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Intersection of different disciplines: Elements

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Abstract

This study aims to reveal the extent to which 7th grade students are able to integrate the “use of elements” topic into different disciplines, to determine their way of accomplishing this integration. The study is conducted with 37 seventh grade students in a private school in İstanbul in 2008-2009. Integration of Elements Test (IET) is administered both as a pretest and a posttest and activity sheets are formed to be used during the treatment. After the completion of the treatment, a semi-structured interview is conducted with 4 randomly selected students and they are videotaped and analyzed qualitatively.

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1. Introduction

In everyday life, people interpret the world they live, the problems in their environment and the relationships with other people not as a separate event, but as a unity of skills and information of different disciplines. Thus, if the information and skills that are formed during the teaching and learning process could be unified in an interdisciplinary way, then the students are more able to internalize the things that they have learnt.

Interdisciplinary approach, which has a crucial role in every phase of our life, is defined both as “the conceptual integration of a concept with different disciplines”, and as “the presentation of subject matters by unifying them on a specified concepts or themes” (Erickson, 1995; Yıldırım, 1996). Moreover, Dezure (2000) describes the interdisciplinary approach as the information generation process in which teachers and students search for the interdisciplinary solution of the problems and make a synthesis altogether (Dervişoğlu and Soran, 2003). As it is understood from the statements, the aim of an interdisciplinary approach is to prevent the dissociation of knowledge and to have “higher order thinkers” who can think holistic, analytical, sensitive and practical during problem solving process (Duman and Aybek, 2003; Özkök, 2005).

An interdisciplinary programs which helps to explain the events in science as a whole, to form the relations between the concepts and to learn meaningfully, should be planned carefully. This can be accomplished by setting

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up the program on concepts or problems and integrating knowledge from various disciplines as an efficient and meaningful way, rather than mentioning about different disciplines in an artificial environment in one class hour. (Yıldırım, 1996).

It is seen in the studies which are conducted in order to examine the efficiency of an interdisciplinary approach that the integration of different disciplines and techniques has a positive effect on the students' understanding of some concepts. Aydın and Balım (2005) tried to have students learn meaningfully the concepts of “conversion of energy” and “conservation of energy” by integrating physics, chemistry and biology disciplines. Oğur and Bağcı Kılıç (2005) emphasize that not only the integration of different disciplines, but also the integration of different techniques such as techniques used in science lessons and creative drama has a positive effect on student achievement.

Presenting different perspectives in the teaching-learning process of a person in the early years of his/her education affects the development of his/her way of thinking (Güner, 2003). Thus, this study examines the extent to which 7th grade students are able to integrate the “use of elements” topic into different disciplines, determines their way of accomplishing this integration, and indicates their views on using interdisciplinary approach in learning the specified topic.

2. Method

The study is conducted with 37 seventh grade students in a private school in İstanbul in 2008-2009 academic year. Integration of Elements Test (IET), which includes 4 open-ended questions, is administered both as a pretest and a posttest. It is viewed by a professor on science education for content validity. After the administration of a pretest, a 10-day treatment which includes activities about the use of elements in five different disciplines such as physics, biology, mathematics, art and music is conducted with all the students. The activity worksheets that include problem situations are designed by the researchers, and students are let free to choose at least one of these activities. After the treatment, IET is administered as a posttest to all the students. Moreover, a semi-structured interview is conducted with four randomly selected students and they are videotaped. The interviewer, one of the researchers, focused on five open-ended questions during the interview. Qualitative data gathered from the interviews is transcribed and analyzed with content analysis, while some quantitative analysis, such as frequencies and percentages, is conducted with the data gathered from the pre and posttest.

3. Results

In the study, data gathered from the Integration of Elements Test (IET), from the worksheets designed about five different disciplines, and from the interviews conducted with four randomly selected students are analyzed.

Firstly, the results of the data gathered from the pre and posttest (IET) will be discussed. One of the questions in IET is “what is an element?”, and %32,43 of the students cannot answer this question in the pretest, while the percentage of these students drops to %14,28 in the posttest. Another question in the IET is “what are the elements that you know?”, and % 24,32 of the students cannot answer this question in the pretest, while this declines to % 5,71 in the posttest. From the ones who has answered this question, % 78,94 of them are scientifically correct in the pretest, but this percentage rises to %99,83 in the posttest. The third question in the IET is “what are the elements that you come across the most in your daily life?”, and the percentage of students that cannot answer to this question drops from %18,91 to %8,57 in the posttest. In addition, the number of scientifically correct element examples that are given to this question is 59 in the pretest, while this number is 92 in the posttest. Some of the daily life examples that are given by the students in the IET are given in Table 1.

Tablo 1. Some examples from student answers to the question of “What are the elements that you come across the most in your daily life? Where did you come across with these elements in your daily life?” in IET

	Pretest	Posttest
Correct number of elements	59	92
Daily life examples	Jewelery, ornament, kitchen tools, electricity, air, food, thermometer, bullet.	Electricity, kitchen tools, food (milk...), air, fuels (benzoline, petroleum...), soap, battery, computer, balloons, toothpaste, building tools, bones.
Percentage of the students that could give daily life examples	%51.85	%96.43

In the last question of IET, there is a 33-itemed table is given to the students (items are formed from the matters that are used in daily life), and students are asked to choose “contains element” or “doest not contain element” for each 33 matter, and if s/he chooses “contains element”, s/he should write examples of an element that this matter contains. The percentage of the answers as “contains element” is %91,89 in the pretest, but it is dropped to %48,51 in the posttest. Also, the total number of items which are marked as “does not contains element” are dropped to 451 to 147 from pretest to posttest. The percentage of students who think that the matters contain an element rised from %97,29 to %100. The total number of items which are marked as “contains element” are 590 in the pretest and 893 in the posttest. Additionally, the percentage of students who did not make scientific mistakes is %64,86 in pretest, but this percentage is %94,28 in posttest. The number of elements that the students have written is rised from 167 to 845 in the posttest.

Secondly, data that is gathered from the interviews made with four randomly selected students is also analyzed. Some of the questions that are asked to these four students in the interview and the answers that these students give can be seen in table 2.

Tablo2. Some student statements from the interview

Your teacher gave an activity sheet about “the use of elements” from five different disciplines such as art, music, math, biology and physics and wanted you to fill in this sheet at home. About this activity sheet;				
Questions	1st student	2nd student	3rd student	4th student
How did you decide on the discipline that you will done your homework? Which factors affected your decision?	“I enjoy drawing, and also it seemed to be funny”	“Because I like to cook, I chose menu”	“I like element topic. I like electricity related subjects. It seemed to be easy for me”	“I thought how to find information. I thought how to search. I chose the easiest one. It seemed both interesting and easy”.
After you completed your homework, what did you think about “elements”? Is there any change in your thoughts before? Example.....	“Yes, I learnt many things. It seemed difficult before, but then I understood it was easy, because I learnt it”.	“I did not know the symbols of the elements. After the homework, I learnt them”.	“I haven’t thought that there is an element in an electrical circuit before. After the homework, I learnt that there are many”.	“Yes, there are some changes. For example, I haven’t thought that which elements are there in the bulb and ammeter. After the homework (now) I learnt them”.
Did you enjoy the activity? Why?	“I liked the subject. I enjoyed drawing. It was easy. I learnt without memorizing. Thus, it was easy”.	“Yes, I liked it. I learnt better and quicker. I would have learnt difficult otherwise”.	“It was good. I liked it. It was good to have different choices. The choices are the ones that we like. I like science and research”.	“Yes. When everyone makes different things, you lear from them”
Which topics of science do you think can be related to different disciplines? How?	“Light, sound (music, violin...)	“Force. Simple machines. Levers. It could be with art again”.	“Body systems, organs in biology subjects. Circulatory system (by drawing). Blood. Electricity (by song). Light (by drawing or song)	“Simple machine, wheel and axle (iron). Light (with dyes)”.
With which different disciplines would you like to learn the elements topic? How could you do this? Example.....	“It may be sport. The machines used in sport. Refetory. Kitchen tools”.	“I don’t know”.	Light and reflectioncould be related. Mirrors reflect light, and there is siver in the mirror”.	“With technology, maybe.”

Thirdly, data gathered from interdisciplinary activity worksheets is analyzed. The results reveal that %21,21 of the students selected the biology related activity, while %24,24 of them wanted to conduct math related activity. The other %27,27 of them chose an art activity, %18,18 of them chose physics and %9,10 music activities. Results of the analysis of the activity sheets are summarized in Table 3.

Table 3. Results of the data gathered from the activity sheets

Interdisciplinary activities	Examines Properties	Percentage (%)		
		Yes	Partially	No
Mathematics (3 students)	Wrote his/her mass	100	0.00	0.00
	Made the calculations	33.33	0.00	66.67
	Wrote the result	66.67	0.00	33.33
	Found the correct results	66.67	0.00	33.33
	Wrote the elements found in the specified food	42.86	57.14	0.0
Biology (7 students)	Wrote the correct elements found in the specified food	42.86	57.14	0.0
	Wrote the symbols of the elements	85.71	14.29	0.0
	Wrote the symbols of the elements correctly	57.14	42.86	0.0
	How many elements are written correctly?		Totally 89	
	Wrote the correct elements found in the electrical devices	60	20	20
Physics (5 students)	Draw the electrical circuit correctly	60	40	0.00
	There is no missing electrical device in the circuit	40	40	20
	How many elements are written correctly?		Totally 11	
	How many times does the “element” word is used in the song lyric?		Totally 9	
	How many instruments does s/he use to compose his/her song?		Totally 5	
Music (2 students)	Wrote the correct elements in the musical instruments	100.0	0.0	0.0
	How many elements does s/he mention in the musical instruments?		Totally 5	
	Wrote the correct elements his/her drawing	100.0	0.0	0.0
Art (8 students)	Wrote the symbols of the elements	87.5	0.0	13.5
	Wrote the symbols of the elements correctly	37.5	50.0	12.5
	How many elements does s/he write?		Totally 5	

4. Discussion

Results of this study indicate that students are able to integrate the elements topic to different disciplines such as physics, biology, math, art and music. In addition, students indicate that although the topic was seem to be difficult for to them at the beginning of the study, they learnt the subject matter without any difficulty and by enjoying the activities. This shows that knowledge can be related to different scopes or domains with the integration of different disciplines as well as even the difficult subjects can be learnt in a pleasant and enjoyable way (Brandt,1991).

One of the most important results of this study is the increase in the number of daily life examples that the students gave in the posttest. This result indicates that interdisciplinary approach helps students to think in different perspectives and to make associations with daily life situations (Özkök, 2005).

In addition, students stated that they could be able to learn the subject matter by participating the activities with a great interest, without memorizing anything and having difficulty in any situation. The understanding of students that they could be able to use the knowledge in different areas in their daily lives helps them to make their knowledge networks more meaningful. This shows that interdisciplinary approach contribute to meaningful learning (Yıldırım, 1996).

Writing song lyrics about elements and composing them or drawing a picture and showing the elements in the picture helps students to relate their activities to the subject matter as well as give them chance to develop their creative thinking and holistic thinking. Thus, higher order thinking ability can be developed by using an interdisciplinary approach. Furthermore, it is seen in the activity sheets that students relate the subject matter with different perspectives, with different discipline and with different levels. Therefore, interdisciplinary approach also helps students to learn with their own learning styles and to construct the knowldege with their own experiences.

5. Conclusion and Recommendation

When the data gathered from IET, interviews and activity sheets EEEDT is analyzed, it is seen that students are able to integrate the elements topic to different disciplines and to relate the topic with daily life experiences. This results indicate that learning experiences with an interdisciplinary approach increase the transfer of knowledge to out of school experiences. Interdisciplinary approach contributes to both learning of the knowledge in different disciplines and integration of this knowledge to daily life experiences (Yıldırım, 1996).

In this study, it is found interesting that students made different suggestions to teaching and learning of elements topic. During the interview, some students expressed that in addition to these five disciplines (biology, physics, math, art and music), this topic can be integrated to different other disciplines such as sport and technology. This shows that interdisciplinary approach emphasizes the “multidisciplinary” and “integrative” property of the topic by helping students to gain thinking abilities in different perspectives. In order for this approach to be implemented in the schools, school administrators and teachers should work cooperatively; individual solutions to time, content, place problems should be accomplished; and in addition to class activities, out of school activities should be planned (Dervişoğlu and Soran, 2003; Schoch and Seitz, 1997). Thus, when the affects of interdisciplinary approach to the teaching-learning process are analyzed, it is seen that the use of this approach in schools more widely may help to have more learner-centered situations.

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