic at the stage of labeling. Affecting, ranking and acknowledgement wish arise in the students at this position. Quantum note taking, memory techniques, graphics, posters and quantum study strategies can be used at this stage.

4th Stage: Demonstrate: Provide students with opportunities for their adapting of topic-related learning to other situations. Giving them additional activities in which they can apply the things they have learnt gives them confidence by making them see what they know (Ayvaz and others, 2007; DePorter, Reardon and Nourie, 1999).

5th Stage: Review: It is the stage where the knowledge and skills gained are nailed in brain. Repeating ensures nerve strings to strengthen and content to take place in mind. However, it is important for this reinforcement to include multiple intelligences and to address various senses (game, drama, demonstration, etc.) (DePorter, Reardon and Nourie, 1999).

6th Stage: Celebrate: Celebrate your students' success at this stage. It will provide close relationship to honor effort, attentive study and success (Lazanow, ref. Usta, 2006). Various activities can be used at the stage of celebration. Multi-awarding contests which both entertain and make them enjoy for gaining new knowledge at the end of the lesson can be applied.

This circle in quantum learning and its different techniques have also changed students' position in learning process. In interviews with students; the students stated positive opinions about the method (Demir, 2006; Vos-Groenendal, 1991; Nourie, 1998; Barlas, 2002; Hanbay, 2009). Vos-Groenendal (1991) explained that quantum learning affects students' attitude marks. Students whose attitude marks are high need checking, arranging, internal and external motivation and success when they perform learning activities and experiences (Aydede and Kesercioğlu, 2009). And this leads to success. Nourie (1998); Vos-Groenendal (1991); Le Tellier and DePorter (2002), Benn (2003); Myer (2005) found out in their studies that quantum learning contributes students' success in a positive way.

Problem Sentences

1. Is there a meaningful difference between the treatment and control group students' academic achievement post-test points in the Science and Technology course?
2. Is there a meaningful difference between the treatment and control group students' permanence points in the Science and Technology course?
3. Is there a meaningful difference between the treatment and control group students' pre-attitude and post-attitude points in the Science and Technology course?

Aim of the Study

The aim of this study was to investigate the effect of Quantum Learning Model on students' achievement, permanence and attitudes towards science.

Method

The study is a quantitative study which has pre-test post-test control group design in experimental model.

Participants

The treatment and control groups of this study consist of 40 seventh grade students who were student in 2010 academic year in Turkey. The classes were defined as treatment and control groups by random sampling method. There were 20 students in each group. T test of the independent groups in SPSS statistical package program was performed to determine the equivalence of pre-test scores of Science and Technology course Academic Achievement Test (AAT) of the students which are in study group. These results are shown in Table 1.

Table 1

Results of independent t test related with AAT pre-test scores of treatment and control group

| | N | \bar{X} | S | Sd | t | p |
|-------------|----|-----------|-------|----|-------|------|
| Treatment G | 20 | 16.500 | 5.404 | 38 | 0.032 | .975 |
| Control G. | 20 | 16.450 | 4.430 | | | |

p > 0.05, AAT: Academic Achievement Test

According to table 1 we see that there isn't any significant difference between the mean of treatment and control group AAT pre-test score ($t(38) = 0.032, p > 0.05$). In this case, both groups can be said to be equivalent in terms of AAT pre-test scores.

For the 3th sub-problem of the research, comparison of the attitude scores of the groups is required for determine the equivalence of students' attitudes which are in study group. For this reason, to determine the equivalence of the pre-test scores of Attitude Scale Towards Science and Technology Course (ASTSTC), t test is done. These results are shown in table 2.

Table 2.

ASTSTC pre-test score means of Treatment and Control groups

| ASTSTC | N | \bar{X} | S | Sd | t | p |
|--------------|----|-----------|-------|--------|--------|------|
| Treatment G. | 20 | 68.500 | 7.762 | 30.187 | -1.951 | .060 |
| Control G. | 20 | 72.400 | 4.429 | | | |

$P > 0.05$, ASTSTC: Attitude Scale Towards Science and Technology Course

According to table 6, we see that there is no significance difference between the groups' means of ASTSTC pre-attitude scores. ($t(30.187) = -1.951, p > 0.05$). In this case, we can say that both groups are equivalent in terms of their ASTSTC pre-attitude scores.

Furthermore, it was seen that there was no meaningful difference between the groups and the groups were equivalent by comparing the groups' first term science and technology course mean in their school report cards ($t(38) = 1.185, p > 0,05$), their first term general mean in student report cards ($t(38) = 0.318, p > 0,05$) and their first grade SBS (an exam for evaluating their success in national) results mean ($t(31) = 0.604, p > 0,05$).

The Instruments

Academic Achievement Test (AAT)

Academic Achievement Test (AAT) was used to collect data for research in Science and Technology course for Unit "Structure and Properties of Matter." The test was consisting of 40 questions and it was developed by researchers. In the process AAT reliability analysis of Bisection Test (equivalent halves) method is based on. It was divided into two in respect of attainments and pilot application was done with parallel tests consisting of 40 and 41 questions and the correlation between tests was found to be 0.907. The reliability coefficient of the Spearman-Brown formula test was determined as 0.951 by using this correlation coefficient. By subjecting the test to the process of testing the validity and reliability, the final version was prepared. Then, the 40 question test was conducted on a group of 78 people in another application, the internal consistency of the test was calculated, and KR-20 value was found as 0.900.

Attitude Scale towards Science and Technology Course (ASTSTC)

In the study, ASTSC, this was developed by Aktamiş (2007) and consisting of 18 items, was used to measure students' attitudes towards science and technology course. The scale consists of 18 items and Likert-type five-grading system was used. For each attitude statement, there are "strongly agree", "agree", "undecided", "disagree" and "strongly disagree" options. In Factor analysis results it was determined that the original scale consisted of four factors. Original scale's alpha reliability coefficient is $\alpha = 0.90$.

Data Analysis

SPSS 13 data analysis statistical package program was utilized in data analysis. One Sample t-test, independent-samples t test, standard deviations and mean of the differences between pre-test and post-test were calculated and were used to compare control and treatment groups.

Progress of Application

- 1- Quantum learning environment was prepared as a requirement of the method and students were told that the lessons will be applied in this environment during the process. Trigger posters, colorful figures of science and technology, motivation, articles and banners may be given as examples of some of the themes which provide this environment
- 2- The materials which will cover six subjects and 49 attainments of 7th grade Science and Technology course were prepared by the Ministry of Education by taking quantum learning in centre and applied to students for nine weeks.
- 3- Worksheets, experiment application guidelines, presentations, models and various posters were prepared and used for the group's good as secondary and primary material throughout the experimental process.
- 4- The learning and teaching process, in which principles of quantum were adopted and appropriate techniques for the method such as writing quantum, memory, reading quantum, critical thinking, problem solving, mind map were used, was constituted. Additionally, music was on during the lesson.

Findings

T test of the independent groups in SPSS statistical package program was performed to determine the significance of difference between the means of groups post test scores. These results are shown in table 3.

Table 3

Independent t test results related with AAT post-test score of treatment and control group.

| AAT | N | \bar{X} | S | Sd | t | p |
|--------------|----|-----------|-------|----|-------|--------|
| Treatment G. | 20 | 29.050 | 5.942 | 38 | 2.811 | 0.008* |
| Control G. | 20 | 24.450 | 4.273 | | | |

*p < 0,01 AAT: Academic Achievement Test

According to table 3 we see that there is statistically significant difference between the mean of treatment and control group AAT post-test scores. ($t(38) = 2.811, p < 0.05$). According to the analysis, when we look at the means to determine the direction of the significant difference between AAT post-test scores, we see that this difference is in favour of treatment group. Demir (2006), Hanbay (2009), Vos-Groenendal (1991), Le Tellier ve DePorter (2002), Nourie (1998), Barlas (2002), Benn (2003) and Myer (2005) are the researchers

who reached the conclusion that quantum teaching model is effective on the academic achievements of the students.

Means of AAT permanence test score and standard deviation of treatment and control groups are calculated and the results are shown in Table 4.

Table 4

T test results related with the means of permanence AAT test scores of Treatment and Control groups

| AAT | N | \bar{x} | S | Sd | t | p |
|---------------------------------|----|-----------|-------|----|-------|--------|
| Treatment G. permanence Test | 19 | 27.842 | 5.708 | | | |
| Control G. permanence Test | 20 | 23.550 | 4.310 | 37 | 2.659 | 0.012* |

* $p < 0,05$ ABT: Academic Achievement Test

According to table 5 we see that there is statistically significance level between the means of AAT permanence test scores of treatment and control groups. ($t(37) = 2.659, p < 0.05$). When we have a look at the means to determine the direction of significance level between the AAT permanence test scores of the groups, we see that this difference is in favour of treatment group.

For the 3rd sub-problem of the research, means of ASTSTC pre-attitude and post-attitude scores and standard deviation of treatment and control groups are calculated and the t tests results are shown in Table 5.

Table 5

T test results of treatment and control groups related with the means of ASTSTC pre-test and post-test scores

| ASTSTC | N | \bar{X} | S | Sd | t | p |
|--------------------------|----|-----------|-------|----|--------|--------|
| Treatment G. Pre Test | 20 | 68.500 | 7.762 | 19 | -2.307 | 0.033* |
| Post Test | 20 | 72.350 | 7.435 | | | |
| Control G Pre Test | 20 | 72.400 | 4.429 | | | |
| Post Test | 20 | 70.400 | 5.941 | 19 | 1.427 | 0.170 |

* $p < 0,05$ ASTSTC: Attitude Scale Towards Science and Technology Course

According to table 5, we see that there is statistically significance between the means of pretest and posttest ($t(19) = -2.307, p < 0.05$) in treatment group. When we check the control group, we see that according to t test results there is no statistically significance difference between the means of pre-test and post-test scores of control group ($t(19) = 1.427, p > 0.05$).

Vos-Groenendal (1991), Nourie (1998) and Barlas (2002); are the researchers who reached the conclusion that quantum learning helps the students to develop positive attitude towards their lessons.

According to the findings, there is significant difference between treatment and control groups in terms of achievement and attitude. The reason for this change can be said to be the variable method.

Discussion and Conclusion

In this century schools are targeted to not only gain students' academic achievement but also lifelong teaching methods, effective communication, creative thinking, learning how to learn and problem solving (Meydan, 2004). In this context, the approach which will be seen as basement is very important. The researches about education emphasize that placing students into the center of education is necessary. It is a must for learning concept to be learner centered to make the process effective. So, it directs us to think the concept of being learning rather than teaching. According to Yıldırım (2004), we should limit the concept of teaching to helping to learn and leave learning to the learner in order to reach achievement. (ref. Avcı, 2007, p.5).

Study has examined some effects of quantum learning on learners. In the 1st and 2nd sub-problems, intergroup AAT post-test scores and AAT permanence test scores are checked and seen that there is significant difference in terms of treatment group. Achievement variable is high at a significant level in treatment group, on which quantum learning is applied, when compared with control group.

Additionally, the other researches in the literature; Nourie (1998), Vos-Groenendal (1991), Barlas (2002), Le Tellier ve DePorter (2002), Benn (2003), Myer (2005), Demir (2006) and Hanbay (2009) are in line with the study and lends a support to the result. This result may result from reasons which effect academic achievement such as effective note taking, creative thinking, problem solving, motivation, reaching the truth in different ways, defining his own strategy of study, including sensorial skills to learning process and effective group work. According to Hanbay (2009), academic achievement in quantum learning results from finding an environment in which students can stand on their own legs.

Quantum learning likened learning teaching process to the rhythm of a symphony orchestra. This orchestra is a structure which contains a lot of variables and components effecting the environment simultaneously through different sources, and which is in harmony with the voice, body language, atmosphere and music used, and which is focused to demonstrate a show. And teacher is the chief of that orchestra who handles the mission of making the process effective and organizes the environment with his on time directions and evaluations. From this point of view, DePorter defines quantum teaching as “student achievement orchestra” with all (DePorter and others,1999).

In group pre-attitude and post-attitudes are checked in the 3th sub-problem of the study. As a result the difference between pre-attitude and post-attitude scores in treatment group is significant. So, the effect of method on attitude can be said to be positive. Vos-Groenendal' (1991) did researches on the effects of learning on students' attitudes towards lesson. And his studies are in line with the result above. Additionally, there is a decrease as 2.00 point in the mean of post-attitude score of control group. The reason for this decrease may be the teacher's aptitude, the applied method or the topics that the unit includes. Figley (1985) reached the conclusion that teacher's aptitude and the method that the teaching programme uses as base are the ones mentioned most about positive and negative attitudes towards lesson (ref. Şişko and Demirhan, 2002).

Attitude towards the lesson comes first from the most important factors which effect the achievement. The academic achievement will increase in parallel with this factor when it is checked. Quantum learning method differs from the other methods with its features such as different methods, using music, celebrating the learning, learning frame. According to Demir (2006), this method handles a student as a whole and another feature of it is trying to make students gain the skill of showing respect to the others' ideas. This makes students to experience the feeling of self-reliance and effects the learning process in account of the attitude.

Recommendations

In the light of these results, as a suggestion to the practitioners and other researchers;

1. We see that quantum learning model does not only contribute to the academic achievement of students but also to the development of their attitudes. For this reason, primary schools must be encouraged to use quantum learning approach properly.
2. At the beginning, some students may not get used to and may object to this approach during the application of quantum learning. This may stem from students objection to take responsibility and not willing to be expected much apart from sitting & listening to the teacher or not being in the habit of group work. In this situation, we must give chances to the students by encouraging them to participate in the lesson and we must make them taste the pleasure of learning by producing. For this reason, the stage of celebration must be structured effectively.
3. Through quantum learning approach, Researchers may do experimental studies on different academic levels and grades. In addition, studies may be done on different lesson and unit.

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