The Effect of a Sheep Heart on the Cognitive and Affective Area of the Elementary Students, Case Study: Canakkale, Science Camp

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Abstract

Learning referred to the changing and expansion of the schemes in the mind of the child through the addition of new knowledge. This determination is based on the cognitive area. The learning also happens in the affective area. The aim of this research is to study the effects of the usage of advanced organizer and haptic learning applications on the cognitive and affective learning area of the 5th grade students in Canakkale, Turkey. The activity has been applied on a sheep heart in a science camp. The data is collected within the mixed methodology, and evaluated within a case study. At the completion of the study, students were observed to acquire knowledge successfully and they had found the activity interesting and entertaining. As a result, it was concluded that the advanced organizer and haptic learning are effective on cognitive and affective learning area.

Key words: haptic learning, advanced organizer, sheep heart, cognitive, affective area

Introduction

The learning areas are comprised of the cognitive, affective, and psychomotor. (Ozcelik, 2010; Demirel, 2005; Reigeluth & Moore, 1999). The cognitive learning theory has been one of the most researched theories of learning since the beginning of the twentieth century (Kraft, 1999).

Cognitive learning

The concept of 'cognition' refers to the condition of being knowledgeable about a given event or object; and 'cognitive' refers to being related to the functioning of intelligence (TDK, 2010.) Intellectual learning dominates the field of cognitive learning. The recalling of knowledge, comprehension, application, analysis, synthesis and evaluation form the subcategories of this field (Ozcelik, 2010; Demirel, 2005; Reigeluth & Moore, 1999). Teaching models developed to date are observed to have been mostly directed towards the cognitive field (Ozcelik, 2010; Gunter, Estes, & Mintz, 2010; Joyce, Weil & Calhoun, 2004). Hence there are many more studies related to the cognitive learning (Leanne, 2013; Kinchin, 2011; Usak, 2009; Fisher, Wandersee, & Moody, 2000).

Learning is also referred to as the changing and expansion of the schemes in the mind of the child through the addition of new knowledge (Driver, Guesne, & Tiberghien, 1985). This definition appears to subscribe to the theory of cognitive learning. Cognitive learning theory focuses on the process of knowledge acquisition and knowledge function. The usage of various tables, pictures, advanced organizers, diagrams, along with the conduction of applications and the passing on of appropriate reinforces have proven to be effective in the transferring of data into long-term memory (Gagne, 1985). This study also focuses on the utilization of two paths in the acquisition of knowledge. One of these is the usage of an advanced organizer; and the other is the conduction of a haptic learning application.

Affective learning

The teaching models intended for the affective area are rarely. The two theoretical researches might be evaluated in terms of the affective learning area: 'The Humanistic Program' (McNeil, 1996) and 'Enhancement of Affective Outputs' which is the EQ perspective to the affective teaching (Bichelmeyer, Marken, Haris, Misanchuk, Hixon, & Fostering, 2009). Meredith, Fortner, and Mullins (1997) mention significance of the affective learning area, and state that there is not enough research about it. The affective area studies usually focus on the attitudes (Khan & Kahn, 2012; Usak, Prokop, Ozden, Ozel, Bilen, & Erdogan, 2009; Prokop, Prokop, & Tunnicliffe, 2007; Yaman, 2007). However, the affective area is only not formed by the attitude. The concepts such as pain, sting, anxious, fear, enjoying, interesting etc. are related to the affective area (Martin& Briggs, 1986, in Bichelmeyer, Marken, Haris, Misanchuk, Hixon, & Fostering, 2009; Combs, 1982) but the researches related to these concepts in education are very limited.

Combs (1982) and Reyes (1984) mention the importance of the affective learning area in education as theoretically. Combs (1982) and Reyes (1984) state the feelings are very

important in education. If a student enjoys the lesson then s/he will learn better. Reyes (1984) also says if the anxiety level is low and the self-confidence level is high the then the students will be successful in mathematics.

Okur, Sezer, Guder and Yalcin- Ozdilek (in press)'s experiential study confirms Comb and Reyes' evaluation. The aim of this experiential research is to determine the affective perspective of the students to an outdoor hydrobiology activity in Canakkale, Turkey. A form is designed in order to have the students' view. This form is filled out after the activities. The forms are evaluated by discourse analysis. It is found that students are learnt by touching, considered the activities as interesting and enjoyable, and changed their perspective on stream.

The cognitive and affective learning areas might be seen as two different areas. However, the neurologist Antonio Damasio (1994, in Bichelmeyer et al., 2009), who studies on the patients with damaged brain, says that the emotion is essential for the reasonable thinking. It is thought that the learning can be happened using of both areas. If the people have various properties in their affective area (Martin& Briggs, 1986; in Bichelmeyer et al., 2009) and then the various learning environments should be brought about for them. Outdoor activities, social interactions or varied activities intended for five senses might be used in order to have different learning environments. The haptic learning is used for enrichment of the learning environments within this study. The aim of this research is to analyse the effects of advanced organizer usage and haptic learning on the cognitive and affective learning area of the elementary students.

Methodology

Advanced organizers are used in Ausebel's methods of 'meaningful learning' (Un-Acikgoz, 2007), and 'learning through presentation' (Joyce et al., 2004). Meaningful learning method is also mentioned in Huitt, Monetti and Hummel's (2009) 'direct teaching model'. Ausebel identifies these three conditions as important in meaningful learning: the organization of knowledge with respect to the meanings they carry relative to each other, the cognitive structure of the individual, and the intentions of the learner. One of the most challenging parts here is the organization of knowledge; in other words, the preparation of an advanced organizer.

The developmental process of the individual concerned plays a significant role. The reason for this is the existence of schemes present within the individual's mind that has been brought forward since birth. The starting point of the construction of an advanced organizer should be influenced by a phenomenon existing within the individual's scheme. This would secure a linkage spot for newly acquired concepts within the individual's scheme. In line with the learning process defined above, the addition of new concepts into an individual's mental scheme is expected to generate change and development. The reverse effect would be the conditioning of the individual towards memorization rather than meaningful learning. The proper layout of concepts should be such that those concepts introduced following the

establishment of the very first concept are in either in relation with it, or carry a relative relation between each other whilst occupying the same level within the advanced organizer. The aim of preparing an advanced organizer is to have the learner experience a singular, direct delivery of several related concepts, which are meaningfully arranged amongst each other (Huitt et al, 2009; Un-Acikgoz, 2007; Joyce et al, 2004).

Haptic Learning

Rousseau (in Shanely, 2006), and Piaget (2000) argue that the children acquire their first data through the use of their five senses. Auer (2008) has coined the term 'sensory learning' in referring to data acquisition through the five senses of smell, hearing, touch, sight and taste. Symmons (2004) argues that the sense of touch has a unique place amongst the five senses in the direct relationship it facilitates between the person and the environment. According to this, senses such as hearing can only be realized after the travel of sound waves through the anvil, stirrup, and malleus inside the ear; and the act of seeing requires the successful travel of light to the retina. In other words, stimuli arrive at the sensory organs in a passive state. Yet the act of touching is purpose-driven (Bellesteros, 1993); where the individual utilizes the use of his/her hands and fingers in order to intentionally touch the object they want to detect.

Haptic learning is an experience which simultaneously qualifies as an application. The individual not only touches a given object of interest with his or her hand and fingers; but also tries to record acquisitions through the sensory medium of sight. This is the juncture where 'experiences' come to the fore. The fact of having more than one of the five senses active during the experience helps the transfer of data into long-term memory (Kraft, 1999). Pestallozi argues the effectiveness of first-hand experiences in the learning cycle of the child – direct answers to the child's questions should be avoided for the sake of allowing s/he the chance of acquiring data through the usage of first-hand experiences (in Shanely, 2006). In other words, first-hand, touch-based activities are advised to facilitate the child's heuristic learning skills (Keskin & Bal, 2000; Unal, Akinci, & Sahin, 2000; Siraj-Blatchford & Macleod-Brudenell, 1999). In a similar vein, Novak (1998; in Rodriguez & Kitchen, 2005) argues that learning can only be realized through a combination of the individual's own thoughts, touches, and actions. Martin, Bright, Cafaro, Mittelstaedt and Bruyere (2007), on the other hand, emphasize the importance of combining frequent touch-based activities with those of high cognitive levels in realizing permanent learning. Stine (1997) also identifies the role 'touch' plays in enriching the worldviews of children. Newell, Ernst, Tjan and Bülthoff (2001) emphasize the need to evaluate visual and haptic data together in obtaining more consistent results in positive environmental appreciation.

Siraj-Blatchford and Macleod-Brudenell (1999) state the need to include practices related to the sense of touch in both social and cognitive activities. Bennett (1994) emphasizes the need to construct a cooperative environment in which the child's cognitive skills are improved simultaneously with his or her independent comprehension. Social interaction is the most important component of this process (Siraj-Blatchford & Macleod-Brudenell, 1999; Bennett, 1994). The importance of having social and cognitive activities together within the

class environment during the formulation and understanding of data is emphasized (Bennett, 1994).

In light of the above content, these titles come to the fore within the context of haptic learning:

a. The individual's first-hand participation in activities,

b. The utilization of several senses during activities,

c. Social interaction

d. Change in the individual's mental scheme.

All the above titles, just like Piaget (2000) has identified, are important for the process of active learning. This research has also emphasized the partaking of students in active education through focusing on haptic learning during applications; whilst encouraging students to do the activities on their own, in a socially interactive context where students worked in pairs, and with the use of advanced organizers aimed at activating mental schemes.

Non-Turkish Studies focusing on Haptic Learning

Gibson (1962) mentions two types of haptic learning: one based on active touching, and the other on passive touching. In haptic learning based on active touching, the individual's detection of any given object is processed by the use of the hands and fingers. On the other hand, during haptic learning based on passive touching, the object is only brought into contact with the individual's skin. Gibson's (1962) research has found that 49% of individual's detect objects correctly by passive touching, while 95% correctly detect via active touching. The haptic learning act used during this research corresponds to 'active learning by touching.' Non-Turkish academic literature uses the term 'haptic' when referring to learning by touching (Symmons, 2004; O'Dell and Hoyert, 2002; Bellesteros, 1993; Gibson, 1962); while learning by touching is also used within literature aimed at the education of the visually impaired (Bellesteros, 1993).

Haptic Learning Research Based in Turkey

A close analysis of studies from Turkey reveals the main focus being on the education of the visually impaired. Buyurgan and Demirdelen (2009), for example, have conducted a research looking at the interaction between students defined as 'totally blind' (blind from birth) and education within a museum environment at the Museum of Civilizations in Ankara. The subjects were allowed to touch certain exhibits inside the museum during the research. The reasoning behind this type of detection by students during research was cited as a need to activate other sensory organs to make up for the unavailability of the sense of sight.

In another study, Morgil, Yilmaz and Yoruk (2003), have worked with seventh grade students based on the subject of 'matter and its properties' – a sub-field of the chemistry curriculum. A learning wheel model based on seven different stations was used during the research. Students were asked to define objects by touching in the third station, and a

successful identification rate of 73.33% was achieved. In a different line of research, haptic learning has also been determined as a learning style.

Sunbul (2003) mentions visual, auditory, and haptic; while Kaya and Akcin (2002) talk about cognitive, affective, and physiological in defining the three types of learning styles. Kaya and Akcin (2002) argue that haptic learning falls within the context of physiological learning. Sunbul (2003) maintains that each individual student will have a tendency to prefer different learning styles. Those students having a haptic learning style can acquire information via doing and experiencing. Sunbul (2003) has experimentally proven the effectiveness of haptic learning in facilitating the permanent acquisition of data. Kaya and Akcin (2002), on the other hand, have identified haptic learning as one of the learning styles which can be used in the education of nurses. Knowledge acquired this way, it is hoped, will be committed and actually learnt, instead of memorized.

Literature review of Turkish and non-Turkish research reveals the importance of haptic learning within the context of education – especially regarding the education of individuals visually impaired from birth. On the other hand, no study on the assessment of activities based on haptic learning has been encountered. Therefore, research based on the elaboration of studies on haptic learning and their effects on education is thought to be in demand.

The preparation of the study

It was made on four topics:

a. Determining the subject field.

b. Academic achievement test preparation to collect the quantitative data.

c. Preparation of advanced organizers.

d. Preparation of the form to take the opinions in order to collect qualitative data

a. Determining the subject field

In the initial phase of the study, the subject area related to the haptic learning on which we can work was determined. In determining the subject area, the level of education of the students who participated in the research was taken into consideration. As the students were the fifth grade, and the first level Science and Technology course content was examined. Through the opinions of the basic science research team specialist, within the ‘Living and Life’ learning space, the circulatory system in the unit ‘Let's solve the puzzle of our body’ was investigated.

For the haptic learning activity, investigation of the circulatory system and examination of a mammalian heart were decided. Primary reason for the selection of a mammalian heart is that the issue was included in the fourth grade unit. As students who are the object of research are in the fifth grade, the issue of the circulatory system is thought to have been committed at school before. Because when the learner faces with a subject for the first time, learning could also occur as the subject interesting to him (Joyce et al, 2004). As

such a situation could cause a swerving in the research results; a subject previously treated was selected. At the same time, the direct connection between the subject and the learner himself is another important issue. In other words, it is thought that holding a heart similar to his own heart can attract his attention.

b. Academic achievement test preparation to collect quantitative data

In order to obtain quantitative data, a graduate-level academic achievement test that was prepared in advance related to the circulatory system was adapted to the primary school level. One of our master students prepared this test within her final project. We were allowed to use the test by her.

To ensure the validity of the test coverage and the adaptation of the test, a preliminary study was done on a group similar to an experimental group. Pre-study was held with the students who participated in the project TUBITAK (The Scientific and Technical Research Council of Turkey) 'Funny Summer Science Camp 2009'. Items difficulty index and items distinguishing index were calculated (Erdogan, Ural, & Ural, 1993); and 9 of 20 items were omitted from the test. Final form 11-items achievement test was given in the Appendix 1.

According to this, the index of difficulty in the test materials ranged between 0.06 to 0.93, and the distinguishing index ranged between 0.3 and 0.8. To ensure the validity of the prepared questions, basic 'science specialist' and 'educational measurement and evaluation specialist' were asked their opinions. Sencan (2005) offers that the test indexes and specialist views should be evaluated together. According to the specialist views, the last version of the academic achievement test is accepted as suitable on order to determine knowledge level of the 5th grade students about the mammalian heart and blood circulation system.

c. Preparation of the advanced organizers

Taking into consideration the students' level and subject area, two pieces of advanced organizers were prepared. Advanced organizers are presented in Figure I and Figure II.

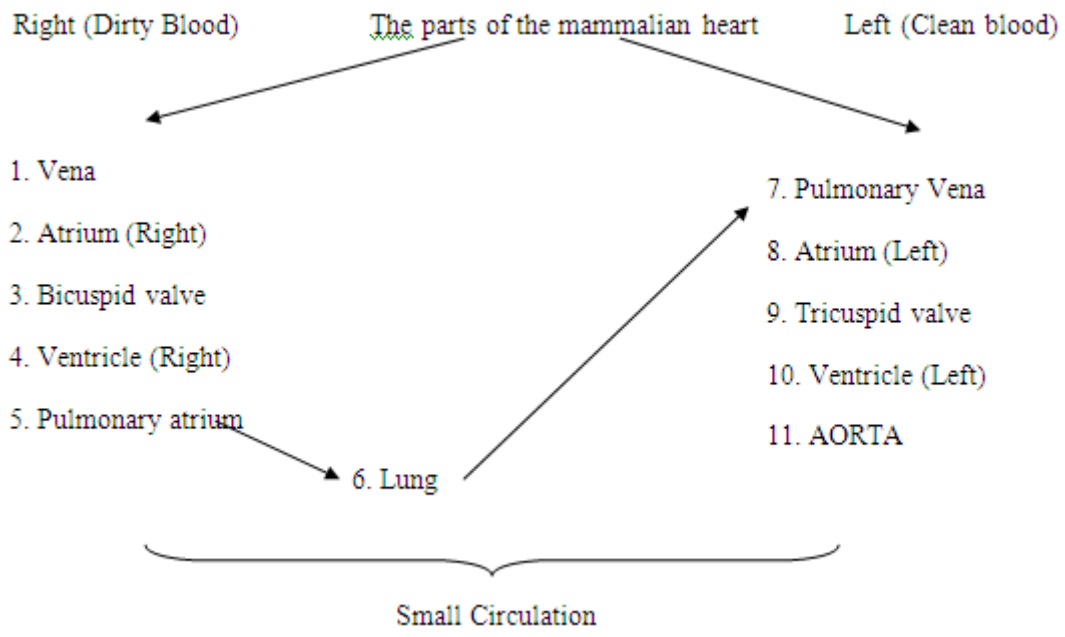

Figure 1. *The parts of the mammalian heart*

In the Figure 1, we tried to show; from which parts of the heart the blood passes respectively; how a small blood circulation comes true; which sections there are in the right and the left parts of the heart; which vessels bring blood to the heart; which vessels take blood from the heart. According to levels of students, advanced organizers concepts are used in Turkish. Except the names of the valves, no Latin phrases were used.

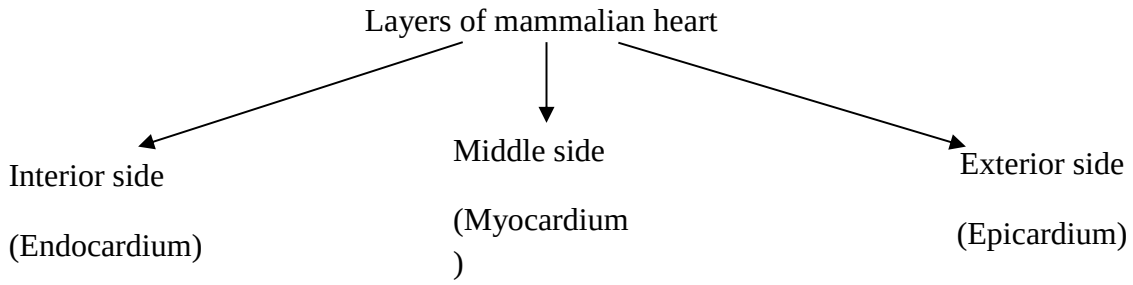

Figure 2. *The layers of the mammalian heart*

The layers of the heart were tried to show in Figure 2. In this section, the layers are used both in Turkish and Latin equivalents. In this section, the particular use of Latin expressions is for establishing relationship between daily life and the information provided. For example, in daily life, to refer to heart attacks, 'myocardial infarction' is also available.

d. Preparation of the form to take the opinions in order to collect qualitative data

For the preparation of the form to take the opinions, a pre-work has been done with a group similar to the research group. A pre-trial was done with 33 students taking part in the project

titled ‘TUBITAK Fun Summer Science Camp, 2009’. With the preliminary test, it is tried to determine whether the students understood the questions right or not, and their reactions about answering the questions through writing. After the activity, students were asked the following questions:

a. Which part of the activity do you like more?

b. Which topic did you find interesting in this activity?

c. What kind of difference is there between the activity you do here and the ones you do at school?

d. What do you think about this activity that you did here?

After each activity, the students were asked to fill out this form in writing. During the preparation of the questions, 3 experts were asked their opinions. One of the experts is basic science specialist; the other two are education science specialists. It is determined that after the pre-study, the students had difficulty in answering the questions in the c and d options above. Therefore the question in d option was excluded from the form, and the question in c option was re-arranged. Under the light of the answers given to the other two questions, three themes were determined as ‘haptic learning, being funny, and being interesting’. In the final stage, there are the following questions in the form:

a. In addition to what you have learned in school what did you learn different here?

b. Did you find this activity interesting? Please explain why.

c. Did you find this activity funny? Please explain why.

The data for this research were obtained from the students taking part in the project titled ‘TUBITAK Fun Summer Science Camp, 2010’.

The project is organized into three terms of one week. There have been 33 students in the first period, 31 students in the second one, and 31 students in the third one; totally 95 students of the fifth grade in the primary school level took part in the project. Although 95 students participated in the project, some of them stated that they dislike seeing meat; the heart smells bad, they are afraid of seeing a real heart, and they feel nausea. These students weren’t forced to continue the activity, and they left before completing the activity. For this reason, 85 students who had both pre-test and post-test data were evaluated.

It is also very reliable to collect data by triangulation at the social science (Yildirim & Simsek, 2006). Hence, non-participate observation and open-ended questions (Bas & Akturan, 2008; Zanovello, 1999) were also used for the triangulation. All qualitative data were analysed by discourse analysis.

The names of the students were kept. We named them with codes. For instance, 1.5 coded student: ‘1’ was the number of the camp period; ‘5’ was the line number of the students

list. This student, in other words, joined the first period of the camp, and was at the 5th line of the first student group.

The activity was held, respectively, with the implementation of the following steps:

1. Before the start of the lesson, advanced organizers were plotted on the board (Figure 1 and Figure 2).

2. Laboratory was prepared before lesson: students will work in pairs for the application. Therefore, laboratory layout was prepared in a way that every two students will have one sheep's heart (Figure 1).

3. The students put on their gloves and laboratory coats, and they were brought to the hearts (Figure 1).

4. The students were applied the pre-test (Figure 2).

5. In order to stimulate the students' previous knowledge, questions about the heart and the circulatory system were asked.

Figure 1. *Pre-Activity Preparation*

Figure 2. *Pre-Test Application*

6. Subject was described once more via advanced organizer.

7. How to distinguish the right and the left of the heart was explained.

8. The students were asked to find vessels, valves and chambers as in the order shown in the advanced organizer. In the meantime, the path of blood will be monitored. In other words, students' fingers also pass the way the blood passes through the vessels, valves, and chambers (Figure 3)

Figure 3. *Implementation phase*

Figure 4 & Figure 5. *The teachers' guiding for the students during the application*

9. In the transactions process, students were guided by the research team (Figure 4, & Figure 5).

10. After the application, a post-test were implemented; and the students' opinions about the activity were received in writing by distributing the form of opinions.

Data analyses

SPSS.13 was used for the analyses of the quantitative data. The answers of the students were coded to SPSS as '0' and '1'. '0' was wrong answer; '1' was correct answer.

The data obtained from the students were checked through the Kolmogorov-Smirnov test in order to see if they show normal distribution. This test was chosen as the sample size is greater than 50. According to the Kolmogorov-Smirnov test; if the p (meaningfulness) value is higher than 0.5, it means that the scores show normal distribution (Buyukozturk, 2007). In this research, as the p value was smaller than 0.5 for the Kolmogorov-Smirnov test, it was concluded that the scores didn't show a normal distribution. According to this, non-parametric tests were used in the other analyses as the scores didn't show a normal distribution.

Analysis of the tests that were applied before and after the activities were assessed by using the Wilcoxon signed ranks test. It is stated that Wilcoxon signed ranks test can be used when the participants were applied two measurements; in other words, when repeated measurements were applied to the same group and they didn't show a normal distribution (Buyukozturk, 2007; Connolly, 2007).

Findings

Analysis of the tests that were applied before and after the activities were assessed by using the Wilcoxon signed ranks test. The findings related to the Wilcoxon signed ranks test that was used in order to determine whether there was a statistically meaningful difference between the students' total scores obtained from the pre-test and post-test were given in the Table 1.

Table 1. *The result of the students' pre-test and post-test analysis*

Post-test/ Pre-test	n	The average of rank	Total of rank	z	p
Negative rank	2	4.00	8.00	7.92	.000
Positive rank	81	42.94	3478.00		
Equal	2				

Based on the negative rank base

Results of the analysis show that there is a statistically significant difference between the total scores of the students obtained from the pre-test and post-test ($z = -7{,}920$, $p < .05$). When the average of the difference scores and the totals taken into account, it is seen that this difference was in favour of post-test that is positive ranks. According to these findings, haptic learning activity using advanced organizer can be said to be effective in students' acquiring knowledge.

The forms that were written by the students after the activity were assessed through the content analysis for the qualitative analysis. Answers to the first question in the form that was prepared in order to get the students opinions were divided into categories, and themes were identified as in Table 2.

Table 2. *The codes of the answers to the first question in the interview form.*

What did you learn different here besides what you have learnt at school?	Total
The parts of the heart (cubicles -atrium, ventricle-, valvula, veins, layers)	80
The Circulatory System	18
Learning better than school	9

In the form of interviews, students reported that they have received knowledge about the heart and circulatory system components (Table 2). The students stated what they have learnt about atrium, ventricle, valves, and layers as below : 1.5 coded student: 'We learnt the parts of the heart such as atria and ventricles.' ,1.17 coded student: 'atrium/ ventricle of the heart, the transition between the atrium/ ventricle and the blood vessels.' , 2.26 coded student: 'l have learnt the right valvula and the left valvula.' , 1.6 coded student: ' 'Endocardial-myocardial-pericardial-auricle-ventricle.' , 1.18 coded student: 'l learnt the parts of the heart, and which vessel pumps to where.' , 3.1 coded student: 'l learnt the layers of the heart.' Some sample statements related to the circulatory system theme can be given as below: 2.15 coded student:' l learnt the small circulation.' , 2.23 coded student: ' l learnt the large circulation.' , 3.13 coded student: ' l learnt the functioning style of the heart, the vessels, and how the blood circulates.' Through the data obtained, it can be concluded that the qualitative and the quantitative data supported each other, and there was an increase in the students' knowledge related to the parts of the heart and the circulatory system.

Thirdly in the interview form, students stated that with this activity they learnt better than at school. Some statements of the students are below. 1.3 coded student: 'l had learnt nothing at school. I didn't know the heart was so weird and different.' 1.16 coded student: 'We don't do experiments at school, and we learnt the things we didn't know by researching the heart.' 2.9 coded student: 'We understood better here as we worked with a real heart. There is just expression of the subject at school, yet here there are both the expression and a live heart.' 2.12 coded student: 'We didn't learn the heart at school so much, yet in this laboratory I learnt a lot of information.' 2.25 coded student: 'We have never touch a heart in Science lesson.'

It was concluded from the interview form that the students especially stressed on the learning through applying. Answers to the second question in the form that was prepared in order to get the students opinions were divided into categories, and themes were identified as in Table 3.

Table 3. *The codes of the theme 'entertaining'*

Why did you find the activity entertaining?	**Total**
Touching a real heart for the first time	30
Examining the heart	18
Learning new information	9

All of the students reported that they found the activity entertaining (Table 3). The primary reason for activity to be found entertaining was reported as touching a real heart for the first time. Some students statements are these: 1.6 coded student: 'Yes, because we touched a real heart.' 1.13 coded student: 'Yes, I touched a real heart for the first time.' 1.12 coded student: 'Yes, I found it entertaining. Looking, touching, and examining a real heart is enjoyable.' 2.10 coded student: 'It was entertaining as I have never examine a heart before.'

Examining the heart and learning new information during this investigation was another reason for the students to find the activity entertaining. Some sample student statements are these: 1.2 coded student: 'Yes, I loved to learn what I didn't know.' , 1.16 coded student: ' Yes, we examined all parts of the heart freely.' , 1.22 coded student: ' Examining the heart and learning new things were nice.' , 2.16 coded student: ' This activity was very good. Some information sticks in our minds.' 3.3 coded student: 'I found this activity enjoyable. Examining the heart and touching it were so enjoyable. And we learnt the information in an enjoyable way.' 3.9 coded student: 'I found it enjoyable because I learnt better by touching the heart.'

In this study, bilateral working groups were formed basing on the thesis that social interaction is effective on learning. Yet no question related to the social interaction was asked among the questions directed to the students. Although the students were not questioned in the direction of social interaction, 1.12 coded student found the activity as she did it with her friend. The statement of 1.12 coded student is this:

'Yes, as I did it with my friends.'

Answers to the third question in the form that was prepared in order to get the students opinions were divided into categories, and themes were identified as in Table 4.

Table 4. *The codes of the theme "interesting"*

Why did you find the activity interesting?	**Total**
Touching a real heart for the first time	29
Touching a real heart for the first time	19
Awareness	2

The students reported their first reason to find the activity interesting as 'touching the heart for the first time' (Table 5). Students stated their opinions as follows: 1.2 coded student: 'Yes, because we examined a real heart.' 1.11 coded student: 'We touched and examined the heart.' 1.20 coded student: 'Because I touched the heart for the first time.' 2.9 coded student: 'I found it interesting because I have never done something like this before.' 2.13 coded student: 'I have never seen a sheep's heart before.' However, in the observer notes, the student stated that he has seen a sheep's heart before but he was excited as he would examine it for the first time.

It can be seen that another reason of students' finding the activity interesting stems from the difference of the heart's internal structure. Some sample statements are these: 1.1 coded student: 'I found it interesting. The reason is that I didn't know there are so many qualities of the heart.' 1.3 coded student: 'I have never seen that the heart was so different.' 1.8 coded student: 'I found it interesting. I didn't know that the heart has such different places yet when I learnt both I was surprised and I found it interesting.' , 1.22 coded student: ' Heart vessels and the parts of the heart were interesting.' , 2.6 coded student: 'Yes, we inserted our

finger in the heart.' , 2.24 coded student: 'The atrium and ventricle were interesting.' , 3.2 coded student: 'Examination of the heart and the vessels in it were interesting.' , 3.3 coded student:' Yes, I found this activity interesting because I didn't know that the heart was something like this.' , 3.6 coded student: 'I found it very interesting because we were inserting our fingers in one of the heart vessels, and our fingers were going out from the other side.' , 3.14 coded student: 'It was so interesting. I was inserting my finger in a vessel and it was going out from the ventricle.' 3.27 coded student: 'I found it interesting as I insert my finger there and it goes out from another place.'

Two of the students stated awareness about the subject of the parts of mammalian heart. 3.14 coded student noticed that what he had learnt before was wrong. 3.19 coded student reported that what he found interesting was that a sheep's heart and a human's heart resembled each other so much.

3.14 coded student: 'Yes. Because I learnt that what I had learnt before was wrong.'

The observer also wrote the following note: 'They think the heart cleans the dirty blood.' In this case, it is thought that students have some misconceptions.

3.19 coded student: 'Yes, a sheep's heart and a human's heart resemble each other so much.'

In the observer's note, the students stated that the heart doesn't resemble the one they see in pictures. Especially they found it interesting that 'the heart shown in the figure and the real form of the one they see in front of them' were different from each other. At the same time, the heart's inner structure and the heart valvulas were different from what they expected. Some of them likened the valvula to the tongue. A student said:

'The valvula does not look like the cover of the door.'

'I have heard that the heart has four atrium and ventricle, but I have never seen them. They don't look like what I have dreamt. They are so different.'

11 of the 85 students stated that they found the activity enjoyable but not interesting. The students reported that they didn't found the activity interesting as they have seen a sheep's heart before, there was blood in the heart, and they didn't like touching the heart. Also in the observer's note, this statement is located 'Some students didn't want to work as there was blood in the heart.'

Discussion

When the qualitative and the quantitative data were assessed together, it can be specified that the heart activity that was done through using advanced organizer and haptic learning action was effective on the cognitive and affective learning area.

Cognitive learning area

The students expressed that they learnt better than at school with this activity in the open-ended questions form. The selected topic belonged to the fourth grade and the students stated

that they learnt theoretically what they had learnt at school and they couldn't make enough applications. In other words, the usage of the advanced organizer and haptic learning activity is effective on the knowledge acquisition. This result is coherent the literatures (Sunbul, 2003; Kaya& Akcin, 2002).

Although the last elementary teaching program is based on the activity (MEB [National Education Ministry of Turkey], 2013), if there is trouble in the application phase, it is thought to be beneficial to assess this situation with another study in terms of the schools and the teachers. The expression of the 3.9 coded student is thought to be quite striking. Because the student states that he learns through grasping the information in his hands. And this shows the importance of the application. However, the teachers sometimes complain about the density of the syllabus (Skamp & Bergmann, 2001; Akaydin & Guler, 2000). This situation might be an obstacle in front of the teachers or they might not feel competency or self-confidence (Gayford, 2000) for the activities. Hence, the teachers should be supported by the professional development. According to the professional development programs, a handbook about the activities or the advanced organizer might be prepared by collaboration of the universities, TUBITAK and MEB.

In this study, the advanced organizer was also used for a better understanding of the subject. The use of advanced organizer is stated to be effective on the knowledge transfer (Un-Acikgoz, 2007; Joyce et al, 2004). If only the act of haptic learning is performed without using the advanced organizer, the question of 'what the outcome might be' can come to mind. However, because of the limited time in this study, the data must be given in the most regular manner as soon as possible. Therefore, just the haptic learning activity can be assessed in a larger period of time. Therefore, it is thought that both the use of advanced organizer and the haptic learning activity are effective on knowledge acquisition; in other both of them are effective on cognitive learning area.

Affective learning area

It is understood that the use of advanced organizer and the haptic learning activity are also effective on the 'affective learning area.' The students found the activity either enjoyable or interesting in this research (Table 3). Examining a heart by touching it was accepted enjoyable. Usually the concept of 'having fun' comes to mind along with the concept of 'game'. The students might evaluate the activity as a game. The expressions of the 3.6, 3.14 and 3.27-coded students made us think that they perceived the course as a game at the same time. Okur et al. (in press) mention 'game and funny' dual in their study. The students try to find macro vertebrate in stream water, and at the end of the activity all students count the macro vertebrates. They ask each other how many macro vertebrate each group finds. The students say that they enjoy the activity.

Touching a heart for the first time and the difference of the heart's internal structure were also interesting for the students. The structure of the heart with atrium/ventricle and covers, and the students' inserting their fingers in and their coming out of another place were the interesting topics for them. Another important element here may also be that the student held a heart similar to his own heart. Because in the observer's note, a student asked: "is our

heart like this?'. 3.19 coded student stated that the similarity between the human heart and a sheep's heart was interesting. All these results are very coherent with the literatures (Okur et al. [in press]; Reyes, 1984; Combs, 1982). Okur et al. (in press) also have 'interesting' theme in their study. The students evaluate the activity as 'interesting' because they see the macro vertebrates at the first time in their life. They also say they learnt better than school. Combs (1982) and Reyes (1984) point out same result; if the student enjoys the lesson s/he learns better. The students of this research said they learnt better than school, as well.

The results of the affective learning studies are important and mentionable but they are not enough. We could reach to the 1980's studies (Reyes, 1984; Combs, 1982), and a study belongs to 2010 (Okur et al. [in press]). If the researches mention different outputs and successes then the other researcher should focus on this area and its components, as well. For instance, another different output of this study is fear and repugnance. We could not see these components in the other researches.

Some student did not enjoy and rejected to do the activity because of the fear or repugnance. Some students didn't like meat or its image. 11 students did not find the activity interesting. When one of the students saw the hearts then he said "I do not want to do this activity because I have bloody dreams!" We did not persist about the application and gave them permission to leave the laboratory. We unintentionally triggered a different part of the affective area. It is expressed that the developmental maturity and the learning style of the individual have an effect on learning (Sunbul, 2003; Kaya & Akcin, 2002); yet to what level/extend the organs of sense are effective on learning is unknown. Research can be done on what can be done in such cases of rejection in this kind of activities. These kinds of results might be evaluated with a psychologist or psychiatrist because recently psychology and education are merged within 'psychodrama'.

The psychodrama has been used in education since last decade because it helps the increasing of the people awareness, and self-reflection of the feelings/ opinions (Gershoni, 2003; Bona, 2003; Oflaz, Meri, Yuksel, & Ozcan, 2011). The psychodrama is also used in the nurse education (Oflaz et al., 2011), adolescent education (Fong, 2006), or as a social work modality (Konopik & Cheung, 2013). However we have not yet seen the psychodrama application within a science or biology education. In further research, a psychodrama activity might be added to the intervention in order to understand the affective area. The psychodrama might also present a different learning environment.

Enrichment of the learning environments

The different learning environments will cause the different outputs (Ozdemir, 2010; McNeil, 1996). Hence, the haptic learning and advance organizer can be examined in the education of different subject areas of the science and social sciences (Morgil et al., 2003; Kaya & Akcin, 2002) or with different age groups (Buyurgan and Demirdelen, 2009; Bellesteros, 1993). For instance, there are outdoor education centres like museums or science museums, aquariums, botanical gardens, and these centres also have haptic learning activities (Bozdogan, 2007; Weels & Zeece, 2000). The effectiveness of these activities should be examined via different

researches. After these studies, the varied outputs of the haptic learning can be evaluated altogether.

Yet another component of the enrichment of the learning environments is social interactions. The social interaction is also reported to be important in learning (Siraj-Blatchford & Macleod-Brudenell, 1999 & Bennett, 1994). Hence the bilateral groups were formed in this study. Yet in the questions directed to the students, the social interaction was not focused on. For this reason, no data related to the effect of social interaction on learning was collected. One of the students -coded 1.12-, found the activity enjoyable as she did it with her friend. He expressed this situation independently. It shows that the social interaction is really important for the learning. Hence, a more detailed study on the effect of social interaction on learning during the haptic learning can be done because the social interaction might be more effective on the affective learning area. Case study can be used for the detailed study because it is stated that the case study is useful in order to collect enough data (Yildirim & Simsek, 2006), to have descriptive and explanatory result (Forces & Richer, 1973: in Zanovello, 1999) about people or events.

The research was carried out within a six-day science camp, and the data were evaluated through a single activity. This is considered as the limitation of the study. As there hasn't been any study done on haptic learning especially in Turkey, this research is thought to be useful in terms of guiding the upcoming researches. It is believed that researching on the different outcomes of the haptic learning through more long-term follow-ups in the formal, academic, and common teaching environments can be useful.

The last primary education curriculum is known as activity-based (Kiroglu, 2008). In each activity, students use at least one of the five senses. This study focused especially on the haptic learning, in other words learning by touching. By doing much more researches on the sensory learning, the importance of doing application can be reflected more clearly, and different activities and programs can be developed.

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Appendices

Appendix 1. *The academic achievement test of the study*

THE ACADEMIC ACHIEVEMENT TEST ON THE SUBJECT NAMED 'STRUCTURE OF THE HUMAN HEART'

1. How many cubicles does the heart consist of in humans?
A. 1 **B.** 3 **C.** 4 **D.** 2 **E.** 5

2. Which of the organs referred below are there in the chest?
A. Lung-heart **B.** Lung-liver **C.** Stomach-liver **D.** Heart-kidney **E.** Heart-liver

3. In which of the following organs is the contaminated blood after circulating our body removed?
A. Heart **B.** Liver **C.** Lung **D.** Spleen **E.** Bone marrow

4. Which of the following organs works involuntarily although it consists of skeletal muscles?
A. arm muscles **B.** muscles of the heart **C.** leg muscles
D. back muscles **E.** stomach muscles

5. Which of the following are listed from outside to inside layers of the heart?
A. Epicardial-myocardial-endocardial
B. Myocardial-endocardial-epikard
C. Epicardial-myocardial-endocardial
D. Epicardial-myocardial-endocardial
E. Epicardial-endocardial-myocardial

6. I-Oxygen-rich II-rich organic nutrients III-carbon dioxide-rich
Which of the above features do the vessels bringing blood to the heart in human carry?
A. only I **B.** only II **C.** only III **D.** I-II **E.** I-II-III

7. Which of the following veins has the maximum rate of oxygen in the blood in it?
A. Pulmonary artery **B.** Aorta **C.** Pulmonary vein
D. Upper main vein **E.** Lower main vein

8. Which one of the followings is the endocardium?
A. The artery of the right ventricle of the heart
B. The layer composed of a thin layer of epithelium, and covering the heart valves and margins
C. Simpatic nerve slowing the rhythm of the heart
D. Blood pressure at the time of the heart's contraction
E. One of the inorganic substances in the blood serum

9. Which is wrong about the features of the human heart?
A. While pumping blood round the body, the atria are relaxed; and the ventricles are contracted.
B. There are valves between the ventricles and the atria.
C. Clean and contaminated blood are carried through different vessels.
D. There is just contaminated blood in the heart.
E. The heart consists of 4 cubicle

10. Which of the following information is true?
A. All of the arteries coming out of the heart carry clean blood.
B. All of the veins coming in the heart carry contaminated blood.
C. Pulmonary artery takes the contaminated blood to the lungs.
D. Pulmonary artery brings the clean blood to the heart.
E. Pulmonary vein brings the contaminated blood to the heart.

11. Which of the followings doesn't occur at the time of atria contraction?
A. Clean blood passes through the left ventricle.
B. The ventricles relax.
C. Contaminated blood is pumped to the lung arteries.
D. The valves between the atria and the ventricles open.
E. Contaminated blood passes through the right ventricle.