THE EFFECT OF THE USE OF SMART BOARD IN THE BIOLOGY CLASS ON THE ACADEMIC ACHIEVEMENT OF STUDENT

By

RECEP ONDER * HALIL AYDIN **

* Research Scholar, Anadolu University, Eskişehir, Turkey.
** Professor, Department of Biology Education, Dokuz Eylul University, Izmir, Turkey.

ABSTRACT

The objective of this study is to reveal the effect of the use of smart board in the biology class at the tenth grade of the secondary education on the academic achievements of students. The study used the quasi-experimental model with pre-test and posttest control groups and semi-structured interviews were made with the students. The study group of the research consists of the 50 students at the tenth grade in an Anatolian High School in the Buca District of the izmir province. The lessons with the students in the test group included the contents which were prepared by the methods and techniques based on the constructive learning approach and taught by using the smart board. The students in the control group were instructed with the activities that were specified in the current curriculum. As a result of the study, a significant difference was found between the achievements of the test group and control group students. The achievement of the test group students was found to be higher than the control group students. In addition, the interviews with the test group students provided comprehensive opinions on the use of smart board.

Keywords: Smart Board, Academic Achievement, Constructive Approach, Biology Teaching.

INTRODUCTION

Technology causes important changes in many fields of the society together with the development of the theories in the environments of science and teaching (Aypay & Ozbası, 2008). When using technology in this change within proper environments and times, it makes daily life easier and the user becomes individually satisfied without having any difficulty in accepting the changes in the developing worlds (Akkoyunlu, 1996). One of the areas affected by these innovations is the educational environment. Together with the technological developments in the education environments, technology became an indivisible part of education. As a result of this, technology allows the change and re-structuring of the education systems (Ozkanan & Erdogan, 2013). Therefore, the educational institutions follow this rapid change and constantly renew the technological infrastructure required for education. In this process of changes, schools started to use calculators, overhead projector, computer and finally smart boards.

The smart boards were used initially with the FATİH project (The Movement of Increasing Opportunities and Improving Technology). The FATİH project stipulates the provision of the infrastructure for laptop computers, LCD panel, interactive board and internet at all schools in the level of pre-schools, primary schools and secondary schools for the effective use of the informatics technology equipment in lessons in a way to address more sense organs in the learning-teaching process to provide equal opportunities in education and teaching and to improve technology at schools (FATİH, 2014).

The objectives of this project are primarily based on letting each students have the contributions of the smart board technology in the schools (Onder, 2015), and providing equal opportunities regardless of position and location in education (FATİH, 2014). The use of technology in education offers the benefits like the use of visual material, provision of co-operative learning, having the chance to repeat information, getting the attention of students and accelerating the learning processes (Kirschner & Selinger, 2003). Similarly, it can be argued that, the smart board is an

effective teaching technology with regards to its properties like provision of combined presentation of visual, audio and haptic contents, applicability of various teaching techniques, provision of the use of computer software and fast access to online resources (Solak, 2012).

Smart boards allow the three-way presentation of teaching: Visual, Audio and Sensory. Smart board software enables the teachers to prepare resources where students will be motivated and have fun (Altıncelik, 2009). Smart boards provide a more permanent learning and remembering by letting us present visual material supported by audio and animation and make experiments through animations instead of laboratory environment (Ekici, 2008). While explaining abstract subjects and subjects that are difficult to understand, it is essential to develop and use teaching activities that may trigger the visual and intellectual structures of students (Kose, Ayas & Tas, 2003). The visual material plays an important role in guiding people, gather their attention, make analysis and synthesis. Presentations and teachings by the use of such material provide a grasping which cannot be created by words and make remembering easier. Smart boards provide a more permanent learning and remembering by letting the teachers to use visual material that are supported by audio and animations (Marzano, 2009). In addition, smart boards also compromise the qualities like capturing a display image, recording the instructions in the lesson and using the recorded lessons when necessary and creating an environment of sharing with students (Onder, 2015).

With these qualities provided by smart boards, various learning strategies and models can be implemented in classes. One of these methods is the learning and teaching model based on constructive approach. The constructive approach basically intends to avoid giving ready information to students by teachers and to create environments where students will question their thinking (Akpınar & Ergin, 2005). Based on the constructive approach, students are expected to become individuals who can use their intellectual abilities, comment on learned information, take decisions on the learning process, be involved actively in lessons rather than being passive viewers. Teachers are in this process who facilitate learning and also learn with their students. In this sense, smart boards have a rich content as they create a learning environment in line with the constructive approach understanding (Basıbüyük, Sahin, Gokkurt, Erdem & Soylu, 2013).

1. Literature Review

When the investigators looked at the literature on smart board technology, they found studies in the fields of Science and Technology, Mathematics, Foreign Language Education or other fields (Cogill 2002; Beeland 2002; Zengin, Kırılmazkaya & Kececi, 2011; Tercan, 2012 & Oztan, 2012). When examined the studies on smart boards in the literature, the researchers found very limited researches on the use of smart board in the biology lesson (Schut, 2007). The study of Schut (2007) is about the views of students and teachers on the use of smart boards in the biology lesson. Therefore, instruction the lessons with the smart board activities in line with the constructive approach for the teaching of the biology subjects are among those that the students find most difficult to learn (Aydın, 2000) will make the comprehension of the subject easier (Dhindsa & Emran, 2006). One of the difficult tasks is to understand the subject of photosynthesis (Marmaroti & Galanopoulou, 2006). In this context, this study was conducted to reveal the extent of the effect of using the smart boards in biology lesson, which doesn't include much studies on the smart board application on the academic achievement of the students. In addition, more comprehensive data were obtained by semi-structured interviews. This study is important to determine the compliance of smart boards with our life in education and to reveal the usability of this technology.

2. Objective of the Study

The objective of this study is to reveal the effect of the use of smart board in the biology class at the tenth grade of the secondary education on the academic achievements of students. For this purpose, lessons were instructed to the test group students with smart board activities, while the students in the control group were instructed with the activities stated in the current curriculum.

3. Problem Statement

The problem statement of the study is as follows: "Does the use of smart board in the biology lesson in the tenth grade of the secondary education have an effect on the academic achievement of the students?"

The sub-problems of the study based on the above problem statement are given below:

3.1 Sub-Problems

- Is there a significant difference between the academic achievements of the control group students and test group students using smart boards in the biology lesson in the tenth grade of the secondary school and the control group students using the activities given in the current curriculum?
- What are the views of the students to use smart boards in the biology lesson in the tenth grade of the secondary school?

4. Method

Quasi-experimental model with pre-test and post-test control groups was used in this study. The model with the pre-test and post-test control group have two groups made by unbiased designation. One of them is used as test group and the other as control group. Both groups carry out measurements before and after the test (Karasar, 1994). The research subject was selected as "photosynthesis: linkage of energy". "Photosynthesis Conceptual Achievement Test (PCAT)" was applied to the test group students and control group students before the implementation stage. In the implementation stage, test group students were instructed by using the smart board activities and the control group students were instructed with the activities given in the education program. The implementation was completed in a period of five weeks. PCAT was applied to the test group and control group students after the implementation stage. In addition, semi-structured interviews were made with ten people in the test group.

4.1 Study Group

It is difficult to say that the quasi-experimental patterns are solid with respect to external validity; and therefore sample and population were not selected in this study and the study group was determined (Büyükoztürk, 2007). The reason for this is, the classes are certain in the schools to be selected and it is not possible to make changes in the classrooms.

The study group of the research consists of 25 students (11 boys, 14 girls) in the test group and 25 students (11 boys, 14 girls) in the control group after the random selection of the tenth grade students in an Anatolian High School in the Buca District of the İzmir Province.

4.2 Data Collection Instruments

4.2.1 Photosynthesis Conceptual Achievement Test

The purpose in the preparation of the Photosynthesis Conceptual Achievement Test (PCAT) is to determine whether any significant difference in the lesson achievement of the photosynthesis subject of the test group students who were instructed by the use of smart board in lessons and the control group students who were instructed with the activities given in the current curriculum and to determine the conceptual illusions. In this study, the data obtained from the first stage of PCAT were analysed and interpreted.

In the preparation process of PCAT, literature survey on the subject of "Photosynthesis: Linkage of Energy" was done initially and the scales used in the studies were analysed and interpreted. Taking the study field into consideration, it was decided that, it would be more appropriate to have two-staged type of questions for the objectives of the study.

The two-staged questions that were planned consist of multiple choice questions and figurative questions in the first stage. The students are expected to write the reason of their answers in the second stage. 30 questions were prepared in line with the gainings determined with respect to the multiple choice and figurative questions in the conceptual achievement test. The achievement test was examined by three specialists. In line with the views of the specialists, the number of questions was determined to be 22 after the required arrangements and corrections.

The achievement test developed by the researchers was applied to 93 tenth grade students in a different school who learned the subject for the item analysis. The data obtained after the implementation was analysed by a package program in the computer environment. After the analysis,

Kuder-Richardson 20 (KR-20) internal consistency coefficient was found to be 0.791.

According to the results of the item analysis, 7 items with the item distinction index below 0.30 were removed from the test to reach a multiple choice test of 15 items. The achievement test was prepared after applying the second analysis to 85 tenth grade students in a different school. After the implementation, KR-20 internal consistency coefficient was found to be 0.812. Looking at these values, the researchers concluded that, the items in the scale were convenient to measure the desired behaviour.

4.2.2 Semi Structured Interview Form

When preparing the interview discussion questions, the researchers studied the works in the literature on the student views about the smart board activities. The obtained data and the nature of the study were taken into consideration to prepare nine interview questions. The interview form was subjected to expert opinion with respect to scope validity, conformance of questions with the level and with respect to application period. Attention was paid to ensure that, the questions were simple, comprehensible and conforming to the literature. The opinions of the same experts were taken again for the interview forms to finalize them.

Before starting the implementation stage, interviews were made with the persons with qualities similar to the persons with whom the main interview would be done in order to determine the duration to be dedicated for the interview and whether the meeting questions are open and comprehensible.

In this study, semi structured interviews were made with ten students (5 girls, 5 boys) in the test group after the experimental application is finished. The purpose of this interview is to reveal the views of the students on the effect of having lessons with smart board activities and on the smart boards in general.

4.3 Material Development and Implementation Process

Before preparing the material, the objectives and gainings of the unit were examined. The tenth grade biology course book for the secondary schools of the Ministry of National Education was taken as the basic resource to study the material and gainings on the previously prepared subject of photosynthesis.

When preparing the material, attention was paid to ensure that the material confirm with the end of lesson gainings and with the preparedness level of students and provide coherence between subjects, that the visual course contents are suitable for the student level and simple to provide self-learning by the teacher and students and that the experiments that are difficult to be done in the laboratory can be taught by animations.

After doing the sufficient resource search about the content of the animations to be prepared on the photosynthesis subject, a preliminary work draft was prepared about the animations and the views of three experts were obtained. Following the required arrangements, the content of the design was decided and a plan about the preparation of animation was created. The content of the plan included the subtopics of the photosynthesis subject, selection of the topic content, switch buttons and experiments. The plan was finalized by obtaining the views of the same experts before starting design. The animations used were prepared by using the Adobe Flash Professional CS5 and Adobe Photoshop CS5 programs.

The implementation of the study took place for weeks. Whole subject was instructed by the researchers in the test group and control group. Therefore, it is believed that, the researchers minimized the teacher difference based conditions that would affect the result of the application.

4.4 Data Analysis Techniques

4.4.1 Analysis of the Photosynthesis Conceptual Success Test

Whether there is a significant difference between the pre-test and final test PCAT scores of the students in the test group and control group was compared with the related t-test analysis. The comparisons tested the significance to be 0.5.

On the other hand, unrelated t-test analysis was used to compare whether there is any significant difference between the pre-test achievement scores of the test group and control group students. The comparisons tested the significance to be 0.5.

As a result of these analyses, the pre-test achievement scores of the students in the test group and control group

were found to be different. Covariance Analysis (ANCOVA) is recommended to reveal the statistical difference to eliminate the risk of the result to be affected by this difference (Büyüköztürk, 2011). Therefore, this study applied the ANCOVA test to reveal whether there is a significant difference among the post-test PCAT scores of the test and control groups.

4.4.2 Analysis of the Semi Structured Interview Forms

Data obtained from the interviews with the students were coded and important parts were taken. After organizing the raw data according to certain categories, this data can be displayed to the readers through the direct short quotation, structured abstract, communication diagram or matrices including sentences (Türnüklü, 2000). Among these sections, the words included in the sub themes were selected and tables were prepared to display which students used these keywords.

In order to provide reliability of the interviews with the students, data were divided into categories and coded by two different researchers. The consistency of two different codings were calculated to provide reliability. In this study, average matching percentage for the interview questions of the coders was calculated to be 83%. Yıldırım & Simsek (2006) state that the coding is reliable if the matching percentage is 70%.

5. Findings and Interpretation

5.1 Findings and Interpretation about the Sub-Topic

The first sub-problem of the study is as follows: "Is there a significant difference between the academic achievements of the control group students and the test group students using smart boards in the biology lesson in the tenth grade of the secondary school and the control group students using the activities given in the current curriculum?"

Related sample t-test was used to reveal the significant difference between the scores of the test group and control group students in order to determine the effectiveness of the applied lesson. After this analysis, unrelated t-test was conducted to determine whether there is a significant difference between the pre-test scores of the groups. After the analyses, ANCOVA test was conducted on pre-test achievement scores of the students in the test group and control group were found to be different.

5.1.1 T-Test Results of the Pre-test-post test Scores of the Test Group Students regarding the PCAT

Table 1 includes the results of the related t-test that was applied to determine the average scores of the test group students from PCAT before and after the application.

Table 1 shows that, the conceptual achievement success scores of the test group students measured by PCAT was 8.43 (S=1.32) before the application and 12.67 (S=0.91) after the application. The difference between the averages was found to be statistically significant ($t(24)=-17.113$; $p=0.00<0.05$). According to these findings, it was determined that, teaching material that was prepared by constructive activities in the biology lesson by using smart boards increased the achievement scores of the students.

5.1.2 T-Test Results of the Pre-test-post test Scores of the Control Group Students regarding the PCAT

Table 2 includes the results of the related t-test that was applied to determine the average scores of the control group students from PCAT before and after the application.

From Table 2, it was determined that, the conceptual achievement success scores of the control group students measured by PCAT was 6.38 (S=1.49) before the application and 8.86 (S=1.74) after the application. The difference between the averages was found to be statistically significant ($t(24)=-7.5453$; $p=0.00<.05$). According to these findings, it was determined that teaching the biology lesson through the activities that are available in the current curriculum increased the achievement scores of the students.

Measurement	N	X	S	Sd	t	p
Pre-test	25	8.43	1.326	24	-17.113	0.000
Post-test	25	12.67	0.913			

Table 1. T-Test Results of the Pre-test-Post test Scores of the Test Group Students Regarding the PCAT

Measurement	N	X	S	Sd	t	p
Pre-test	25	6.38	1.499	24	-7.545	0.000
Post-test	25	8.86	1.740			

Table 2. T-Test Results of the Pre-test-Post test Scores of the Control Group Students Regarding the PCAT

5.1.3 The Results of the T-test of the PCAT Pre-test Scores of the Test and Control Group Students

Table 3 includes the results of the unrelated t-test that was applied to determine the average scores of the test and control group students from PCAT before the application.

From Table 3, it is found that, the conceptual achievement score average of the test group students from the pre-test was 8.43 (S=1.32) and the conceptual achievement score average of the control group students from the pre-test was 6.38 (S=1.49). When comparing the scores of the test group and control group students before the application, the researchers found a statistically significant difference between the test and the control group (t(48)=0.1; p=0.01<.05). This difference was found to be in favor of the test group.

The pre-test conceptual achievement score average of the test group students is higher than the pre-test conceptual achievement score average of the control group students. After these analyses, the preliminary test scores of the test and control group students were found to be different and therefore the Covariance (ANCOVA) analysis, that was recommended to reveal the statistical difference in such cases, was applied to remove the risk of this difference to affect the result.

5.1.4 The Results of the Unrelated T-test of the PCAT Post-test Scores of the Test and Control Group Students

Table 4 includes the results of the unrelated t-test that was applied to determine the average scores of the test and control group students from PCAT after the application.

Table 4 shows that, the conceptual achievement score average of the test group students from the post-test was 12.67 (S=0.91) and the conceptual achievement score average of the control group students from the post-test was 8.86 (S=1.74). When comparing the scores of the test group and control group students after the application, the researchers found a statistically significant difference between the test and the control group (t(48)=8.8; p=0.00<.05). This difference was found to be in favor of the test group.

The pre-test conceptual achievement score average of the test group students is higher than the pre-test conceptual achievement score average of the control group students. After these analyses, the preliminary test scores of the test and control group students were found to be different and therefore the Covariance (ANCOVA) analysis, that was recommended to reveal the statistical difference in such cases, was applied to remove the risk of this difference to affect the result.

5.1.5 ANCOVA Analysis of the Test Group and Control Group Students regarding the PCAT Post-test Scores

With the ANCOVA test, the researchers attempted to control and compare the post-test average achievement scores, and pre-test average achievement score levels of the test group and control group students. The results of the ANCOVA test, post-test averages scores of the students per groups and the corrected averages of the same scores according to the pre-test scores are given in Table 5.

According to Table 5, the uncorrected average scores of the post-test (without controlling the pre-test) were calculated to the 12.65 for the test group students and 8.86 for the control group students. Based on these scores, it was determined that, there was a difference and the post-test achievement scores of the test group students were higher. However, when controlling the pre-test scores of the groups, the researchers found changes in the post-test scores in favor of the test group students. The corrected average score of the post-test is 12.67 for the test group and 8.86 for the control group. According to the corrected post-test

Groups	N	X	S	Sd	t	p
Test Group	25	8.43	1.326	48	0.109	0.014
Control Group	25	6.38	1.499			

Table 3. The Results of the Unrelated T-test of the PCAT Pre-test Scores of the Test and Control Group Students

Groups	N	X	S	Sd	t	p
Test Group	25	12.67	0.913	48	8.883	0.000
Control Group	25	8.86	1.740			

Table 4. The Results of the Unrelated T-test of the PCAT Post-test Scores of the Test and Control Group Students

Groups	N	Average	Corrected Average
Test Group	25	12.65	12.67
Control Group	25	8.86	8.86

Table 5. Descriptive Statistics of the Final Test Scores According to the Test and Control Groups

average achievement scores, it is found that teaching lessons with the course material that was prepared based on the constructive approach provided contribution to the achievement.

Table 6 includes the results of the ANCOVA that was conducted to test the significance of the corrected achievement scores of the groups.

According to these results, the researchers found a significant difference between the post-test average scores of the test and control group students that were corrected according to the preliminary test score ($F(1-39)=151.000$, $p=0.00<0.01$). In other words, it was concluded that, teaching by the use of smart boards in the biology lesson was more effective on the achievement of the students compared to the teaching of the activities stated in the current curriculum.

Source of Variance	Total Squares	Sd	Average Squares	F	Significance Level (p)
Pre-test (regression)	9.888	1	9.888	5.726	.022
Group	151.000	1	151.000	87.440	.000
Mistake	67.350	39	1.727		
Total (corrected)	5094.000	42			

Table 6. ANCOVA Results of the Corrected Post-test Results per Groups according to PCAT

5.2 Findings and Interpretations of the Semi Structured Interview

Semi structured interviews were made with ten students within the test group after the application stage. The responses of the students to the questions were presented in Table 7 under sub-topics (Onder & Aydın, 2016).

In the first question of the interviews with the students under the study, students mentioned about the benefits of smart board. With these benefits, they stated that, visual presentation of the lesson content by smart board provides more permanence, that the lessons were more fluent and understandable and that they were able to study the smart board contents again.

In the second question with the students, regarding the views about the interest of the students in the lesson instructed by smart board, three students stated that their

	Question	Sub-topic	Student
Question 1	Views on the Benefits of Smart Board to the students	Visual and permanent	E1, E3, E5, K1, K2
		Fluent	E4, K3, K5
		Consolidation	E2, K4
Question 2	Views about the Interest of the Students in the Lesson instructed by smart board	I had more interest in the biology lesson	E3, K1, K2
		I had more interest in the subject but my interest in the biology lesson didn't change.	E1, E2, K3
		My interest in the biology lesson didn't change.	E4, E5, K4, K5
Question 3	Views on the Process of Instruction by Smart Board	Fast	E1, K2
		Successful and Fun	E2, E3, K3, K4
		Dim atmosphere	K1, E4
		Negative	E5, K5
Question 4	Views on the Effect of Using Smart Board in the Subject of "Photosynthesis: Linkage of Energy"	Visual	E1, E5, K3, K4
		Easy and permanent	E2, E3, E4, K1, K2, K5
Question 5	Views on More Effective use Smart Board	Teachers should be trained	E5, K4, K5
		Remote use should be possible	K1, K2
		Many animations and experiments	E1, E2, K3
		Sound effect	E3, E4
Question 6	Views on the Use of Smart Board in Other Lessons	Prevents waste of time	K3, K4, K5
		Allows to understand abstract concepts, permanent	K1, K2, E3, E4
		Active participation	E1, E2, E5
Question 7	Views on the Instruction Processes with Smart Board and White Board	Updated information	E1, E3, K2, K3,
		Repetition	E4, E2, K5
		With practice	E5, K1, K4

Table 7. Data obtained with Semi Structured Interview

interest in the lesson increased and seven students stated that their interest didn't change. However, students stated that their interest in the subject of photosynthesis increased as this subject was instructed by smart board.

E1: "I don't really like the biology lesson as it includes very complex concepts. Therefore, my interest in the lesson didn't change too much other than the solutions of the sample questions on the subject".

E2: "My interest in the subject was increased. But, I am still uninterested in the biology lesson".

E3: "My interest in the lesson was slightly increased as it was easier to understand by this method."

E5: "Instruction of the lesson by smart board didn't change as I don't like the biology lesson".

In the third question of the interview with the students, four students found it to be successful and fun with respect to the effect of the smart board on the instruction process. Two students stated that, lessons progressed faster and the waste of time caused by the writing of teacher was prevented. Two other students said it was negative to have fast lessons and they had difficulty in learning the subject. In addition, the researchers had a dim classroom atmosphere and so they need to turn the lights off during the instruction of lessons on some days. Therefore some students said that, they had eye aches.

In the fourth question of the interview with the students, students said that, the use of smart board in the subject of "Photosynthesis, Linkage of Energy had positive effects. Hence they stated that they were able to see the abstract concepts in a concrete manner and they were able to learn the subject better by doing practical experiments.

In the fifth question of the interview with the students, students said that, the teachers should allow more time to the smart board applications for more effective use of smart board and required trainings should be given for that. These practices should include animations, sound effects and practical experiments and it should be possible to have remote use of smart boards which would be useful for the classroom management.

E5: "Seminars should be given to the teachers on the use of smart board and computer. Our teachers prefer direct instruction or use ready text from the internet instead of having efficient use of smart board".

K1: "Teachers always stand by the board when they instruct by smart board. Therefore, they have difficulty in ensuring classroom control".

In the sixth question of the interviews with students regarding their views on the use of smart board in other lessons, students mentioned that, they wanted to have other lessons instructed by smart board as well. They wanted to have lessons with these activities particularly in lessons with abstract subjects like Mathematics, Biology and Chemistry. They stated that, lessons were faster with smart board and prevented waste of time, that they were able to see abstract concepts in a concrete manner and their active participation in lessons contributed to better learning of the lesson. They also said they believed such practices would have similar effect on the other lessons.

E4: "If it was used for the mathematics lessons, it would help me to understand and learning the subject".

K1: "Doing the applications of the experiments of the science lesson once more will contribute to the understanding of the subject".

K3: "I believe that visualization of the lesson covering various fields like science and having verbal instruction would increase our achievement in the lesson and that the negative views of many friends in this lesson would change".

K4: "It would be nice for history and geography. I would be excited to see audio visual display of the environments and incidents which are instructed verbally".

In the seventh question of the interview with students about the difference of the instruction processes with smart board and with white board, they stated that, the properties of smart board provided positive contributions to the instruction process. They also stated that, the white board didn't have the internet connection feature of smart board. In addition, the feature of smart board for recording the lessons content and sharing it in the Internet allow them to repeat the lessons more easily.

6. Result and Discussion

The objective of this study is to reveal the effect of the use of

smart board in the biology class at the tenth grade of the secondary education on the academic achievements of students. For this purpose, lessons were instructed to the test group students with smart board activities while the students in the control group were instructed with the activities stated in the current curriculum. Data were collected with PCAT and semi structured interview after the application.

According to the ANCOVA test, the researchers found a significant difference between the post-test average scores of the test and control group students that were corrected according to the preliminary test score ($F(1-39)= 151.000$, $p=0.00<0.01$). In other words, it was concluded that, teaching by the use of smart boards in the biology lesson was more effective on the achievement of the students compared to the teaching of the activities stated in the current curriculum.

When examined the studies in the literature, the researchers found studies that stated the use of smart board particularly in the fields of science and mathematics that increased the achievement of students and had similar findings with this study. For example, Cogill (2002), Beeland (2002), Min & Siegel (2011), Tercan (2012) and Oztan (2012) found similar results that indicated that, the use of smart board had positive contribution to the student achievement. Regarding the reason of this achievement, Oztan (2012) concluded that, the smart board increased the participation of students in the lesson, different learning styles could be implemented with smart board, instruction with smart board could address to more people, and group activities within the class would be easier with the smart board. Dhindsa & Emran (2006) and Akgül (2013) reported the reasons similar to Oztan (2012) for the cause of this achievement. The results of the interviews with the participants in the study provided similar results. For example, four of fourteen students participating in the interviews said that, the use of smart board in the lesson and visual material increased their attention in the lesson and allowed them to focus in the subject while six of them stated that, the practical experiments using animations and smart board helped them have easier understanding of the subject. Similarly, in an observation study, Kennewel (2006) stated that, students were enabled to have easier and faster access to resources when the lessons were instructed by smart board. The students said the visual properties of smart board enabled permanence of the lessons in the memory. In addition, in a study by Beeland (2002), Cogill (2002) and Schut (2007), stated that, the increase of academic achievement by the use of smart board could be explained with active learning. They stated that, the use of smart board in lessons increased participation in the lessons by making students active in the lesson due to applications of students by touching the board and therefore their interest in the lesson increased.

With respect to the increase of the academic achievement of the test group students within the scope of the students, students said that, the interaction feature of the smart board drew their attention, that the reaching updated information by internet connection feature was important for fluent and continuous lesson, that each experimental application was exciting and important for the permanence of the knowledge. In addition, they stated that, lessons were instructed faster and there were resources for the repetition of the subject as the smart boards had the feature of recording what was written on them in the classroom and teachers would share them in the internet. Students stated that the lessons were better understood with the display of the concepts in the smart board instead of verbal expression of abstract concepts during the lesson. In addition, practical application of animations and experiments in the lesson's contents increased participation in the lessons and this active participation increased motivation to the lessons. Ekici (2008) and Altıncelik (2009) stated that, the lessons were better understood with the use of various materials in smart boards like sound clips, animations and learning objects. Wall, Higgins & Smith (2005), Wood & Ashfield (2008) stated that, the lessons were instructed faster and became resources for the students to repeat by the feature of smart boards to record what was written on them during the lesson and by teachers' sharing in the classroom or internet environment. Zengin, Kırılmazkaya & Kececi (2011) concluded that, the smart boards increased motivation and the achievement of students in the lessons increased. Glover & Miller (2001) conducted an observation study in a

primary school and stated that, the use of smart board in the lessons increased the motivation and interest of students in the lessons. The studies of Kennewel (2006) and Wood & Ashfield (2008) support this result. A similar result was given by Min & Siegel (2011) who stated that, the use smart boards increased the attention in the lessons and that the students wanted to use this technology in the other lessons. In this study, the researchers found that, the smart boards didn't increase the interest of the students in the biology lesson, but increased the interest in the subject of photosynthesis. The reason is believed to be the fact that, the biology lesson consisted of abstract concepts and was found by the students difficult to be understood. Aydın (2000) and Schut (2007) stated that, the biology lesson was one of the most difficult lessons for the students to understand and therefore their attention in this lesson was not big.

Different from these findings, some studies in the literature reported that, there was no significant difference between the academic achievements of the test group students who were instructed by smart boards and control group students who were instructed with the activities available in the current curriculum (Akbas & Pektas, 2011; Emre, Kaya, Ozdemir & Kaya, 2011; Ermis, 2012).

As to the reason for not having significant difference in these studies, students achievement was increased by the lesson instructions with technology support according to Ermis (2012), by the laboratory environment according to Akbas & Pektas (2011), by the powerpoint presentations according to Emre, Kaya, Ozdemir & Kaya (2011) during the lessons of the control groups in addition to the lesson instruction processes. However, significant difference was found between the academic achievement of the students in the classrooms where instruction was given totally through traditional methods and in the classrooms where instruction was given by smart boards (Ekici, 2008; Lopez, 2010).

According the results of study, technology supported teaching in classrooms usually drew the attention of students. Students find the behaviourist teaching of students boring and not motivating. Students stated that, the different learning material in the instruction process increased their interest and achievement in the lesson.

7. Suggestions for Further Studies

Under the light of this study, there may be further studies on the effect of smart board in the interest and permanence of lessons. The Photosynthesis Conceptual Achievement Test that the researchers developed may be used to see the results regarding the effect of the use of smart board in different schools. In addition, more comprehensive interviews can be made with the teachers and students to have their opinions on the use of smart board in lessons.

References

[1]. Akbas O., and Pektas, M. H. (2011). "The Effects of using an İnteractive Whiteboard on the Academic Achievement of University Students". *Asia-Pacific Forum on Science Learning and Teaching,* Vol. 12, No. 2. Retrieved from http://www.ied.edu.hk/apfslt/download/v12_issue2_files/akbas.pdf

[2]. Akpınar, E., and Ergin, O. (2005). "The Role of Science Teacher in Constructivist Theory". *Ilkogretim Online,* Vol. 4, No. 2, pp. 55-64.

[3]. Akgül, B. (2013). "Effects of Smart board to the Student Success in the Elementary Art Lessons". Unpublished Master's Thesis, Gazi University, Institute of Educational Sciences, Ankara.

[4]. Akkoyunlu, B. (1996). "The Effect of integration of Computer Literacy Skills into Curriculum Primary Pupils' Achievements and Attitudes Toward Computers". *Journal of Hacettepe Education Faculty,* Vol. 12, pp. 127-134.

[5]. Altıncelik, B. (2009). "The Teachers' Views about interactive Whiteboards that Provide Learning Permanence and Motivation in Primary Level". Unpublished Master's Thesis, Sakarya University, Institude of Social Science, Sakarya.

[6]. Aydın, H. (2000). "Turkish Students Understanding of Some Concepts of Heredity". Unpublished Doctoral Thesis, Leeds University.

[7]. Aypay, A., and Ozbasi', D. (2008). "Investigating Teacher Attitudes Towards Computers". *Educational Administration: Theory and Practice,* Vol. 55, No. 55, pp. 339-362.

[8]. Basıbuyuk, K., Sahin, O., Gokkurt, B., Erdem, and E. ve

Soylu, Y. (2013). "Overview of the Smart Board with Mathematics Education". *1st Turkish Journal of Computer and Mathematics Education Symposium,* (20-22 June 2013). Trabzon: Karadeniz Teknik Unıversity.

[9]. Büyükoztürk, S. (2011). *Data Analysis Handbook for Social Sciences.* Ankara: Pegem Akademi Publishing.

[10]. Beeland, W. D. (2002). *Student Engagement, Visual Learning and Technology: Can Interactive White boards Help?"* Retrieved from http://chiron.valdosta.edu/are/Artmanscrpt/vol1no1/beeland_am.pdf

[11]. Cogill, J. (2002). *How is the Interactive Whiteboard Being used in the Primary School and How does this affect Teachers and Teaching.* Retrieved from http://districts.teachade.com/resources/support/5035b24fab097.pdf

[12]. Dhindsa, H. S. and Emran, S. H. (2006). "Use of The İnteractive Whiteboard in Constructivist Teaching for Higher Student Achievement". In *Proceedings of the Second Annual Conference for the Middle East Teachers of Science, Mathematics, and Computing,* pp. 175-188. Retrieved from http://www.teachade.com/resources/support/5035b2500c1cb.pdf

[13]. Ekici, F. (2008). "Effects of Smart Board Usage on Primary School Maths Students' Success". Unpublished Master's Thesis, Marmara Unıversity, Institude of Educational Sciences, Istanbul.

[14]. Emre, I., Kaya, Z., Ozdemir, T.Y. and Kaya, O.N. (2011). "Effects of using Interactive Whiteboard on Pre-Service Science Teachers' Achievement in Topic of Structure of Cell Membrane and Attitudes Toward Information Technology". *5th International Computer & Instructional Technologies Symposium,* (22-24 September 2011). Elazıg: Fırat Unıversity.

[15]. Ermis, U. F. (2012). "The Effect of the Use of Interactive Whiteboard on Students' Achievement and Motivation in Science and Technology Classrooms". Unpublished Master's Thesis, Gazi University, Institute of Educational Sciences, Ankara.

[16]. FATİH (2014). *Increasing Opportunities and Improvement of Technology (FATIH).* Retrieved from http://fatihprojesi.meb.gov.tr/proje-hakkinda/

[17]. Karasar, N. (1994). *Scientific Research Method.* Ankara: 3A Research Training Consultancy.

[18]. Glover, D. and Miller, D. (2001). "Running with Technology: The Pedagogic Impact of The large-Scale Introduction of Interactive Whiteboards in One Secondary School". *Journal of Information Technology for Teacher Education,* Vol. 10, No. 3, pp. 257-276.

[19]. Kennewell, S. (2006). "Reflections on the Interactive Whiteboard Phenomenon: A Synthesis of Research from the UK". *AARE Conference,* (26-30 Kasım 2006), Avustralya, Adelaide. Retrieved from http://www.ore.org.pt/filesobservatorio/pdf/KENNEWELL.pdf

[20]. Kirschner, P., and Selinger, M. (2003). "The State of Affairs of Teacher Education with Respect to Information and Communications Technology". *Technology, Pedagogy and Education,* Vol. 12, No. 1, pp. 5-17.

[21]. Kose, S., Ayas, A. and ve Tas, E. (2003). "The Effects of Computer-Based Instruction on Misconceptions: Photosynthesis". *Journal of Education,* Vol. 2, No. 14, pp. 106-112.

[22]. Lopez, O. (2010). "The Digital Learning Classroom: Improving English Language Learners Academic Success in Mathematics and Reading using Interactive Whiteboard Technology". *Computers & Education,* Vol. 54, pp. 901-915.

[23]. Marmaroti, P. and Galanopoulou, D. (2006). "Pupils' Understanding of Photosynthesis: A Questionnaire for the Simultaneous Assessment of all Aspects". *International Journal of Science Education,* Vol. 28, No. 4, pp. 383-403.

[24]. Marzano, R. J. (2009). "Teaching with Interactive Whiteboards". *Educational Leadership,* Vol. 67, No. 3, pp. 80-82.

[25]. Kathryn Min and Christine Siegel (2011). "Integration of Smart Board Technology and Effective Teaching". *i-manager's Journal on School Educational Technology,* Vol. 7, No. 1, Jun-Aug 2011, Print ISSN: 0973-2217, E-ISSN: 2230-7133, pp. 38-47.

[26]. Onder, R. (2015). "The Effect of the Interactive Whiteboard use in Biology Lesson on Students' Achievements and Attitudes Towards the Course and the Interactive Whiteboard". Unpublished Master's Thesis, Dokuz Eylul University, Institute of Educational Sciences, İzmir.

[27]. Recep Onder and Halil Aydin, (2016). "Students' Views

towards the Usage of Smart Board in Biology Lessons". *i-manager's Journal on School Educational Technology,* Vol. 11, No. 3, Dec 2015-Feb 2016, Print ISSN: 0973-2217, E-ISSN: 2230-7133, pp.18-28.

[28]. Ozkanan, A. and ve Erdogan, A. (2013). "The Contribution of Learning Environment Acceptance and Community Feeling to Learner Satisfaction in Distance Education". *Journal of Süleyman Demirel University Institute of Social Sciences,* Vol. 1, No. 1, pp. 209-220.

[29]. Oztan, A. Y. (2012). "The Effect of using Active Board on Academic Success of Primary 7th Grade Students on Science and Technology Teaching". Unpublished Master's Thesis, Necmettin Erbakan University, Institute of Educational Sciences, Konya.

[30]. Schut, C. R. (2007). "Student Perceptions of Interactive Whiteboards in a Biology Classroom". Unpublished Master's Thesis, Cedarville University, B.A. Life Science Education. http://digitalcommons.cedarville.edu/cgi/viewcontent.cgi?article=1015&context=education_theses (09.05.2016).

[31]. Solak, M. (2012). "The Analysis of the Teacher's Attitudes Towards the Usage of the Smart boards According to the Technology Acceptance Model". Unpublished Master's Thesis, Sakarya University, Institute of Educational Sciences, Sakarya.

[32]. Tercan, I. (2012). "The Effects of Interactive Whiteboard use on Achievement, Attitude and Motivations on Science and Technology Course of Students". Unpublished Master's Thesis, Necmettin Erbakan University, Institute of Educational Sciences, Konya.

[33]. Türnüklü, A. (2000). "Education Science Research Qualitative Research Techniques that can be used as Effective: Interview". *Educational Administration: Theory and Practice,* Vol. 24, No. 6, pp. 543-559.

[34]. Wall, K., Higgins, S., and Smith, H. (2005). "The Visual helps me understand the complicated things: Pupil views of teaching and learning with interactive whiteboards". *British Journal of Educational Technology,* Vol. 36, No. 5, pp. 851–867.

[35]. Wood, R. and Ashfield, J. (2008). "The use of the Interactive Whiteboard for Creative Teaching and Learning in Literacy and Mathematics: A Case Study". *British Journal of Educational Technology,* Vol. 39, No. 1, pp. 84-96.

[36]. Yildirim, A. and Simsek, H. (2006). *Qualitative Research Methods in Social Sciences.* Ankara: Seckin Publishing.

[37]. Zengin K. F., Kırılmazkaya, G., and Kececi, G. (2011). "Elementary Students Use of Smart Board the Effect of Achievement and Attitude in Science and Technology Course". *5th International Computer & Instructional Technologies Symposium.* pp. 22-24.

ABOUT THE AUTHORS

Recep Onder is currently pursuing his Ph.D degree in Augmented Reality at Anadolu University, Eskişehir, Turkey. He is also working as a part time Lecturer in different Universities, Izmir, Turkey. He received his M.Sc. degree in Computer Education and Instructional Technologies Teacher Education from Dokuz Eylul University, Izmir, Turkey. He teaches Undergraduate courses in Computer Education and Instructional Technologies. His research interest includes Graphics and Animation in Education, Smart Board, Constructivism, etc.

Halil Aydin is working as a Professor in the Department of Biology Education at Buca Faculty of Education, Dokuz Eylul University, Izmir, Turkey. He received his M.Sc. degree in Biology Education from Dokuz Eylul University, Izmir, Turkey. He received his Ph.D in Science Education from Leeds University, Leeds, UK. He teaches Undergraduate and Graduate courses in the field of ICT in Education, Biology Education, Environmental Education. His research interest includes Conceptual Understanding, ICT in Science Education, etc.