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Turkish primary school students' performance on basic science process skills

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Abstract

The aim of this research is to determine Turkish primary school second grade students' level of performance on basic science process skills and weather there are statically significant differences in their performance linked to their gender, grade level, economic background, the education background of their mother, the number of family. Data were collected with the authors' constructed basic science process skills test. The test is comprised 10 items related to observing, classifying, measuring metrically, inferring, predicting and communication. The results indicated that the subjects' mean score was not low but not satisfactory. However, there was a positive relationship between their performance and their gender, grade level, economic background, the education background of their mother, the number of family.
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Keywords: Science education; science process skills; science inquiry; primary school students; education background of students' mother

1. Introduction

Science process skills are based on scientific inquiry and associated with cognitive and investigative skills (Hidi, 1990). Teaching science by inquiry involves teaching students science process skills, critical thinking, scientific reasoning skills used by scientists to learn about the world and helping the students apply these skills involved with learning science concept (Padilla et al., 1983; Germann, 1989; Westbrook et al., 1994; Pratt and Hackett 1998). After the debut same programs such as 'Science-A Process Approach (SAPA)' developed by the American Association for the Advancement of Science, many researchers have focused their attention on the basic and integrated science process skills and science curriculums in many countries have been getting include these skills (Baird and Borich, 1987; Padilla et al., 1984; Roth and Roychoudhury, 1993; Goh et al., 1989; Germann and Aram, 1996; Mattileis et al., 1992; Walters and Soyibo, 2001). With the last educational reform in Turkey introduced and

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piloted in 2004-2005 science process skills have been emphasized actively in science curriculum for grades 4-8 (Talim Terbiye Kurulu, 2004). This curriculum suggests a lot of science activities required science process skills by expecting the teachers to use inquiry teaching strategies.

Except for unpublished research only a few past studies on science process skills have reported in Turkish local literatures (Kılıç, 2002; Dökme, 2005). One justification for this study is that there is a dearth of studies on Turkish elementary school students' performance on basic and integrated science process skills. We, therefore, took the first step to broaden new horizons to Turkish science education researchers for analyzing student' performance on science process skills in all dimensions and enabled researchers from other country to compare the elementary school student' level of performance in Turkey with that in other country.

1.1. Purpose

This study is to determine if: (a) some Turkish elementary school student' level of performance on a test of basic science process skills is satisfactory or not; and (b) there is any statically significant difference in students' performance on the test of basic science process skills linked to their gender, grade level, economic background, the education background of their mother and the number of family.

1.2. Research questions

(1) Is the level of performance of some Turkish sixth, seventh and eighth grades on a test of basic of basic science process skills satisfactory or not?
(2) Are there any significant differences in the in students' performance on the test of basic science process skills linked to their gender, grade level, economic background, the education background of their mother, the number of their family?

1.3. Sample

The main study sample is comprised 670 students (410 boys, 260 girls; 230 sixth grades, 239 seven grades, 201 eight grades; 249 from a low economic background, 238 from a middle economic background, 183 from a high economic background). The education background of their mother is categorized four kinds called a) non-literacy b) graduated primary school c) graduated high school d) graduated university. The number of their family is categorized four kinds called a) 2-4 b) 5-8 c) 9-12 and d) above 12. The sample students randomly selected from five state elementary schools.

1.4. Instrumentation and procedure

For assessing students' performance on science process skills the multiple choice tests were commonly used by researcher (Molitor and George, 1976; Soyibo, 1992). While some researchers (German and Aram 1996) have criticized the use of multiple choice tests, only a few researchers (Baxter et al. 1992; Rebza et al., 1995) have developed practical laboratory tests to assess these skills. In this study, data were collected with the authors' constructed basic science process skills test. Prior to the pilot study, to ensure that the basic science process skills test items had satisfactory content and construct validity, one university senior lecturer in science education department, one assessment and evaluation lecturer, and one experienced elementary science teacher were given copies of the basic science process skills test blue print, 14 written performance test items, and guidelines for its content and construct validation. The valuators' comments were used in selecting the pilot test items. The basic science process skills test with 14 items was asked 30 students in *Konakdüzü School* for the plot study. After the analysis of the plot study results 4 items were omitted due to decrease reliability. The science process skills test measured six skills: observing, classifying, measuring, inferring, predicting, and communicating. The test comprised ten written performance items and maximum score is 10. The Cronbach alpha of the basic science process skills test was found 0·72. The basic science process skill test, finally, apply the students in sample.

2. Result and Discussion

The first purpose of this study was to determine whether the level of the performance of selected Turkish sixth, seventh and eighth graders on basic science process skills test was satisfactory or not. For each item of the test if the students find the proper answer, this scored 1 point, if not 0 point. Each sample students' score on the basic science process skills test are calculated and computed variance (ANOVA) analysis. Table 1 indicates that the performance score of sixth, seventh and eighth graders on basic science process skills test. When the student find the proper answer between 1-5 items, her/his performance on basic science process skills is accepted insufficient and when the student find the proper answer between 6-10 items, her/his performance on basic science process skills is accepted sufficient.

Table 1: The subjects' performance on basic science process skills test

		F	%
Sixth grade	1 - 5	149	64,8
	6 – 10	81	35.2
	Total	230	100.0
Seventh grade	1 - 5	77	32.2
	6 – 10	162	67.8
	Total	239	100.0
Eighth grade	1 - 5	95	47.3
	6 – 10	106	52.7
	Total	201	100.0

Table 2 suggests that the subjects' mean score on the entire the basic science process skills test (5.58) is not less than a score of 2.50 on a five-point scale, their overall level of performance in this study is considered as high but not satisfactory for us, because of the fact that the basic sciences processes skills providing the intellectual ground work in scientific enquire are the terminal skills for the integrated science process skills (Molitor and George, 1976). It is acceptable that students on a large scale have to use basic science process skills to acquire integrate science process skills. The interview of the teachers in the sample schools have been reveal that these teachers faced same uncomfortable case by using new science curriculum as follow: a) Lack of materials, b) high number of students in the class c) inquiry approach is too difficult and much more time consuming. Although science new curriculum today continue to promote inquiry-based science, rapid implementation will not occur until the issues articulated by Eltinge and Roberts (1993) and Welch *et al* (1981) are implemented. The second purpose of this study is to determine if there are any statically significant differences in the students' performance on the basic sciences processes skills test linked to their grade level, their gender, economic background, the education background of their mother, the number of family. Table 1 shows that there is a statically difference in the students' performance on the basic sciences processes skills test linked to their grade level ($p<0.05$). The means of the seventh graders was much higher than the others. However the means of the eighth graders was lower than the seventh graders. Normally, it is expected that the subjects' performance in increasing order should be as 6th, 7th and 8th grade. The possible reason of this finding is that the students in eighth grade focus on high school examination and work hard unilateral. Table 2 indicates that the means of the females was higher than that of males. There is statically significant difference in the subjects' score linked to their gender ($p<0.05$). The finding that there was significant gender difference in their performance is inconsistent with the finding in other same country (Greenfield, 1996; Walters and Soyibo 2001). We could not explain the likely reason for this finding based on this study's data. As seen in Table 2, the means are increasing with increasing economic background. This finding receives some indirect support from Gallagher (1994) regarding middle school students' performance on basic science process skills and the finding of many previous studies on the link between students' economic background and science performance (Blosser,I 1994). No studies in literature have reported that differences in students' basic science process skills performance were linked to the education background of their mother, the number of their family.

Table 2: Means and standard deviations (SD) by grade level, gender, economic background, education background of their mother and the number of their family on the test of basic science process skills.

VARIABLES	N	Mean	SD
Grade Level			
6	230	4.67	2.45
7	239	6.30	2.47
8	201	5.76	2.63
TOTAL	**670**	**5.58**	**2.60**
Gender			
Females	260	6.39	2.36
Males	410	5.06	2.62
Economic Background			
Low	248	4.33	2.41
Middle	238	5.78	2.40
High	184	7.04	2.26
Education Background of Their Mother			
Non-literacy	217	4.49	2.42
Graduated primary school	284	5.35	2.52
Graduated high school	108	7.17	2.16
Graduated university	61	7.71	1.69
The number of their family			
2-4	265	6.43	2.64
5-8	271	5.35	2.47
9-12	103	4.34	2.02
above 12	31	4.47	2.72

In this study it is found that there is statically significant difference in the students' performance on the basic sciences processes skills test linked to the education background of their mother and the number of family($p<0,05$). The means of subjects' students in increasing order are as follows: non-literacy, graduated primary school, graduated high school, graduated university. The means of the students whose mother graduated from a university are highest. As education level of their mother is become less, the performance level of the students is decreasing. The similar change is seen the other variable of the number of subjects students' family. The subject students' performance on basic science process skills is changing as a function of the number of subjects' students' family. It is open to researchers that the correlation between students' performance on science process skills and cognitive ability or motivation according to these variable.

3. Conclusion and suggestion

After the last educational reform with science curriculum suggesting inquiry teaching as a strategy it is significant to determine Turkish elementary school students' level of performance on science process skills. For this reason, Turkish primary school second grade students' level of performance on basic science process skills was to determine in this study. On the contrary our expectation, the subject students' level of performance on basic science process skills was not high. The results obtained interviews to teachers in sample school do suggest that further research should be carried out in future studies on some topic. They include the effect of the lack of materials, the number of students in the class and physical condition of class, teachers' qualifications, teaching experience and teaching styles on students' level of performance on basic science process skills. This study determined the relationships among the subjects' grade level, their gender, economic background, the education background of their mother, the number of family. To improve poor students' understanding and performance on basic science process skills it is recommended that science teachers should give these students additional opportunities as follows: a) When these student practice activities in class teachers should help these student to use basic science process skills and get them to be aware of using these skills. b) Teacher should concentrate on more hands-on activities including more basic science process skills for these students. c) Teacher should give these student homework including hands-on activities and encourage them use basic science process skills.

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