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## The level of understanding of elementary education students' some chemistry subjects

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### Abstract

The purpose of the study was to determine the eighth grade students' understanding level of some the chemistry topics in Turkish Science and Technology program. It was found that while electron configuration, states of matter, and physical and chemical changes understanding level was at the good level, acids, bases and salts, structure of the matter, mixtures, and classification of matter was at the moderate level. However, results showed that periodic table, chemical bonds, chemical reactions, and heat and temperature could not learn by the students at sufficient level, as these subjects were less aright responded.

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*Keywords:* Chemistry subjects; level of understanding; misunderstanding; elementary education.

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### 1. Introduction

The correct and complete teaching of basic chemistry subjects is important for the understanding of following subjects by students at the primary and high school level. This is because unlearned subjects or misunderstood knowledge cause bigger problems of understanding and learning for students at upper classes (Özmen et al., 2002). There are many academic studies which aim to determine misunderstandings and understanding level of chemistry subjects by students from primary school to higher education level.

Gürdal, Bayram, and Sökmen (1999) stated that some difficulties are often met in the teaching of elements, compounds, physical and chemical changes subjects among fifth and eighth grade students. In another study Karamustafaoğlu and Ayas (2002) found that 60% of the eighth grade students had misunderstanding about the metals, nonmetals, semi metals, and alloys topic and only half of them could apply the knowledge to daily life. When the studies examined, it can be seen that not only elementary school students but also pre-service, primary, and science teachers have similar misconceptions on the chemistry subjects.

In a study done to determine the understanding level of some chemistry subjects with pre-service elementary teachers, the findings are that students use one instead of other mass and weight notions and confuse them, they are not aware of atomic fission, they can not associate chemical and physical phenomenon with daily life examples, they have errors on boiling point, they mix up acid and base and they can not understand properties of compounds. Furthermore, students have a good level of understanding and comprehension on compounds, metals, nonmetals, solid-liquid-gas elements, solution, and dissolutions. (Konur and Ayas 2008). Erdem, Yılmaz, and Morgil (2001)

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found that pre-service science teachers had some difficulties related the topics of mol- molecules, atomic mass, and redox. Similarly, Can and Harmandar (2004) stated that preservice science and elementary students did not have enough knowledge on chemical bonds, polarity of bonds, and polarity of molecule. Ayas and Ozmen (2002) showed that first and second year secondary school students' understanding level of the granular structure of material was weak. Sökmen and Bayram (1999) implemented a study in order to determine the level of understanding of basic chemistry concepts of first and second year high school first year students. They found that students could not learn the concepts meaningfully and memorization of concepts was the main cause of this consequence. Doğan et.al, (2007) stated that high school students and pre-service chemistry teachers had problems to understand and apply Le-Chateiler principle.

Elementary school is the period while scientific basis are installed. The subjects not well understood make harder following learning, therefore, in this study it was examined the level of understanding of some chemistry subjects within Science and Technology Course by the students. The importance of this study is that it aims to determine the understanding level of basic chemistry subjects by students and it shows us the subjects with which students have difficulties and easiness to understand. Therefore, the purpose of this study was to determine the understanding level of some chemistry subjects in Turkish Science and Technology course by eighth grade students. The following research question guided the study:

What is the understanding level of eight grade elementary students of some chemistry topics?

## 2. Method

The study was conducted in 2008-2009 spring semester of academic year. The sample of the study constituted of 193 elementary school students of 8<sup>th</sup> grade in Bursa. In order to define the understanding level of some chemistry subjects from Science and Technology course by the students, a 30 question multiple choice test was used as a data collection tool. After the application of the test, according to the formula KR-20, the reliability coefficient is calculated as 0.71.

In the test, the answers of students were classified as “correct”, “wrong”, and “blank”. If the question was marked by right answer by the students it was classified as understood level, if it was marked wrong it was classified as non-understood level, if it was blank, it was classified as non-answered.

## 3. Results

The dispersion of questions by subjects and the answers given by students to the test to determine understanding level of some chemistry questions by students were given on Table 1.

Table 1. Dispersion of questions by subjects and the number and percentage of answers to test questions

question number	subject	correct		wrong		blank	
		n	%	n	%	n	%
1	Structure of the atom	105	54.40	86	44.57	2	1.03
2	States of the matter	184	95.33	8	4.16	1	0.51
3	Physical and chemical changes	87	45.07	101	52.34	5	2.59
4	Classification of matter	72	37.30	116	60.11	5	2.59
5	Classification of matter	142	73.57	40	20.74	11	5.69
6	Classification of matter	86	44.55	103	53.38	4	2.07
7	Classification of matter	142	73.57	50	25.92	1	0.51
8	Structure of the atom	89	46.11	82	42.50	22	11.39
9	Physical and chemical changes	150	77.72	39	20.21	4	2.07
10	Classification of matter	85	44.04	102	52.86	6	3.10
11	Structure of the atom	140	72.53	48	24.88	5	2.59
12	Structure of the atom	107	55.44	70	36.27	16	8.29
13	Chemical bonds	42	21.76	142	73.58	9	4.66
14	Electronic configuration	171	88.60	18	9.33	4	2.07
15	Chemical bonds	81	41.96	107	55.45	5	2.59
16	Chemical bonds	87	45.07	79	40.95	27	13.98
17	Chemical bonds	120	62.17	65	33.69	8	4.14
18	Chemical bonds	127	65.80	49	25.40	17	8.80
19	Mixtures	52	26.94	121	62.70	20	10.36

20	Mixtures	118	61.13	69	35.77	6	3.10
21	Mixtures	151	78.23	36	18.67	6	3.10
22	Chemical bonds	80	41.45	68	35.24	45	23.31
23	Chemical reactions	83	43.00	80	41.46	30	15.54
24	Physical and chemical changes	134	69.43	54	27.98	5	2.59
25	Chemical reactions	109	56.47	63	32.65	21	10.88
26	Periodic table	40	20.72	135	69.96	18	9.32
27	Heat and temperature	94	48.70	74	38.35	25	12.95
28	Acids and bases	114	59.06	67	34.73	12	6.21
29	States of matter	121	62.69	51	26.43	21	10.88
30	Heat and temperature	101	52.33	74	38.35	18	9.32

The total number of questions in test for all subjects the dispersion numbers and percentage of the answers by students to the questions were given on the Table 2.

Table 2. The total number of questions in each subject and the dispersion number and percentage of all answers by categories

subject	number of questions	understood		non-understood		non-answered	
		n	%	n	%	n	%
Acids and bases	1	114	59	67	34	12	6
Structure of atom	4	441	57	286	37	45	5
Electronic configuration	1	171	88	18	9	4	2
Physical and chemical changes	3	371	64	194	33	14	2
Heat and temperature	2	195	50	148	38	43	11
Mixtures	3	321	55	226	39	32	5
Chemical bonds	6	537	46	510	44	11	9
Chemical reactions	2	192	49	143	37	51	13
States of matter	2	305	79	59	15	22	5
Classification of matter	5	527	54	411	42	27	2
Periodic table	1	40	20	135	69	18	9

Descriptive statistics related to students' answers indicated that certain chemistry topics for example; electronic configuration (88%), states of matter (79%), physical and chemical changes (64%), acids and bases (59%), structure of atom (57%), mixtures (55%), classification of matter (54%) and heat and temperature (50%) showed that these topics were understood level. It can be seen that the most dramatic findings were arisen on the topics of periodic table (20%), chemical bonds (46%), and chemical reactions (49%), for which the level of understanding were none-understood.

#### 4. Conclusions and Discussion

The purpose of this study was to determine the understanding level of some chemistry subjects in Turkish Science and Technology course by eighth grade students. The results showed that eighth grade students had some difficulties with some of the chemistry subjects. According to results the following conclusions can be made:

The first question related to structure of atom showed that students were not aware of the dividing of an atom.

The sixth question on structure of material revealed that the subject of compounds and mixtures were mixed up by students. The answers given to this question showed that students thought that compounds can be separated by physical methods and when it was said the materials made up of different types of atoms, they thought mixtures more than compounds when it was said them a matter including different types of atom.

The questions 7 and 10 showed that students could not learn the concept of element.

The answers given for chemical bonds to questions of 13 and 15 showed that students could not distinguish between ionic and covalent bonds.

The question 16 indicated that some students could not comprehend between which atoms in a compound there were a chemical bond between each other.

The question 19 showed that students could not associate homogeneous and heterogenic compounds to daily life examples.

The question 23 showed that the students could not distinguish between the wasted and obtained substances in a chemical reaction.

The 26<sup>th</sup> question showed that students did not have enough knowledge on the change of atomic diameter according to periods and groups.

According the results of the study, the understanding level of chemistry subjects by students in Science and Technology Course is low except some subjects such as electronic configuration, structure of matter, physical and chemical changes. The main cause of that might be the using of traditional instruction method. Furthermore, because of their abstract nature, chemistry subjects are difficult to understand by students. Previous studies indicated that students can not learn abstract concepts without having concrete concepts and the abstract concepts learning period begins after the ages 14 and 15 (Lawson and Renner, 1975; Cantu and Herron, 1978; Bayram, Sökmen and Gürdal, 1998). The teaching of abstract concepts in early years make difficult understanding of the concepts by students. This may cause that students memorize the subjects, forget all in next educational periods and can not learn future subjects. (Erdem, Yılmaz and Morgil, 2001).

## 5. Recommendations

It should be determined actual lacks and misunderstandings of students in order to eliminate their learning difficulties. For an effective and meaningful learning, it should be considered previous learning of students as they can be directly affected new acquisitions of students. Primary education is the first stage of scientific view so it must be well constructed. The basis gained during that period will make more effective and permanent the future learning at next stages.

It is also recommended that it should be examined by the researchers the possible reasons of why eight grade students' success level of some chemistry subjects were low. It can be examined some possible reasons such as the appropriateness of the class level of the chemistry subjects and whether or not the science teachers implemented accordingly the chemistry activities in classrooms.

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