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The relationship between primary school students' scientific literacy levels and scientific process skills

Volkan Hasan Kaya [a], Dilber Bahceci [b], Yasemin Godek Altuk [c] *

[a] *Gazi Üniversitesi, Ankara, 06500, Turkey*
[b] *Ahi Evran Üniversitesi, Kırşehir, 40100, Turkey*
[c] *Ahi Evran Üniversitesi, Kırşehir, 40100, Turkey*

Abstract

The main aim of this research is to explore the relationship between scientific literacy levels and scientific process skills of primary school students. It has been carried out with 24 students of 6th grade, 21 students of 7th grade and 25 students of 8th grade, aggregating to a total of 70 students participating in this research. According to the results, 7th grade students' scientific literacy levels and scientific process skills were more positive than that of the other grades. According to the grades, no significant difference was found between scientific literacy levels and scientific process skills of students. Furthermore, a highly positive and meaningful relationship between the scores of scientific process skills and scientific literacy levels has been registered.

Keywords: Scientific literacy, scientific process skills

1. Introduction

Understanding science is understanding life. Whereas, understanding life is a life-long continuous process of change in our lives. Formal learning process should not be restricted to classrooms; it should contain examples of life and even should contain life itself. Accordingly, a restructuring of the educational system in Turkey has been recently initiated. If an individual is to be scientifically literate, his/her interest in, and awareness of science should be promoted in earlier ages. In other words, scientific literacy inoculated to individuals at an early age, will provide the individuals with the opportunity to extend their point of views in their future lives. The purposes of scientific literacy are for the use of knowledge and skills gained by students in basic courses, where and when they are needed, analyzing a variety of problems, reason, and effectively presenting the results obtained(MEB, 2003). It is expected from individuals to detect and identify the social problems they face and find solutions to these problems to a certain extent (Aktamış & Ergin, 2007). Scientific literacy can be expressed as science literacy or science and technology literacy (Keskin, 2008). Science and Technology literacy is accepted as he adequacy of a citizen who requires to think rational about science and the personal, social and economic problems (Yetişir, 2007). Additionally, the principle of problem solving is to learn to gain science process skills (Aktamış & Ergin, 2007). Acquiring the scientific process skills facilitates access to scientific information (Başdağ, 2006). In today's

*Yasemin Gödek Altuk.Tel.: +0-090-5366490772
E-mail address: ygodek@ahievran.edu.tr

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educational process, gaining scientific thinking skills is crucial. In particular, important responsibilities concerning teaching of scientific process skills are vested in the stakeholders of science education in our country (Dökme, 2005). For this reason, science process skills should be included in the science curriculums. As the basis of analytical thinking, scientific process skills are lifelong learning process which we use in constructing knowledge and in problem solving (Hazır & Türkmen, 2008).

In literature, Bağcı Kılıç(2003) stressed the importance of the teaching of science process skills, but this has not been sufficiently implemented in most countries. Kılıç, Haymana & Bozyılmaz (2008) pointed out thatin 4th, 5th,6th, 7thand8thclasses, rather than the combined process skills importance has been given to the basic scientific process skills. In particular, observation, comparison, and inference skills were emphasized, while classification, estimation, measurement, and communication skills were less highlighted. Regarding the combined scientific process skills, more emphasis on data collection, its interpretation, conducting experiments and designing models was given. Even though scientific process skills were included in the science curriculum, the combined scientific process skills were less emphasized in the objectives of the lesson. Taşar, Temiz and Kan (2002) have analyzed the Elementary Science Education Curriculum of 2000, to find out whether it targeted the development of students' scientific process skills. They came to the conclusion that the 2000 science education curriculum was not sufficient in the development of primary school students' science process skills. Aydınlı (2007) suggested that students should be taught in scientific process skills, together with the information itself and the methods of obtaining the information. Başdağ (2006) compared the science education curriculums of 2000 and 2004 in terms of the scientific process skills included, and found that the 2004scienceandtechnology education curriculum to be more successful than the 2000 science education curriculum .

The main aim of this research is to determine the relationship between primary second grade students' scientific literacy levels and their science process skills. Therefore, the main research questions guiding this research are:

1. What are the scientific literacy levels of students of Science and Technology lesson?
2. Is there any significant difference in 6th, 7thand8thclass students in terms of their scientific process skills?
3. Is there any significant difference in 6th, 7thand8thclass students in terms of their scientific literacy levels?
4. Is there any significant relation between 6th, 7thand8thgrade students' scientific process skills and scientific literacy levels?

2. Method

The Survey method was implemented in this descriptive study. This kind of research is carried out in their natural environment to collect first-hand data (original data) (Arıkan, 2000). Survey research is used to determine the characteristics of a group (Büyüköztürk & others, 2008). The scope of this research reached for 6th, 7thand 8thclass students of the primary schools in the Nevşehir province, a district of Avanos. The sample of the study was determined by "random sampling method". The basis of random sampling method is based on the rule of neutrality. This rule provides for each unit in the sample independently of each other; with each unit within the universe having an equal chance of being selected. (Başdağ, 2006). This study has been carried out with 24 students of 6th grade, 21 students of 7th grade and 25 students of 8th grade, aggregating to a total of 70 students participating in this research. The "Scientific Process Skills Test" (α=.77) developed by Enger and Yager (1998) and translated into Turkish by Koray and others (2005), and the 'Scientific Literacy Test' (α=.81) developed by Keskin (2008) were implemented in this research. The analysis has been conducted with the SPSS package program.

3. Findings

3.1. The scientific literacy levels of 6th, 7th and 8th grade students

According to the results, 7th grade students' scientific literacy levels and scientific process skills were more positive than the other grades (Table 1).Both the scientific literacy levels (X=79) and scientific process skills (X=62) of 7th grade students were higher than that of the other classes. Averages of both scientific literacy levels and the scientific process skills of the 8th grade students were lower than the total averages. According to the grades, no significant difference was found between scientific literacy levels and scientific process skills of students.

Table 1: BOY levels and BSB scores

Measurement	Grades	n	X	S	Se	Minimum	Maximum
The Scientific literacy levels (BOY)	6	24	77,25	16,67	3,40	20,00	97,00
	7	22	78,50	9,61	2,05	56,00	95,00
	8	24	69,21	18,53	3,78	31,00	100,00
	Total	70	74,89	15,89	1,90	20,00	100,00
The scientific process skills (BSB)	6	24	61,25	16,80	3,43	27,00	88,00
	7	22	62,14	14,66	3,13	42,00	88,00
	8	24	60,54	21,18	4,32	23,00	100,00
	Total	70	61,29	17,59	2,10	23,00	100,00

3.2. The scientific literacy levels and the scientific process skills of students

Statistical comparisons were made by one-way analysis of variance (ANOVA) for repeated measures and Scheffe'stest. The findings are shown in Tables 2 and 3.

Table 2: The ANOVA results of BOY levels and BSB scores

Measurement	Source of variance	Sum of squares	sd	Mean square	F	P	Significant difference
The scientific literacy levels	Between-groups	1195,127	2	597,564	2,468	,092	
	Within-group	16223,96	67	242,149			
	Total	17419,09	69				
The scientific process skills	Between-groups	29,236	2	14,618	,046	,955	
	Within-group	21319,05	67	318,195			
	Total	21348,29	69				

p<.01

The results of the analysis show that there is a mathematical difference between the students' scientific literacy levels and scientific process skills, whereas this difference does not constitute a statistically significant difference (F_{BOY} (2, 67) = 2, 47 p >.01; F_{BSB} (2, 67) = 0, 46, p >.01). According to the results of Scheffe test, the scientific literacylevels of 7th grades (X= 78,50) and 6th grades (X= 77,25) were more positive than that of the 8th grades (X= 69,21).

It might be stated that 7th class students were scientifically more literate than the other class levels. Similarly, according to the results of Scheffe test, the scientific process skills of the 7th (X= 62,14) and 6th grades (X= 61,25), were more positive than that of the 8th grades (X=60,54). The scientific process skills scores of the 7th grades were higher than that of the other class levels, therefore, this might be interpreted to as that in terms of the scientific process skills, 7th grade students are more successful than the others.

Table 3: The Scheffe test results of BOY levels and BSB scores

Measurement		(I) class	(J) class	The average difference (I-J)	Se	p	95% Confidence interval	
The scientific literacylevels	Scheffe	6	7	-1,25	4,59	0,96	-12,75	10,25
			8	8,04	4,49	0,21	-3,20	19,29
		7	6	1,25	4,59	0,96	-10,25	12,75
			8	9,29	4,59	0,14	-2,21	20,79
		8	6	-8,04	4,49	0,21	-19,29	3,20
			7	-9,29	4,59	0,14	-20,79	2,21
The scientific process skills	Scheffe	6	7	-0,89	5,27	0,99	-14,07	12,29
			8	0,71	5,15	0,99	-12,18	13,60
		7	6	0,89	5,27	0,99	-12,29	14,07
			8	1,59	5,27	0,96	-11,59	14,78
		8	6	-0,71	5,15	0,99	-13,60	12,18
			7	-1,59	5,27	0,96	-14,78	11,59

3.3. The correlation between the scores of the scientific literacy levels test and the scientific process skills test

As Table 4 shows, there is a positive and significant relationship between the scientific literacy levels and the scores scientific process skills ($r = 0.855$, $p < .01$). According to this, it might be stated that there is a direct correlation between the scores of scientific process skills and the levels of scientific literacy. In other words, any work done to improve the scientific process skills will contribute to the student's scientific literacy.

Table 4: The correlation between the BOY levels and the BSB scores

		The scientificliteracylevels	The scientific process skills
The scientific literacylevels	Simple correlation	1	
	p		
	N	70	
The scientific process skills	Simple correlation	,855(**)	1
	p	,000	
	N	70	70

** p< 0.01

4. Discussion

Research results show that, there is a positive and statistically significant relationship between the levels of scientific literacy and the scores of scientific process skills.In supporting this finding, a study conducted with elementary school students Aydoğdu (2006) found that there was a significant relationship between the levels of students' scientific process skills and their attitudes towards Science. Keskin (2008) found a positive and significant relationship between the level of students' scientific literacy and their achievements in science and technology lesson. In this study, both, 7th grade students' levels of scientific literacy and the scores of scientific process skills were more positive than that of the other grade students. In terms of grades, there was no significant difference between students' levels of scientific literacy and the scores of scientific process skills. However, Aydınlı (2007) determined significant differences between the levels of the scientific process skills of 6th, 7th and 8th classes. According to the class-level variable, Koruyucuoğlu (2008) also found significant differences in physics student teachers' levels of scientific process skills. Tunç Şahin (2008) attained that 4th and 5th grade students' scientific literacy levels significantly differed according to their class levels. 7th grade students' scores of scientific process skills were more positive than that of the 8th grade students. This may be due to the fact that 7th grade students do not have as much exam anxiety as 8th grade students have. Therefore exam anxiety may prevent the development of 8th grade students' scientific process skills. Aydınlı (2007) also reported that during exam preparations, 8th grade

students have to solve more knowledge-based questions; this situation might impede the development of students' science process skills.

5. Conclusions and Suggestions

In this research, 7th grade students' scientific literacy levels and scientific process skills were more positive than that of the other grades. According to the grades, there was no significant difference between scientific literacy levels and scientific process skills. There was a mathematical difference but no statistically significant difference between the students' scientific literacy levels and scientific process skills. A positive and a significant relationship between the scientific literacy levels and the scores of scientific process skills could be accounted. This was interpreted to as a direct correlation between the scores of scientific process skills and the levels of scientific literacy. In other words, if students' scientific process skills are developed; this will promote student's scientific literacy levels. However, the scientific process skills may not develop quickly; up to a year as soon as possible. During the lessons, teachers should give priority to develop students' scientific process skills. Teachers' efforts in this direction should be encouraged and honored. As Hazır and Türkmen (2008) point out success is possible in science classes through students' positive attitudes. One of the most important keys to achieve this goal, would be through spending more time with activities and developing students' scientific process skills.

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