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Determination Of Levels Of Use Of Basic Process Skills Of High School Students

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Abstract

It aims to determine the abilities of use of basic process skills of the students and the levels of conceptual learning of the students as oriented to general chemistry topics. The sampling comprises 160 students whose were studying at 10th and 11th grades of seven different high schools in Turkey. The study design is based on Survey model. The questionnaire prepared by considering the levels of conceptualization of chemistry topics of the students aims to measure their ability of use of science process skills. The questions and items were selected in the manner that it covers basic skills such as observation, classification, measurement, the sensing of space-time relationship and communicating, and also classified on the Bloom Taxonomy of cognitive development which consist of knowledge, comprehension, application, analysis, synthesis, and evaluation. The results from analysis of variance (ANOVA) show that. The differences between students' grade levels, score and order of admission to high school and the type of school have a significantly effect on the potential of use of basic process skills.

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Keywords: Learning, thinking; science process skills; basic and integrated (causal and experimental) skills; chemical concepts

1. Introduction

When human being initially started to produce knowledge is not known, however in ancient time's people wondered variety of events and situations as they faced with, and therefore exploration process with observation and research has begun. Experiences derived from nature have been processed and systematised according to proper methods, scientific knowledge have been produced, and thus the phenomenon of science has emerged. Scientific

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knowledge includes theory, principles and laws forming content part of sciences. Ways to knowledge acquisition are ways to get scientific knowledge. One of the ways to knowledge acquisition is science process skills. Science process skills are the basic skills of facilitating learning in science, allowing students to be active, developing a sense of responsibility, increasing the permanence of learning and providing research methods (Bahadır, 2007; Batı, Ertürk and Kaptan, 2010; Kaya, Bahceci and Gödek Altuk, 2012; Temiz, 2007). Chemistry subjects in science education come to students as difficult (Doğar, Gürses and Geban, 2010). As much as students' science process skills improve, their capabilities of inquiry, inference and prediction improve, and they can now better understand the complex issues. In recent years, especially in secondary programs in science, teaching subjects by means of inquiry is attempted. There are also some limitations in generally all courses including chemistry course for maintenance of teaching correspond with mobilizing science process skills.

In science education, teacher's professional knowledge, pedagogical knowledge, current conditions of the school and classroom, appropriate curriculum materials and ease of access are factors that affect this situation. However, it is accepted by many researchers that there is a reality; inquiry approach is a good way for improvement of critical thinking skills and conceptual understanding. With this approach, students can reach the target resource and are able to study them, can ask questions easily and receive knows that answers are consistent. By this way, student's attitudes towards science and scientific inquiry changes (Lati, Supasorn and Promarak, 2012; German, Aram and Burke, 1996). It is seen on the literature that several studies aiming to evaluate scientific process skills have done from 1960's (Lati *et al.,* 2012; Shahali & Halim, 2010; Walbesser, 1965; Tannenbaum, 1971; Ludeman. 1975; Molitor & Kenneth, 1976; Shaw, 1983; McKenzie & Padilla, 1986; Smith & Welliver, l990; Solano-Flores, 2000; Beaumont-Walters and Soyibo, 2001). In Turkey, very few studies have been done (Geban, Aşkar and Özkan, 1991; Arslan. 1995; Temiz, 2001). From review of available literature, very few studies about science process skills have been found. Therefore, it is studied whether there is a statistically significant difference or not according to the students' differences in grade level, gender, family, parental education level, parental occupations by means of students' performances on the test associated with determination of secondary school students' science process skills and using level of them. In this study, survey research model which is one of non-experimental methods of the quantitative research methods is used.

2.1. Subjects

The research sample was determined by convenient sampling method. Participants consists of total of 160 students who are 10th and 11th grades level students of seven high schools are randomly selected from high schools in Turkey. 69 of the students are 10th grade, 91 of them are 11th grade students. 103 of these students are female students. The male students consist of 57. Participants' father occupations are categorized as workers, civil servants, farmers and self-employed professions and their mother works are categorized as housewife, workers, civil servants and self-employers. Education level of students 'parents is listed as illiterate, primary school graduated, high school graduated and university graduated.

2.2. Data Collection Tool

In this research, "Science Process Skills Test" is used in order to evaluate students' basic and scientific process skills. The test is prepared by us convenient to students' comprehension level on chemistry context. Reliability coefficient of the test is determined as 0.70. Three of questions were removed because they decreased reliability of the test. Science Process Skill Test is composed of two parts. First part is composed of questions determining students' demographic features such as gender, grade level, parents' education level, parents' works, and number of family members. Second part of the test is composed of 21 questions with 5 options which are intended to determine students' science process skills level. 45 minutes are given students to answer questions.

2.3. Data analysis

Findings of study obtained data from 160 students are analysed by SPSS 18.0 packaged programme. In the analysis, independent t-test was applied to data whether there is a significant difference or not between students in terms of gender and class varieties, school type, education level of parents, and occupation varieties of parents were

analysed by using ANOVA. Also, Tukey test is applied as post-hoc test.

3. Findings

The table 1 depicts that ANOVA results from administrated science process skills test in order to determine the level of students' science process skills in attended high schools. In the examination of table 1, there are significant differences between students in different high schools in terms of basic, casual, and experimental process skills ($p<0.05$). In other words, students' basic, casual, and experimental process skills significantly change depending on the schools.

Table 1. ANOVA results about science process skills according to the students' attending school.

		Sum of Squares	df	Mean Square	F	p
Basic process skills	Between Groups	84.811	6	14.135	9.682	.000*
	Within Groups	223.383	153	1.460		
	Total	308.194	159			
Casual process skills	Between Groups	157.789	6	26.298	11.911	.000*
	Within Groups	337.811	153	2.208		
	Total	495.600	159			
Experimental process skills	Between Groups	99.985	6	16.664	10.783	.000*
	Within Groups	236.458	153	1.545		
	Total	336.444	159			
Science process skills	Between Groups	710.443	6	118.407	22.071	.000*
	Within Groups	820.801	153	5.365		
	Total	1531.244	159			

*p<.05

Table 2 shows means and standard deviations of 10th and 11th grades students. It is seen that 10th grade students' science process skills are higher than 11th grades students. In table 2 examination, there is a significant difference in terms of basic process skills between 10th and 11th grades students ($p<.05$) except for casual and experimental process skills ($p>0.05$).

Table 2. t-test results about science process skills according to students' grade levels.

	Grade level	N	Mean	S.S	t	p
Basic process skills	10th	69	7.5072	1.31309	2.417	.017*
	11th	91	6.9780	1.41404		
Casual Process Skills	10th	69	7.9565	1.45960	1.672	.096
	11th	91	7.5055	1.95149		
Experimental Process Skills	10th	69	6.0435	1.42906	1.615	.108
	11th	91	5.6703	1.46101		
Science Process Skills	10th	69	16.9565	2.80983	1.411	.106
	11th	91	16.2747	3.29331		

*p<.05

Table 3. T-test results about scientific process skills of students by gender

	Gender	N	Mean	S.S	t	p
Basic process skills	Boy	57	7.6842	1.05488	3.667	.000*
	Girl	103	6.9417	1.48737		
Casual Process Skills	Boy	57	8.3333	1.34075	3.837	.000*
	Girl	103	7.3495	1.87715		
Experimental Process Skills	Boy	57	6.3860	1.11410	4.081	.000*
	Girl	103	5.5243	1.53294		

Science Process Skills	Boy	57	17.8947	2.30438	4.655	.000*
	Girl	103	15.8350	3.25124		

*p<.05

In table 3, there is a significant difference between students' gender in terms of basic, casual, experimental, and science process skills(p<0.05).

Table 4: Analysis of Variance results about science process skills in terms of mothers' educational level

		Sum of Squares	df	Mean Square	F	p
Basic process skills	Between Groups	6.368	3	2.123	1.097	.352
	Within Groups	301.825	156	1.935		
	Total	308.194	159			
Casual Process Skills	Between Groups	19.011	3	6.337	2.074	.106
	Within Groups	476.589	156	3.055		
	Total	495.600	159			
Experimental Process Skills	Between Groups	6.062	3	2.021	.954	.416
	Within Groups	330.382	156	2.118		
	Total	336.444	159			
Science Process Skills	Between Groups	61.054	3	20.351	2.159	.095
	Within Groups	1470.190	156	9.424		
	Total	1531.244	159			

In examination of Table 4, it is observed that there is not a significant difference between science process skills and mothers' education levels.

Table 5: Analysis of Variance results about science process skills in terms of fathers' educational level

		Sum of Squares	df	Mean Square	F	p
Basic process skills	Between Groups	8.858	2	4.429	2.323	.101
	Within Groups	299.336	157	1.907		
	Total	308.194	159			
Casual Process Skills	Between Groups	20.983	2	10.491	3.470	.034*
	Within Groups	474.617	157	3.023		
	Total	495.600	159			
Experimental Process Skills	Between Groups	10.830	2	5.415	2.611	.077
	Within Groups	325.614	157	2.074		
	Total	336.444	159			
Science Process Skills	Between Groups	74.449	2	37.224	4.012	.020*
	Within Groups	1456.795	157	9.279		
	Total	1531.244	159			

*p<.05

In examination of table 5, it is observed that fathers' education levels cause a significant difference in terms of casual process skills (p<0.05).Additionally, it is determined that there is a significant difference at level of %5 between science process skills at total. In examination of table 6, it is determined that students whom mothers are civil servants have higher means in terms of basic, casual and experimental process skills. In table 6, it is seen that there is not a significant difference between science process skills and mothers' occupation levels (p>0.05), however there is a significant difference in terms of casual process skills at level of %5 (p<0.05).

Table 6. ANOVA results about science process skills according to mother's occupations,

		Sum of Squares	df	Mean Square	F	p
Basic process skills	Between Groups	13.660	4	3.415	1.797	.132
	Within Groups	294.534	155	1.900		
	Total	308.194	159			
Casual Process Skills	Between Groups	30.774	4	7.694	2.565	.040*
	Within Groups	464.826	155	2.999		
	Total	495.600	159			
Experimental Process Skills	Between Groups	9.772	4	2.443	1.159	.331
	Within Groups	326.671	155	2.108		
	Total	336.444	159			
Science Process Skills	Between Groups	82.858	4	20.715	2.217	.070
	Within Groups	1448.386	155	9.344		
	Total	1531.244	159			

*p<.05

In examination of table 7, it is determined that students whom fathers are workers have higher means in terms of experimental process skills. Students whom fathers are workers have higher means in terms of basic process skills. Students whom fathers are farmers have higher means in terms of casual process skills.

Table 7. ANOVA results about science process skills according to father's occupations.

		Sum of Squares	df	Mean Square	F	p
Basic process skills	Between Groups	1.576	3	.525	.267	.849
	Within Groups	306.617	156	1.965		
	Total	308.194	159			
Casual Process Skills	Between Groups	10.491	3	3.497	1.125	.341
	Within Groups	485.109	156	3.110		
	Total	495.600	159			
Experimental Process Skills	Between Groups	10.263	3	3.421	1.636	.183
	Within Groups	326.181	156	2.091		
	Total	336.444	159			
Science Process Skills	Between Groups	40.078	3	13.359	1.398	.246
	Within Groups	1491.166	156	9.559		
	Total	1531.244	159			

4. Results and Discussions

This study is done in order to determine using level of 10th and 11th grade students' science process skills. Science process skills predict knowledge and ways to knowledge acquisition. Among students participating different high schools, a significant difference is determined in terms of basic, casual and experimental process skills. According to the findings, it can be explained that students' attending schools which are general achievement level or acceptance order can cause a significant difference in terms of potential use of science process skills. Kozcu Çakır and Sarıkaya (2010) reported on their studies on general high school, Anatolian high school, and Anatolian teacher high school, that there was a significant difference between high schools in terms of science process skills. Additionally, students are attending in these schools effect development of their science process skills. This situation may stem from different instructional methods, teachers' content knowledge and efficiency in the schools. In comparison of 10th and 11th grade students in terms of basic, casual and experimental process skills, it is seen that 10th grade students had higher means than 11th grade students at all. There is a significant difference between 10th grade students and 11th grade students only in terms of basic process skills. Because 11th grade students solve problems based on knowledge due to preparation to entrance of university exams, this situation may restrain their science process skills (Aydınlı, 2007). It is determined that there is a significant difference between male and female students in terms of basic, casual, experimental and science process skills. Male students have higher means than female students in terms of basic, casual, and experimental process skills. Hazır and Turkmen (2008), and Saracoglu *et al* (2012) reported on their studies that there is not a significant difference between boy and girl students in terms of science process skills. However, Aydınlı (2007) stated that there is a significant difference between male and female students. Especially, in societies with low-income families, it is believed that taking the family's economic and social responsibility is the duty of the male members. It means that male students may concerns with raising their family in the future. That means male students may work much and use science process skills at higher level. It is observed that in terms of science process skills there is not a significant difference among students whose mothers' education levels are different. On the other hand, it is found that father's education level causes significant difference in terms of students' casual process skills. Parents' education level plays an important role in development of students' science process skills. Because educated people attach more importance to education, it can be said that they interested in the student actively and encourage the student to study (Aydınlı, 2007; Saracoglu *et al*., 2012). It is determined that in term of casual process skills there is a significant differences among student whose mothers' occupations are different. However, there is not a statistically significant difference among students whose fathers' occupations are different. Mother and father's occupational status because it will affect the family's income level, allows offering students better opportunities. Therefore, it can be said that parents' occupations have an important role in development of students' science process skills. Karar and Yenice (2012) stated in their studies on 8th grade students that there is significant difference among students according to parents' occupations.

5. Suggestions

- This study is limited to 10th and 11th grades of 7 high schools. By creating new tests in aim of measuring science process skills in other high and primary schools, works for development of science process skills can be done.
- At this work, by taking students studied the school, grade level, gender, and a number of demographic characteristics into account, science process skills were examined. However, there would be another variables affect science process skills. Therefore, new studies carrying out what might these variables, and how they affect science process skills, can be done.
- Teachers have a big responsibility to develop students' science process skills. Therefore, higher education institutions educating teachers must graduate prospective teachers as fully equipped.
- Teacher can make activities and use effective materials in their lessons in order to help students develop their science process skills.

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