International Journal of Environmental & Science Education
Vol. 5, No. 1, January 2010, 105-126

How are the perceptions of high school students and teachers on NOS as a knowledge type presented in schools in terms of "importance" and "interest"?

Canan Tunç Şahin and Mustafa Serdar Köksal

Received 01 January 2009; Accepted 01 August 2009

The common resources of the misunderstandings on NOS are textbooks, teachers and media. However, students with their affective characteristics such as value given to any task related to NOS might also be a resource for misunderstandings. With this idea in mind, the perceptions of teachers and their students in Anatolian Teacher High School on the importance of and interest in NOS knowledge as a school subject were studied. In this study, quantitative research approach supported by qualitative data, descriptive research method and survey technique as data collection way were used. The study was conducted with 85 ninth grade students and 25 teachers. As a result of the study, it was found that the teachers and the students had many misconceptions about the aspects of NOS. In addition, it was also found that the knowledge of NOS was perceived differently by the teachers and the students in terms of "importance" and "interest". Teachers have more positive perception about NOS knowledge among the other types of knowledge in terms of "importance" than the students. The students' perception on knowledge of NOS is corresponding to "of little importance". The knowledge on NOS was ranked in "moderate interest" category by the students as similar to the knowledge types of social sciences. The teachers also put the knowledge of NOS in "moderate" category for "interest" aspect. The implications and results will be discussed in the article.

Keywords: NOS knowledge, expectancy-value theory, high school students

Introduction

One of the most important aspects of informed decision making in scientifically literate society includes teaching about aspects of nature of science (NOS) as an objective for education of all people (Uno & Bybee, 1994; Demastes & Wandersee, 1992). The NOS has many aspects for education from scientific method to science in society. As a result of epistemological and educational studies, some aspects were determined to be necessary to teach about nature of science in formal education (McComas, 1998). These aspects of NOS are described as the following sentences;

a) Scientific knowledge is based on evidence and observation
b) Scientific knowledge is tentative
c) Scientific knowledge is embedded in social and cultural context
d) Creativeness and imagination are also important to produce scientific knowledge

ISSN 1306-3065

http://www.ijese.com/

e) There is no hierarchy among hypothesis, theory and law and they have different roles
f) Science is a way of knowing
g) Scientist is not objective when he or she begins to study, he or she has a background
h) There is no universally accepted one way to do science (McComas, 1998, Lederman, Abd-El-Khalick, Bell, & Schwartz, 2002).

Quality of learning NOS knowledge as similar to learning of other knowledge types is dependent on some measurable factors. The factors can be classified as affective and cognitive ones. The cognitive domain measurements include information processing level, reasoning ability and academic achievement (Lawson, 2006; Lawson, Banks & Logvin, 2007; Schunk, 2000; Yumuşak, Sungur, & Çakıroğlu, 2007). However, the most frequently emphasized factors of the affective domain in education literature are attitude, self-efficacy, anxiety and motivation (Osborne, Simon, & Collins, 2003; Ekici, 2005; Savran & Çakıroğlu, 2001, Baldwin, Ebert-May, & Burns, 1999; Mallow, 2006; Yumuşak, Sungur, & Çakıroğlu, 2007, Glynn & Koballa, 2006). As an affective factor, motivation in education was determined as effective in action by some researchers (Osborne, Simon, & Collins, 2003). Motivation is defined as the process which instigates and sustains a goal directed activity (Pintrich & Schunk, 2002). There are many models for explaining it. Especially, one of the most emphasized models; expectancy-value model that accepts the individual as an active and rational decision maker might be a strong reflective model for explaining the motivational situations of individuals who have been gaining, using and constructing knowledge for their daily lives (Pintrich & Schunk, 2002). The model explains that individuals' choice, persistence and performance can be explained by their beliefs about how well they do task and how much they value task. The model claims that expectancies and values are directly effective on achievement choices, performance, effort and persistence (Wigfield & Eccles, 2000). Task value component of the model was shown to be positively correlated with the other important motivational constructs such as self-efficacy, intrinsic motivation, extrinsic motivation, control of learning beliefs and cognitive factors in the literature (Pintrich, 1999; Pintrich & De Groot, 1990, Douglas, 2006, Yumuşak, Sungur, & Çakıroğlu, 2007; Bong, 2001). The correlational evidence gathered has been supporting the importance of "task value" component of the model on motivational forces which can initiate and provide action on task. Wigfield and Eccles (2000) explained that the most studied subcomponents of the "task value" were "importance", "utility" and "interest" (intrinsic value). They described the "importance" as the importance of doing well on a given task, "utility" as a degree of how a given task fits into an individual's future plans and "interest" as the enjoyment one gets from doing a given task. The importance and interest factors are more related to intrinsic processes to explain choices, persistence and performance. Intrinsic factors are rooted from more complex and unobservable constructs; therefore they have potential to explain more than pragmatist surface ideas such as useful or not useful for the aim. Therefore, importance and interest components have a strong potential to predict educationally important outcomes and misunderstandings regarding to learning NOS aspects.

Different Knowledge Types Belonging to Disciplines and NOS

The structures of different knowledge types have been showing different patterns. Donald (1983) stated that number of relevant concepts, key concepts, rate of technical concepts, degree of concreteness of concepts, modes of representations and relationship patterns between concepts differentiated knowledge types related to academic disciplines. She showed that Physics concepts have a hierarchical structure; English course concepts have a linear structure while Social Psy-

chology course concepts have a web structure in terms of relationship among concepts. Again, the author showed that science knowledge has more concrete concepts than social science knowledge. These differences are an issue for epistemology of science. As related to these differences in structure of knowledge types, epistemological beliefs about scientific knowledge and science also vary by disciplinary differences caused by knowledge type differentiation (Schommer-Aikins, Duell & Barker, 2002; Hofer, 2000). Hofer (2000), in her study, showed that first-year college students see knowledge in science as more certain and unchanging than knowledge in psychology. Again, Paulsen and Wells (1998) stated that students in applied fields held more naïve views on structure and certainty of knowledge than students in pure fields. Then, Paulsen and Wells (1998) suggested disciplinary contexts related to specialized courses with their different knowledge structures are also associated to epistemological understanding differences. Nature of science as an epistemological title is also associated with disciplinary contexts related to specialized courses with their different knowledge structures. Epistemological issues about other knowledge types should be presented in schools to provide a basis to think and use disciplinary knowledge for informed decision making. The NOS knowledge is a higher-order knowledge type that provides ways of thinking and criticizing about other knowledge types. Therefore, existence of the NOS knowledge among other types presented in schools has an important place to learning general organization of knowledge and nature of disciplines. But, only focusing on NOS knowledge is not enough to see more complete picture for NOS teaching. Motivational factors regarding learning NOS knowledge as a school subject are also important determiners and they are related to epistemological understandings of students (Paulsen & Feldman, 1999). Misunderstandings about the NOS knowledge might be reflected in epistemological understandings on other knowledge types or vice versa. At the same time incorrect applications in the courses for other knowledge types and lack of the NOS content teaching might cause motivational problems for the task of development of NOS understanding. Therefore, lack of motivation to learn NOS aspects might be a reason for misunderstandings on the NOS aspects due to the overexposure to naïve understandings caused by the other knowledge types. Therefore, the place of NOS knowledge among other types of knowledge presented in schools in terms of motivational factors has an important factor to explain misunderstandings on NOS aspects.

Rationale of the Study

The NOS aspects are not understood enough by the students, scientists, teachers and prospective teachers (Blanco & Niaz, 1997; Tsai, 2006; Irez, 2006; Ryan & Aikenhead, 1992; Sandoval & Morrison, 2003; Dagher & Boujaoude, 2005). They have misunderstandings about NOS. The resources of these common misunderstandings are explained as textbooks, teachers and media (McComas, 2003; Irez, 2008). But, the students and teachers themselves are not considered as the resources with their perceptions on value of NOS knowledge in schools. High school lessons are the most important contexts for learning NOS aspects. But these contexts do not include only teaching NOS, they also include teaching on other knowledge types such as math, biology, physics and social sciences. Interaction of NOS knowledge and other types of knowledge and related perceptional differences might be effective on choosing activities, giving more time one type than other, reading more on some types of knowledge. In these contexts, teachers out of cognitive and affective factors are the most important factors for quality of learning due to their responsibilities on choice of activities and assessment, and on planning. Interaction of both teachers' and students' perceptions on NOS knowledge might be an important resource for NOS misunderstandings. By considering importance and interest as the effective factors on components of task value, this study aimed at examining the perceptions of teachers and their students of high school for

teacher education on importance and interest about NOS knowledge among the other types of knowledge as school subjects.

Method

In this study, quantitative research approach supported by qualitative data, descriptive research method and survey technique as data collection way were used.

Participants

The study was conducted with teachers and students in an Anatolian Teacher High School in the northern part of Turkey. It included 85 participants in ninth grade students and 25 teachers who taught different subjects to the ninth graders. The ninth graders were selected due to their experience with all types of knowledge with the same opportunities. The upper graders were more experienced on some of the knowledge than other types since they might have selected social sciences, science, language or equal weight departments after the ninth grade. The focus of the school is to provide education on teaching competencies for school subjects across all levels, basic knowledge about school subjects and basic understandings and affective characteristics about education. Participants' age range for the high school students is from 14 to 15. Again, forty two percent of the students indicated that they have been taking newspaper everyday while 57% of them sometimes have been taking newspaper. So, majority of them (99%) are affected by newspapers as media resource. The students have been taking basic courses on contents of science and social sciences rather than educational sciences at the time of the study. As the other group in the study, the teachers' experiences ranged from 5 to 24 years. Three of the teachers were science teachers, four of them were mathematics teachers whereas five of them were social science teachers. The number of foreign language teacher was 5 and the number of art teachers was one. The three of the teachers taught educational sciences while four of them taught native language and literature. Forty five of the student participants were female whereas 11 of the teachers were female. The participation of the study was based on willingness. For the purpose of the study, all of participants enrolled in the program were asked to determine whether they were willing to participate to the study.

Instruments

To collect data, one ranking questionnaire prepared by researchers was used. The questionnaire included 15 names of knowledge type as knowledge given in the school. In the questionnaire, the students were asked to rank the knowledge types by using "15" for the most important and interesting and 1 for the least important and interesting. Then, the instrument was applied to both teachers and prospective teachers. In addition to the ranking questionnaire, modified VNOS (views on nature of science questionnaire) including 11 open-ended questions was used to determine misunderstandings of the participants. The modified VNOS instrument was applied to randomly selected and representative part of the participants (27 students, 5 teachers).

Analysis of the Data

Quantitative data analysis was conducted by tallying the observations for each ranking unit (1, 2,… 14,15). Then all of the frequencies for each unit of ranking were determined and 15 units were combined into three different categories as "Of little" *for* 1–5, "Moderately" for 6–10 and "Very or Much" for 11–15. The combined frequencies were used to determine and compare the

perceptions of the teachers and prospective teachers on knowledge types in terms of interest and importance. The perceptions on NOS knowledge were labeled in the frequency order on the categories of both rankings. As another data type, qualitative data coming from the modified VNOS instrument was analyzed by content analysis using the categories of Lederman et. al.' (2002) frame. The initial analysis for 10 students and 5 teachers' answers was independently conducted by two researchers to increase trustworthiness of the qualitative analysis. It was found that there was 96% agreement between researchers. Then, the main analysis was conducted by a researcher for 27 students and 5 teachers' answer.

Results

The results of the study will be introduced under this title. As the first finding of the study, it was determined that the students and teachers have misunderstandings about "tentativeness", "difference between evidence and observation", "only one way to do science", "no hierarchy between theory and law" and "definition of science". The results about misunderstandings can be seen in Table 1 and Table 2.

As the second and focus findings of the study on ranking for NOS knowledge among other types of knowledge, the frequencies and corresponding percentages for each ranking category are presented in the appendix. The combined score results will be presented after that point in the result section.

As seen in Table 3, when considered NOS knowledge separately, it is ranked in "of little importance" category by 20 students (23.6%) whereas it is indicated in "very important" category by 33 of the students (38.9%) in terms of "importance" aspect. Majority of the students (86.4%) accept that NOS knowledge is important with the degrees from moderate to much.

The "interest" aspect showed different pattern from the "importance" aspects for the students (see Table 4). When taken NOS knowledge into account separately, it can be seen that 37 (43.6%) of students ranked it in the "of little interest" category while the 23 (27.1%) students saw it appropriate for "much interest" category. Again, majority of the students (56.4%) are interested in "NOS knowledge" with changing degrees from "moderate" to "much".

Differently from students, teachers presented that the majority of them (n=13, 52 %) ranked "NOS knowledge" in the very" important" category whereas only 2 (8%) individuals indicated it in "of little importance" category. Twenty-three of the teachers (92%) ranked it in the "moderate" and "very" categories as seen Table5.

When taken "NOS knowledge" into consideration separately for interest of the teachers, it is seen in Table 6 that 5 (20%) of the teachers ranked it in "of little interest" category whereas 9 (36%) of them ordered in the category of "much interest". The majority of the teachers (n=20, 80%) are interested in "NOS knowledge" with the degrees from "moderate" to "much".

Table 7 shows the general tendency of the majority (over 50%) that the students ordered "NOS knowledge" in the category of "moderate importance" while teachers ordered it as "very important". When the order on the types of knowledge are considered, it is seen that "Knowledge of NOS" is perceived as more important than "Knowledge of Economics" and "Knowledge of Art" by students while it is ordered in the same category with "Knowledge of Geography" and "Knowledge of History". All knowledge types related to science are ordered in the "very important" category by both teachers and students. Teachers ranked "Knowledge of Physics", "Knowledge of Chemistry", "Knowledge of Biology", "Knowledge of Art", "Knowledge of Economics" as less important knowledge types than "NOS knowledge" while they ranked "Knowledge of Health" and "Knowledge of Geometry" in "very important" category in the same order.

Table 1. The results of content analysis of the students' answers

Student	NOS Aspects										
	Tentat-iveness	Observation and evidence based science	Observat-ion and inference	Theory-laden science	Only one way to do science	No hierarchy between theories and laws	Roles of theory and laws	Creativity and imagination	Subjectiv-ity	Science as a way of knowing	Social and cultural embedded-ness
St1	N	N	N	N	N	N	N	I	NA	N	N
St2	T	NA	I	I	N	NA	I	I	NA	N	N
St3	N	I	N	I	N	N	N	I	NA	N	T
St4	I	I	N	I	N	N	NA	I	I	N	N
St5	N	NA	N	I	N	N	N	I	N	N	T
St6	N	I	N	N	N	N	NA	I	I	N	N
St7	N	N	N	I	N	N	NA	I	NA	N	N
St8	N	T	NA	N	N	N	N	I	I	NA	T
St9	N	I	N	NA	NA	N	N	I	T	N	I
St10	N	N	N	NA	N	N	NA	I	T	N	T
St11	N	I	N	I	N	N	NA	I	I	N	T
St12	N	I	N	I	N	N	NA	I	N	N	T
St13	N	NA	N	I	N	N	NA	I	N	N	N
St14	NA	I	N	I	NA	N	NA	I	N	N	N
St15	I	I	N	I	N	N	NA	I	I	N	N
St16	I	NA	N	I	N	N	NA	I	I	N	N
St17	N	I	N	I	NA	N	NA	I	I	N	I
St18	N	NA	N	I	N	N	NA	I	I	N	N
St19	N	NA	N	I	N	N	I	I	NA	N	N
St20	T	NA	N	NA	I	N	N	I	I	N	N
St21	T	I	N	I	I	N	N	I	I	N	N
St22	N	I	NA	NA	I	N	N	I	I	N	N
St23	N	I	I	I	NA	N	N	N	N	N	I
St24	N	I	I	NA	N	N	N	I	I	N	N
St25	N	I	N	I	N	N	NA	I	N	N	I
St26	N	I	N	NA	N	I	NA	I	I	N	N
St27	N	I	N	N	N	N	NA	N	NA	N	I

Note: N: Naïve, I: Informed, T: Transitional, NA: Not applicable

Table 2. The results of content analysis of the teachers' answers

Teacher	**NOS Aspects**										
	Tentat-iveness	Observation and evidence based science	Observat-ion and inference	Theory-laden science	Only one way to do science	No hierarchy between theories and laws	Roles of theory and laws	Creativity and imagination	Subjectiv-ity	Science as a way of knowing	Social and cultural embedded-ness
Tc1	N	I	N	I	N	N	I	I	N	N	N
Tc2	N	I	NA	T	N	N	N	I	NA	N	T
Tc3	I	NA	N	NA	I	N	N	I	I	N	I
Tc4	T	I	N	I	N	N	I	I	N	N	N
Tc5	N	I	N	I	NA	N	I	I	N	N	I

Note: N: Naïve, I: Informed, T: Transitional, NA: Not applicable

Table 3. Results for combined categories constructed from rankings of the students on importance of knowledge types

Types of Knowledge		Categories		
		Of Little Importance	Moderate Importance	Very Important
Knowledge on Native Language and Literature	%	6	57,7	36,5
	f	5	49	31
Knowledge of History	%	16,5	52,9	30,6
	f	14	45	26
Knowledge of Geography	%	16,4	52,9	30,7
	f	14	45	26
Knowledge of Mathematics	%	0	8,3	91,9
	f	0	7	78
Knowledge of Physics	%	4,8	28,2	67,2
	f	4	24	57
Knowledge of Chemistry	%	2,4	23,7	74,1
	f	2	20	63
Knowledge of Biology	%	7,1	17,7	75,3
	f	6	15	64
Knowledge of NOS	%	***23,6***	37,7	***38,9***
	f	***20***	32	***33***
Knowledge of Foreing Language	%	3,6	10,7	85,9
	f	3	9	73
Knowledge of Art	%	41,3	41,2	17,8
	f	35	35	15
Knowledge of Education	%	30,6	31,7	37,6
	f	26	27	32
Knowledge of Health	%	25,9	33	41,3
	f	22	28	35
Knowledge of Ecomonics	%	43,4	29,4	27,2
	f	37	25	23
Knowledge of Technology	%	21,2	35,2	43,5
	f	18	30	37
Knowledge of Geometry	%	2,4	18,9	78,8
	f	2	16	67

Table 4. Results for combined categories constructed from rankings of the students on interest for knowledge types

Types of Knowledge		Categories		
		Of Little Interest	Moderate Interest	Much Interest
Knowledge on Native Language and Literature	%	29,4	47,1	23,5
	f	25	40	20
Knowledge of History	%	31,7	36,4	31,7
	f	27	31	27
Knowledge of Geography	%	34,2	34	31,8
	f	29	29	27
Knowledge of Mathematics	%	0	16,5	83,4
	f	0	14	71
Knowledge of Physics	%	14,2	31,8	54,1
	f	12	27	46
Knowledge of Chemistry	%	8,3	30,7	61,2
	f	7	26	52
Knowledge of Biology	%	18,9	29,4	51,8
	f	16	25	44
Knowledge of NOS	%	***43,6***	29,4	***27,1***
	f	***37***	25	***23***
Knowledge of Foreing Language	%	16,6	21,3	62,4
	f	14	18	53
Knowledge of Art	%	37,7	40	22,4
	f	32	34	19
Knowledge of Education	%	40	41,2	19
	f	34	35	16
Knowledge of Health	%	37,7	38,8	23,6
	f	32	33	20
Knowledge of Ecomonics	%	57,6	30,7	11,8
	f	49	26	10
Knowledge of Technology	%	28,3	38,8	32,9
	f	24	33	28
Knowledge of Geometry	%	2,4	27,1	70,7
	f	2	23	60

Table 5. Results for combined categories constructed from rankings of the teachers on importance of knowledge types

Types of Knowledge		Categories		
		Of Little Importance	Moderate Importance	Very Important
Knowledge on Native Language and Literature	%	8	12	80
	f	2	3	20
Knowledge of History	%	4	12	84
	f	1	3	21
Knowledge of Geography	%	12	28	60
	f	3	7	15
Knowledge of Mathematics	%	8	20	72
	f	2	5	18
Knowledge of Physics	%	16	40	44
	f	4	10	11
Knowledge of Chemistry	%	16	40	44
	f	4	10	11
Knowledge of Biology	%	20	24	56
	f	5	6	14
Knowledge of NOS	%	***8***	40	***52***
	f	***2***	10	***13***
Knowledge of Foreing Language	%	8	16	76
	f	2	4	17
Knowledge of Art	%	4	36	60
	f	1	9	15
Knowledge of Education	%	4	24	72
	f	1	6	18
Knowledge of Health	%	4	24	72
	f	1	6	18
Knowledge of Ecomonics	%	8	48	44
	f	2	12	11
Knowledge of Technology	%	8	16	76
	f	2	4	19
Knowledge of Geometry	%	8	52	40
	f	2	13	10

Table 6. Results for combined categories constructed from rankings of the teachers on interest for knowledge types

Types of Knowledge		Categories		
		Of Little Interest	Moderate Interest	Much Interest
Knowledge on Native Language and Literature	%	8	32	60
	f	2	8	15
Knowledge of History	%	12	32	56
	f	3	8	14
Knowledge of Geography	%	20	40	40
	f	5	10	10
Knowledge of Mathematics	%	20	20	60
	f	5	5	15
Knowledge of Physics	%	40	32	28
	f	10	8	7
Knowledge of Chemistry	%	40	36	24
	f	10	9	6
Knowledge of Biology	%	28	32	40
	f	7	8	10
Knowledge of NOS	%	***20***	44	***36***
	f	***5***	11	***9***
Knowledge of Foreing Language	%	20	28	52
	f	5	7	13
Knowledge of Art	%	16	36	48
	f	4	9	12
Knowledge of Education	%	16	28	56
	f	4	7	14
Knowledge of Health	%	8	36	56
	f	2	9	14
Knowledge of Ecomonics	%	24	52	24
	f	6	13	6
Knowledge of Technology	%	12	40	48
	f	3	10	12
Knowledge of Geometry	%	36	24	40
	f	9	6	10

Table 7. The place of the knowledge on NOS for the students and teachers in rank order of 15 categories for "importance"

Types of Knowledge		Of Little Importance						Moderate Importance					Very Important				
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**
Knowledge on Native Language and Literature	Student												58.6%			
	Teacher															56%
Knowledge of History	Student									57.7%						
	Teacher															60%
Knowledge of Geography	Student									57.6%						
	Teacher													52%		
Knowledge of Mathematics	Student															64.7%
	Teacher														***52%***	
Knowledge of Physics	Student													60.1%		
	Teacher												60%			
Knowledge of Chemistry	Student														60%	
	Teacher												52.2%			
Knowledge of Biology	Student														61.2%	
	Teacher												56%			
Knowledge of NOS	*Student*									**55.3%**						
	Teacher													**56%**		
Knowledge of Foreign Language	Student															55.3%
	Teacher														68%	
Knowledge of Art	Student						53%									
	Teacher												72%			
Knowledge of Education	Student											55.2%				
	Teacher														60%	
Knowledge of Health	Student										55.3%					
	Teacher													60%		
Knowledge of Economics	Student							55.2%								
	Teacher												52%			
Knowledge of Technology	Student											56.6%				
	Teacher														56%	
Knowledge of Geometry	Student														60%	
	Teacher													56%		

Table 8. The place of the knowledge on NOS for the students and teachers in rank order of 15 categories for "interest".

Types of Knowledge		Of Little Interest						Moderate Interest						Much Interest					
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**
Knowledge on Native Language and Literature	Student							56%								
	Teacher												60%			
Knowledge of History	Student							55.2%								
	Teacher													56%		
Knowledge of Geography	Student								51.8%							
	Teacher											60%				
Knowledge of Mathematics	Student															62.3%
	Teacher											***60%***				
Knowledge of Physics	Student													57.7%		
	Teacher							56%								
Knowledge of Chemistry	Student														53%	
	Teacher								56%							
Knowledge of Biology	Student													57.6%		
	Teacher										52%					
Knowledge of NOS	*Student*							**56.4%**								
	Teacher										**52%**					
Knowledge of Foreign Language	Student														55.3%	
	Teacher											60%				
Knowledge of Art	Student							54.1%								
	Teacher											60%				
Knowledge of Education	Student						56.5%									
	Teacher													56%		
Knowledge of Health	Student						55.3%									
	Teacher												56%			
Knowledge of Economics	Student			52.9%												
	Teacher									60%						
Knowledge of Technology	Student									50.6%						
	Teacher												52%			
Knowledge of Geometry	Student													56.5%		
	Teacher							60%								

Tablo 9. Results for rankings of the students on importance of knowledge types

Types of knowledge		**Ranking Categories**															
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	**Range**
Knowledge on Native Language and Literature	%	1,2			2,4	2,4	7,1	9,4*	14,1*	7,1	20*	1,2	8,2	9,4*	2,4	15,3*	1-15
	f	1			2	2	6	8	12	6	17	1	7	8	2	13	
Knowledge of History	%			1,2	4,7	10,6*	4,7	14,1*	8,2	4,7	21,2*	5,9	3,5	11,8*	1,2	8,2	3-15
	f			1	4	9	4	12	7	4	18	5	3	10	1	7	
Knowledge of Geography	%			3,5	3,5	9,4*	7,1	8,2	8,2*	9,4*	20*	5,9	7,1	10,6*	1,2	5,9	3-15
	f			3	3	8	6	7	7	8	17	5	6	9	1	5	
Knowledge of Mathematics	%							1,2		1,2	5,9	2,4	5,9	7,1	11,8	64,7*	7-15
	f							1		1	5	2	5	6	10	55	
Knowledge of Physics	%				2,4	2,4	1,2	3,5	3,5	8,2	11,8*	1,2	7,1	16,5*	10,6	31,8*	4-15
	f				2	2	1	3	3	7	10	1	6	14	9	27	
Knowledge of Chemistry	%					2,4	1,2	2,4	7,1	1,2	11,8	4,7	9,4	14,1*	14,1*	31,8*	5-15
	f					2	1	2	6	1	10	4	8	12	12	27	
Knowledge of Biology	%	1,2		1,2	1,2	3,5		5,9	4,7	1,2	5,9	3,5	10,6	22,4*	12,9*	25,9*	1-15
	f	1		1	1	3		5	4	1	5	3	9	19	11	22	
Knowledge of NOS	%	5,9	1,2	2,4	3,5	10,6*	5,9	9,4*	2,4	4,7	15,3*	10,6*	9,4*	7,1	4,7	7,1	1-15
	f	5	1	2	3	9	5	8	2	4	13	9	8	6	4	6	
Knowledge of Foreing Language	%		1,2			2,4	1,2		1,2	1,2	7,1	5,9	4,7	12,9	7,1	55,3*	2-15
	f		1			2	1		1	1	6	5	4	11	6	47	
Knowledge of Art	%	11,8*	4,7	5,9	2,4	16,5*	7,1	7,1*	4,7	4,7	17,6*	3,5	7,1	2,4	2,4	2,4	1-15
	f	10	4	5	2	14	6	6	4	4	15	3	6	2	2	2	
Knowledge of Education	%	4,7	3,5	3,5	4,7	14,1*	4,7	3,5	8,2		15,3*	8,2*	8,2*	5,9	5,9	9,4*	1-15
	f	4	3	3	4	12	4	3	7		13	7	7	5	5	8	
Knowledge of Health	%	4,7	2,4	3,5	4,7	10,6*	5,9	7,1	8,2*		11,8*	2,4	10,6*	7,1	7,1	14,1*	1-15
	f	4	2	3	4	9	5	6	7		10	2	9	6	6	12	
Knowledge of Ecomonics	%	9,4*	3,5	8,2	4,7	17,6*	7,1	8,2*	2,4	3,5	8,2*	7,1	11,8*		1,2	7,1	1-15
	f	8	3	7	4	15	6	7	2	3	7	6	10		1	6	
Knowledge of Technology	%	4,7	2,4		4,7	9,4*	8,2	3,5	3,5	3,5	16,5*	5,9	9,4*	8,2	4,7	15,3*	1-15
	f	4	2		4	8	7	3	3	3	14	5	8	7	4	13	
Knowledge of Geometry	%	2,4					2,4	3,5	2,4	1,2	9,4	3,5	5,9	20*	9,4	40*	1-15
	f	2					2	3	2	1	8	3	5	17	8	34	
Total Frequency		39	16	25	33	95	54	74	67	44	168	61	101	132	82	284	

* The highest percentages to provide fifty percent of the participants.

Tablo 10. Results for rankings of the students on interest of knowledge types

Types of Knowledge		**Ranking Categories**															
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	**Range**
Knowledge on Native Language and Literature	%	3,5	1,2	3,5	7,1	***14,1****	11,8*	11,8*	5,9	4,7	12,9*	3,5	7,1	8,2	1,2	3,5	1-15
	f	3	1	3	6	***12***	10	10	5	4	11	3	6	7	1	3	
Knowledge of History	%	4,7	3,5	3,5	8,2*	***11,8****	8,2*	10,6*	5,9	3,5	8,2*	8,2	8,2*	4,7	3,5	7,1	1-15
	f	4	3	3	7	***10***	7	9	5	3	7	7	7	4	3	6	
Knowledge of Geography	%	3,5	2,4		11,8*	***16,5****	3,5	8,2	3,5	5,9	12,9*	10,6*	9,4	4,7		7,1	1-15
	f	3	2		10	***14***	3	7	3	5	11	9	8	4		6	
Knowledge of Mathematics	%								3,5	1,2	11,8	3,5	9,4	8,2	18,8*	***43,5****	8-15
	f								3	1	10	3	8	7	16	***37***	
Knowledge of Physics	%	5,9	1,2		4,7	2,4	10,6	2,4	4,7	10,6*	3,5	3,5	3,5	10,6*	14,1*	***22,4****	1-15
	f	5	1		4	2	9	2	4	9	3	3	3	9	12	***19***	
Knowledge of Chemistry	%	1,2	3,5	1,2	1,2	1,2	5,9	5,9	4,7	7,1	7,1	3,5	4,7	10,6*	16,5*	***25,9****	1-15
	f	1	3	1	1	1	5	5	4	6	6	3	4	9	14	***22***	
Knowledge of Biology	%	5,9	5,9		2,4	4,7	5,9	4,7	5,9	4,7	8,2*	2,4	8,2*	14,1*	11,8*	***15,3****	1-15
	f	5	5		2	4	5	4	5	4	7	2	7	12	10	***13***	
Knowledge of NOS	%	10,6*	7,1	5,9	7,1*	***12,9****	7,1	5,9	8,2*	3,5	4,7	8,2*	5,9	2,4	1,2	9,4*	1-15
	f	9	6	5	6	***11***	6	5	7	3	4	7	5	2	1	8	
Knowledge of Foreing Language	%	2,4	2,4		5,9	5,9	2,4	5,9	2,4	2,4	8,2	7,1	12,9*	10,6*	9,4*	***22,4****	1-15
	f	2	2		5	5	2	5	2	2	7	6	11	9	8	***19***	
Knowledge of Art	%	***15,3****	3,5	7,1	1,2	10,6*	5,9	8,2*	5,9	11,8*	8,2	8,2*	3,5	2,4	2,4	5,9	1-15
	f	***13***	3	6	1	9	5	7	5	10	7	7	3	2	2	5	
Knowledge of Education	%	9,4	10,6*	5,9	3,5	10,6*	2,4	***12,9****	10,6*	3,5	11,8*	2,4	4,7	2,4	2,4	7,1	1-15
	f	8	9	5	3	9	2	***11***	9	3	10	2	4	2	2	6	
Knowledge of Health	%	11,8*	5,9	5,9	3,5	10,6*	8,2*	9,4*	1,2	4,7	***15,3****	7,1	3,5	5,9	1,2	5,9	1-15
	f	10	5	5	3	9	7	8	1	4	***13***	6	3	5	1	5	
Knowledge of Ecomonics	%	***20****	4,7	10,6*	9,4*	12,9*	3,5	7,1	7,1	7,1	5,9	3,5	2,4		2,4	3,5	1-15
	f	***17***	4	9	8	11	3	6	6	6	5	3	2		2	3	
Knowledge of Technology	%	8,2	4,7	2,4	2,4	10,6*	1,2	12,9*	8,2	5,9	10,6*	3,5	5,9	3,5	3,5	***16,5****	1-15
	f	7	4	2	2	9	1	11	7	5	9	3	5	3	3	***14***	
Knowledge of Geometry	%	1,2			1,2		3,5	5,9	2,4	5,9	9,4	7,1	14,1*	11,8*	7,1	***30,6****	1-15
	f	1			1		3	5	2	5	8	6	12	10	6	***26***	
Total Frequency		88	48	39	59	106	68	95	68	70	118	70	88	85	81	192	

* The highest percentages to provide fifty percent of the participants.

Tablo 11. Results for rankings of the teachers on importance of knowledge types

Types of Knowledge		**Ranking Categories**															
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	**Range**
Knowledge on Native Language and Literature	%	4				4					12		12	8	4	***56****	1-15
	f	1				1					3		3	2	1	***14***	
Knowledge of History	%		4						4		8		8	12	4	***60****	2-15
	f		1						1		2		2	3	1	***15***	
Knowledge of Geography	%					12				4	24*		16	8	8	***28****	5-15
	f					3				1	6		4	2	2	***7***	
Knowledge of Mathematics	%		4		4				4	4	12		16	8	12	***36***	2-15
	f		1		1				1	1	3		4	2	3	***9***	
Knowledge of Physics	%			4	4	8	4	12*	4		***20****	4	16*	12*	4	8	3-15
	f			1	1	2	1	3	1		***5***	1	4	3	1	2	
Knowledge of Chemistry	%			4	4	8		12	4	4	***20****	8	16*	16*	4		3-14
	f			1	1	2		3	1	1	***5***	2	4	4	1		
Knowledge of Biology	%			4	4	12		8	4		12*		20*	***24****	8	4	3-15
	f			1	1	3		2	1		3		5	***6***	2	1	
Knowledge of NOS	%					8		8			***32****	4	12	12		24*	5-15
	f					2		2			***8***	1	3	3		6	
Knowledge of Foreing Language	%		4			4		4	4		8		20*	8	20*	***28****	2-15
	f		1			1		1	1		2		5		5	***7***	
Knowledge of Art	%					4	4		4	4	***24****	4	***24****	8		***24****	5-15
	f					1	1		1	1	***6***	1	***6***	2		***6***	
Knowledge of Education	%			4			8	4			12	4	12*	8	12*	***36****	3-15
	f			1			2	1			3	1	3	2	3	***9***	
Knowledge of Health	%		4						8		16*	8	12	20*	8	***24****	2-15
	f		1						2		4	2	3	5	2	***6***	
Knowledge of Ecomonics	%					8	12	4	4	12*	***16****	4	12*	8	8	12*	5-15
	f					2	3	1	1	3	***4***	1	3	2	2	3	
Knowledge of Technology	%			4		4	4			4	8	4	8	24	8	***32***	3-15
	f			1		1	1			1	2	1	2	6	2	***8***	
Knowledge of Geometry	%			4	4		8	4	8	4	***28****	4		8*	8	20*	3-15
	f			1	1		2	1	2	1	***7***	1		2	2	5	
Total Frequency		1	4	6	5	18	10	14	12	9	63	11	51	44	27	98	

* The highest percentages to provide fifty percent of the participants.

Tablo 12. Results for rankings of the teachers on interest of knowledge types

Types of Knowledge		**Ranking Categories**															
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	**Range**
Knowledge on Native Language and Literature	%					8	4	8			20*	12*	8	4	8	***28****	5-15
	f					2	1	2			5	3	2	1	2	***7***	
Knowledge of History	%				4	8	4		4		24*	8	4	12		***32****	4-15
	f				1	2	1		1		6	2	1	3		***8***	
Knowledge of Geography	%					***20****	8	4	8	8	12*	4	16*		8	12*	5-15
	f					***5***	2	1	2	2	3	1	4		2	3	
Knowledge of Mathematics	%		4	4		12*		4	8		8		***24****	4	8	***24****	2-15
	f		1	1		3		1	2		2		***6***	1	2	***6***	
Knowledge of Physics	%	8	8	8*		***16****	4		4	8*	***16****	8	4	8		8	1-15
	f	2	2	2		***4***	1		1	2	***4***	2	1	2		2	
Knowledge of Chemistry	%	8	8	***12****		***12****		8	8*	***12****	8	4	4	***12****	4		1-15
	f	2	2	***3***		***3***		2	2	***3***	2	1	1	***3***	1		
Knowledge of Biology	%	4	4	12		8	4	8*	8*		12*	4	***16****	4	8*	8	1-15
	f	1	1	3		2	1	2	2		3	1	***4***	1	2	2	
Knowledge of NOS	%				4	16*	8	8	12		16*	4	4	4	4	***20****	4-15
	f				1	4	2	2	3		4	1	1	1	1	***5***	
Knowledge of Foreing Language	%			8		12*		8		4	16*		12	12*	8	***20****	3-15
	f			2		3		2		1	4		3	3	2	***5***	
Knowledge of Art	%			4		12		12*		4	***20****	8	12*	4	8	16*	3-15
	f			1		3		3		1	***5***	2	3	1	2	4	
Knowledge of Education	%	4		4	4	4			4	4	20*	8	8	12*	4	***24****	1-15
	f	1		1	1	1			1	1	5	2	2	3	1	***6***	
Knowledge of Health	%		4			4	8	8	8*		12*	8	20*	8	4	***16****	2-15
	f		1			1	2	2	2		3	2	5	2	1	***4***	
Knowledge of Ecomonics	%	4		4	4	12*	4	16*	4	8	***20****	4			12*	8	1-15
	f	1		1	1	3	1	4	1	2	***5***	1			3	2	
Knowledge of Technology	%			4		8	4	12			***24****	12*	8		12	16*	2-15
	f			1		2	1	3			***6***	3	2		3	4	
Knowledge of Geometry	%	4	4	12*	4	12*	12*		4	8		8		4	4	***24****	1-15
	f	1	1	3	1	3	3		1	2		2		1	1	***6***	
Total Frequency		8	8	18	5	41	15	24	18	14	57	23	35	22	23	64	

* The highest percentages to provide fifty percent of the participants.

The other all types of knowledge presented in the school were ordered as in "very important" by the teachers.

Table8 presents the general tendency of the majority (over 50%) that the students and the teachers ordered "NOS knowledge" in the category of "moderate interest", but the teachers put it into the tenth order while the students put it into seventh order. When the order on the types of knowledge is taken into consideration, it can be seen that "Knowledge of NOS" is perceived as more important than "Knowledge of Economics", "Knowledge of Education" and "Knowledge of Health" by students while it is put in the same category with "Knowledge on Native Language and Literature", "Knowledge of History" and "Knowledge of Art" by them. Although the "Knowledge of Geography" and "Knowledge of Technology" are in the same category with "NOS knowledge", they have higher value for the category. All other types of knowledge were ranked as in "much interest" category by students. Teachers ordered "Knowledge of Physics", "Knowledge of Economics", "Knowledge of Geometry" and "Knowledge of Chemistry" in the categories which had less order value than "NOS knowledge" while they ranked "Knowledge of biology" in the same category and the same order. The other all types of knowledge presented in the school were ranked in "much interest" category by the teachers. All of the uncombined ranking results on both importance and interest can bee seen in Table 9, 10, 11 and 12.

Discussion and Implications

In the study, both teachers and their students have certain misunderstandings about the six out of 11 aspects on NOS. In spite of these misunderstandings, they also presented informed ideas on the aspects of "subjectivity", "theory-laden science", "creativity and imagination" and "observation and evidence based science". Similarity of the informed and naïve ideas of teachers and student has been meriting a certain attention. This finding is consistent with literature in which teachers and students have misunderstandings about the NOS aspects (Sondoval & Morrison, 2003; Dagher & Boujaoude, 2005; Tsai, 2006). Another interesting thing to consider is similarity in understandings of the teacher and students. Both of them presented the same pattern for the eight aspects. When the results were investigated for motivational factors, it was seen that the teachers and students also showed lack of motivational preparedness to teach and learn NOS knowledge. The place of knowledge about NOS among other types of knowledge presented in the high school for teacher training was determined as the third least important knowledge type by the students while the teachers ranked it as the sixth least important knowledge type. The result showed that teachers have more positive perception about NOS knowledge among the other types of knowledge in terms of "importance" than the students. The students' perception on knowledge of NOS is corresponding to "of little importance". This result might be a reason for misunderstandings on NOS aspects. As indicated in the literature, "value of the task" is directly related to learn task correctly by effecting enrollment and performance (Bong, 2001). Although the order is corresponding to moderate level for the teachers, there is no enough importance perception of the teachers on NOS knowledge. The situation will be clearer when other knowledge types are considered. The knowledge types related to science content knowledge are considered as similar for their importance level while knowledge of NOS is perceived as a different thing from them. Again, the order provided by students showed that the knowledge types about science content are put in similar category whereas they put the knowledge of NOS in a different category with giving less importance. This result might be another reason of misunderstandings on NOS aspects. The knowledge types related to science courses are considered as more important than NOS knowledge by the students whereas the teachers ordered it as more important than knowledge types related to science courses. In this situation, separation of NOS knowledge from the science subject knowledge is clear for both teachers and students. In fact, the definition of NOS knowledge is coming from social science fields such as history, epistemology, education and sociology (Lederman, 1992; McComas, 1998). To order NOS knowledge in similar category with the history and education might be meaningful. But the students perceived the place of NOS

knowledge as to be different from knowledge types for both social science and science itself. As another difference for the teachers and the students, the teachers ordered some knowledge types related to social sciences such as history, literature and education as more important than NOS knowledge while the students did not make such a ranking. When the "interest" aspect concerned, it was seen that the students were more interested in knowledge types regarding to science than the knowledge types of social sciences such as "Knowledge on Native Language and Literature", "Knowledge of History" and "Knowledge of Education". The knowledge on NOS was ranked in "moderate interest" category by the students as similar to the knowledge types of social sciences. Differently, although the teachers put knowledge of NOS in the category of "moderate interest", they presented opposite "interest pattern" from the students. They were more interested in the knowledge types regarding to social sciences such as "Knowledge on Native Language and Literature", "Knowledge of History", "Knowledge of Education" and knowledge types of technology, art, mathematics, and geography than the knowledge types of science content. Again, knowledge on NOS did not take required interest to teach the aspects of it in the educational environment constructed by the teachers. All the teachers must have appropriate knowledge about NOS due to its importance for scientifically literate society and having and appreciating the knowledge of NOS might provide appropriate educational atmosphere to teach and learn NOS aspects. The science and social science teachers were compared to describe the situation for this study. As a result of comparison, it was found that biology teacher put "the knowledge of biology" in the 15th order for both "importance and interest" whereas he put the "knowledge of NOS" in the 10th order for both "importance and interest". The physics teachers ordered the knowledge of content in similar category with the "knowledge of NOS" as the most important and in "much interest" category. Social science teachers ordered "Knowledge on Native Language and Literature" and "Knowledge of History" as the most important and in the much interest" category while they put the "knowledge of NOS" in "moderate" and "of little" categories for both "importance and interest" aspects except for one sociology and one literature teacher. This result also supported lack of importance and interest to teach or learn the knowledge of NOS. The misunderstandings on NOS aspects might be explained by the motivational problems explained in this article. The quantitative regression studies are necessary to conclude about this relationship. This study might provoke a probability of existence of such a relationship.

This study is a descriptive study in nature. Therefore, the results of it should be carefully examined. The sample of the study is limited to 85 students and 25 teachers. So, the generalizability of the study is limited. The results of the study might provide clues to go further in analysis of contexts in social science and science courses of the teachers and the students having not enough importance and interest perception. The level of the students on knowledge types regarding to the courses in terms of achievement and other affective factors should be taken into consideration to get idea about the students' achievement and affective state in these types of knowledge. The previous experiences on the issues about NOS or other knowledge types might be reason of their perception. Again, science definitions of the students and teachers should also be provided to investigate the perceptions in detail for further studies. Scientific literacy level of the students and teachers should also be combined with the perception categories to get more detailed information. With these results, the reasons for the perception of NOS, science and social science as different things in spite of their relationship might be studied to explain underpinnings of these different perceptions. Scientific literacy aspect emphasized in the Turkish curriculum and other international documents might be investigated by considering contribution of the knowledge types including knowledge on NOS. The results might contribute to modify educational opportunities for the students and the teachers by showing their differences in perception on knowledge of NOS.

Referrences

Baldwin, L. A., Ebert-May, D., & Burns, D. L. (1999). The development of a college biology self-efticacy instrument for nonmajors. *Science Educatian, 83(4),*397-408

Blanco, R. & Niaz, M. (1997). Epistemological beliefs of students and teachers about the nature of science: from "baconian inductive ascent" to the "irrelevance" of scientific laws. *Instructional Science*. *25(3),*203-231.

Bong, M (2001). Role of self-efficacy and task-value in predicting college students' course performance and future enrollment ıntentions. *Contemporary Educational Psychology*, *26(4),*553-570.

Dagher, Z, R. & Boujaoude, S. (2005). Students' perceptions of the nature of evolutionary theory. *Science Education, 89(3)*,378-391.

Demastes, S. & Wandersee J H. (1992), Biological literacy in a college biology classroom *BioScience, 42(1),* 63-65.

Donald, J. G. (1983). Knowledge structures: methods for exploring course. *The Journal of Higher Education*, *54(1)*,31-41.

Douglas, L. (2006). Motivational factors, learning strategies and resource management as predictors of course grades. *College Student Journal*. *40(2)*,(423-427).

Ekici, G. (2005). The validity and reliability of the biology self-efficacy instrument. *Hacettepe University Journal of Education, 29(2),* 85-94.

Glynn, S. M. & Koballa, T. R. (2006). *Motivation to learn in college science*. In J. J.Mintzes & W. H. Leonard (Eds.), Handbook of college science teaching: Theory, research, practice. Arlington, VA: NSTA Press.

Hofer, B.K. (2000). Dimensionality and disciplinary differences in personal epistemology. *Contemporary Educational* Psycholog, *25(4), 378*-405.

Irez, S. (2006). Are we prepared?: An assessment of preservice science teacher educators' beliefs about nature of science. *Science Education, 90(6),* 1113-1143.

Irez, S. (2008). Nature of science as depicted in Turkish biology textbooks. *Science Education*. *98(3),*422-447.

Lawson, A.E. (2006). Developing scientific reasoning patterns in college biology. In J. J.Mintzes & W. H. Leonard (Eds.), *Handbook of college science teaching: theory, research, practice. arlington,*(pp.109-118). VA: NSTA Press.

Lawson, A. E., Banks, D. L. & Logvin, M. (2007). Self-efficacy, reasoning ability, and achievement in college biology. *Journal of Research in Science Teaching*, *44(5),*706-724.

Lederman, N.G. (1992). Students' and teachers' conceptions of the nature of science: A review of the research. Journal of Research in Science Teaching, *29(4),*331–359.

Lederman, N.G., Abd-El-Khalick, F., Bell, R.L. & Schwartz, R.S. (2002). Views of nature of science questionnaire: toward valid and meaningful assessment of learners' conceptions of nature of science. *Journal of Research in Science Teaching*. *39(6)*. 497-521.

Mallow, J.V (2006). Science anxiety: research and action. In Mintzes, J. J. and Leonard, W. (Eds.), *Handbook of college science teaching: Theory, research, practice, arlington,*(pp. 3-14). VA: NSTA Press.

McComas, W. F. (1998). The principal elements of the nature of science: Dispelling the myths of science. In W. F. McComas (Ed.) *The nature of science in science education: Rationales and strategies*. (pp. 53-70). Kluwer Academic Publishers.

McComas, M. R. (2003). A textbook case of the nature of science: laws and theorıes in the science of biology. *International Journal of Science and Mathematics Education,*1, 141-155.

Osborne, J., Simon, S. & Collins, S. (2003). Attitudes towards science: a review of the literature and its implications, *International Journal of Science Education, 25(9),* 1049-1079.

Paulsen,M.B. & Wells, C.T. (1998). Domain differences in the epistemological beliefs of college students. *Research in Higher Education, 39(4),*365-384

Pintrich, P.R.(1999). The role of motivation in promoting and sustaining self-regulated learning. *International Journal of Educational Research. 31(6),* 459-470.

Pintrich, P. R., & Schunk, D. H. (2002). *Motivation in education: Theory, research, and Applications (2nd Ed.).* Columbus, OH: Merrill-Prentice Hall

Pintrich, P.R. & De Groot E. (1990). Motivational and self-regulated learning components of classroom academic performance. *Journal of Educational Psychology, 82(1),* 33-50.

Ryan, A. G.& Aikenhead, G.S. (1992). Students' preconceptions about the epistemology of science. *Science Education, 76(6),* 559-580.

Sandoval, W., & Morrison, K. (2003). High school students' ideas about theories and theory change after a biological inquiry unit. *Journal of Research in Science Teaching, 40(4),* 369-392.

Savran, A., & Çakıroğlu, J. (2001). Preservice biology teachers perceived efficacy beliefs in teaching biology.*Hacettepe University Journal of Education, 21(2),* 105-112.

Schunk, D. H. (2000). *Learning theories: An educational perspective.* New Jersey: Prentice-Hall, Inc.

Schommer-Aikins, M.,. Duell, O.K.,& Barker, S. (2002). Epistemological beliefs across Domains using biglan's classification of academic disciplines. *Research in Higher Education, 44(3),* 347-366.

Tsai, C. (2006). Reinterpreting and reconstructing science: Teachers' view changes towards the nature of science by courses of science education. *Teaching and Teacher Education, 22(3),* 363-375.

Uno, G. E., & Bybee, R. W. (1994).Understanding the dimensions of biological literacy. *BioScience, 44(8),* 553-557.

Wigfield, A. & Eccles, J.S. (2000). Expectancy-value theory of achievement motivation. *Contemporary Educational Psychology, 25(1),* 68-81.

Yumuşak, N., Sungur, S., & Çakıroğlu J. (2007). Turkish high school students' biology achievement in relation to academic self-regulation. *Educational Research and Evaluation, 13(1),*53-69.

Authors

Canan Tunç Şahin has been studying as a research assistant in Department of Social Studies Education of Karaelmas University for three years. She has completed her master study in Department of Educational Curriulum Development and Instruction. The author has studied on scientific literacy at the level of elementary education. The author has been conducting her PhD studies in Marmara University for two years and has been interested in scientific literacy and socio-scientific issues. **Correspondence:** Karaelmas University, Eregli Education Faculty, Department of Elementary Education, 67300, Eregli/Zonguldak, Turkey.
E-mail: cnntnc@gmail.com

Mustafa Serdar Köksal has been studying as a research assistant in Department of Science Education of Karaelmas University for five years. He has completed her master study in Department of Biology Education. The author has studied on multiple intelligences theory at the level of secondary science education. The author has been conducting her PhD studies in Middle East Technical University for four years and has been interested in scientific literacy and nature of science.
Email: bioeducator@gmail.com

Öğretmen lisesi öğrenci ve öğretmenlerinin okullarda sunulan bir bilgi türü olarak bilim doğasina ilişkin "ilgileri" ve "önemlilik" algilari nasildir?

Canan Tunç Şahin ve Mustafa Serdar Köksal

Bilimin doğası hakkındaki yanlış anlayışların yaygın olarak bilenen kaynakları, ders kitapları, öğretmenler ve medyadır. Ancak öğrencilerin bilimin doğasına ilişkin herhangi bir göreve verdikleri değer gibi, duyuşsal karakterler de bilimin doğası ile ilgili yanlış anlayışlara neden olabilir. Bu düşünceyi temel alarak, Anadolu Öğretmen Lisesi öğretmenlerinin ve öğrencilerinin bilimin doğası ile ilgili bilgilere ilişkin ilgilerini ve bu bilgi türüne verdikleri önemi saptamak için bu çalışma yapılmıştır. Bu çalışmada nitel veri toplama yaklaşımından ve tarama tekniğinden faydalanılarak, nicel bir araştırma yaklaşımı olan, tanımlayıcı araştırma metodu kullanılmıştır. Çalışma 85 dokuzuncu sınıf öğrencisi, 25 öğretmen ile yürütülmüştür. Çalışma sonunda öğretmen ve öğrencilerin bilimin doğasına ilişkin algılarında birçok yanlış anlayış olduğu görülmüştür. Ayrıca bilimin doğasına ilişkin bilgi üzerine öğretmen ve öğrencilerinin "ilgi" ve "önem" algılarında farklılıklar olduğu görülmüştür. Bilimin doğasına ilişkin bilginin önemi ile ilgili öğretmenlerin daha olumlu algıya sahip oldukları bulunmuştur. Bilimin doğasına ilişkin bilgi öğrencilerce "az önemli" olarak algılanmaktadır. İlgi açısından ise, öğrenciler bilimin doğasına ilişkin bilgiye karşı "orta düzeyde" bir ilgi algısına sahiptirler, bu algıları sosyal bilimler kategorisinde yer alan bilgi türlerine ilişkin algılarına benzerdir. Öğretmenlerin bilimin doğasına ilişkin bilgi üzerine, "ilgi" açısından algılarının "orta düzey" kategorisinde olduğu bulunmuştur. Bu çalışmanın sonuçları ve önemi makale içerinde tartışılacaktır.

Anahtar kelimeler: bilimin doğasına ilişkin bilgi, beklenti-değer teorisi, lise öğrencileri