academicJournals

Vol. 12(11), pp. 604-610, 10 June, 2017
DOI: 10.5897/ERR2017.3248
Article Number: A61FA9564682
ISSN 1990-3839

http://www.academicjournals.org/ERR

Educational Research and Reviews

Full Length Research Paper

The mediating role of scientific attitudes in the relationship between teacher candidates' scientific epistemological beliefs and approaches to scientific research

Hasan Hüseyin ŞAHAN

Department of Science Education, Balıkesir University, Turkey.

Received 12 April, 2017; Accepted 1 June, 2017

The study aims to analyze scientific attitudes' effect on the relationship between teacher candidates' scientific epistemological beliefs and their approach to scientific research. The research model of the study is relational survey, a type of descriptive model. The study group is comprised of 647 pre-service teachers from Balıkesir University Necatibey, Faculty of Education. "Scientific Epistemological Beliefs Scale", "Attitudes to Scientific Research Scale", and "Academic Motivation Scale" were used for data collection. Mediation analysis was conducted to answer the research questions of the study. The major finding of the study was that scientific epistemological belief affects academic motivation levels, and attitudes towards scientific research act as partial mediators in this relation. That is, a direct relationship was found between prospective teachers' scientific epistemological beliefs and academic motivation levels. In addition, epistemological beliefs have revealed indirect attitudes towards scientific research and academic motivation level.

Key words: Pre-service teacher, epistemological beliefs, attitude, motivation, mediating role.

INTRODUCTION

The meaning of knowledge and how to access it has been much debated since the early ages. As knowledge has become increasingly more important, the viewpoint on knowledge and science is changing. Epistemology is a branch of philosophy inquiring into the nature, source, and boundaries of knowledge (Deryakulu, 2004; Cevizci, 2005; Aksan, 2006). Scientific epistemology has also dwelled on what science is. The formation of knowledge, significance of scientific knowledge, process of accessing and interpreting it are all about epistemological beliefs (Deryakulu, 2004). Beliefs are an ongoing web of emotions formed by an aspect of one's own feelings, and perceptions and definitions (Eren, 1998). Epistemological belief, on the other hand, is the personal interpretations of how one learns and teaches knowledge. It is how individuals interpret information, set standards, and decide on an appropriate course of action (Siegel and Ryan, 1984; Hofer and Pintrich, 2002; Deryakulu and

*Corresponding author. E-mail: hasansahan@windowslive.com. Tel: +905062016014.

Bıkmaz, 2003). Schommer relates epistemological beliefs to the nature and acquisition of knowledge (1990).

Growing emphasis has been placed on research on epistemology, personal epistemology, and epistemological beliefs since 1990s (Schommer, 1990; Hofer and Pintrich, 1997). According to Aypay (2011), epistemological beliefs affect the teaching-learning processes, yet Başbay (2013) asserts that students' beliefs about knowledge shape their academic performance and knowledge acquisition. It is observed that beliefs have an important role in people's lives, influencing their behaviors and attitudes. Schommer-Aikins and Hutter (2002) found that daily decisions taken by individuals are affected by epistemological beliefs. Thus, there is a strong correlation between individuals' attitudes and beliefs (Fishbein and Ajzen, 1975). In brief, literature points to the influence of epistemological beliefs on attitudes, which are believed to be unobservable tendencies leading to observable behaviors. Thus, they can be used as an intervening variable when examining phenomena (Kağıtçıbaşı, 1992). The related literature provides evidence that people's beliefs, attitudes, and behaviors are related (Koballa and Crawley, 1985), and pre-service teachers' beliefs and attitudes towards the education they received from instructors influence their future behaviors in teaching learning environments (Osborne et al., 2003). Such effects of attitudes, which are defined by Pajares (1992) as the sum of beliefs about a situation or subject, have led the researchers to inquire into individual's behaviors and learning outcomes. Related research manifests that both scientific attitude and beliefs are important predictors affecting the teaching process, and that these predictors are in a chain relation. According to Başaran (1978), scientific attitude is the researcher's ability to interpret the problems, phenomena, and situations encountered based on rational data, freed from one's own feelings as much as possible (Demirbaş and Yağbasan, 2006).

Many studies focus on the relation between epistemological beliefs and different variables (learning strategies, gender, self-efficacy, higher-order cognitive skills, learning style, academic achievement, motivation, self-efficacy perception, metacognitive skills, critical thinking, etc.) (Aksan and Sözer, 2007; Başbay, 2013; Biçer et al., 2013; Bendixen and Rule, 2004; Dahl et al., 2005; Kapucu and Bahçıvan, 2015; Lin et al., 2013; Meral and Çolak, 2009; Kızılgüneş et al., 2009; Özkal et al., 2010). Wigfield and Eccles (2000), Eccles et al. (1983) and Buehl and Alexander (2005) proposed that students' competency beliefs and achievement values are based on their perceptions of task difficulty. Students may use their beliefs about knowledge in a particular domain to determine the difficulty of acquiring knowledge in that or a related domain, which may influence their motivation. Motivation refers to individuals' desire to act or behave in a particular manner (Weiner, 1992). Paulsen and Feldman's (1999) study revealed statistically significant relations between dimensions of epistemological beliefs (that is, simple knowledge, quick learning, and fixed ability) and motivational constructs (that is, task value, self-efficacy, intrinsic-goal orientation, extrinsic-goal orientation, test anxiety, and control of learning). Designing a model of possible associations between students' beliefs, achievement motivation, and learning outcomes, Buehl (2003) assumed that epistemological beliefs increase students' achievement, motivation, and cognitive processing (strategy use). The rationale behind the model is that they are somewhat connected with their achievement and academic performance because of the effect of students' motivation, cognitive processing, and tactics in the learning situation (e.g., effort and persistence). Murphy et al. (2002) concluded that dimensions of epistemological beliefs tend to be differentially related to students' motivation (Buehl et al., 2002). Thus, a relation, direct or indirect, seems to exist between motivation and epistemological beliefs, which can be defined as significant learner characteristics facilitating or obstructing academic cognition, motivation, and learning (Pintrich, 2002; Wyre, 2007).

Understanding how and with which variables scientific epistemological belief relates is important in shaping the characteristics of the individual that a program aims to train.

In brief, studies focusing on the relation between scientific epistemological belief and motivation (Buehl and Alexander, 2005; Chen and Pajares, 2010; Hofer, 1999; Kızılgüneş et al., 2009; Liang et al., 2010; Lin et al., 2013; Paulsen and Feldman, 1999), and between scientific epistemological belief and attitude (Fishbein and Ajzen, 1975; Kapucu and Bahçıvan, 2015; Öztürk, 2016) exist in the related literature, yet it seems that no study has dealt with the relation among the three variables.

The present study intends to analyze the mediating effect of pre-service teachers' attitude to scientific research on the relation between their scientific epistemological beliefs and academic motivation levels.

METHODOLOGY

Research design

The study adopted a descriptive model: relational survey because it focuses on related relations. The study group is comprised of 647 first year and fourth year pre-service teachers receiving education at Balıkesir University, Necatibey Faculty of Education. The data was collected in the Fall semester of 2015-2016 academic year.

Data collection tools

Data was collected by three instruments: 'Scientific Epistemological Beliefs Scale' developed by Pomeroy (1993) and adapted to Turkish by Deryakulu and Bıkmaz (2003), 'Attitude to Scientific Research Scale' developed by Korkmaz et al. (2011), and 'Academic Motivation Scale' developed by Bozanoğlu (2004).

Scientific epistemological beliefs scale

The scale was developed by Pomeroy (1993) to be used in primary,

secondary, and higher education institutions. It aims to determine the scientific epistemological belief levels of the participants. The original scale had 50 items and three dimensions: (a) traditional scientific approach, (b) traditional science education approach, and (c) non-traditional science approach.

The validity and reliability tests of the scale were run by Deryakulu and Bıkmaz (2003) on Turkish students. The original scale, which is comprised of 50 items, were translated into Turkish. Some items were amended to ensure clarity in terms of cultural context. Then, item equivalence was assured between English and Turkish forms, and the scale was administered to 204 class teachers by the researcher. As a result of the first step of factor analysis run to compute the construct validity, 20 items were removed because of having either too low or too high factor loadings, and the test was re-run on the remaining 30 items. The Cronbach Alpha internal consistency coefficient of the 30-item scale was calculated as 0.91. The new scale emerged as a two-end instrument, reflecting the respondent's science attitude. The 22 items reflecting a traditional science approach were positively coded, and 8 items reflecting the non-traditional approach were negatively coded. In this phase, the Cronbach Alpha internal consistency coefficient was computed as 0.72.

Attitude to scientific research scale

The scale, developed by Korkmaz et al. (2011), aims to determine participants' attitudes towards scientific research and is comprised of 68-items. For reliability analysis, explanatory and confirmatory factor analysis was performed, along with item discrimination powers. For the construct validity, Kaiser-Meyer-Olkin (KMO) and Bartlett analyses were performed, and the following results were found: KMO= 0.862; Bartlett test value χ^2=13680,357; sd=2278 (p=0.000). As, in behavioral science, KMO value above 0.60 is accepted as sufficient to run factor analysis (Büyüköztük, 2002), the researcher proceeded with factor analysis of the 68-item scale.

To test the discriminant validity of the scale, *Varimax orthogonal rotation technique was utilized and factor loading were examined*. Accordingly, a total of 38 items with item loadings below 0.30, whose loadings diverge on different factors at similar levels, were removed from the scale, and the analyses were performed again with the remaining items.

Ultimately, the remaining 30 factors seemed to belong to four groups of factors. The final form of the scale with 30 items produced the KMO value of 0.874, and Bartlett Test values of χ^2=6773,126; sd=435; p<0.000.

The content of the items was analyzed to name the four main factors. Accordingly, 8 items were gathered under the factor called 'Unwillingness to help the researchers (F1)'; 9 items under 'Negative attitude towards researchers (F2)', 7 items under 'Positive attitude towards researchers (F3)', and 6 items under 'Positive attitude towards researchers (F4)'.

The confirmatory factor analysis, which was run without any limitation on the number of factor loadings, yielded the following fit indices: [χ^2 (d=399, N=372) = 816,14, p<0.01, RMSEA< 0.053, S-RMR= 0.047, GFI= 0.90, AGFI= 0.85, CFI= 0.95, NNFI= 0.95, IFI= 0.94]. The observed values on the scale in χ^2/d<3; 0<RMSEA<0.05; 0≤SRMR≤ 0.05; 0.97≤NNFI≤1; 0.97≤CFI≤1; 0.95≤GFI≤1; 0.90≤AGFI≤1 and 0.95≤IFI≤1 intervals showed a perfect fit, and in 4<χ^2/d<5; 0.05<RMSEA<0.08; 0.05≤S-RMR≤0.1; 0.95≤NNFI≤0.97; 0.95≤CFI≤0.97; 0.90≤GFI≤0.95; 0.85≤AGFI≤0.90 and 0.90≤IFI≤0.95 intervals showed an acceptable fit (Kline, 2005; Şimsek, 2007).

The correlation values between the two co-half in the scale comprised of 30 items and 4 factors are 0.598 and 0.760; Sperman Brown reliability coefficients are 0.748 and 0.864; Guttmann Split-Half values are 0.751 and 0.861; Cronbach alpha reliability coefficients are 0.765 and 0.851. As can be seen here, the internal consistency coefficients of the factors, as well as the Cronbach Alpha internal consistency coefficient of 0.83, are high.

Academic motivation scale

Developed by Bozanoğlu (2004), the scale aims to determine the academic motivation level of the participants. It is comprised of 20 items and 3 sub-scales. In the construct validity test, initially 53 items were subject to factor analysis. The items which load the least, or which load on more than one factor so closely that they are indistinguishable, were removed from the analysis, and the analysis was performed again. The remaining 20 items were grouped under three factors, and no item was left out.

In the same way, 30.3% of the totally explained 42.2% variance is explained by the first factor, while the remaining 11.9% was explained by the second (6.9%) and the third factor (5.0%).

After analyzing the variances explained by the factors and the content of the items placed under factors, it was concluded that the scale could be used with factors or as a one-dimensional scale. Thus, the item analyses were performed on factors and overall, separately. Academic Motivation Scale (AMS) is composed of 20 items, all of which are 5-point Likert scale type. All items, but one, were positively scored. Thus, the scoring of one item required reversed rotation. The respondents can get a minimum score of 20 and maximum score of 100 from the scale.

Test-retest method was used to compute the reliability of the scale with 101 participants. The correlation between the two administrations was found to be 0.87. The Cronbach alpha value computed for additional reliability evidence was found between 0.77 and 0.85 in the same group at different times, and between 0.77 and 0.86 in different groups. The Cronbach Alpha value of the scale in this study was found as 0.86.

Data analysis

This study aimed to understand the mediating role of scientific attitude on the relationship between scientific epistemological beliefs and motivations of teacher candidates. It was designed as correlational research. Mediation analysis was conducted through the use of IBM SPSS Statistics 22 software to answer the research question of the study.

RESULTS

Before the mediation analysis, the means, standard deviations and zero-order correlations among the variables were computed (Table 1). The results indicated that predictor and criterion variables were all significantly and positively correlated with each other.

After correlation analysis, the mediation of the effect of scientific epistemological belief on motivation through scientific attitude was computed using process analysis (Table 2). The interpretation was made due to Preacher and Hayes' process analysis (Preacher and Hayes, 2008) whether zero lies within the interval range was checked.

In this case, the true indirect effect 95% is likely to range from 0.0143 to 0.0894. The estimated effect is 0.0464 (lying between these two values). Thus, significant indirect effect was found. Due to the violation of the assumption of normality, bootstrapping was applied (Preacher and Hayes, 2008).

Table 1. Means, standard deviations of and inter-correlations among the criterion, predictor, and mediating variables.

Measure	M	SD	1	2	3
1.Scientific attitude	87.98	14.63	-	0.25**	0.23**
2.Scientific epistemological beliefs	116.97	12.41		-	0.24**
3.Motivation	68.17	12.55			

**p<0.01.

Table 2. Mediation of the effect of scientific epistemological belief on motivation through scientific attitude.

Predictors	b(s.e)	T	F	df	R^2
X	0.05	5.70	32.49	(1,645)	0.06
M	0.05	3.18	-	-	0.09
X	0.04	4.39	28.78	(2,644)	0.09

N= 647, *p<0.05

The results indicated that scientific epistemological belief was a significant predictor of attitude, b= 0.29, SE= 0.07, p< 0.05, and that scientific attitude was a significant predictor of motivation, b= 0.01, SE= 0.05, p<0.05. Scientific epistemological beliefs proved to be a significant predictor of motivation after controlling of the mediator effect, b=0.20, SE= 0.05, p<0.05 (Figure 1). There was a significant indirect effect of scientific epistemological belief on motivation through scientific attitudes, ab= 0.04, BCa CI [0.14, 0.89]. The mediator could account for roughly half of the total effect, P_M= 0.18. Bootstrap estimation was used to test the indirect effect with a sample of 1000 participants. It indicated that the indirect coefficient was significant, b= 0.05, SE= 0.001, 95% CI= 0143, 0894, which suggested the mediating role of scientific attitude. However, the direct effect between scientific epistemological belief and motivation remained significant after the inclusion of mediator. Thus, partial mediation was found. Overall, approximately 33% of the variance in motivation was accounted for by the predictor (R^2= 0.34).

DISCUSSION

The study, which aims to examine the effect of scientific attitudes on the relationship between teacher candidates' scientific epistemological beliefs and approaches to scientific research, revealed that scientific epistemological belief affects academic motivation, and attitude to scientific research affects partial mediation. In other words, it showed that there is a direct relation between pre-service teachers' scientific epistemological beliefs and academic motivation levels, and an indirect relation between epistemological belief and academic motivation, through approach to science. As also demonstrated by Pintrich (2002), epistemological beliefs, academic cognition, and motivation are such learner qualities can ease or hinder learning. A major finding of the study is that epistemological belief, which refers to the subjective perception of what valid-reliable knowledge is and how it is accessed and produced, affects the motivation level by means of attitude. However, when the effect of the attitude is eliminated, the effect of epistemological belief on motivation prevails, so attitude has a function of partial variable.

Attitudes play a prominent role in learning scientific research methods because training individuals with a researcher's attitude lies in the root of scientific research (Saracaoğlu, 2008). Since attitudes are qualities that can change through time, it is regarded important that pre-service teachers should acquire a positive attitude to scientific research (Kürşad, 2015; Önen, 2011; Öztürk, 2016). Kapucu and Bahçivan (2015) found a significant positive correlation between scientific epistemological beliefs of Turkish high-school students and attitudes to physics. Similarly, Schruba (2008) found that university students' attitude to science significantly correlates with self-efficacy in learning biology, and Fulmer (2014) found that it correlates with attitude to science. The study carried out by Kızılgüneş et al. (2009) revealed a significant correlation between students' epistemological beliefs and learning outcomes. A study conducted by Ravindran et al. (2005) revealed that there is a significant relation between pre-service teachers' epistemological beliefs, learning objectives, and learning processes. Similarly, some studies provided evidence that epistemological beliefs influence students' academic performance (Holschuh, 1998; Tsai, 1998). The findings demonstrate that scientific epistemological beliefs correlate with attitudes positively.

The finding that scientific epistemological belief affects academic motivation levels is in line with that of other studies. Paulsen and Feldman (1999) demonstrated that

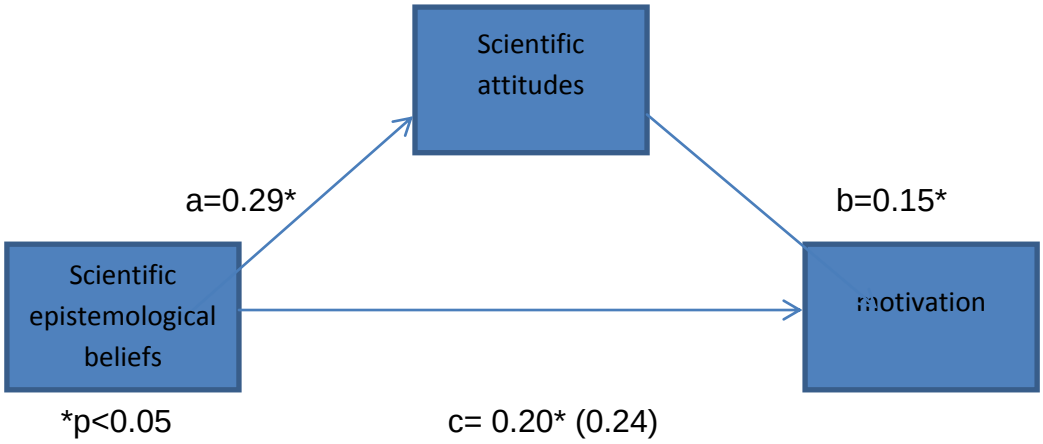

Figure 1. Standardized regression coefficients for the relationship between scientific epistemological belief and motivation as mediated by scientific attitudes. The standardized coefficient between scientific epistemological belief and motivation, controlling for scientific attitudes is in parentheses.

epistemological beliefs and motivation are positively correlated; learners who believe that the ability to learn can be improved tended to be goal orientated, appreciate the learning tasks, have control over their learning, and feel confident to learn, unlike the learners who simplistically believe that learning is an unchanging ability. Buehl (2003) showed evidence that epistemological beliefs increase students' motivation to achieve and enhance cognitive skills. Similarly, Murphy et al. (2002) carried out a study with 255 eight-grade students and 195 ninth-grade students, revealing that different dimensions of epistemological beliefs are differentially related to students' motivation. Kızılgüneş et al. (2010) claimed that epistemological beliefs influence learning approach directly, and learning approach and achievement indirectly through their direct effect on achievement motivation. Research conducted by Chen and Pajares (2010) demonstrated that epistemological beliefs have direct and indirect effects on academic motivation. A similar result was found in Buehl and Alexander's (2005) research, which yielded that students' Epistemological belief levels and motivation levels are in a linear relationship. Lin et al. (2013) conducted a similar study and the correlation coefficients in their study pointed to a certain relation between scientific epistemological beliefs and motivation to learn science. In conclusion, a positive relation seems to exist between scientific epistemological beliefs and motivation.

Gaining pre-service teachers a positive approach to scientific research is important as they will train students with similar attitudes in the future. Thus, it will help develop pre-service teachers' scientific approach and increase motivation towards scientific research. Within this framework, it seems critical to prepare settings and processes conducive to develop scientific approaches and increase motivation to research in the teacher training process. In addition, research can be conducted to evaluate instructors, who have a significant role in equipping pre-service teachers with certain skills, as regards similar dimensions. The sample of this study is restricted to a group of pre-service teachers that are undergoing training in a single university in Turkey. Therefore, utmost care should be taken when generalizing the findings of the study. Finally, further qualitative research can be conducted to have a deep insight into the impact of pre-service teachers' attitude to scientific research on the relation between their scientific epistemological beliefs and academic motivation levels.

CONFLICT OF INTERESTS

The authors have not declared any conflicts of interests.

REFERENCES

Ajzen I, Fisbein M (1980). Understanding attitudes and predicting social behavior. New Jersey: Englewood Cliffs, Prentice-Hall.
Aksan M (2006). Metaphors of anger: an outline of a cultural model. Mersin Üniversitesi Dil ve Edebiyat Dergisi, 3(1):31-59.
Aksan N, Sözer MA (2007). Üniversite öğrencilerinin epistemolojik inançları ile problem çözme becerileri arasındaki ilişkiler. Ahi Evran Üniversitesi Kırşehir Eğitim Fakültesi Dergisi (KEFAD), 8(1):31-50.
Aypay A (2011). Öğretme ve öğrenme anlayışları ölçeği'nin Türkçe uyarlaması ve epistemolojik inançlar ile öğretme ve öğrenme anlayışları arasındaki ilişki. Kuram ve Uygulamada Eğitim Bilimleri, 11(1):7-29.
Başaran İE (1978). Eğitim psikolojisi. Ankara: Bilim Matbaası.
Başbay A (2013). Analyzing the relationship of critical thinking and metacognition with epistemological beliefs through structural equation modeling. Education and Science, 38(169):249-262.
Bendixen LD, Rule DC (2004). An Integrative approach to personal epistemology: a guiding model. Educ. Psychol. 39:69-80.
Biçer B, Er H, Özel A (2013). The relationship between the epistemological beliefs and educational philosophies of the teacher candidates adopted. J. Theory Practice Educ. 9(3):229-242.
Bozanoğlu İ (2004). Akademik güdülenme ölçeği: geliştirmesi, geçerliği, güvenirliği. Ankara Üniversitesi Eğitim Bilimleri Fakültesi Dergisi, 37(2):83-98.

Buehl MM, Alexander PA, Murphy PK (2002). Beliefs about schooled knowledge: domain general or domain specific?. Contemporary Educ. Psychol. 27:415-449.
Buehl M (2003). At the Crossroads of Epistemology and Motivation: Modeling the Relations between Students' Domain-Specific Epistemological Beliefs, Achievement Motivation, and Task Performance. Unpublished Doctoral Dissertation. Maryland University. America.
Buehl MM, Alexander PA (2005). Motivation and performance differences in students' domain-specific epistemological belief profiles. Am. Educ. Res. J. 42(4):697-726.
Cevizci A (2005). Paradigma felsefe sözlüğü. Ankara: Paradigma Yayınları.
Chen JA, Pajares F (2010). Implicit theories of ability of grade 6 science students: relation to epistemological beliefs and academic motivation and achievement in science. Contemporary Educ. Psychol. 35:75-87.
Dahl TI, Bals M, Turi AL (2005). Are students' beliefs about knowledge and learning associated with their reported use of learning strategies?. Brit. J. Educ. Psychol. 75:257-273.
Demirbaş M, Yağbasan R (2006). An evaluative study of social learning theory based scientific attitudes on academic success, gender and socio-emotional level. Educ. Sci. Theory Prac. 6:363-371.
Deryakulu D, Bıkmaz FH (2003). Bilimsel epistemolojik inançlar ölçeğinin geçerlik ve güvenirlik çalışması. Eğitim Bilimleri ve Uygulama, 2(4):243-257.
Deryakulu D (2004). The relationships between university students' learning and study strategies and their epistemological beliefs. Educ. Admin. Theory Prac. 38:230-249.
Eccles (Parsons) J, Adler TF, Futterman R, Goff SB, Kaczala CM (1983). Expectancies, values, and academic behaviors. In Achievement and Achievement Motivation, ed. JT Spence, 75–146. San Francisco: Freeman.
Eccles JS, Wigfield A, Flanagan CA, Miller C, Reuman DA, Yee D (1989). Self-concepts, domain values, and self-esteem: Relations and changes at early adolescence. J. Pers. 57(2):283-310.
Eccles JS, Wigfield A, Harold R, Blumenfeld PB (1993a). Age and gender differences in children's self- and task perceptions during elementary school. Child Dev. 64(3):830-847.
Eren E (1998). Örgütsel davranış ve yönetim psikolojisi. İstanbul: Beta Yayınevi.
Fishbein M, Ajzen I (1975). Belief, attitude, intention and behavior. Reading, MA: Addison-Wesley.
Fulmer GW (2014). Undergraduates' attitudes toward science and their epistemological beliefs: positive effects of certainty and authority beliefs. J. Sci. Educ. Technol. 23(1):198-206.
Hofer BK, Pintrich PR (1997). The development of epistemological theories: Beliefs about knowledge and knowing and their relation to learning. Rev. Educ. Res. 67:88-140.
Hofer BK (1999). Instructional context in the college mathematics classroom: epistemological beliefs and student motivation. J. Staff Prog. Organ. Dev. 16 (2):73-82.
Hofer BK, Pintrich PR (Eds.). (2002). Personal epistemology: the psychology of beliefs about knowledge and knowing. Mahwah, NJ: Erlbaum.
Holschuh JL (1998). Epistemological beliefs in introductory biology: Addressing measurement concerns and exploring the relationship with strategy use. Unpublished doctoral dissertation, University of Georgia, Athens.
Kağıtçıbaşı Ç (1992). İnsan ve insanlar. İstanbul: Evrim Basımevi.
Kapucu S, Bahçivan E (2015). High school students' epistemological beliefs, self-efficacy in learning physics and attitudes towards physics: a structural equational model. Res. Sci. Technol. Educ. 33(2):252-267.
Kızılgüneş B, Tekkaya C, Sungur S (2009) Modeling the relations among students' epistemological beliefs, motivation, learning approach, and achievement. J. Educ. Res. 102(4)243-256.
Kline RB (2005). Principles and Practice of Structural Equation Modeling, 2nd ed, New York: Guilford Press.
Koballa TR, Crawley FE (1985). The influence of attitude on science teaching and learning. School Sci. Math. 85(3):222-232.
Korkmaz Ö, Şahin A, Yeşil R (2011). Study of validity and reliability of scale of attitude towards scientific research. Elem. Educ. Online, 10(3):961-973.
Kürşad MŞ (2015). Bilimsel araştırmaya yönelik tutum ve epistemolojik inanç arasındaki ilişkinin incelenmesi. Abant İzzet Baysal Üniversitesi Eğitim Fakültesi Dergisi, 15(2):217-246.
Liang JC, Lee MH, Tsai CC (2010). The relations between scientific epistemological beliefs and approaches to learning science among science-major undergraduates in Taiwan. Asia-Pac. Educ. Researcher, 19(1):43-59.
Lin T, Deng F, Chai CS, Tsai C (2013). High school students' scientific epistemological beliefs, motivation in learning science, and their relationships: A comparative study within the Chinese culture. Int. J. Educ. Dev. 33:37-47.
Meral M, Çolak E (2009). Öğretmen adaylarının bilimsel epistemolojik inançlarının incelenmesi. Ondokuz Mayıs Üniversitesi Eğitim Fakültesi Dergisi, 27:129-146.
Murphy PK, Buehl MM, Monoi S, Long JF (2002). Understanding the achievement of inner-city adolescents: The influence of epistemological beliefs and achievement goal orientation on academic achievement. Paper presented at the Annual Meeting of the American Educational Research Association, New Orleans, LA.
Osborne J, Simon S, Collins S (2003). Attitudes towards science: a review of the literature and its implications. Intern. J. Sci. Educ. 25(9):1049-1079.
Önen AS (2011). The effect of candidate teachers' education and epistemological beliefs on proffessional attitudes. Hacettepe Univ. J. Educ. 41:293-301.
Özkal K, Tekkaya C, Sungur S, Çakıroğlu J, Çakıroğlu E (2010). Elementary students' scientific epistemological beliefs in relation to socio-economic status and gender. J. Sci. Teacher Educ. 21:873-885.
Öztürk FÖ (2016). Bilimsel epistemolojik inançlar, bilimsel bilginin doğası hakkındaki görüşler ve bilimsel tutumlar üzerine bir çalışma: Abu Dhabi örneği. Muğla Sıtkı Koçman Üniversitesi Eğitim Fakültesi Dergisi 3(2):16-29.
Pajares F (1992). Self-efficacy beliefs in academic settings. Rev. Educ. Res. 66:543-578.
Paulsen MB, Feldman KA (1999). Student motivation and epistemological beliefs. New Directions for Teach. Learn. 78:17-25.
Pintrich P, Smith DA, Garcia T, Mc Keachie WJ (1993). Reliability and predictive validity of the motivated strategies for learning questionnaire (MSLQ). Educ. Psychol. Measure. 53:801-813.
Pintrich PR (2002). The Role of Metacognitive Knowledge in Learning, Teaching and Assessing. Theory into Practice. Vol. 1, No. 1 - Vol. 48, No. 4. Taylor & Francis, Ltd.
Pomeroy D (1993). Implications of teachers' beliefs about the nature of science: Comparison of the beliefs of scientists, secondary science teachers, and elementary teachers. Sci. Educ. 77(3):261-278.
Preacher KJ, Hayes AF (2008). Asymptotic and resampling strategies for assessing and comparing ındirect effects in multiple mediator models. Behav. Res. Methods 40(3):879- 891.
Preacher KJ, Hayes AF (2004). SPSS and SAS procedures for estimating indirect effects in simple mediation models. Behav. Res. Methods Instrum. Comput. 36:717-731.
Ravindran B, Greene BA, De Backer TK (2005). Predicting preservice teachers' cognitive engagement with goals and epistemological beliefs. J. Educ. Res. 98(4):222-232.
Saracaoğlu SA (2008). Lisansüstü öğrencilerinin akademik güdülenme düzeyleri, araştırma kaygıları ve tutumları ile araştırma yeterlikleri arasındaki ilişki. Yüzüncü Yıl Üniversitesi Eğitim Fakültesi Dergisi, 5(2):179-208.
Schommer M (1990). Effects of beliefs about the nature of knowledge on comprehension. J. Educ. Psychol. 82:498-504.
Schommer-Aikins,M., & Hutter, R. (2002). Epistemological beliefs and thinking about everyday controversial ıssues. J. Psychol. 136:1.
Schruba AE (2008). Evaluation of student attitude toward science and self-efficacy in a non-majors college biology course. Master's Thesis. Retrieved from ProQuest Dissertations and Theses database.
Siegel LS, Ryan EB (1984). Reading disability as a language disorder. RASE 5:28-33.
Şimşek ÖF (2007). Yapısal eşitlik modellemesine giriş. Ankara: Ekinoks.
Tsai CC (1998). An analysis of scientific epistemological beliefs and

learning orientations of Taiwanese eighth graders. Sci. Educ. 82:473-489.
Weiner B (1992). Human motivation: metaphors, theories and research. Newbury Park, CA: Sage.
Wigfield A (2000). Expectancy-value theory of achievement motivation: a developmental perspective. Educ. Psychol. Rev. 6:1.
Wigfield A, Eccles JS (2000). Expectancy-value theory of achievement motivation. Contemp. Educ. Psychol. 25:68-81.
Wyre HS (2007). Critical thinking, metacognition, and epistemological beliefs. Unpublished Doctoral Dissertation. Educational Leadership University of Phoenix.