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Investigating the Relationships Between University Students' Epistemological Beliefs and Learning Approaches: A Path Analysis Study

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Abstract

The purpose of this study was to investigate the relationships between epistemological beliefs and learning approaches of university students. The mediator effect of gender was also tested. A theoretical model was created, and considering the literature personality types' effects on learning approaches were kept under control. A total of 244 university students studying in 26 different departments of a university in Turkey participated in the study. Data collection tools were *Epistemological Beliefs Scale* (attaining knowledge, nurture vs. nature, absolute and single reality, and epistemic confliction), *Learning Approaches Scale* (deep approach and surface approach), and *Personality Types Scale* (type A and type B personality). It was hypothesized that sophisticated epistemological beliefs positively predict deep approach and naive epistemological beliefs positively predict surface approach. In addition, it is predicted that the model will differ for males and females. Path analysis method was used to test the models. Results showed that in attaining knowledge and epistemic confliction dimensions sophisticated epistemological beliefs positively predict deep approach. In absolute and single reality, nurture versus nature, and epistemic confliction dimensions naive epistemological beliefs positively predict surface approach. The moderator effect of gender was not significant in the overall model. The results of the research indicate that epistemological beliefs and learning approaches are interrelated structures.

Keywords

epistemological beliefs, gender, learning approaches, personality types, university students

Introduction

Universities are compelled to make new educational regulations to train individuals who are suitable for the changing economic and social conditions of the 21st century. The rapidly increasing number of students and the changing workforce competencies require university students to transform their learning experiences, learn how to learn, and create their own belief systems and methods regarding learning and knowledge. The duty of universities is to conduct an effective education that will provide students with these skills. The prerequisite for effective education is to have knowledge about students' learning processes and how they make sense of their learning. Students' relationships with knowledge and cognitive processes related to learning are closely related to their epistemological beliefs and learning approaches (Nisbet & Shucksmith, 1986; Perry, 1981; Republic of Turkey Board of Education, 2017; Rodríguez & Cano, 2007; Schommer, 1990). In the literature, studies in the higher education level focus on the relationship between these two variables or their relationships with other variables such as gender, grade, age, personality characteristics, conceptions of learning, self-regulated learning, motivation, and problem-solving skills (Baydar, 2020; Chan, 2003; Chiu et al., 2016; Dawson, 2006; Gronostay, 2019; Kanadlı & Akbaş, 2015; Karataş & Erden, 2017; Khalid et al., 2021; Nussbaum & Bendixen, 2003; Phan, 2008; Rodríguez & Cano, 2006, 2007; Şahin-Taşkın, 2012; Zhu

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et al., 2008). This study created a theoretical model that hypothesizes that there are significant relationships between epistemological beliefs and learning approaches based on the literature and tested this model by controlling the effect of personality types on learning approaches. In fact, Chamorro-Premuzic et al. (2007), Sadeghi et al. (2012), Von Stumm and Furnham (2012), and Zhang (2004) found significant relationships between learning approaches and personality types. In addition, this study examined the moderator effect of the gender variable and tested whether the model created showed differences in terms of male and female students.

Background

Since the 1950s, the epistemological beliefs of learners, that is, their beliefs about knowledge and the process of making sense of knowledge as a concept, attracted the attention of scientists, and researchers began creating different models and classifications on the subject (Hofer & Pintrich, 1997). It is accepted that Perry (1968) created the first classification of epistemological beliefs (Hofer & Pintrich, 1997; Schommer, 1994); he categorized the thinking development of students in nine positions from simple to advanced as a result of his study examining the developmental patterns of thinking and values by interviewing university students. The positions and their contents (Perry, 1968, 1981) are as follows:

1. *Basic Dualism*: In this position there is only one truth and it is certain. The truth must be learned from the familiar authority and there must be unconditional conformity to authority. There is no room for the thought that others may have better ideas.
2. *Multiplicity Pre-legitimate*: In this position, truth is not inherently problematic. However, the perspective about authority differs. The method of authority can be seen as right/good or wrong/bad.
3. *Multiplicity Sub-ordinate*: In this position, while the ideas about the nature of the truth do not change, the perception of uncertainty begins to develop. The relationship between authority and certainty of knowledge is questioned, and it is accepted that there would be better answers.
4. *Multiplicity Correlate or Relativism Subordinate*: In this position, it is accepted that people may have different perspectives and opinions in approaching problems, and independent opinions should be taken into account. It has been understood that authority is not the only source in finding the truth.
5. *Relativism Correlate, Competing, or Diffuse*: In this position, simple right or wrong perspective gives way to complexity and relativism. This position covers the transition from the understanding that some knowledge is absolute while some knowledge is relativistic to full relativism.
6. *Commitment Foreseen*: In this position, there is an adaptation to the relativist world and developing a positive attitude towards it. Although relativist understanding is perceived as a necessity, it has not been experienced yet.
7. *Initial Commitment*: In this position, individual values and opinions are at the forefront. There is a relativist and independent understanding in the decision-making process.
8. *Orientation in Implications of Commitment*: In this position, there is an evaluation of the consequences of commitments related to the individual's personality and position in society.
9. *Developing Commitments*: This position is the maturity level. It is also about defending one's own values by respecting others and being open to learning.

Perry (1968) grouped these positions in four sequential categories: simple dualism, complex dualism, relativism, and commitment within relativism. According to him, students, in their formative years, believe that there are certain truths and that authorities know these truths. There are the concepts of "right" and "wrong" for students in these years. Gradually, the certainty of the truth and the mentality of fully obeying the authority begin to weaken. Researchers believe that everyone can form their own understanding of "right" in future stages, and people consider the effects of the society one lives in and an individual's sense of responsibility and their adopted lifestyle when determining the perception of "right."

Alternatively, Schommer (1990) described epistemological beliefs as a multidimensional system consisting of different beliefs rather than a one-dimensional system. Schommer focused on four dimensions in relation to the epistemological beliefs of individuals: certain knowledge, simple knowledge, quick learning, and innate ability. One can analyze the beliefs related to these four dimensions between the levels of naive and sophisticated beliefs. Individuals with naive epistemological beliefs accept that knowledge never changes; knowledge consists of independent pieces; one must acquire knowledge instantly and quickly; and that the ability to learn is innate. Conversely, individuals with sophisticated epistemological beliefs accept that knowledge is in a state of constant change; information is interrelated; learning can occur within a certain period of time; and learning ability can change throughout life. Each of these dimensions can

develop differently. Someone who believes that knowledge never changes can also believe that one can acquire the learning ability all throughout life (Schommer, 1990, 1993; Schommer-Aikins et al., 2003).

Kutluca et al. (2018) adapted the Epistemological Beliefs Scale by Sing-Chai et al. (2009) into Turkish. At the end of the study, they reviewed epistemological beliefs in the following four dimensions: attaining knowledge, nurture versus nature, absolute and single reality, and epistemic confliction. These dimensions differ from the original scale due to cultural and linguistic differences. This study used the classification of Kutluca et al. (2018) because it is culturally more appropriate in determining the epistemological beliefs of all Turkish-speaking university students.

Epistemological beliefs are considered a factor affecting learning because the learner is expected to develop positive beliefs about knowledge and the process of acquiring knowledge for learning to occur (Demir & Doğanay, 2009). The learners' beliefs, intentions, orientations, and styles of processing information in the learning process constitute their learning approach (Ekinci, 2009). As a result of a qualitative research Marton and Säljö (1976) conducted, they categorized learning approaches into two groups: deep learning approach and surface learning approach. Biggs et al. (2001), who conducted research on the same topic, reviewed learning approaches multidimensionally and identified four subdimensions (deep motive, deep strategy, surface motive, and surface strategy). These subdimensions are gathered under the two main dimensions of deep and surface learning approaches, as in Marton and Säljö's (1976) classification.

Students who prefer the surface learning approach concentrate on the learning material and use methods of memorization and recalling. They prefer to complete their tasks at the earliest and with the least amount of effort (Biggs, 1993; Marton & Säljö, 1976). They focus on what they will gain or lose at the end of the task (such as passing–failing, the score, reward, and teacher satisfaction) rather than the nature of the task. They keep in mind true–false type single purpose answers. Learning occurs in independent parts. Moreover, combining information, reinterpreting information from a new perspective, focusing on understanding, and transferring is rare (Biggs, 1993; Draper, 2009; Ramsden, 2003).

Conversely, students who prefer the deep learning approach are more interested in comprehension as they try to understand what the learning material conveys. With their intrinsic motivation, they try to make out as much meaning as possible in the tasks assigned to them (Biggs, 1993, 1999; Marton & Säljö, 1976). They use higher-order thinking skills such as analysis, synthesis, evaluation, and reflection. They make use of their previous knowledge and adapt it to new situations. They can combine information and structure what they have learned. They make connections between events, concepts, and examples and pair different examples with different concepts (Biggs, 1993; Draper, 2009; Laird et al., 2008; Ramsden, 2003).

Research indicates that epistemological beliefs can have significant effects on learning; these beliefs can affect understanding, conceptualization, learning strategy, and cognitive processes (Chan, 2008; Schommer, 1990). Generally, researchers expect that the surface learning approach has a significant and positive relationship with naive epistemological beliefs, and the deep learning approach has a significant and positive relationship with sophisticated epistemological beliefs. While some studies reached findings that support this hypothesis, some could not. In their study with university students, Rodríguez and Cano (2007) found a significant relationship between naive epistemological beliefs and surface learning approach and between sophisticated epistemological beliefs and deep learning approach. Chiu et al. (2016) examined the relationship between medical school students' epistemological beliefs and learning approaches by including gender and grade-level variables in their model, and, contrary to their hypotheses, they could not find a significant relationship between sophisticated epistemological beliefs and deep learning. Şahin-Taşkın (2012) examined the relationship between teacher candidates' epistemological beliefs and learning approaches. She found a significant relationship between having advanced beliefs in the learning ability dimension of epistemological beliefs and deep learning. In the certainty of knowledge dimension, there was a relationship between having naive beliefs and surface learning. Kanadlı and Akbaş (2015) found a negative and significant relationship between the beliefs of science teacher candidates that learning depends on effort and their deep learning approaches; they determined positive and significant relationships between the same variable and surface learning approaches.

Parallel to the literature, this study expects that the surface learning approach will have a positive and significant relationship with naive epistemological beliefs, and the deep learning approach will show a positive and significant relationship with sophisticated epistemological beliefs. The created model checked the effect of personality types on learning approaches. Learners' personality traits can shape their learning styles, learning approaches, motivations, and attitudes toward learning. Focusing on learning approaches while ignoring personality types can cause bias (De Raad & Schouwenburg, 1996; Perry, 1981; Sadeghi et al., 2012; Schommer, 1990). This study considers the personality types described by Friedman and Rosenman (1974) as type A and type B personality. Friedman and Rossman (1974) posit that individuals with type A personality are hasty,

constantly on the move, impatient, aggressive, focused on more than one job simultaneously, competitive, focused on winning instead of spending time on themselves and their hobbies, and workaholic; they value time and focus on their own thoughts even while listening to others; they can exhibit hostile attitudes toward their competitors and make numerical evaluations about themselves and others. Conversely, individuals with type B personality do not make haste to complete their tasks, and they place more emphasis on quality. They are not only work- and success-oriented but also take time to have fun and rest. They do not feel guilty when they are not working, and they are aware of their abilities and shortcomings. They do not always try to be successful and stay in the spotlight owing to their success. One can find type A and B personality traits at different levels in individuals.

Furthermore, this study examined the moderator effect of the gender. In the literature, researchers had predicted that there would be a significant relationship between gender and university students' epistemological beliefs and learning approaches, so they examined the relationships between those variables. However, the results differ. While some studies have found that gender has a significant relationship with epistemological beliefs and learning approaches, others have reached opposite results. Aslan (2017) found that in all three dimensions of epistemological beliefs which are "learning depends on effort," "learning depends on ability," and "there is only one truth," females have more sophisticated beliefs. Eroğlu and Güven (2006) found a significant difference in favor of females only in the dimension that "learning depends on ability," and they did not find a significant difference between females and males in the other two dimensions. On the other hand, Tümkaya (2012) did not find any significant difference between males and females in all three dimensions. Dinç and Üztemur (2017) found that female students have more sophisticated beliefs than males in the dimensions of the access to knowledge and the knowledge acquisition, the certainty of knowledge, and the control of knowledge. On the contrary, Demir (2012) did not find any gender differences in all dimensions of the source of knowledge, rational society, superstitious rituals, and supernatural powers. Ordóñez et al. (2016), unlike all these studies, found a significant difference in favor of males in the certain knowledge dimension of epistemological beliefs, and they did not find any significant difference in simple knowledge, quick learning, and innate ability dimensions according to gender. A similar situation exists for the learning approaches variable. There is no consensus on the relationship between gender and learning approaches in literature. Rosander and Bäckström (2012) found a difference in favor of females in surface motivation, and in favor of males in deep strategy. Tarabashkina and Lietz (2011), Veloo et al. (2015), and Zakaria et al. (2018) found significant relationships between gender and learning approaches, while Lake and Boyd (2015) concluded that learning approaches did not differ according to gender. Considering all these studies, it was thought that it would be useful to investigate the effect of gender in the model examining the relationship between epistemological beliefs and learning approaches. Culturally adopted gender roles (Çuhadaroğlu, 2011) may differentiate students' approaches to knowledge and learning in some dimensions. It is important to contribute to the literature in comparing the role of gender in the relationship between epistemological beliefs and learning approaches in the context of different cultures. For this reason, the hypothesis that the model created in this study will differ between male and female students has been tested.

Understanding the beliefs and goals of university students toward knowledge and learning, revealing the relationship between epistemological beliefs and learning approaches by analyzing personality types, and determining the role of the gender variable in this relationship could help provide a more productive teaching environment.

Method

This research analyzed whether the four dimensions of the epistemological beliefs, which are attaining knowledge, nurture versus nature, absolute and single reality, and epistemic confliction, predict deep learning and surface learning approaches. A theoretical model was created based on the literature and personality types' effects on learning approaches were kept under control (Figure 3). Path analysis method was used to test the model using SPSS-AMOS 23.0 package program. Then, using the Stats Tool Package created by Gaskin (2016), it was tested the moderator effect of the gender, through the multigroup path analysis method. The hypotheses of the research are presented below.

Hypotheses

1. When controlling the effect of the personality type on learning approaches, sophisticated epistemological beliefs positively predict deep learning approaches.
2. When controlling the effect of the personality type on learning, naive epistemological beliefs positively predict surface learning approaches.
3. When controlling the effect of the personality type on learning approaches, the relationship between epistemological beliefs and learning approaches changes according to gender.

Participants

The research sample consisted of 244 students studying in 26 different departments at a university located in the Central Anatolian region of Turkey. All students were Turkish-speaking. Of the participants, 152 (62.3%) were female, and 92 (37.7%) were male; 118 (48.4%) were first year students, and 126 (51.6%) were second year students.

Instruments

In the research "Epistemological Beliefs Scale," "Learning Approaches Scale," and "Personality Types Scale" were used as data collection tools.

The Epistemological Beliefs Scale. Sing-Chai et al. (2009) developed this scale, and with some additions and changes, Kutluca et al. (2018) adapted it to Turkish. The Turkish form of the scale consists of 23 items and 4 dimensions and has a 5-point Likert-type rating that ranges from 1 (strongly disagree) to 5 (strongly agree). These dimensions are attaining knowledge, nurture versus nature, absolute and single reality, and epistemic confliction. The four dimensions explain 56% of the variance. The factor analysis and reliability analysis determined that the scale was valid and reliable. The "Attaining Knowledge" factor consisted of nine items; the "Nurture versus Nature" factor consisted of six items; and the "Absolute and Single Reality" and "Epistemic Confliction" factors consisted of four items each. As a result of the reliability analysis, the Cronbach alpha internal consistency coefficients were, for the dimension of attaining knowledge ($r = .63$), for the nurture versus nature dimension ($r = .80$), and for the absolute reality dimension ($r = .64$). The 16th item in the epistemic confliction dimension dramatically decreased the reliability. Therefore, the study excluded this item from the analysis. The Cronbach's alpha coefficient for the remaining three items was calculated as ($r = .65$). The following are details regarding the dimensions.

Attaining Knowledge: This dimension desires to measure the structuring of information and the effort one makes in reaching knowledge. According to research, individuals with sophisticated epistemological beliefs believe that information is structured gradually and that it is essential to strive and not stop trying to reach knowledge.

Nurture versus *Nature*: This dimension measures beliefs about the relationship between learning, learning processes, and factors affecting learning and genetic characteristics. According to research, individuals with sophisticated beliefs believe that abilities related to learning are not innately fixed, and one can develop these abilities.

Absolute and Single Reality: This dimension measures beliefs about the certainty and uniqueness of knowledge. According to research, individuals with sophisticated beliefs believe that knowledge is relative and can change.

Epistemic Confliction: This dimension measures beliefs about uncertain situations and problems with more than one solution. According to research, individuals with sophisticated beliefs do not avoid uncertainty and believe that there can be more than one solution to problems. High scores for all four dimensions indicate one has sophisticated epistemological beliefs.

The Learning Approaches Scale. Biggs et al. (2001) developed this scale, and Batı et al. (2010) adapted it to Turkish. The original and Turkish adaptation of the scale consists of 20 items and 2 main dimensions, and the scale has a 5-point Likert-type rating ranging from 1 (strongly disagree) to 5 (strongly agree). The dimensions are the deep learning approach (10 items) and surface learning approach (10 items). As a result of factor and reliability analyses, the study determined that the scale was valid and reliable. At the end of the reliability analysis, the Cronbach's alpha internal consistency coefficients of the dimensions were ($r = .79$) for the deep learning approach and ($r = .71$) for the surface learning approach. The following sections present details of the dimensions:

Deep Learning Approach: This dimension measures situations such as understanding the learning materials, one conducting research on what they learned outside the classroom, finding what they learned interesting, and trying to gain more information. Studies indicate that students who adopt the deep learning approach have high scores in this dimension.

Surface Learning Approach: This dimension measures situations such as passing the lessons with the least effort, studying only the important parts, using the memorization method, and paying attention to the learning material only during the lesson. Studies indicate that the students who adopt the surface learning approach will have a high score in this dimension.

The Personality Types Scale. Friedman and Rosenman (1974) developed this scale. This study used the Turkish version reached from Aktaş (2001). The scale has seven items and an 8-point Likert-type rating. There are opposite propositions for each item, and participants were asked to mark the propositions they were closer to on a scale ranging from 1 to 8. For example, the ratings for *not competitive at all* and *very competitive* are not competitive at all = 1, very competitive = 8. The total score of the scale was calculated by multiplying the scores obtained by 3. The highest score that one can obtain is 168, and the lowest score is 21. As an individual's scores

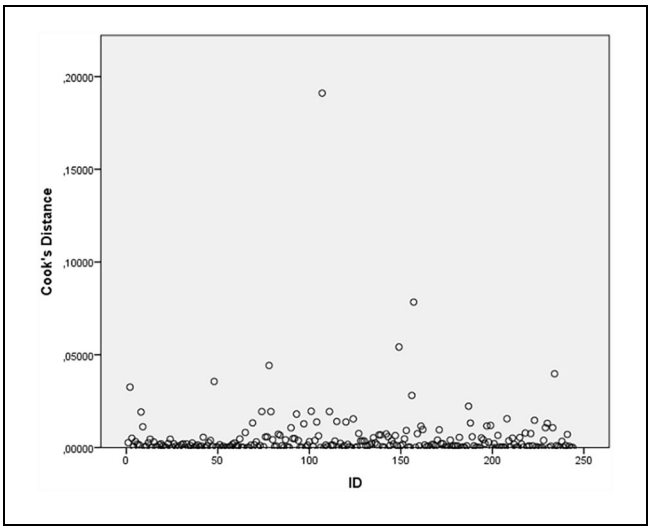


Figure 1. Cook's *D* graph for deep approach.

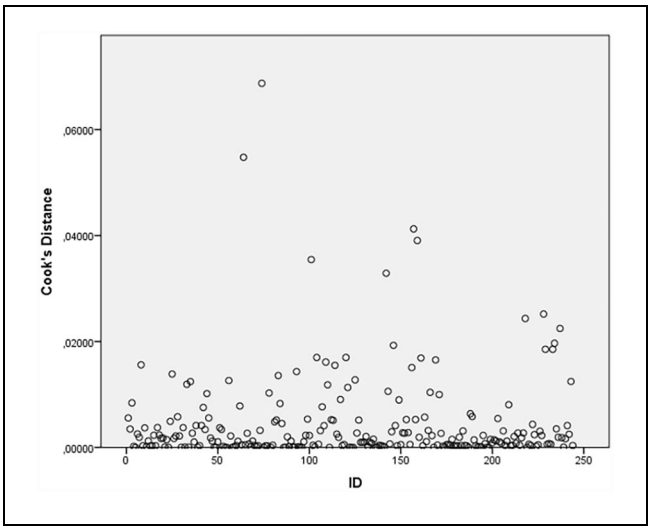


Figure 2. Cook's *D* graph for surface approach.

increase, they get closer to the type A personality; as their points decrease, they get closer to the type B personality.

Data Screening

Outliers and multicollinearity assumptions were checked before analysis. Cook's distances (*Di*) were calculated in order to determine the outliers. As a rule of thumb, Cook's *D* is considered acceptable if it is less than 1, but it is more effective to examine Cook's *D* graphs and select the case or the cases that are very different from the others (Chatterjee & Price, 1991). Cook's *D* graphs are presented in Figures 1 and 2. The first graphic is for the deep learning approach and the second graphic is for the surface approach. For both graphs, four dimensions of the epistemological belief were independent variables. According to the first graph, case 107 was excluded from the analysis because it had 0.20 Cooks *D*. Cook's *D* values in the second chart are quite low and sufficient for analysis.

VIF and tolerance values were determined to test multicollinearity. VIF values are less than 3 and tolerance values are greater than 0.1 (Attaining to knowledge, *Tolerance* = 0.78, *VIF* = 1.27; Absolute and single reality, *Tolerance* = 0.83, *VIF* = 1.20; Nurture vs. nature, *Tolerance* = 0.74, *VIF* = 1.35; Epistemic confliction, *Tolerance* = 0.85, *VIF* = 1.18). There is no multicollinearity problem.

Findings

Descriptive Statistics and Bivariate Correlations

Descriptive statistics and bivariate correlations of the variables are presented in Table 1.

According to the Table 1, students have moderately sophisticated beliefs in attaining knowledge, nurture versus nature, and absolute and single reality ($M = 3.69$, $SD = 0.51$; $M = 3.46$, $SD = 0.93$; $M = 3.25$, $SD = 0.87$) while they have naive beliefs in epistemic conflict

Table 1. Descriptive Statistics and Bivariate Correlations.

	M	*SD*	1	2	3	4	5	6
AK	3.69	0.51	1	.036	.283**	−.330**	.543**	−.047
AR	3.25	0.87		1	.398**	.106	−.204**	−.389**
NN	3.46	0.93			1	.108	.066	−.340**
EC	2.43	0.91				1	−.079	−.342**
DA	3.62	0.63					1	.035
SA	2.85	0.63						1

Note. AK = attaining knowledge; AR = absolute and single reality; NN = nurture vs. nature; EC = epistemic conflict; DA = deep approach; SA = surface approach.
**$p < .01$.

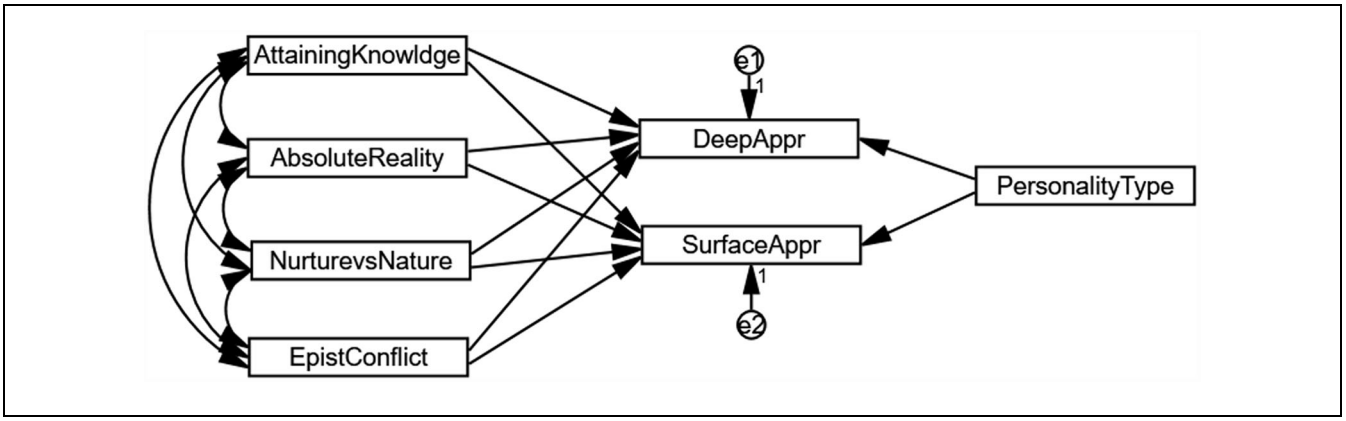


Figure 3. Hypothetical model.

Table 2. Regression Weights for the First Model Tested.

Variables			Unstand. Reg. weights (*B*)	Standard error	Critical ratio	Stand. Reg. weights (β)
AK	→	DA	0.83**	0.08	10.52	.61**
AK	→	SA	−0.13	0.08	−1.61	−.09
AR	→	DA	−0.41**	0.10	−4.08	−.23**
AR	→	SA	−0.47**	0.11	−4.46	−.26**
NN	→	DA	−0.04	0.07	−0.54	−.03
NN	→	SA	−0.17*	0.07	−2.37	−.15*
EC	→	DA	0.34**	0.13	2.68	.15**
EC	→	SA	−0.77**	0.13	−5.71	−.34**
PT	→	DA	0.00	0.02	−0.03	−.00
PT	→	SA	0.05**	0.02	3.24	.18**

Note. AK = attaining knowledge; AR = absolute reality; NN = nurture vs. nature; EC = epistemic conflict; DA = deep approach; SA = surface approach; PT = personality type.
*$p < .05$. **$p < .01$.

($M = 2.43$, $SD = 0.91$). Also, students prefer deep learning more than surface learning ($M = 3.62$, $SD = 0.63$; $M = 2.85$, $SD = 0.63$).

Attaining knowledge has a low positive relationship with nurture versus nature ($r = .283$, $p < .05$), a moderate negative relationship with epistemic conflict ($r = -.330$, $p < .05$), and a moderate positive relationship with the deep learning approach ($r = .543$, $p < .05$). Absolute and single reality has a moderate positive relationship between nurture versus nature ($r = .398$, $p < .05$), a low negative relationship with the deep learning approach ($r = -.204$, $p < .05$), and a moderate negative relationship with the surface learning approach ($r = -.389$, $p < .05$). Nurture versus nature and epistemic conflict have moderate negative relationships with the surface learning approach ($r = -.340$, $p < .05$; $r = -.342$, $p < .05$).

Path Analysis

The fit indices of the model in Figure 3 show that it has a good fit ($\chi^2/df = 2.18$, normed fit index (NFI) = 0.96, comparative fit index (CFI) = 0.98, goodness of fit index (GFI) = 0.98, adjusted goodness of fit index (AGFI) = 0.93, and root-mean-square error of approximation (RMSEA) = 0.07). The results of significance testing for all the path coefficients are shown in Table 2.

According to Table 2, attaining knowledge does not significantly predict the surface learning approach, and nurture versus nature does not significantly predict the deep learning approach. In addition, there was no significant effect of personality types on the deep learning approach.

In the next step, it was tested whether the model differed in terms of males and females. The results are in Table 3.

According to Table 3, the model does not differ significantly for males and females ($\chi^2 = 13.07$, $df = 20$, $p = .87$). However, when each path is evaluated separately the relationships between attaining knowledge and surface learning as well as nurture versus nature and surface learning differ significantly between males and females. While there was a negative and significant relationship between attaining knowledge and surface approach for

Table 3. Moderator Effect of Gender.

Variables			Female		Male		
			Estimate	*p*	Estimate	*p*	*z*-score
AK	→	DA	0.84	.00	0.90	.00	0.39
AK	→	SA	−0.26	.02	0.09	.48	2.07*
AR	→	DA	−0.55	.00	−0.16	.34	1.92
AR	→	SA	−0.50	.00	−0.37	.03	0.59
NN	→	DA	0.05	.50	−0.14	.27	−1.29
NN	→	SA	−0.06	.50	−0.38	.00	−2.11*
EC	→	DA	0.43	.01	0.16	.46	−1.02
EC	→	SA	−0.96	.00	−0.50	.02	1.65
PT	→	DA	−0.01	.50	0.02	.54	0.90
PT	→	SA	0.05	.01	0.05	.08	−0.08

Note. Overall model comparison: $\chi^2 = 13.07$, $df = 20$, $p = .87$. AK = attaining knowledge; AR = absolute reality; NN = nurture vs. nature; EC = epistemic conflict; DA = deep approach; SA = surface approach; PT = personality type.
*$p < .05$.

females (girls with naive epistemological beliefs preferred surface learning more), no significant relationship was found for males ($z = 2.07$, $p < .05$). The negative relationship between nurture versus nature and surface learning was stronger for males ($z = -2.11$, $p < .05$).

The results indicate that the first two hypotheses of the study are partially acceptable. According to the first hypothesis, sophisticated epistemological beliefs are supposed to predict deep learning approach positively and significantly. Research results support this hypothesis in attaining knowledge and epistemic confliction dimensions ($\beta = .61$, $p < .05$; $\beta = .15$, $p < .05$). Contrary to expectations, there was a significant but negative relationship between the absolute and single reality dimension and the deep learning approach ($\beta = -.23$, $p < .05$). The nurture versus nature dimension does not significantly predict the deep learning approach.

According to the second hypothesis, naive epistemological beliefs are supposed to positively and significantly predict the surface learning approach. Absolute and single reality, nurture versus nature, and epistemic confliction support the hypothesis ($\beta = -.26$, $p < .05$; $\beta = -.15$, $p < .05$; $\beta = -.34$, $p < .05$). The attaining knowledge dimension does not significantly predict the surface learning approach.

According to the third hypothesis, it was expected that the gender variable has a moderator effect, and the model changes for males and females. The overall model does not support the third hypothesis ($\chi^2 = 13.07$, $df = 20$, $p = .87$).

Results and Discussion

Results reveal that university students have moderately sophisticated beliefs in the attaining knowledge, absolute and single reality, and nurture versus nature dimensions of epistemological beliefs. The highest scores are in the dimension of attaining knowledge. The most developed epistemological beliefs of students are that learning depends on effort and that there is a hierarchy in knowledge. Moreover, students also believe that the learning ability is not innate; one can develop it; and truth is relative. The average score in the epistemic confliction dimension indicates naive beliefs. One can interpret this result as students do not like to deal with uncertain situations and generally prefer to use one solution method when solving problems. The epistemological beliefs of university students are not parallel to each other in all dimensions; they have different levels of development. Students' having mostly developed epistemological beliefs is a positive factor for their understanding, learning, and academic success (Kanadlı & Akbaş, 2015). However, students avoiding uncertain situations and not choosing more than one solution are among the beliefs that they should develop. These findings are partially in line with the results of the studies conducted by Dinç and Üztemur (2017), Kanadlı and Akbaş (2015), Koç-Erdamar and Bangir-Alpan (2011), and Kösemen and Şahin (2014). In addition, these studies found that the epistemological beliefs of students or teachers at the higher education level were at an advanced level, and the highest scores belonged to the beliefs that learning depends on effort.

University students prefer the deep learning approach more than the surface learning approach. One can expect that students have high-level thinking skills, as they are partly responsible for their learning at the higher education level. Deep learning is the learning approach that university students prefer because it is associated with the abovementioned high-level thinking skills (Laird et al., 2008). Similar to this study, Olpak et al. (2018),

Özgür and Tosun (2012), Öztürk (2018), Rozgonjuk et al. (2020), and Tanrıverdi (2012) concluded that university students prefer deep learning approaches more than surface learning approaches.

As sophisticated beliefs increase in the attaining knowledge and epistemic confliction dimensions of epistemological beliefs, people prefer the deep learning approach more. Attaining knowledge dimension signifies the relevance of effort and constant experimentation in reaching information. Epistemic confliction relates to being willing to deal with uncertainties and being able to produce more than one solution to problems. Because the deep learning approach includes forming meaning, being willing to learn outside the classroom, and to use what one has learned, it is an expected result that students who believe in the significance of effort in accessing information, who do not give up when faced with problems, and who do not avoid uncertain situations, prefer the deep learning approach. Similar to these results, Chiu et al. (2016) concluded that students with sophisticated beliefs about dealing with uncertainties significantly prefer deep learning approaches. Again, in support of these findings, Cano (2005), Kanadlı and Akbaş (2015), Rodríguez and Cano (2006), and Tanrıverdi (2012)found positive and significant relationships between deep learning and sophisticated beliefs regarding the significance of effort in attaining knowledge.

This study indicated that students with sophisticated beliefs in the absolute reality dimension prefer deep learning approaches significantly less. It is expected that individuals with sophisticated beliefs in this dimension believe that knowledge is relative and changeable. One can interpret that result as students who believe that knowledge is changeable also want to access information as soon as possible. Unlike these results, Chan (2003) and Chiu et al. (2016) could not find a significant relationship between the two variables. They could not find a relationship between the nurture versus nature dimension and the deep learning approach. The students' belief that one can develop learning skills did not affect their level of adopting the deep learning approach. In support of this fact, Chan (2003) could not detect a significant relationship between the innate/fixed ability dimension of epistemological beliefs and deep learning. One can interpret the differences in the results of studies conducted in different countries as cultural influences on epistemological beliefs and learning approaches. Similarly, Zhu et al. (2008) concluded in their study that there are cultural differences in the relationship between epistemological beliefs and learning approaches.

Students with naive beliefs in the dimensions of absolute and single reality, nurture versus nature, and epistemic confliction prefer surface learning more. One can say that students who believe that knowledge is unchangeable, who think that their learning ability is fixed from birth, and who do not like to deal with uncertainties prefer the surface learning approach more. Another finding indicates that the relationship between nurture versus nature and the surface learning approach is stronger for male students than that for female students. In support of these findings, Chan (2008) states that students who believe that learning ability is innately fixed, and knowledge is certain and unchangeable, tend to prefer the surface learning approach. The study could not find a significant relationship between believing that effort is effective in attaining knowledge and the surface learning approach. However, the situation is different for female students. There is a positive relationship between having naive beliefs in attaining knowledge and preferring the surface approach in female students, which supports the research hypothesis. Kanadlı and Akbaş (2015) and Tanrıverdi (2012) discovered that students with naive beliefs who believe that learning depends on effort prefer the surface learning approach significantly more. Although the findings do not support the overall model, they support the result for female students. Upon a general observation, one can see that students with naive beliefs prefer the surface learning approach for three of the four dimensions of epistemological beliefs (absolute and single reality, nurture vs. nature, and epistemic confliction). For one dimension (attaining knowledge), female students with naive beliefs prefer surface learning more. Because epistemological beliefs and learning approaches share a common metacognitive structure, researchers believe that they are related to each other (Rodríguez & Cano, 2006).

Another result obtained from the research is that there is a significant relationship between personality types and the surface learning approach. The adoption of surface learning approaches increases as one gets closer to a type A personality. It was not an unexpected result that individuals who adopt the type A personality, which is defined as being ambitious, hasty, and success-oriented, prefer the surface learning approach in which people try to reach the goal in the shortest way possible instead of trying to form meaning. There are studies in the literature that reveal the relationship not only between these two personality types but also between different personality traits and surface learning. Chamorro-Premuzic and Furnham (2009) found negative relationships between the personality trait of openness and surface learning approach, and Zhang (2004) found negative relationships between realistic and investigative personality traits and surface motivation and surface strategy. Additionally, De Raad and Schouwenburg (1996) emphasized that learners' goals, motivations, and other personality traits can affect the learning process. Upon reviewing the studies together, one can say that keeping the personality

types variable under control to support of the hypothesis created in this research will help reduce the bias while researching learning approaches.

Finally, the study examined the moderator effect of gender in the model, and there was no significant effect in the overall model. The level of students' epistemological beliefs predicting their learning approaches does not differ according to gender. Chiu et al. (2016) examined the relationship between epistemological beliefs and learning approaches by reviewing the effect of gender on learning approaches, and they could not find a significant effect of gender on learning approaches. Chan (2003) and Ismail et al. (2013) examined the relationship of gender with epistemological beliefs and learning approaches separately, and they could not find a significant relationship for either variable. According to Lake and Boyd (2015), learning approaches do not differ according to gender, and according to Chen and Pajares (2010) and Tümkaya (2012), epistemological beliefs do not differ according to gender as well.

Conclusion and Recommendations

The results of the research indicate that epistemological beliefs and learning approaches are interrelated structures. Knowing the epistemological beliefs of students will be effective in predicting their approaches toward learning. University students are expected to use the deep learning approach and high-level thinking skills effectively to become experts in their fields and become lifelong learners (Asikainen et al., 2014; Biggs, 1999). They must possess developed epistemological beliefs to achieve this goal. Supporting ideas such as the fact that teachers work to develop beliefs about knowledge and the nature of knowledge, that learning depends on effort, that one can develop skills and apply different solutions to problems, and that knowledge is relative will shape students' approach to learning and make it easier for them to form meaning and make learning continuous.

Limitations

There are some limitations of this study. While determining the relationship between epistemological beliefs and learning approaches, the moderator effect of gender was examined and the effect of personality types on learning approaches was kept under control. However, other variables such as the major, class level, socio-economic characteristics may also play a role in this relationship. Apart from these, it should not be forgotten that cultural differences may also affect the relationship between epistemological beliefs and learning approaches. This study is limited to Turkish-speaking students. Comparative education studies can be used to test these differences. Lastly a purposive sample was used in this study. It should be taken into account that this will create a sampling bias.

Author Contributions

SAY and HP created the idea of the study and helped to draft the manuscript. SAY constructed the study design, carried out the survey, analyzed the data, and interpreted the statistical results. Both authors read and approved the final manuscript.

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Ethical Approval

This study was conducted based on the permission obtained from the Tokat Gaziosmanpaşa University Social and Human Sciences Research Ethics Committee dated 01/08/2021, session number 01, and decision number 01-16.

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