Regression Levels of Selected Affective Factors on Science Achievement: a Structural Equation Model with TIMSS 2011 Data

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Abstract

The aim of this study is to demonstrate the science success regression levels of chosen emotional features of 8th grade students using Structural Equation Model. The study was conducted by the analysis of students' questionnaires and science success in TIMSS 2011 data using SEM. Initially, the factors that are thought to have an effect on science success were detected out of TIMSS questionnaire and KMO and Bartlett's tests were done to test appropriateness of these items to factor analysis. Explanatory Factor analysis was done for the sub-dimensions that were seen to be suitable for factor analysis and then, confirmative factor analysis was done using LISREL and the appropriateness of dimensions to the model was tested. Seeing that the concordance indexes od dimensions were suitable to the model, structural model was rested. At the end of the SEM test, it was found that the attitudes and values of 8th grade students predicted their science success in a positive way, and their self-confidence predicted their success in a negative way.

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Key words: structural equation model, science achievement, attitude, value, confidence, TIMSS

Introduction

One of the main characteristics of scientific knowledge is that it is of a dynamic nature. Incremental increases in information, as well as giant technological advances, are making themselves evident in every aspect of our lives. In Turkey, the Ministry of National Education (MEB) acknowledges that science and technology education plays a key role in the future of societies in today's age of information and technology; that all societies, especially developed ones, make constant efforts to enhance the quality of their science and technology education; and that there is a need for a curriculum designed to teach all Turkish citizens to become scientifically literate (MEB, 2005). Therefore, the Ministry put into effect the new science curriculum first starting from the 2005-2006 and the newest 2014-2015 Academic Year in order to catch up with global developments.

One of the objectives of the new science curriculum is to enable students to acquire cognitive, affective and psycho-motor skills simultaneously. The new curriculum has established learning domains pertaining to skills, perceptions, attitudes and values, and these learning domains include attainments related to "science-technology-society-environment", "science process skills" and "attitudes-values" (Demirbas & Yagbasan, 2006). Whereas the preceding curricula specified targets and behaviors, the new curriculum attaches more importance than ever to affective and psycho-motor skills, suggesting a significant shift to understanding that focusing only on cognitive skills in learning environments will not yield a sufficient achievement level (Dede & Yaman, 2008). In fact, learning in the affective domain does not only constitute a particular instructional objective but also serves as an instrument for cognitive learning (Demirbas & Yagbasan, 2006). Learning in the affective domain is concerned with emotional changes that individuals undergo throughout the learning process (Gazel & Erol, 2012), and it refers to such mental traits as interests, demands, and enthusiasm. Similarly, the affective domain is characterized by psychological factors from attention and reaction to attitudes, values, beliefs and character traits (Akdag, 2008). Apart from these factors, the affective domain is also reported to be influenced by individual differences in intelligence, cognitive styles, general ability, preliminary information, learning methods, gender, motivation, attention, anxiety, and age, all of which are believed to have an effect on learning (Savas, Tas & Duru, 2010). As a matter of fact, it is important to take into account these factors, which are related to students' characteristics that affect their academic performance (Uredi & Uredi, 2005).

For an efficient teaching and learning process, the first thing is to identify learner needs. These needs form the basis for learning objectives that learners need to accomplish. However, the initiation of the process depends on whether the learner has had the entry behaviors required for new learning (Demirbas & Yagbasan, 2004). These entry behaviors, first identified by Bloom, are comprised of "cognitive entry behaviors" and "affective entry behaviors" (Demirel, 2012). The former refers to cognitive prerequisites and factors in the beginning of any instructional process that will enable an individual to acquire target behaviors throughout the process. The later are defined as learners' attitudes towards, interests in, motivation for, self-confidence in, and efforts for a particular subject or learning/teaching activities in the beginning of the instructional process (Ozkan, 2005). Senemoglu (2007) reports that affective entry behaviors, described as a combination of learners' interests in, attitudes towards, and academic self-confidence in any given learning item, account for 25% of the variance in learning outcomes. Likewise, Akdag (2008) reports that the effects of affective entry behaviors on learner achievement are acknowledged by all educationalists and these entry behaviors are considerably similar or even equal to the affective aspect of learner motivation. Furthermore, it is accepted that there is a significant relationship between affective entry behaviors and learner achievement (Yucel & Koc, 2011) and affective domain skills are a crucial factor in learner achievement (Dede & Yaman, 2008). A look at the attainments pertaining to "attitudes-values" in the science curriculum strongly suggests that these attainments are actually statements corresponding to the affective domain and designed to enable students to acquire affective skills. A number of studies have revealed that achievement in science classes is directly or indirectly influenced by various traits, which are considered as sub-units of the concept of affective that cannot be observed directly, such as interests, attitudes, affection, self-efficacy, beliefs, and values (Alexander, Johnson & Kelley, 2012; Alsop & Watts, 2000; Bryan, Gkynn & Kittleson, 2011; Duit & Treagust, 2003; Francis & Greer, 1999; Littledyke, 2008; Kupermintz, 2002; Thomson & Mintzes, 2002).

The Trends in International Mathematics and Science Study (TIMSS), conducted by the International Association for the Evaluation of Educational Achievement (IAE), has as a goal to form a standard by which countries will be able to judge their curricula and teaching methods and to identify how these are correlated with their students' achievement in science and mathematics, so that the quality of teaching and learning science and mathematics can be enhanced all around the world (Ceylan and Berberoglu, 2007). The method used by TIMSS for selecting its sample enables its results to become notably generalizable (Berberoglu, Celebi, Ozdemir, Uysal & Yayan, 2003). TIMSS was carried out for the first time in 1995 on 41 education systems whereas the latest administration, in which 63 education systems participated, was completed in 2011 and the results were shared with the public (TIMSS, 2011). Turkey participated in the 1999, 2007 and 2011 versions of TIMSS. In all the three versions, Turkish eight graders were below average in science achievement. The achievement tests used in TIMSS are generally focused on basic skills covered in the curriculum while the student questionnaires are designed to reveal students' attitudes towards, beliefs in, affections and values for science and mathematics as well as what they do at home and outside school (Karamustafaoglu and Sontay, 2012). Thanks to its large scope, a number of studies in recent years using TIMSS data to identify students' achievement in and views of science and mathematics have been conducted (Dogan & Baris, 2010; Drebt, Meelissen & Van Der Kleij, 2012; Hojo & Oshio, 2012; Karamustafaoglu & Sontay, 2012; Savas, Tas & Duru, 2010; Uzun, Butuner & Yigit, 2010; Uzun, Gelbal & Ogretmen, 2012; Wang, Osterlind & Bergin, 2012; Yoshino, 2012; Yu, 2012). The fact that Turkey was included in the latest version of the TIMSS makes it even more important to evaluate and share its findings in order that significant contributions can be made to the overall educational system and science teaching in Turkey.

Aim of the study: In this context, the purpose of the present study is to use TIMSS 2011 data on Turkey and to establish a structural equation model in order to identify whether eight graders' attitudes towards, values for, and confidence in science influence their achievement in science, i.e. the extent to which selected affective factors affect their achievement in science.

Methodology

The present study was based on structural equation modeling (SEM) to analyze the student questionnaire and student achievement scores in science as revealed by TIMSS 2011 data on Turkey. The reason for using SEM is that it enables researchers to match theories with the data, to decide on the extent to which they fit each other, and to use latent variables (Simsek, 2007). Considering that variables in achievement cannot be measured directly, they can be accounted for through the measurement of certain observable variables that define or are thought to define them. Since the use of latent variables enables errors in such variables to be identified, estimated values of variables in SEM studies are much more reliable (Simsek, 2007). SEM is a comprehensive statistical approach used to test the models characterized by causal and correlational relationships between observable and latent variables, and it allows one to study the set of relationships between one or more independent variables and one or more dependent variables (Anagun, 2011). Below is the most common standard ranges that are used for evaluating the fit between a model and data and testing the accurateness of the model formed (Kayacan and Gultekin, 2012).

Table 1.
Evaluation of SEM Fit

Goodness-of-Fit Indicator	Good Fit	Acceptable Fit
NFI	≥ 0.95	0.94 – 0.90
IFI	≥ 0.95	0.94 – 0.90
CFI	≥ 0.95	≥ 0.95
RMSEA	≤ 0.05	0.06 – 0.08
GFI	≥ 0.90	0.89 – 0.85
AGFI	≥ 0.90	0.89 – 0.85
RMR	≤ 0.05	0.06 – 0.08

Population and Sample

The population of the study was comprised of eight graders in Turkey. The sample consisted of 6928 students from 240 randomly chosen schools in seven geographical locations of Turkey (60 from the Marmara Region and 30 from each of the other regions) that participated in the 2011 version of TIMSS. The sample was chosen through stratified two-stage sampling. Whereas the first stage included the selection of the schools, the classrooms were chosen in the second stage. Both phases were chosen through systematic random sampling (Joncas & Foy, 2011).

Data Collection Instrument

The data files for the study were retrieved from the international database on the webpage of the TIMSS. The data contained student scores in the science test and their responses to the student questionnaire. A total of 21 items in the student questionnaire were grouped under three headings, namely “students like learning science”, “student confident in science”, and “students value science”. The responses were rated on a four-point Likert scale, in which students could choose one of the four options ranging from “totally agree” (1) to “totally disagree” (4). Items number 17b, 17d, 19b, 19c and 19i were reversely coded, for they were negative statements. Table 3 presents the variable codes in TIMSS for the items used in the student questionnaire, statements of latent variables used for the model to be tested in the present study (adapted from the student questionnaire and webpage, TIMSS 2011) and Cronbach’s alpha values.

Data Analysis

The items related to the factors in science achievement were extracted from the student questionnaire. Next, they were grouped under certain sub-dimensions. Finally, the Kaiser-Meyer-Olkin (KMO) and Bartlett’s tests were conducted to determine whether each sub-dimension was suitable for factor analysis. The results are presented in Table 2.

Table 2.
Results of the KMO and Bartlett’s Tests for Sub-Dimensions

Latent Variable	KMO test	Bartlett’s test χ^2	sd	p	Variance Accounted for (%)
achievement	.932	53897.241	10	.000	92.196
attitude	.766	12069.779	10	.000	56.096
confidence	.878	24233.516	36	.000	63.287
value	.803	12259.239	10	.000	57.417

The results of the tests suggest that each dataset was suitable for factor analysis, for a KMO value higher than 0.60 and a significant result obtained from Bartlett’s test indicate that data are suitable for factor analysis (Tuna, Bircan and Yesilbas, 2012). Next, an exploratory factor analysis (EFA) was carried out. Following the analysis, the items with the variance codes BSBS17C (0.459) and BSBS19J (0.425) were excluded from the model, for they had factor loadings lower than 0.50. Table 3 presents the results of the EFA for the other items.

Table 3.
Items about science, item codes, factor loadings and cronbach's alpha values

Variables and items	Item codes	Factor loadings	Cronbach's Alpha
Students like learning science (ATTITUDE)			
I enjoy learning science	BSBS17A	0.694	0.79
I wish I did not have to study science	BSBS17B	0.655	
Science is boring	BSBS17D	0.672	
I learn many interesting things in science	BSBS17E	0.710	
I like science	BSBS17F	0.707	
Students confident in science (CONFIDENCE)			
I usually do well in science	BSBS19A	0.657	0.85
Science is more difficult for me than for many of my classmates	BSBS19B	0.716	
Science is not one of my strengths	BSBS19C	0.721	
I learn things quickly in science	BSBS19D	0.644	
Science makes me confused and nervous	BSBS19E	0.743	
I am good at working out difficult science problems	BSBS19F	0.717	
My teacher thinks I can do well in science with difficult materials	BSBS19G	0.775	
My teacher tells me I am good at science	BSBS19H	0.786	
Science is harder for me than any other subjects	BSBS19I	0.758	
Students value science (VALUE)			
I think learning science will help me in my daily life	BSBS19K	0.637	0.82
I need science to learn other school subjects	BSBS19L	0.847	
I need to do well in science to get into the university of my choice	BSBS19M	0.875	
I would like a job that involves using science	BSBS19N	0.691	
It is important to do well in science	BSBS17G	0.645	

The EFA yielded the model found in Figure 1 to be used in the present study.

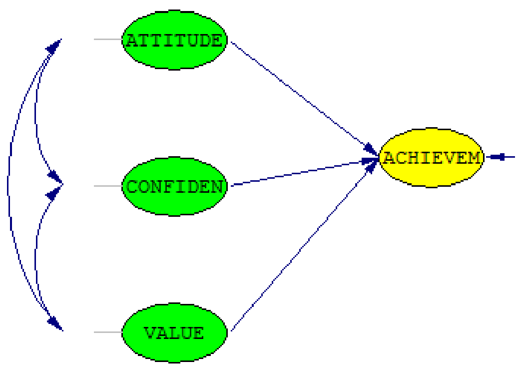

Figure 1. The model to be used in the study

After finalization of the model to be used in the study, a confirmatory factor analysis (CFA) was conducted for each latent variable through LISREL in order to test the fit between the latent variables and the model. The structural model was tested after it was observed to comply with the standards for the goodness-of-fit indicators presented in Table 1.

Findings

In studies forming a model with latent variables, it is necessary to measure each measurement model separately before the analysis (Byrne, 2009; Simsek, 2007). Testing the measurement models must be similar to a confirmatory factor analysis, and any unconfirmed measurement model should be excluded from the model (Cokluk, Sekercioglu and Buyukozturk, 012). In the present study, each latent variable was tested separately to decide whether they fit the structural model in reference to the goodness-of-fit standards.

Testing the Measurement Models

The KMO and Bartlett's tests were conducted to determine whether the variable *achievement* was suitable for factor analysis. Whereas the KMO value for the variable was 0.932, Bartlett's test yielded the following result: $\chi 2$ = 53897.241; sd=10 and p=.000 (Table 2). Seeing that the KMO value was higher than 0.60 and Bartlett's test yielded a significant result at the level of 0.01, it was clear that the dataset was suitable for factor analysis. Afterwards, the dataset was subject to a factor analysis. Table 4 presents the descriptive statistics for the latent variable *achievement* following the factor analysis.

Table 4
Descriptive Statistics for the Items in the Latent Variable "achievement"

Nominative Variables	Mean	SS	Parameter Estimation (t)	R^2	Cronbach's Alpha
BSSSCI01	478.47	100.686	0.95 (106.09)	0.90	
BSSSCI02	478.83	101.736	0.95 (107.01)	0.91	
BSSSCI03	479.06	101.016	0.95 (106.41)	0.90	0.97
BSSSCI04	479.56	101.331	0.95 (106.14)	0.90	
BSSSCI05	478.94	101.239	0.95 (106.50)	0.90	

The reliability coefficient for the nominative (observable) variables for the variable *achievement* was 0.97 (Table 4). It is acknowledged that a value higher than 0.7 suggests the model is reliable (Ozdamar, 2011: 605). Table 5 presents the goodness-of-fit values for the variable *achievement*.

Table 5.
The Goodness-of-Fit Values for the Variable "achievement"

AGFI	GFI	NFI	CFI	RMSEA
1.00	1.00	1.00	1.00	0.00

The values for the Adjusted Goodness-of-Fit Index (AGFI), Goodness-of-Fit Index (GFI), Normed Fit Index (NFI), Comparative Fit Index (CFI) and Root Mean Square Error of Approximation (RMSEA) were 1.00, 1.00, 1.00, 1.00, and 0.00 respectively (Table 5). Considering the goodness-of-fit standards for SEM (Table 1), the values suggested that the measurement model for the variable ACHIEVEMENT had perfect fit and could be used in the structural model.

The results of the KMO and Bartlett's tests for the other latent variables were as follows: KMO=0.766, Bartlett's test $\chi 2$ = 12069.779; sd=10 and p=0.000 for *attitude*, KMO=0.878, Bartlett's test $\chi 2$ = 24233.516; sd=36 and p=0.000 for *confidence*, and KMO=0.803, Bartlett's test $\chi 2$=12259.239; sd=10 and p=0.000 for *value* (Table 2). In other words, the KMO values for these latent variables were higher than 0.70, and Bartlett's test yielded a significant result at the level of 0.01, suggesting that all the datasets were suitable for factor analysis. Table 6 presents the descriptive statistics for the items in these latent variables following the factor analysis.

Table 6.
Descriptive Statistics for the Items in the Latent Variables "attitude","confidence"and "value"

Latent Variables	Nominative Variables	Mean	SS	Parameter estimation (t)	R^2	Cronbach's Alpha
	BSBS17A	1.46	.76	0.64 (47.55)	0.70	
	BSBS17B	2.02	1.09	0.47 (30.20)	0.19	
attitude	BSBS17D	1.88	1.03	0.57 (39.79)	0.31	0.79
	BSBS17E	1.44	.76	0.38 (36.13)	0.24	
	BSBS17F	1.59	.86	0.84 (55.13)	0.94	
	BSBS19A	1.76	.81	0.64 (71.84)	0.61	
	BSBS19B	2.19	1.04	0.40 (31.00)	0.15	
	BSBS19C	2.06	1.05	0.49 (37.99)	0.22	
	BSBS19D	1.88	.87	0.66 (69.38)	0.58	
confidence	BSBS19E	1.98	1.05	0.39 (29.24)	0.14	0.85
	BSBS19F	2.33	.98	0.71 (64.63)	0.52	
	BSBS19G	2.13	.98	0.64 (55.84)	0.42	
	BSBS19H	2.15	1.00	0.71 (62.89)	0.50	
	BSBS19I	2.12	1.07	0.42 (30.88)	0.16	
	BSBS19K	1.96	.96	0.58 (48.12)	0.36	
	BSBS19L	1.90	1.02	0.80 (59.16)	0.61	
value	BSBS19M	2.03	1.05	0.89 (66.54)	0.72	0.82
	BSBS19N	2.35	1.14	0.79 (55.68)	0.47	
	BSBS17G	1.36	.67	0.29 (33.02)	0.18	

The reliability coefficients for the models measuring the latent variables were 0.79 for *attitude*, 0.85 for *confidence*, and 0.82 for *value* (Table 6), suggesting that the measurement models were reliable. Table 7 presents the goodness-of-fit values for the latent variables.

Table 7.
Goodness-Of-Fit Values for the Latent Variables

	AGFI	GFI	NFI	CFI	RMSEA
attitude	1.00	1.00	1.00	1.00	0.022
confidence	0.98	0.99	1.00	1.00	0.039
value	0.99	1.00	1.00	1.00	0.049

All the goodness-of-fit values for the latent variables to be used in the model suggested good fit according to the standards in Table 1. In other words, they fit the model and could be used in the model.

In studies of structural equation, the separate analysis of the measurement models is followed by releasing the relationships between the measurement models in order to see how much the latent variables for the structural model differed from one another (Simsek, 2007). Accordingly, the model for the present study was tested with the latent variables being released, and Figure 2 presents the standardized values and t values.

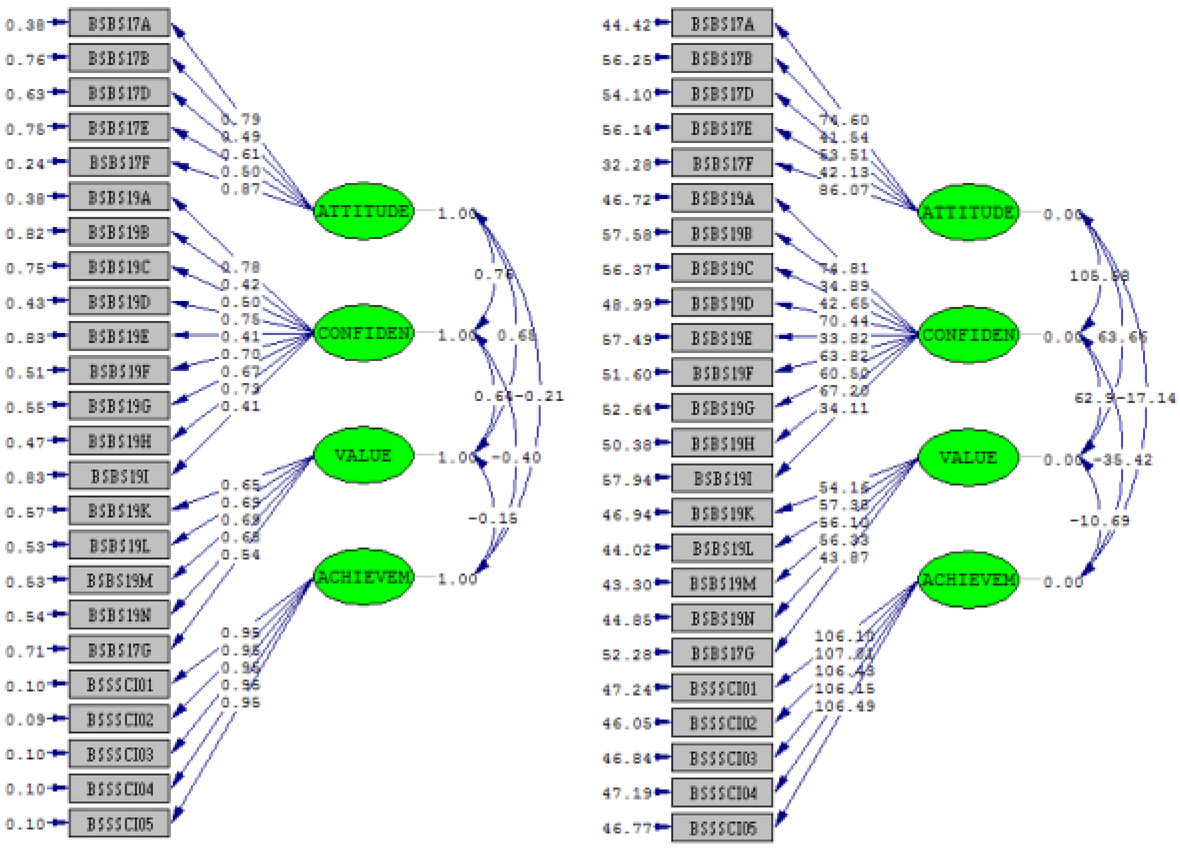

Figure 2. The just identified model (standardized values – *t* values)

The goodness-of-fit values for the fully described model with the relationships between the variables being released were as follows: AGFI=0.95, GFI=0.96, NFI=0.99, CFI=0.99, and RMSEA=0.043 ($\chi 2$ = 3077.83 and p=0.000). A look at both the RMSEA value and the others indicated that the model had perfect fit, for a RMSEA value lower than 0.05 suggests perfect fit (Joreskog & Sorbom, 1996). Furthermore, there were significant relationships between the observable variables and latent variables as well as between the latent variables themselves. The next step was to test the ultimate model that formed the basis for the study (Figure 1).

Testing the Structural Model

The second part of the study was focused on testing the described structural model. The test yielded the following result: $\chi 2$ =6527.82 and p=0.000. The goodness-of-fit values are presented in Table 8.

Table 8.
Goodness-of-Fit Values for the Structural Model

AGFI	GFI	NFI	CFI	RMSEA
0.91	0.93	0.97	0.97	0.063

The goodness-of-fit values for the structural model (Table 8) indicated that AGFI, GFI, NFI and CFI had perfect fit whereas RMSEA was acceptable. In order to enhance the fit of the structural model, the modification index was taken into consideration, and the errors between the items that were theoretically more appropriate than the others were matched in accordance with the suggestion of LISREL. Accordingly, the items BSBS17B and BSBS17D, BSBS19E and BSBS19C, BSBS19H and BSBS19G, and BSBS17G and BSBS17N, which were under the same factor, were matched respectively. Next, the model was retested. Table 9 presents the fit indexes following the retest.

Table 9.
Goodness-of-Fit Values for the Structural Model After Modification

AGFI	GFI	NFI	CFI	RMSEA
0.95	0.96	0.99	0.99	0.043

According to the goodness-of-fit values presented in Table 9, the model had perfect fit; in addition, the standardized RMR value was 0.050, a value acknowledged in many studies as notably good fit (as cited in Keskin & Basbug, 2014). The values suggested that the structural model complied with the goodness-of-fit standards given in Table 1. Therefore, the structural model had perfect fit, and it was the valid for the whole dataset. Figure 3 presents the t values for the structural model ford in the present study.

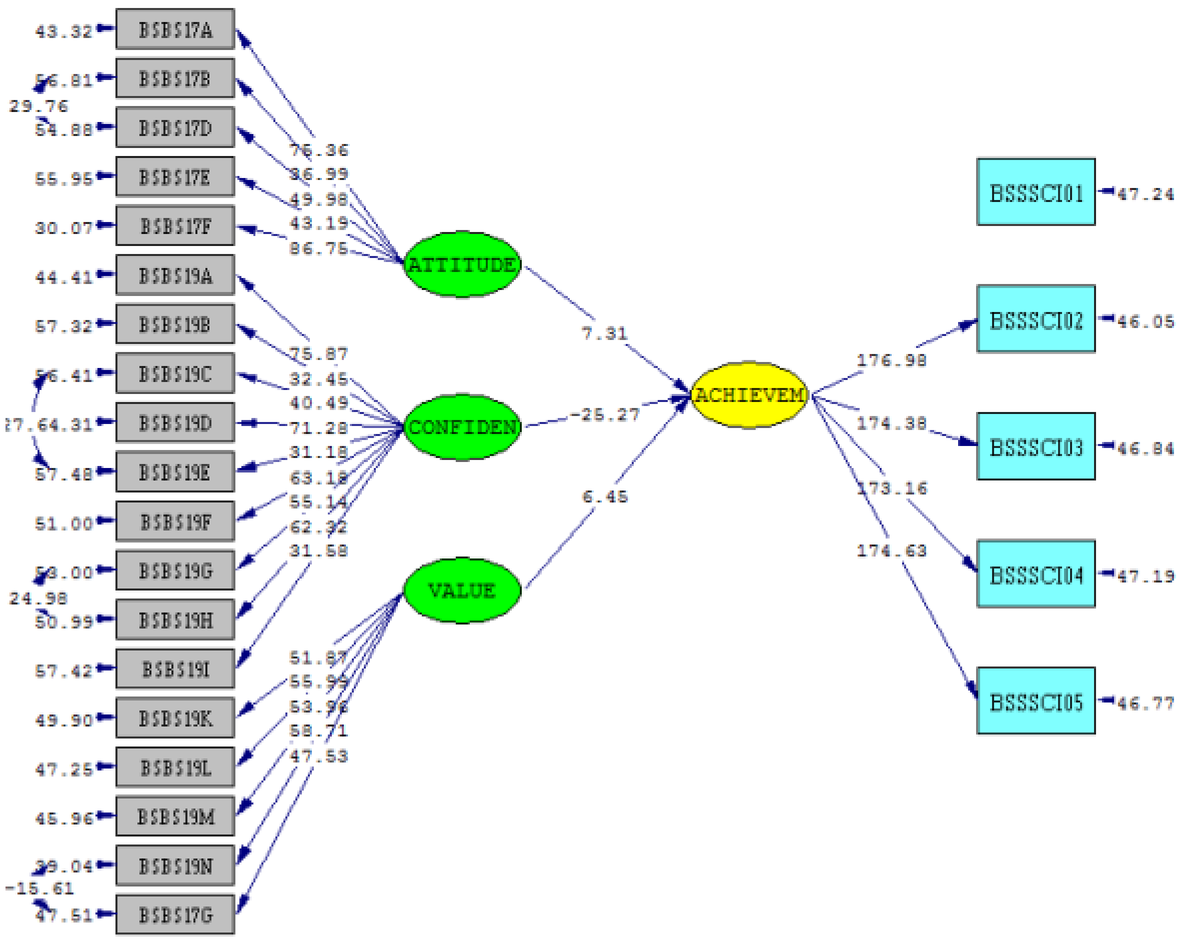

Figure 3. *t* values for the structural model

All the t values were significant at the level of 0.1 (Figure 3). Figure 4 presents the standardized values for the structural model.

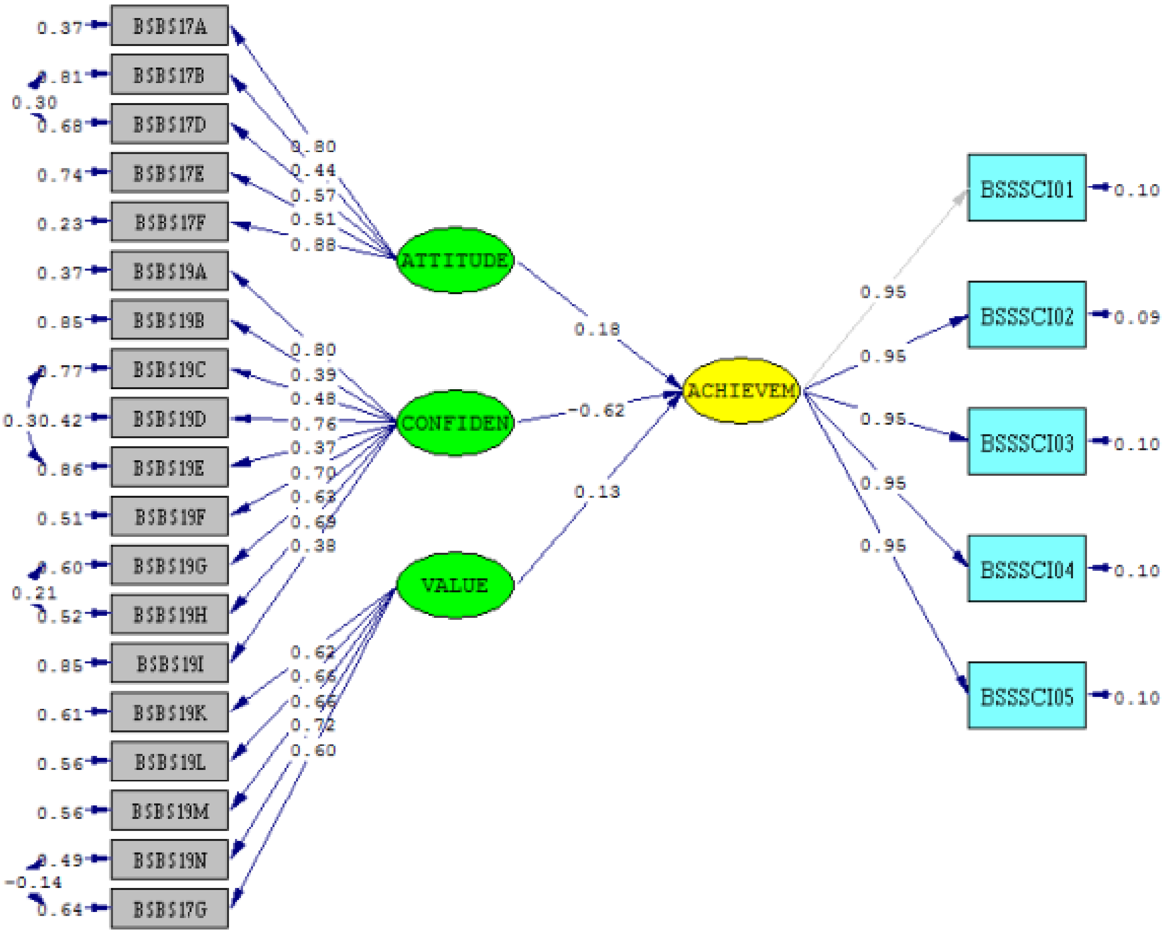

Figure 4. The structural model

The structural equation model obtained from the analysis could be expressed in the following way:

achievement = 0.18**attitude* - 0.62**confidence*+ 0.13**value*

The equation allows for an interpretation of the relationship between *achievement* and *attitude*, *confidence* and *value*. *achievement*, which was a dependent variable, was positively correlated with *attitude* and *value* but negatively correlated with *confidence*.

The formula for the structural equation model and Figure 4 collectively indicated that the correlation coefficient was $\gamma = 0.18$ between *attitude* and *achievement* in learning science, $\gamma = -0.62$ between *confidence* and *achievement* in science, and $\gamma = 0.13$ between *value* for and *achievement* in science.

Conclusion and Discussion

The purpose of the present study is to identify the effect of selected affective factors on science achievement on the basis of TIMSS 2011 data. According to the model formed in the study, attitude towards and values for science have a positive influence on science achievement whereas self-confidence in science negatively affects science achievement. Similarly, the correlation coefficients in Figure 4 indicate that there is a positive correlation between science achievement and attitudes ($\gamma = 0.18$). The finding is supported by other previous studies on the relationship between attitudes towards science and science achievement (Mohammadpour, 2013; Ng, Lay, Areepattamannil, Treagust & Chandrasegaran, 2012), which have reported that positive attitudes towards science lead to improved science achievement. However, Uzun, Gelbal & Ogretmen (2010) concluded from their study on TIMSS 1999 data that there was a negative correlation between attitudes towards science and science achievement. The contrast between this study and the present study in their findings could be considered significant for the evaluation of science education in Turkey. In other words, the time period between 1999 and 2011 was marked by decreased negative effects and increased positive effects of attitudes on science achievement. In fact, nationwide studies in recent years have demonstrated the positive correlation between positive attitudes and science achievement (Akpinar, Yildiz, Tatar & Ergin, 2009; Aydeniz & Kaya, 2012; Ozel, Caglak & Erdogan, 2013).

A look at the structural model indicates a positive relationship ($\gamma = 0.13$) between learners' values for science and their science achievement, too. This is similar to what Chen & Pajares (2010) found in their study. Likewise, Magno (2003) conducted a study on students who were 11 to 13 years old. The researcher identified a significant correlation between values for science and achievement in science for first year students. Although the finding supports what the present study revealed, the second part of the same study (Magno, 2003), which was focused on those students who were spending their second year at their schools, could not identify a significant relationship between values for science and achievement in science. Therefore, it is safer to argue that various variables, such as grade, should be taken into account when interpreting the relationship between values for science and achievement in science.

Another finding of the present study is that confidence in science is negatively correlated with achievement in science ($\gamma = -0.62$). On the other hand, both theoretical (Fritzsche, Kroner, Dresel, Kopp & Martschinke, 2012; Kleitman & Gibson, 2011; Singh, Granville & Dika, 2010) and experimental (Chang & Cheng, 2008; Lin & Tsai, 2012) studies in the literature tend to report a positive correlation between confidence and achievement in science. Although the finding of the present study seems to be contradicted by common research and assumptions, it is still possible to see the issue from a different viewpoint. For instance, it might be argued that too much self-confidence will have a negative influence on one's study habits or exam concentration, which, in turn, might lead him/her to getting lower grades. Furthermore, the relationship between confidence and achievement in science is subject to change depending on grade, school or country. For example, Kaya & Rice (2010), Leung (2002) and Van de gaer, Grisay, Schulz & Gebhardt (2012), who investigated the relationship at an international level, reported a negative correlation between confidence and achievement in science. According to these international studies, increased confidence brings about lower achievement in science. Van da gaer et al. (2012) attributed this to certain differences between countries, including educational criteria, performance indicators, performance standards, and styles. In this context, it might be asserted that there should be certain amendments to the curriculum in Turkey and expectations/standards should be revised so that Turkish students could be enabled to have more confidence in science, as well as acquiring attitudes and values specified in the curriculum, and they could be more successful in such international examinations as TIMSS.

The present study, which was focused on identifying the effect of selected affective factors on science achievement through SEM on the basis of TIMSS 2011 data, concluded that science achievement is significantly influenced by attitudes and values, two concepts that the Science curriculum attaches more importance. On the other hand, the present study identified a negative correlation between self-confidence and science achievement, a finding that is contradicted by widely accepted research or assumptions.

There is a nonignorable fact that success in science and technology play a key role in a society's future plans for their developments and improvements. In this study, it was found that the attitudes and values of 8th grade students positively predicted their science success, and their self-confidence negatively predicted their success. In this context, toward new science curriculum to educate the students as scientifically literate citizens and to increase their science success, developing student's affective factors about science should be the main goal. For this purpose, MEB drew attention to this issue by creating learning areas in the new curriculum. One of these learning areas in science curriculum is affective learning which consists of emotions like attitude, motivation, value and responsibility (MEB, 2013). Findings of this study support one of the important attributions of curriculum to affective domain. On the other hand it can be suggested to science teachers and science education researchers that they should study on different approaches to improve students' affective behaviors about science which contribute to science success. Different practices like learning activities, experiments or scientific trips and observations during science lessons can improve students' attitudes, curiosity, motivations, values or other affective behaviours. Accordingly this improvement creates more successful and scientifically literate students.

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