MIDDLE SCHOOL STUDENTS' SCIENTIFIC EPISTEMOLOGICAL BELIEFS

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ABSTRACT
The purpose of this study is to investigate fifth, sixth, seventh and eighth grade students' scientific epistemological beliefs. For this purpose, descriptive study method was used. Sample of the study involved purposively selected 431 middle school students from convenient schools. The data of the study was collected by a Likert type scale called as "Scientific Epistemological Beliefs Scale". The findings showed that students had sophisticated beliefs about verification aspect of the beliefs while they were naive about the aspects; source of knowledge, development of knowledge and certainty of knowledge.
Key Words: Scientific epistemological beliefs, descriptive study, middle school students.

INTRODUCTION

In today's world, people need to be knowledgeable about different aspects of science because of the constant growth of products in science fields. Being knowledgeable about science helps with choosing what knowledge is needed in life, understanding scientific knowledge, knowing where and how to find the necessary scientific knowledge and how to use scientific knowledge properly. However acquisition of scientific knowledge is not enough to make informed performance or decisions regarding science in life. Also the beliefs regarding scientific knowledge and science as a way of knowing are of great importance in using scientific knowledge properly. Beliefs regarding science and scientific knowledge are studied under the title of "epistemological beliefs", epistemological beliefs involves beliefs about knowledge and knowing (Hofer & Pintrich, 2002, s.3). Individuals should develop coherent and sophisticated epistemological belief system to acquire and to use knowledge in their daily life. Actually individuals believing in existence of only right or wrong knowledge, fragmented or associated structure of knowledge, authoritarian transfer or personal construction of knowledge and simple or complex structure of knowledge have a basis for their further decisions and performances regarding acquirement and use of knowledge (Deryakulu, 2002). Studies of epistemological beliefs in education field link epistemological beliefs to cognitive and motivational learning outcomes, and achievement (Muis, 2004; Tsai, 2000; Topçu & Yılmaz-Tüzün, 2009; Özkal, Tekkaya, Çakıroğlu & Sungur, 2009). Studies related to epistemological beliefs mention three different characteristics of epistemological beliefs (Hofer & Pintrich, 2002):

1. Epistemological beliefs have a developmental nature.
2. Learning is affected by individuals' epistemological beliefs.
3. Epistemological beliefs might be defined as individuals' theories regarding knowledge and knowing, and their epistemological resources. These beliefs affect learning by activating tendencies to learn in associated contexts with the beliefs.

Number of the educational studies on epistemological beliefs increased in the last 20 years (Hofer & Pintrich, 2002). Actually studies on epistemology were first started with Perry (1970)'s study on moral development of the college students. Perry created an epistemological model for development of epistemological beliefs of individuals. According to this model, in terms of their epistemological development levels, individuals first believe in one side (right or wrong) of dualistic nature of knowledge and authority requirement to reach true knowledge, then they reach to second level (multiplicity) involving acceptance of uncertain and tentative nature of knowledge, partial believe in unchanging external reality, partial belief in uncertain knowledge of experts and ability of everybody to structure his or her own knowledge. In following level (relativist), individuals accept that knowledge might be true or wrong in its specific contexts and individuals make their own meanings without an external authority. At the highest level (commitment), individuals believe in relativity of knowledge and flexibility of knower in terms of changing his or her knowledge by commitment.

After the Perry's model, Belenky, Clinchy, Goldberger and Tarule (1986) created another model called as model of women's ways of knowing. Five-dimension epistemological beliefs model of Schommer-Aikins (1990), Kuhn (1991)'s argumentative reasoning model, reflective judgment model of King and Kitchener (1994) and Kuhn (2005)'s intellectual values model are the other models for explaining epistemological beliefs. In spite of the models for explaining epistemological beliefs of students, five-dimension epistemological beliefs model of Schommer (1993) is the most common preferred model for studying epistemological beliefs in Turkey and it provides an explanatory frame for studying epistemological beliefs in Turkish culture. The model has five partially independent dimensions;

1. Structure of knowledge (Simple vs. Complex knowledge): It is about accepting knowledge as simple with unrelated components or as complex with connected components.
2. Certainty of knowledge (Certain vs. Tentative): This aspect is consisted of beliefs about whether knowledge is precise (unchanged) or tentative (changeable).
3. Source of knowledge (Authority vs. Individual Construction): In this aspect, beliefs about source of knowledge as authority or individual construction process are in focus.
4. Speed of knowledge acquisition (Learning suddenly happens vs. Learning needs time): This aspect is about believing whether learning suddenly happens or learning needs time.
5. Control of knowledge acquisition (Fixed learning ability at birth vs. Improvable learning ability): In this aspect, learning ability as knowledge acquisition factor might be accepted as unchanged and fixed factor at birth or as changeable and improvable with experience over time.

Schommer (1993)'s model was tested by studying epistemological beliefs of undergraduate students. However followers (Conley, Pintrich, Vekiri & Harrison, 2004) of Shommer's models in science education field tested the model by applying it to elementary school students and the researchers found that four-dimension structure was observed. They named the dimensions as resource, certainty, improvement, and verification. In resource dimension beliefs about source of scientific knowledge is involved while certainty aspect is about trust to scientific knowledge as the true and only one right answer of questions or not. For the improvement aspect beliefs about whether scientific knowledge is tentative or unchanged while verification aspect involves beliefs about supporting ways (experiments or multiple ways) of scientific ideas. Evidence from the studies (Muis, Franco & Geirus, 2011; Stahl, 2009) focusing on domain-dependency of epistemological beliefs provided empirical support for domain-dependent nature of epistemological beliefs. Hence Conley et al. (2004)'s model has advantage in our study due to the fact that it is focused on science domain. Another reason of choosing this model as a framework is that it has been applied to elementary students and it has been tested in the culture we have made the study.

By using Conley et al. (2004)'s model, we have purposed to determine the epistemological beliefs of middle school students about learning science and scientific knowledge. It was thought that evidence of this study might inform science teachers in designing their courses in line with scientific epistemological beliefs of their students and might provide another set of evidence to the researchers studying on epistemological beliefs regarding scientific knowledge.

Studies on Epistemological Beliefs

Different types of studies have been carried out on the importance of epistemological beliefs in terms of learning and teaching processes (Tsai, 2009; Tsai, 2000; Topcu & Yılmaz-Tüzün, 2009). Tsai (1999) made research to investigate whether lab activities of eight grade students (n=25) changed their scientific epistemological beliefs. The researcher found that the students with nontraditional beliefs made more frequent discussions and sharings with their group members than their counterparts with traditional epistemological beliefs. Also the students with nontraditional beliefs preferred more free and student centered learning environments than their counterparts with traditional epistemological beliefs. This evidence refers to importance of scientific epistemological beliefs in teaching preferences of the students and activities of them in science labs. One year later Tsai (2000) examined the effect of epistemological beliefs of ninth grade girls (n=101) on learning outcomes in two different teaching application groups; teaching by science-technology-society oriented applications and ordinary teaching. The findings showed that the students with nontraditional epistemological beliefs gained more than the students with traditional epistemological beliefs in teaching by science-technology-society oriented applications.

Another line of studies made descriptive and correlation studies about epistemological beliefs. Kurt (2009) differently studied on relationship of epistemological beliefs with gender, grade and field of education. Her sample involved 1557 sixth, eighth, and tenth grade students. At the end of the study it was observed that beliefs of tenth grade students about source of knowledge, certainty of knowledge, and development of knowledge were more sophisticated than the beliefs of sixth and eighth grade students. Also the students in mathematics-science dominated educational field were found to have more sophisticated beliefs about verification of knowledge than their counterparts in literature-social science dominated educational field. Conley, Pintrich, Vekiri and Harrison (2004) in their study investigated 187 5^{th} grade students' scientific epistemological beliefs by applying their instrument including four dimensions (certainty, improvement, verification and resource). They applied their instrument in two points of nine-week period. Their results showed that beliefs of students about resource and certainty of knowledge dimensions became more sophisticated over time. Choi and Park (2013) investigated 700 Korean middle school students' epistemological beliefs. Their findings showed that the participants had sophisticated beliefs regarding 'learning ability is depend on effort or not' and but they did not see authority as a valuable knowledge resource. In a different culture, Yenice and Özden (2013) determined 355 Turkish 8th students' epistemological beliefs. Researchers used scientific epistemological beliefs as their instrument to collect data. The findings showed that the participants had sophisticated beliefs about 'authority is a knowledge resource or not" and 'knowledge is tentative or not'.

Özkal, Tekkaya, Çakıroğlu and Sungur (2009) determined scientific epistemological beliefs of 8th grade students (N=1152). Findings of the study showed that the students believing in tentative scientific knowledge perceived their learning environment more constructivist place. Hence scientific epistemological beliefs are seen to be associated with learning environment preference of the students. Topçu and Yılmaz-Tüzün (2009)'s study involved four grade levels of elementary school (4th, 5th, 6th, 7th and 8th grades). Their purpose was to study the relationship among science achievement, metacognition, and epistemological beliefs of 4th, 5th, 6th, 7th and 8th grade students (n=941). In the study two different instruments were utilized. They were Epistemological Beliefs Questionnaire of Schommer (1990) and Junior Metacognitive Awareness Inventory prepared by Sperling, Howard, Miller& Murphy (2002). Results of the study represented that epistemological beliefs of the students were associated with their science achievement. In study of Chen and Pajares (2010) relationship of epistemological beliefs with academic motivation and science achievement. Their study involved 508 6th grade students. The result from path analyses showed that epistemological beliefs played mediator role between association of implicit theories of ability with achievement goal orientations, self-efficacy, and science achievement.

When looked at the literature about epistemological beliefs, they are mostly focusing on 'general epistemological' beliefs (Schommer-Aikins, 2004; Topçu and Yılmaz-Tüzün, 2009; Özkal 2009). But some of the studies on epistemological beliefs supported domain-dependent nature of the beliefs (Hofer, 2000; Muis, Franco & Geirus, 2011; Stahl, 2009). Hence there is a need to examine scientific epistemological beliefs of middle school students by using a domain-focused frame and more current instrument. At the same time providing more current data about scientific epistemological beliefs of middle school might be useful for science teachers in designing their courses in line with epistemological beliefs of their students and might provide evidence for existent literature. Therefore the purpose of this study is to determine scientific epistemological beliefs of middle school students.

Rationale of the Study

Buehl and Alexander (2006) assert that individuals have both domain-general and domain-dependent epistemological beliefs. Hofer (2006) classifies domain-dependent epistemological beliefs as disciplinary beliefs and discipline-specific epistemological beliefs. When considered discipline-specific nature of epistemological beliefs, value of assessing science-specific epistemological beliefs can be seen as a requirement for further decisions about the relationship between the scientific epistemological beliefs and, teaching and learning science. Studying the relationship between the scientific epistemological beliefs and, teaching and learning science has importance since scientific epistemological beliefs of the students are associated with their perceptions of learning environment (Tsai, 2000), use of deep or surface learning strategies (Chen & Chen, 2014), self-efficacy in learning physics and attitudes towards physics (Kapucu & Bahcıvan, 2015), use of science for their daily life problems and science achievement (Evcim, Turgut & Sahin, 2011). We have limited number of the studies focusing on the relationship between scientific epistemological beliefs of the students and other variables regarding learning science. Before making further researcher on the relationships determining scientific epistemological beliefs by using more current and science-specific instruments might be useful for the researchers and science teachers who are interested in scientific epistemological beliefs of middle school students. This way might also contribute to the studies focusing on defining scientific epistemological beliefs.

Method of the Study

In this study descriptive cross-sectional research method was used. Four hundred thirty one middle school students participated in the research. To make the research feasible for the researcher (time, effort and money), a convenient sampling method was used (Frankel & Wallen, 2006). In the research the data about students' personal characteristics and their epistemological beliefs were collected by personal information form and scientific epistemological beliefs scale. Descriptive values about participants are represented in table 1.

Table 1. Descriptive values about participants.

Grade Level	Number of the Participants		%	
5. grade	34		7.9	
6. grade	138		32.0	
7. grade	110		25.5	
8. grade	149		34.6	
Gender				
Female	227		52.7	
Male	204		47.3	
Parent Educational Level	**Mother**	**Father**	**Mother (%)**	**Father (%)**
Illiterate	13	6	3.0	1.4
Literate without schooling	13	7	3.0	1.6
Elementary school	157	105	36.4	24.4
Middle school	69	70	16.0	16.2
High school	108	123	25.1	28.5
University	64	100	14.8	23.2
Master and PhD Degree	7	20	1.6	4.6
Classes taken about epistemology				
Yes	0		0.00	
No	431		100.0	
Participation in conferences about epistemology				
Yes	0		0.00	
No	431		100.0	
Total	***431***		***100.0***	

When table 1 is examined it can be seen that the study mostly consists of sixth and eighth grade students. Also the percentages of male and female students are very close to each other, and the parents are mostly elementary school, high school or university level graduates. Moreover none of the students participated in a class or conference about epistemology before.

Instruments

In the study personal information form with questions regarding grade level, gender, parent educational level, and class and conference participation situations about epistemology was prepared by the researchers. The form was applied before collecting data by the scientific epistemological beliefs scale. Scientific epistemological beliefs scale was developed by Conley, Pintrich, Vekiri and Harrison (2004) and adapted into Turkish by Kurt (2009). The scale involves Likert type 26 items. Despite the fact that the scale was adapted into Turkish before, reliability and validity evidence regarding our sample were collected again due to a new group for scale application. The scale items are seen in table 2.

Table 2. Items of scientific epistemological beliefs scale.

	Read the sentences below and put an X on the box you personally think is correct. Put a single X per question.	I definitely disagree.	I disagree.	I am hesitant.	I agree.	I definitely agree.
1	All people have to believe in what scientists say.*					
2	İn science all questions have only one correct answer.*					
3	In scientific experiments ideas, events are thought of and come forth from curiosity.					
4	Today, some scientific thoughts are different from what scientists thought of in the past.					
5	Before starting an experiment there is benefit in having a idea about it first.					
6	You have to believe what is written in scientific books.*					
7	The most important part of a scientific study is to reach a correct answer.*					
8	Information in scientific book can change sometimes.					
9	In scientific studies there can be different ways to test thoughts.					
10	In science class everything the teacher says is correct.*					
11	Thoughts in science come forth from your own experiments and questions you ask yourself.					
12	Scientists know practically everything there is to know about science, there’s nothing left to learn.*					
13	There are some questions that even scientists cannot answer.					
14	Experimenting and scientific studies are an important part of learning how things happen.					
15	You can be sure that everything you read in a science book is corrent.*					
16	Scientific information is always correct.*					
17	Scientific thoughts may sometimes change.					
18	To be sure about results, it is good to redo experiments.					
19	Only scientists know for sure what is correct in science.					
20	The result a scientist receives from an experiment is the only answer.*					
21	New discoveries may change what scientists thought to be true.					
22	Good ideas in science are not only from scientists but may also be from normal people.					
23	Scientists always agree upon what is correct and what isn’t in science.*					
24	Best conclusions are based on evidence obtained from the results of different experiments.					
25	Scientists may change what they accept as correct in science.					
26	Experimenting is the best way to be sure if something is correct or not.*					

*: Negative items

Validity Study

Confirmatory factor analysis was applied to validate the scores taken from the scale. Original scale has four dimensions; verification, improvement, certainty and resource. Table 3, table 4, table 5 and table 6 represent the items per dimension.

Table 3. Verification dimension

Item number	Items
3	In scientific experiments ideas, events are thought of and come forth from curiosity.
9	In scientific studies there can be different ways to test thoughts.
11	Thoughts in science come forth from your own experiments and questions you ask yourself.
14	Experimenting and scientific studies are an important part of learning how things happen.
18	To be sure about results, it is good to redo experiments.
22	Good ideas in science are not only from scientists but may also be from normal people.
24	Best conclusions are based on evidence obtained from the results of different experiments.
26	Experimenting is the best way to be sure if something is correct or not.*

*: Negative items

In table 3 the verification dimension is represented with 8 items. Items of improvement dimension are shown in table 4.

Table 4. Improvement dimension

Item Number	Items
4	Today, some scientific thoughts are different from what scientists thought of in the past.
8	Information in scientific book can change sometimes.
13	There are some questions that even scientists cannot answer.
17	Scientific thoughts may sometimes change.
21	New discoveries may change what scientists thought to be true.
25	Scientists may change what they accept as correct in science.

Table 4 shows the development dimension with 6 items. The items of resource dimension are shown in table 5.

Table5. Resource dimension

Item Number	Items
1	All people have to believe in what scientists say *
6	You have to believe what is written in scientific books.*
10	In science class everything the teacher says is correct.*
15	You can be sure that everything you read in a science book is corrent.*
19	Only scientists know for sure what is correct in science.

*: Negative items

In table 5 the resource dimension is represented with 5 items. The items of certainty dimension are shown in table 6.

Table 6: Certainty dimension

Item Number	Items
2	In science all questions only have one correct answer.*
12	Scientists know practically everything there is to know about science, there's nothing left to learn.*
16	Scientific information is always correct.*
20	The result a scientist receives from a experiment is the only answer.*
23	Scientists always agree upon what is correct and what isn't in science.*

*: Negative items

In table 6 the certainty dimension is represented with 5 items. Based on the study of Conley, Pintrich, Vekiri and Harrison (2004), shape of confirmatory factor analysis model was determined as in the following figure (Figure 1).

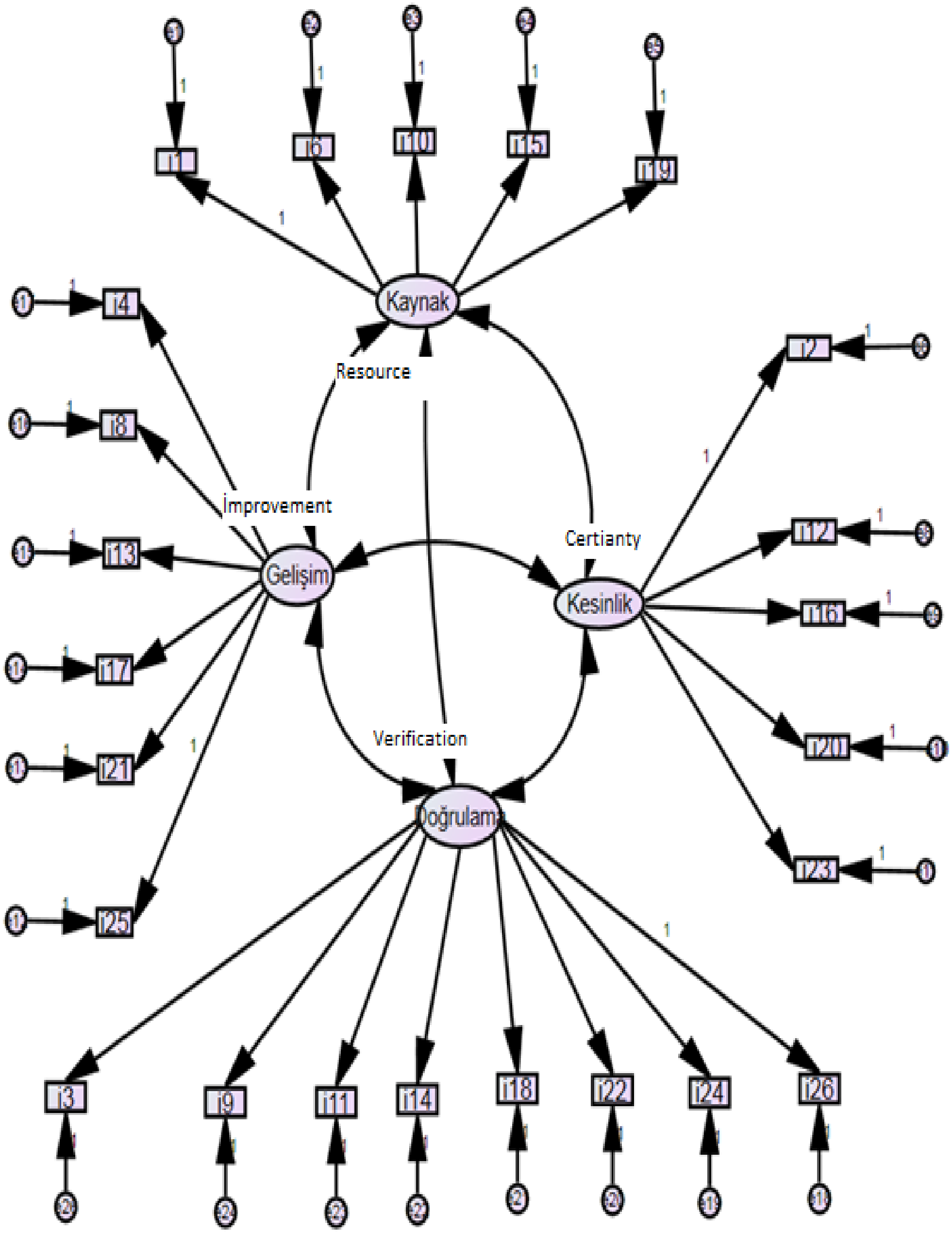

Figure 1. Model suggested for confirmatory factor analysis.

The analysis findings involving standardized results are shown in figure 2.

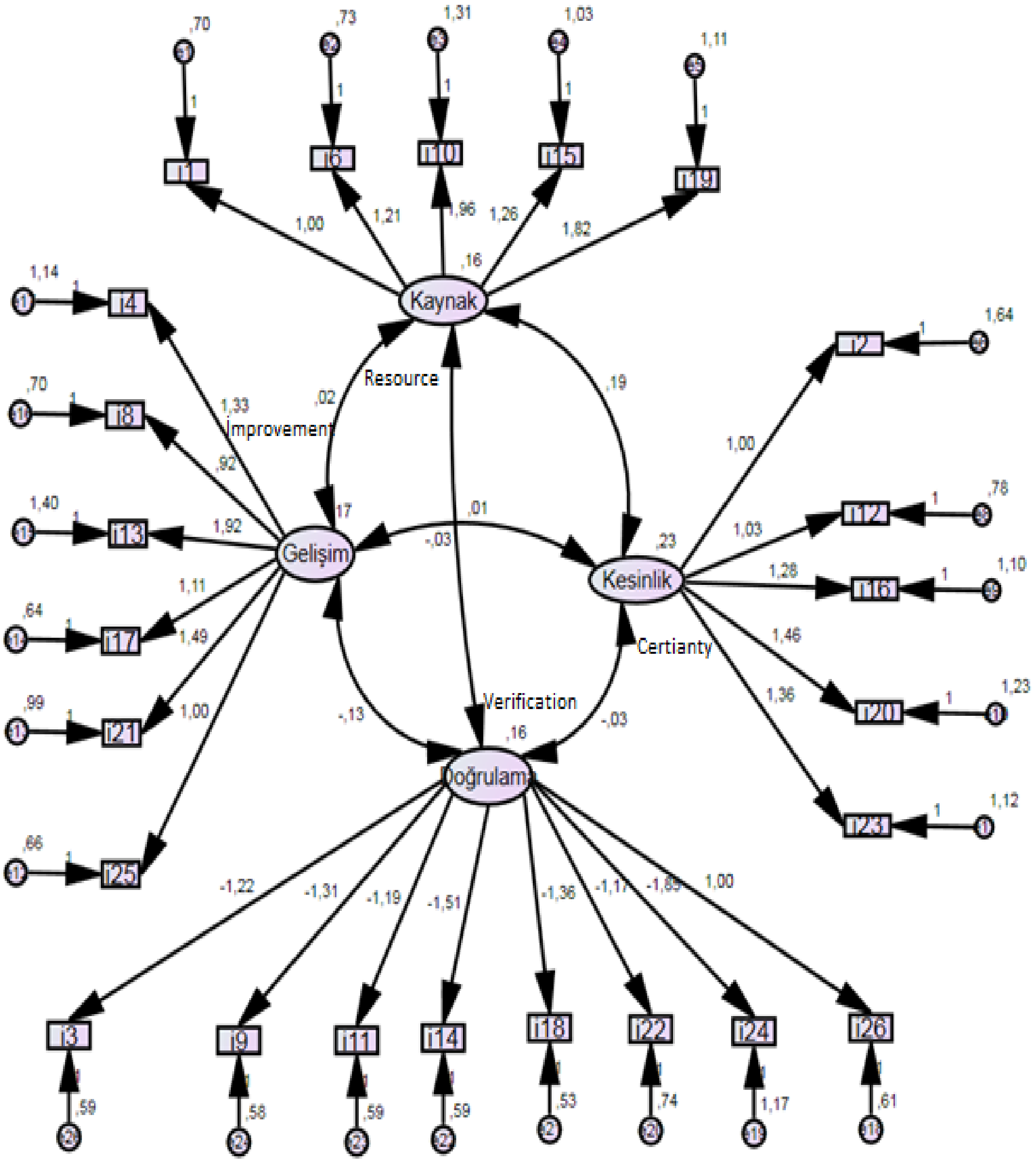

Figure 2. Findings of the tested model for confirmatory factor analysis.

In the study CMIN/DF, CFI, GFI and RMSEA indexes were tested. Values of CFI and GFI fit indexes are 0.90 and 0.85 respectively and they are in acceptable ranges (Hoyle, 2000; Marsh, Balla & McDonald, 1988). The RMSRA as a non-fit index value is 0.05 and this value is acceptable since it should be lower than 0.08 (Raykov & Marcoulides, 2006).Table 7 represents values of CMIN/DF, CFI, GFI and RMSEA indexes.

Table 7. Fit and non-fit index statistics.

Fit and non-fit indexes	Values
CMIN/DF	2.138
GFI	.906
CFI	.848
RMSEA	.O51

Reliability and Descriptive Statistics of Participant's Scientific Epistemological Belief Scores

Cronbach alpha reliability for total scores taken from the scale was calculated. In table 8, Cronbach alpha reliability and descriptive statistics of total score taken from the scale are shown.

Table 8. Reliability for total score gained from the scale and descriptive statistics

Number of Items	26
Cronbach Alpha	0.772
Mean	88.72
Variance	164.60
Standard Deviation	12.83

When table 8 is examined it is observed that Cronbach Alpha value (0.772) is in an acceptable range. Hatcher and Stepanski (1994) state that Cronbach Alpha as low as 0.55 and more is an acceptable value. Preliminary analysis showed that two items should be removed from the scale. Fifth item was removed from the scale due to its non-normal distribution in the sample while seventh item was removed from the scale due to its low factor load. Therefore number of the item in the scale decreased to 24 items. Then Cronbach alpha reliability and descriptive statistics of total score taken from the scale were calculated again. The results are shown in table 9.

Table 9. Reliability for total score gained from the scale and descriptive statistics after removing 5th and 7th items.

Number of Items	24
Cronbach Alpha	0.782
Mean	82.40
Variance	155.02
Standard Deviation	12.45

When table 9 is seen it is observed that Cronbach Alpha value (0.782) is in an acceptable range (Hatcher & Stepanski, 1994). After the total scores were considered for reliability study, reliability for the dimensions was calculated. In table 10 Cronbach Alpha reliability and descriptive statistics for the dimensions are shown.

Table 10. Reliability and descriptive statistics regarding the dimensions.

Verification Dimension	***Number of Items***	8 (i3,i9,i11,i14,i18,i22,i24,i26)
	Cronbach Alpha	0.68
	Mean	28.05
	Variance	33.8
	Standard Deviation	5.81
Improvement Dimension	***Number of Items***	6 (i4, i8, i13, i17,i21, i25)
	Cronbach Alpha	0.71
	Mean	20.70
	Variance	23.01
	Standard Deviation	4.79
Resource Dimension	***Number of Items***	5(i1, i6, i10, i15, i19)
	Cronbach Alpha	0.67
	Mean	17.25
	Variance	16.82
	Standard Deviation	4.10
Certainty Dimension	***Number of Items***	5 (i2, i12, i16, i20, i23)
	Cronbach Alpha	0.61
	Mean	16.40
	Variance	16.19
	Standard Deviation	4.02

Reliability analysis per dimension showed that Cronbach Alpha values for the dimensions are acceptable for using the scores in further analysis (Hatcher & Stepanski, 1994).

FINDINGS

Findings of the study are represented under this title, first scores on scientific epistemological beliefs of the participants will be represented in table 11 and then the correlational findings regarding the dimensions will be represented in table 12.

Table 11. Mean and standard deviations of the participants' scores on scientific epistemological beliefs scale

Dimensions	*Mean*	*Standard Deviation*
Total score	3.43	0.51
Resource Dimension	3.44	0.82
Improvement Dimension	3.45	0.79
Verification Dimension	3.50	0.72
Certainty Dimension	3.27	0.80

Table 11 shows that mean of the total scores and the mean of the scores per dimension are seen to be close to each other. To be able to say that individuals have acceptable constructivist scientific epistemological beliefs, the mean values have to be 4 or more. In table 11 it was seen that mean of the total score of the participant was 3.43. This means that the students do not have sophisticated scientific epistemological beliefs in general. When the dimensions are taken into consideration it can be seen that the means for the dimensions ranges from 3.27 to 3.50. It can be said that the students also do not have sophisticated beliefs about resource, improvement, verification and certainty dimensions. For examining the associations between the scores on the dimensions, Pearson correlations were calculated. Table 12 represents correlation values between the dimensions.

Table 12. Correlation analysis results

Dimensions	*Values*
Resource-Improvement	.09
Resource-Certainty	*.98*
Certainty-Verification	-.14
Improvement-Verification	-*.82*
Resource-Verification	-.17
Certainty-Improvement	.04

According to table 12, it is obvious that there is a strong positive correlation between resource and certainty dimensions. Also there is a strong negative correlation between improvement and verification dimensions. The weakest correlation is between certainty and improvement dimensions. This situation shows that students' epistemological beliefs are partially associated. It is a sign for partially independent beliefs in a personal epistemological beliefs system.

DISCUSSION AND SUGGESTIONS

The results of this study suggested partially independent beliefs of the students and showed existence of unsophisticated scientific epistemological beliefs about resource, improvement, verification and certainty dimensions. These findings are not in line with previous studies on domain-general epistemological beliefs (Schommer-Aikins, Duell & Hutter, 2005; Evcim, Turgut & Şahin, 2011). Actually differences in the results of the studies about scientific epistemological beliefs and domain-general epistemological beliefs might be associated with data collection ways. Since majority of the previous studies used domain-general scales, short answer forms, written essays and interviews (Brownlee, 2001; Schommer & Walker, 1995; Roth & Roychoudhury, 1994). However the studies domain-specific epistemological beliefs have conflicting findings with the results of this study, Boz, Aydemir and Aydemir (2001)'s study showed that 4th, 6th and 8th grade students had sophisticated epistemological beliefs about certainty and resources dimensions. Similarly Sadıç, Çam and Topçu (2012) showed that 4th, 6th and 8th grade student's beliefs about 'resources" dimension were sophisticated. In fact one of the studies is in line with the findings of this study. In this study Yeşilyurt (2013) determined epistemological beliefs of 7th and 8th grade students (n=324) and he found that the students does not have sophisticated epistemological beliefs regarding verification dimension. The difference in the results of this study and previous studies on scientific epistemological beliefs might be related to involvement of fifth grades in this study and the regions from where the data are collected.

When looked at the aspect of the study, theoretical structure of scientific epistemological beliefs was also supported by the data of this study. Since the correlational findings of this study supported partially independent and multidimensional beliefs system of Schommer (1990). Hence findings of this study represent science-specific epistemological beliefs of the students for teachers and researchers. This study used a current and domain-dependent scale for measuring scientific epistemological beliefs. The scale developed by Conley et al. (2004) contributes to this study due to its current and domain-dependent items. So the findings of this study provided more current data about science-specific epistemological beliefs of middle school students.

When the results on validity and reliability are examined, it can be said that evidence from confirmatory factor analysis supports validity of the data in this study. However scores about verification and resource dimensions have low Cronbach Alpa values (0.685 and 0.684 respectively). It might be a limitation for the study, but Hatcher and Stepanski (1994) suggested that Cronbach Alpha value as low as 0.55 is acceptable. At the same time we found higher reliability value (0.71) for improvement dimension than Conley et al. (2004)'s finding. In conclusion it can be seen that both literature support and evidence for reliability values of the scores in this study was provided, so it can be claimed that the instrument measured reliably epistemological beliefs. Another important point in the study is that high positive correlation (0.97) between resource and certainty dimensions is in line with the finding of Conley et al. (2004). They found this value as 0.90. Hence consistency evidence of this study supports Conley et al. (2004)'s study. However collinearity problem should be taken into consideration in following researches.

In summary the findings of this study gave valuable and current evidence about scientific epistemological beliefs of Turkish middle school students. The findings might be informing for science teachers for designing their courses and science education researchers for extending evidence about domain-dependent epistemological beliefs. Especially designing constructivist teaching requires information about epistemological beliefs of the students. Since epistemological beliefs are associated with course or teaching preferences of the students (Tsai, 1999; Tsai, 2000). In spite of these contributions of this study, it is not based on random sampling and the instruments have limited reliability evidence for future studies.

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