Tendencies of Comprehension and Acceptance of Theory of Evolution: A study involving Students from the Faculties of Education and Theology

Kadir Bilen[a], and Orhan Ercan[b]

[a]Alanya Alaaddin Keykubat University, Antalya, TURKEY; [b]Kahramanmaras Sutcu Imam University, Kahramanmaraş, TURKEY

ABSTRACT

The current study aimed to identify the views of students from the Faculty of Education and the Faculty of Theology from the University of Kahramanmaras Sutcu Imam regarding their comprehension and acceptance of the theory of evolution. A survey model was used involving a quantitative research design. The working group of the study was composed of 425 university students attending a state university in the Mediterranean Region of Turkey. Gender, faculty, department, year and political views of the teacher candidates were used as independent variables of the study. According to the findings obtained from the study, the tendency to accept evolution was higher among first year female students from the science department of the Faculty of Education compared to male students in the Faculty of Theology. This tendency was also higher among students with leftist ideas compared to students with other political views. Significant differences in various dimensions were also observed. It was found that university students' acceptance of the theory of evolution was low. This view was as expected mainly due to the students living in a Muslim country.

Introduction

The theory of evolution evoked widespread reactions in biology and in the scientific world in general with the publication of Darwin's "*Origin of Species*" in 1859. The theory of evolution is still the most discussed scientific theory of our day and it is still not understood completely. Evolution, partially supported in scientific environments, is regarded as a controversial topic in public in general (Beardsley, 2004; Bishop & Anderson, 1990; Somel et.al., 2006; Wiles, 2010).

CORRESPONDENCE Kadir Bilen ✉ kadirbilen@gmail.com

However, contrary to general belief, the idea of evolution was not surfaced by the time of Darwin. Evolution theory, supported by approximately ten different disciplines such as universal gravity theory and cell theory, is a theory proposed as a result of scientific processes (Apaydın, Çobanoğlu & Taşkın, 2006).

The theory of evolution is the most basic building block of the biological sciences and has a rather important place in biology education (Dobzhansky, 1973; NRC, 1998). So much so that, Gould (1982) believed biology education without evolution was like chemistry without periodical tables or America without Lincoln. Similarly, Bishop and Anderson (1990) maintained that modern biology could not be understood without understanding evolution. Comprehension of various subjects in biology education such as natural selection, physiology, classification and genetics depend on understanding the theory of evolution (Erkunt, 2006). Naturally, it is the duty of science teachers to effectively teach the theory of evolution in classes due to its importance in science education. In order to provide sufficient training in evolution, teachers should plan the framework of lessons well and develop a systematic approach as to how they can teach evolution. However, it is evident that there are problems in Turkey regarding the teaching of the theory of evolution. A study published in Science Magazine suggests that the U.S.A. and Turkey are two countries where the theory of evolution is least accepted (Miller, Scott & Okamoto, 2006).

Many studies in the literature show that individuals struggle to form a relationship between religion and the nature of science (Akyol et al., 2010; Alters & Nelson, 2002; Dagher & Boujaoude, 1997; Dagher & Boujaoude, 2005; Lawson, 1995; Mansour, 2011; Özyeral-Bakanay, 2008) and that this situation influences their approach to evolution (Lawson, 1995; Southerland, 2001; Özyeral-Bakanay, 2008). Results of studies on the acceptance of the theory of evolution demonstrate a negative relationship between religious belief levels and positive attitudes towards the theory of evolution (Crawford et al., 2005; Sinatra et al., 2003). The main reason for this negative relationship lies in the difference as to how the evolution theory and belief systems explain the "origin of species" (Apaydın & Sürmeli, 2009). For instance, about 20% of the German public refuses to accept the theory of evolution, the main theory of biology, based on religious reasons. The situation is similar in other European countries as well. In Turkey, a candidate country to join the European Union, more than 50% of the public rejects the theory with the percentage of individuals who adopt the evolution theory being merely 25%. Turkey is at the lowest tier among 35 countries regarding adoption of the theory of evolution (Miller et al., 2006).

Many researchers and experts have emphasized that the definition of science, philosophy of science, scientific method and the process of formation of theories and the structural differences between theories and scientific canons should be taught before beginning to teach about the theory of evolution (Akerson & Volrich, 2006; Apaydın & Sürmeli, 2006; Balkı, Coban & Aktas, 2003; Başıbüyük, 2007; Dagher & Boujaoude, 1997; Sinatra et al., 2003). Therefore, the role of teacher training programs has been emphasized in various studies and a wide range of studies have been undertaken to prepare educational programs to meet that need (Akerson, Abd-El-Khalic & Lederman, 2000; Donnelly & Boone, 2006).

Studies on teaching evolution have shown that teachers' personal beliefs, attitudes, pedagogical knowledge, misconceptions and content knowledge had impact on their students' comprehension of evolution and the nature of science

(Smith, 2010; van Dijk & Reydon, 2010). There are various studies in the literature that suggest that teachers and teacher candidates have misconceptions and negative attitudes towards the subject of evolution (Akyol et al., 2010; Özyeral-Bakanay, 2008 Asghar, Wiles & Alters, 2007; Deniz, Donelly, & Yılmaz, 2008; Graf & Soran, 2011; Kim & Nehm, 2010; Smith, 2010; Van Dijk & Reydon, 2010). Therefore, it can be argued that thoughts about the theory of evolution are shaped by many variables such as belief systems, cultural values and educational philosophies of societies. Related research shows that teachers and teacher candidates have difficulties in comprehending abut evolution and have various misconceptions regarding the topic.

According to research results regarding the acceptance of the theory of evolution, individuals with moderate religious beliefs believe that evolution can explain the origin of species other than humans; but the origin of human beings should be explained with genesis. Individuals with stronger religious beliefs think that evolutionary explanations are not valid for any species whatsoever (Crawford et al., 2005). This case points to a negative relationship between religious belief levels and formation of positive attitudes towards the theory of evolution (Sinatra, et al., 2003). The main reason behind this negative relationship is based on the differences in explaining "the origin of human beings" by the theory of evolution and by religious systems (Apaydın & Sürmeli, 2009). The view proposed by the theory of evolution that human beings and other living specieis were evolved from a common ancestor is contradictory to the explanation of Genesis in the holy books (Köse, 2010). Lawson (1995) defines scientific explanations as propositions that continually need to be supported by proofs and corrected according to proofs; however, religious judgments are the canons that are proclaimed by the Creator of human beings via the holy books and the explanations are shaped according to these canons.

Faculties of Education and Faculties of Theology are among the leading institutions that train teachers. Therefore, it is believed that the current study which examines and compares the views of teachers, who have a big role in teaching the theory of evolution from different perspectives, is very crucial and will set an example for future studies.

Method

Research Model

The study undertaken to identify the tendency of teacher candidates to comprehend and accept the theory of evolution, is a descriptive field study based on the survey model.

Working Group

The working group of the study was composed of teacher candidates from the Faculty of Education (FE) Primary School Mathematics (PM), Computer Education and Instructional Technology (CEIT), Classroom Teaching (CT), Science Teaching (ST) and Faculty of Theology (FT) Education of Religion and Ethics (ERE) departments.

Data about the demographic characteristics of the teacher candidates who participated in the study are presented in Table 1.

Table 1. Demographic Characteristics of Teacher Candidates

	Characteristic	N	%
Gender	Female	261	61,4
	Male	164	38,6
Department	PM	68	16,0
	CEIT	65	15,3
	CT	78	18,4
	ST	72	16,9
	ERE	142	33,4
Faculty	FE	283	66,6
	FT	142	33,4
Year	1	89	20,9
	2	101	23,8
	3	72	16,9
	4	163	38,4

The teacher candidates who participated in the study were from PM (N=68, 16,0%), from CEIT (N=65, 515,3%), from CT (N=78, 18,4%), from ST (N=72, 16,9%) and from ERE (N=142, 33,4%) departments. A total of 283 of the participants in the study (N=283, 66,6%) attended FE and 142 participants (N=142, 33,4%) attended FT. Of this total, 261 of the participants were females (N=261, 61,4%) and 164 were males (N=164, 38,6%). Of these participants, 89 (20,9%) in the working group attended year 1, 101 (N=101, 23,8%) attended year 2, 72 (16,9%) attended year 3 and 163 attended year 4 (38,4%). Table 2 presents students' political views based on their faculties.

Table 2. Distribution of Student Views based on Faculty

	Neo-Nationalist		Social Democrat		Nationalist-Conservative		Kemalist		Religious		Neither	
	N	%		%	N	%	N	%	N	%	N	%
FE	40	14,1	54	19,1	58	20,5	22	7,8	21	7,4	88	31,1
FT	3	2,1	5	3,5	67	47,2	23	16,2	39	27,5	5	3,5
Total	43	10,1	59	13,9	125	29,4	45	10,6	60	14,1	93	21,9

Investigation of Table 2 which presents the changes of students' political views based on their faculties shows that while 14,1% of the students (N=40) in FE defined themselves as Neo-Nationalists, 2,1% of the students (N=3) in FT defined themselves as such In total neo-nationalists formed 10,1% (N=43) of the participants. The proportion of participants who considered themselves as social democrats was 19,1% (N=54) in FE, 3,5% (N=5) in FT and 13,9% (N=59) in total. Some of the teacher candidates participating in the study defined themselves as Nationalist-Conservative. The proportion of Nationalist-Conservatives was 20,5% (N=58) in FE, 47,2% (N=67) in FT and 29,4% (N=125) in total. The proportion of students identifying themselves as Kemalists was 7,8% (N=22) in FE, 16,2 % (N=23) in FT and 10,6% (N=45) in total. The second most dominant political view was related to religious views. Teacher candidates defining themselves as religious was 27,5% (N=39) in FE, 7,4% (N=21) in FT and 14,1% (N=60) in general. The most encountered view in FE was "neither" option. The

proportion of participants who selected this option was 31,1% (N=88) in FE, 3,5% (N=5) in FT was and 21,9% (N=93) in total.

Data Collection Tool

The data collection tool consisting of two sections was used in the study to identify the views of teacher candidates regarding the theory of evolution. The first section included questions about the demographic characteristics of teacher candidates. The second section was about the "Measure of the Acceptance of the Theory of Evolution (MATE)" developed by Rutledge and Sadler (2007) and translated to Turkish by Acar (2011).

This section consisted of a five-point Likert-type scale ranging from "completely disagree" to "completely agree". The original form of the scale included 20 items and 6 six sub-dimensions. These sub-dimensions were titled Process of Evolution (PoE) (items 1, 9, 18, 19), Scientific Validity of Evolutionary Theory (SVET) (items 2, 10, 12, 13, 14, 20), Evolution of Humans (EoH) (items 3, 15), Evidence of Evolution (EoV) (items 4, 6, 8, 16); Scientific Community's View of Evolution (SCVE) (items 5, 17) and Age of the Earth (AoE) (items 7, 11). Items 1, 3, 5, 8, 11, 12, 13, 16, 18 and 20 in the scale were positive statements and items 2, 4, 6, 7, 9, 10, 14, 15, 17 and 19 were negative statements. Reverse coding was done in the case of the negative statements. The Cronbach's alpha coefficient of the original scale was 0,94 and the Cronbach's alpha coefficient of the version adapted to Turkish was found to be 0,98. The coefficient in the current study was calculated to be 0,83.

Data Analysis

Data obtained from the scale were analyzed using frequencies, percentages, arithmetic means, one-way ANOVA, independent samples t-test and regression analysis. Differences between groups were controlled with the help of Bonferonni analysis. Results obtained from analyses were interpreted and inferences were drawn. The level of significance was accepted as $p = 0,05$. Evaluation of MATE was undertaken according to the categories below.

- Participants who accepted the theory of evolution at very high levels: $\overline{X}= 4,21 - 5,00$
- Participants who accepted the theory of evolution at high levels: $\overline{X} = 3,41 - 4,20$
- Participants who were undecided about the theory of evolution: $\overline{X} = 2,61 - 3,40$
- Participants who didn't accept the theory of evolution at high levels: $\overline{X} = 1,81 - 2,60$
- Participants who didn't accept the theory of evolution at very high levels: $\overline{X} = 1,00 - 1,80$

Results

The The first research question in the study was "What is the arithmetic means of teacher candidates' critical thinking tendencies?". Analyses undertaken regarding this question are provided in Table 3.

Table 3. Teacher Candidates' MATE Means

Factors	N	$\bar{X}$	SS
PoE	425	2,76	0,68
SVET	425	2,95	0,46
EoH	425	2,77	0,83
EoV	425	2,80	0,63
SCVE	425	3,13	0,91
AoE	425	2,88	0,61
Total MATE	425	2,87	0,40

As shown in Table 3, teacher candidates stated that they were undecided ($\bar{X}$ = 2,87) about the MATE scale. Examination of data in the table shows that the lowest value was 2,76 (PoE sub-dimension) and the highest value was 3,13 (SCVE sub-dimension). According to this result, it was seen that teacher candidates were completely undecided about all the sub-dimensions of the MATE scale.

Table 4 presents the findings obtained from independent samples t-test undertaken to identify teacher views on MATE based on gender.

Table 4. MATE according to Gender

Factor	Gender	N	$\bar{X}$	SS	t	p
PoE	Male	164	2,79	0,69	0,585	0,559
	Female	261	2,75	0,67		
SVET	Male	164	2,93	0,46	-0,621	0,535
	Female	261	2,96	0,46		
EoH	Male	164	2,77	0,81	-0,013	0,990
	Female	261	2,77	0,84		
EoV	Male	164	2,80	0,66	0,186	0,853
	Female	261	2,79	0,62		
SCVE	Male	164	3,02	0,93	-1,972	0,049
	Female	261	3,20	0,90		
AoE	Male	164	2,88	0,59	-0,177	0,859
	Female	261	2,89	0,63		
Total MATE	Male	164	2,86	0,42	-0,432	0,666
	Female	261	2,88	0,39		

Examination of Table 4 shows that views of teacher candidates changed based on gender in the SCVE sub-dimension. The arithmetic means of female teacher candidates' views about this sub-dimension was found to be $\bar{X}$ = 3,20 while the arithmetic means of male teacher candidates was $\bar{X}$ = 3,02. The *p* value was examined to see whether or not this difference was significant (t(423) = -1,972 and *p* = 0,049). According to this result, compared to male teacher candidates, female teacher candidates were more positive about the SCVE sub-dimension of MATE. Significant differences were not observed in the other sub-dimensions of MATE based on gender [PoE t(423)=0,585; *p* = 0,559; SVET t(423) = -0,621; *p* = 0,535; EoH t(423) = -0,013, *p* = 0,990; EoV t(423) = 0,186; *p* = 0,853; AoE t(423) = -0,177; *p* = 0,856]. The arithmetic means of the total MATE scores of teacher candidates showed no significant differences between female and male students (t(423) = -0,432; *p* = 0,666).

Table 5. MATE according to Faculty

Factor	Faculty	N	$\bar{X}$	SS	t	p
PoE	FE	283	2,89	0,64	5,629	0,000
	FT	142	2,51	0,67		
SVET	FE	283	3,03	0,42	5,253	0,000
	FT	142	2,79	0,49		
EoH	FE	283	2,84	0,80	2,712	0,007
	FT	142	2,61	0,87		
EoV	FE	283	2,88	0,61	3,959	0,000
	FT	142	2,63	0,65		
SCVE	FE	283	3,24	0,86	3,677	0,000
	FT	142	2,90	0,98		
AoE	FE	283	2,94	0,55	2,640	0,009
	FT	142	2,77	0,71		
Total MATE	FE	283	2,96	0,37	6,921	0,000
	FT	142	2,69	0,40		

Table 5 shows differences in teacher candidates' views regarding MATE based on the type of faculty. Views of teacher candidates were found to change in all dimensions of MATE based on the type of faculty they were attached to Views related to MATE were more positive among students attending FE compared to students attending FT and the differences between the arithmetic means of these views were found to be significant [PoE $t(423)=5,629$; $p = 0,000$; SVET $t(423) = 5,523$; $p = 0,000$; EoH $t(423) = 2,712$, $p = 0,000$; EoV $t(423) = 3,959$; $p = 0,000$; AoE $t(423) = 2,640$; $p = 0,000$]. The arithmetic means of views related to the overall MATE shows that the means of teacher candidates' views attending FE was $\bar{X} = 2,96$ whereas the means of teacher candidates' views attending FT was $\bar{X} = 2,69$. This difference was statistically significant ($t(423) = 6,921$; $p = 0,000$).

Table 6 displays the change in teacher candidates' views about MATE based on the department they attended.

Examination of the first sub-dimension (PoE) in Table 6 demonstrates that a statistically significant difference existed between the department students attended and PoE ($F(4,420)=14,079$; $p=0,00$). Bonferonni analysis, undertaken to decide between which groups this difference occurred, showed that the difference occurred in favor of the 2nd group between the 1st and 2nd groups, in favor of the 3rd group between the 1st and 3rd groups, in favor of the 4th group between the 1st and 4th groups, in favor of the 2nd group between the 2nd and 5th groups, in favor of the 3rd group between the 3rd and 5th groups and in favor of the 4th group between the 4th and 5th groups. Examination of the SVET sub-dimension showed significant differences among the groups ($F(4,420)=10,904$; $p=0,000$). Differences occurred in favor of the 4th group between the 1st and 4th groups, in favor of the 2nd group between the 2nd and 5th groups, in favor of the 3rd group between the 3rd and 5th groups and in favor of the 4th group between the 4th and 5th groups. Significant differences existed between the groups in the EoH sub-dimension ($F(4,420)=4,288$; $p=0,002$). Differences occurred in favor of the 3rd group between the 3rd and 5th groups and in favor of the 4th group between the 4th and 5th groups. Differences identified for the sub-dimension EoV ($F(4,420)=8,594$; $p=0,000$) were found to be in favor of 3rd group between the 1st and 3rd groups, in favor of the 4th group between the 1st and 4th groups, in favor of the 3rd group between the 3rd and 5th

Table 6. MATE Tendencies according to Department

Factor	Department	N	X̄	SS	Source of Variance	Sum of Squares	F	p	Difference
PoE	PM	68	2,58	0,66	Between groups	22,937	14,079	0,000	1-2, 1-3, 1-4, 2-5, 3-5, 4-5
	CEIT	65	3,02	0,58					
	CT	78	2,91	0,62	In groups	171,061			
	ST	72	3,04	0,61					
	ERE	142	2,51	0,67					
SVET	PM	68	2,88	0,41	Between groups	8,375	10,904	0,000	1-4, 2-5, 3-5, 4-5
	CEIT	65	2,98	0,40					
	CT	78	3,06	0,38	In groups	80,648			
	ST	72	3,16	0,45					
	ERE	142	2,79	0,49					
EoH	PM	68	2,62	0,73	Between groups	11,495	4,288	0,002	3-5, 4-5
	CEIT	65	2,77	0,67					
	CT	78	2,98	0,78	In groups	281,460			
	ST	72	2,97	0,93					
	ERE	142	2,61	0,87					
EoV	PM	68	2,62	0,59	Between groups	12,916	8,594	0,000	1-3, 1-4, 3-5, 4-5
	CEIT	65	2,88	0,56					
	CT	78	2,97	0,51	In groups	157,806			
	ST	72	3,03	0,71					
	ERE	142	2,63	0,65					
SCVE	PM	68	3,11	0,88	Between groups	14,708	4,548	0,001	3-5, 4-5
	CEIT	65	3,13	0,81					
	CT	78	3,35	0,87	In groups	339,554			
	FBÖ	72	3,35	0,87					
	ERE	142	2,90	0,98					
AoE	PM	68	2,90	0,70	Between groups	2,855	1,915	0,107	-
	CEIT	65	2,93	0,42					
	CT	78	2,99	0,54	In groups	156,496			
	ST	72	2,93	0,52					
	ERE	142	2,77	0,71					
Total MATE	PM	68	2,77	0,34	Between groups	11,009	20,001	0,000	1-2, 1-3, 1-4, 2-5, 3-5, 4-5
	CEIT	65	2,96	0,34					
	CT	78	3,03	0,30	In groups	57,791			
	ST	72	3,09	0,42					
	ERE	142	2,69	0,40					

groups and in favor of the 4th group between the 4th and 5th groups. For the SCVE sub-dimension, significant difference ($F_{(4, 420)}=4,548$; $p=0,001$) were found to be in favor of 3rd group between the 3rd and 5th groups and in favor of 4th group between the 4th and 5th groups. While there were no significant differences in teacher views regarding the AoE sub-dimension, ($F_{(4, 420)}=1,915$; $p=0,107$); significant differences were identified regarding their views on the overall MATE scale ($F_{(4, 420)}=20,001$; $p=0,000$). This difference existed in favor of the 2nd group between the 1st and 2nd groups, in favor of the 3rd group between the 1st and 3rd groups, in favor of the 4th group between the 1st and 4th groups, in favor of the 2nd

group between the 2nd and 5th groups, in favor of the 3rd group between the 3rd and 5th groups and in favor of the 4th group between the 4th and 5th groups.

Table 7 presents the data showing how the views of teacher candidates about MATE change based on year of school attendance.

Table 7. MATE according to year

Factor	Year	N	$\bar{X}$	SS	Source of Variance	Sum of Squares	F	P	Difference
PoE	1	89	3,03	0,63	Between groups	13,955	10,877	0,000	1-2, 1-4, 3-4
	2	101	2,68	0,69					
	3	72	2,93	0,65	In groups	180,043			
	4	163	2,59	0,65					
SVET	1	89	3,06	0,45	Between groups	3,852	6,346	0,000	1-4, 2-4, 3-4
	2	101	2,99	0,48					
	3	72	3,00	0,46	In groups	85,172			
	4	163	2,83	0,42					
EoH	1	89	3,04	0,83	Between groups	10,353	5,141	0,002	
	2	101	2,78	0,88					
	3	72	2,74	0,67	In groups	282,602			1-4
	4	163	2,62	0,84					
EoV	1	89	3,01	0,72	Between groups	9,806	8,551	0,000	1-4, 2-4
	2	101	2,88	0,53					
	3	72	2,81	0,59	In groups	160,917			
	4	163	2,62	0,62					
SCVE	1	89	3,22	0,96	Between groups	11,538	4,725	0,003	2-4
	2	101	3,31	0,92					
	3	72	3,23	0,84	In groups	342,723			
	4	163	2,92	0,88					
AoE	1	89	2,92	0,58	Between groups	0,509	0,450	0,717	-
	2	101	2,86	0,54					
	3	72	2,94	0,60	In groups	158,841			
	4	163	2,86	0,68					
Total MATE	1	89	3,04	0,42	Between groups	6,333	14,228	0,000	1-4, 2-4, 3-4
	2	101	2,91	0,38					
	3	72	2,94	0,34	In groups	62,467			
	4	163	2,73	0,38					

Table 7 demonstrates significant differences in the teacher candidates' PoE ($F_{(3,421)}=10,877$; $p=0,000$), SVET ($F_{(3,421)}=6,346$; $p=0,000$), EoH ($F_{(3,421)}=5,141$; $p=0,002$), EoV ($F_{(3,421)}=8,551$; $p=0,000$), SCVE ($F_{(3,421)}=4,725$; $p=0,003$) and total MATE ($F_{(3,421)}=14,228$; $p=0,000$) scores based on class level but no significant differences in the AoE [$F_{(3,421)}=0,450$; $p=0,717$] sub-dimension. Bonferonni analysis, undertaken to decide between which groups this difference occurred, showed that the differences existed in favor of the 1st group between the 1st and 2nd groups; in favor of the 1st group between the 1st and 4th groups and in favor of the 3rd group the between 3rd and 4th groups in the PoE sub-dimension; in favor of the 1st group between the 1st and 4th groups, in favor of the 2nd group between the 2nd and 4th groups and in favor of the 3rd groups between 3rd and 4th groups in SVET sub dimension; in favor of the 1st group between the 1st and 4th groups in the EoH sub-dimension; in favor of the 1st group between the 1st and 4th groups and in favor of the 2nd group between the 2nd and 4th groups in the EoV

sub-dimension and in favor of the 2nd group between the 2nd and 4th groups in the SCVE sub-dimension. Regarding the overall MATE, the difference was found in favor of the 1st group between the 1st and 4th groups; in favor of the 2nd group between the 2nd and 4th groups and in favor of the 3rd group between the 3rd and 4th groups.

Table 8 provides the data related to how the views of the teacher candidates about MATE changed based on their political views.

Table 8 demonstrates that teacher candidates' PoE $(F_{(5,419)}=4,441;$ p=0,001), SVET $(F_{(5,419)}=2,972;$ p=0,012), EoV $(F_{(5,419)}=2,851;$ p=0,015), SCVE $(F_{(5,419)}=4,008;$ p=0,001) and overall scores MATE $(F_{(5,419)}=5,984;$ p=0,000) present significant differences in their definitions according to their political views but no statistically significant differences were observed in the EoH $(F_{(5,419)}=2,168;$ p=0,057) and AoE $(F_{(5,419)}=1,766;$ p=0,119) sub-dimensions. Bonferonni analysis, undertaken to decide between which groups this difference occurred, showed that the difference existed in favor of the 2nd group between the 2nd and 3rd groups; in favor of the 2nd group between the 2nd and 5th groups and in favor of the 2nd group between the 2nd and 6th groups in the PoE sub dimension; in favor of 1st group between the 1st and 5th groups; in favor of 2nd group between the 2nd and 5th groups and in favor of 6th group between the 5th and 6th groups in the SVET sub dimension; in favor of the 6th group between the 3rd and 6th groups in the EoH sub dimension and in favor of the 2nd group between the 2nd and 5th groups and in favor of 2nd group between the 2nd and 6th groups in the EoV sub dimension and in favor of the 2nd group between the 2nd and 3rd groups and in favor of the 6th group between the 3rd and 6th groups in the SCVE. In terms of overall MATE, differences were found in favor of the 1st group between the 1st and 3rd groups, in favor of the 2nd group between the 2nd and 3rd groups, in favor of the 2nd group between the 2nd and 5th groups and in favor of the 6th group between the 3rd and 6th groups. (Please change all p values to *p,* sub dimension to sub-dimension).

Discussion and Conclusion

The current study aimed to determine whether or not there were differences between students from the faculty of education and the faculty of theology regarding their comprehension and acceptance of the evolution theory based on several variables.

According to the research findings (Table 4), there were no significant differences in general regarding the Acceptance of the Theory of Evolution in terms of the teacher candidates' gender (p>,05); but views of the teacher candidates were found to change according to gender only in the SCVE sub-dimension (p<,05). Parallel findings exist in the literature. For instance, Lord and Marino's (1993) study demonstrated that gender was not important in university students' attitudes towards the theory of evolution. In their study, Apaydın and Sürmeli (2009) established that gender of university students did not create significant differences in their attitudes towards the theory of evolution.

However, some studies mentioned that the proportion of acceptance of the theory of evolution by female students was higher than that of male students (Peker, Cömert & Kence, 2010; Gross & Simpson, 1982; Tolon, 2008). In some other studies, female students were found to approach the teaching of the theory of evolution more moderately but it was emphasized that they believed that the Genesis approach should also be taught in addition to the theory of evolution (Czerniak & Chiarelott, 1984; Kahle, 1983; Schibeci & Riley, 1986).

Table 8. MATE according to Political View

Factor	View	N	X̄	SS	Source	Sum	F	P	Difference
PoE	Neo-Social	43	2,94	0,53	Between	9,764	4,441	0,001	2-
	Social	59	3,03	0,62					
	Nationalist-	125	2,61	0,70					
	Kemalist	45	2,66	0,65	In	184,234			
	Religious	93	2,65	0,76					
	Neither	60	2,83	0,63					
SVET	Neo-Social	43	3,05	0,33	Between	3,049	2,972	0,012	1-
	Social	59	3,07	0,38					
	Nationalist-	125	2,87	0,47					
	Kemalist	45	2,96	0,38	In	85,974			
	Religious	93	2,83	0,57					
	Neither	60	3,00	0,47					
EoH	Neo-Social	43	2,76	0,65	Between	7,389	2,168	0,057	3-
	Social	59	2,81	0,79					
	Nationalist-	125	2,59	0,78					
	Kemalist	45	2,76	0,77	In	285,566			
	Religious	93	2,80	0,98					
	Neither	60	2,96	0,90					
EoV	Neo-Social	43	2,93	0,61	Between	5,617	2,851	0,015	2-
	Social	59	3,03	0,57					
	Nationalist-	125	2,75	0,65					
	Kemalist	45	2,82	0,64	In	165,106			
	Religious	93	2,70	0,65					
	Neither	60	2,70	0,62					

Table 8. MATE according to Political View (Continued)

Factor	View	N	X̄	SS	Source of Variance	Sum of Squares	F	P	Difference
SCVE	Neo-Nationalist	43	3,16	0,85	Between groups	14,170	4,008	0,001	2-3, 3-6
	Social Democrat	59	3,42	0,70					
	Nationalist-Conservative	125	2,87	0,97					
	Kemalist	45	3,29	0,82	In groups	338,091			
	Religious	93	3,04	1,03					
	Neither	60	3,25	0,88					
AoE	Neo-Nationalist	43	2,98	0,76	Between groups	3,289	1,766	0,119	-
	Social Democrat	59	2,97	0,62					
	Nationalist-Conservative	125	2,79	0,60					
	Kemalist	45	2,78	0,59	In groups	156,061			
	Religious	93	2,86	0,69					
	Neither	60	2,98	0,49					
Total MATE	Neo-Nationalist	43	2,98	0,31	Between groups	4,585	5,984	0,000	1-3, 2-3, 2-5, 3-6
	Social Democrat	59	3,05	0,33					
	Nationalist-Conservative	125	2,76	0,42					
	Kemalist	45	2,86	0,31	In groups	64,215			
	Religious	93	2,79	0,48					
	Neither	60	2,92	0,39					

The findings in Table 5 demonstrate that university students' tendency to comprehend and accept the theory of evolution did not show a significant difference in all the sub-dimensions based on the faculty that they attended ($p < .05$). This result may be interpreted that students in the faculty of education have a more moderate view of the theory whereas students in the faculty of theology were found to have stricter views. It has been emphasized in many studies that religion is the most important factor in accepting the theory of evolution (Crawford et al., 2005; Lawson, 1995). Sinatra, et al., (2003) indicating

a negative relationship between religious belief levels and positive attitudes towards the theory of evolution. The main reason for this negative relationship is related to the way the theory of evolution and belief systems explain "the origin of human beings" differently (Apaydın & Sürmeli, 2009).

Other than the Age of the Earth (AoE) dimension, university students' tendency to comprehend and accept the theory of evolution showed significant differences in all the sub-dimensions according to the department they attended ($p<$,05). Table 6 demonstrates that students in the faculty of education had the highest average. This was an expected result since the theory of evolution is closely related to various topics in biology classes such as natural selection, physiology classification and genetics (Erkunt, 2006).

Relationship between university students' tendency to comprehend and accept the theory of evolution and their seniority at school (Table 7) indicated that first year students had higher means compared to other students. As a matter of fact, Somel (2007) stated that novice teachers had lower rates of support for the theory of evolution compared to more senior teachers. In their study Annaç and Bahçekapılı (2012) also showed that freshmen had more positive attitudes compared to other students.

The relationship between university students' tendency to comprehend and accept the theory of evolution and their political views (Table 8) demonstrated that other than the Age of the Earth (AoE) dimension, university students' tendency to comprehend and accept the theory of evolution showed significant differences in all the sub-dimensions based on their political views ($p<$,05). This difference mostly occurred in favor of students with left wing ideas over students with other political views. This result is not surprising considering the fact that the factor of religion underlies political views. Annaç and Bahçekapılı (2012) also identified that students with left wing ideas have more positive views towards the theory of evolution. Miller et al. (2006) also stated that political view is an important factor in accepting the theory of evolution.

Recommendations for further studies

Based on these results similar studies can be undertaken by including students from other faculties besides students from the faculties of education and theology. Similar studies can be undertaken with university students throughout Turkey or in various regions of Turkey. In addition variables such as studying biology, history of science, philosophy of science can be added to the variables used in the current study and the effect of these variables on student views can be examined. In addition to these, factors that affect the acceptance of the theory of evolution can be examined in more depth by utilizing qualitative research techniques.

Disclosure statement

No potential conflict of interest was reported by the authors.

Notes on contributors

Kadir Bilen holds a PhD in science education and now is an associate professor at Alanya Alaattin Keykubat University, Antalya, Turkey.

Orhan Ercan holds a PhD in science education and now is is an associate professor at Kahramanmaras University, Kahramanmaras, Turkey.

References

Abuhmaid, Akerson, V. L., Abd-El-Khalick, F., & Lederman, N.G. (2000). Influence of a reflective Explicit Activity-Based Approach on Elementary Teachers' Conceptions of Nature of Science. *Journal of Research in Science Teaching, 37*(4), 395-317.

Akerson, V. L., & Volrich, M. L. (2006). Teaching nature of science explicity in a first-grade internship setting. *Journal of Research Science Teaching, 43*(4), 377-394.

Alters, B., ve Nelson, C. E. (2002). Perspective: teaching evolution in higher education. *Evolution, 56(10)*, 1891-1901.

Annac, E. & Bahcekapili, H.G.(2012). Understanding and acceptance of evolutionary theory among turkish university students, *Dogus University Journal, 13*(1) ,1-11.

Apaydın, Z., Çobanoğlu, E.O., ve Taşkın, Ö.(2006). Evrim öğretimi için model önerisi: soyağacı, hat modeli ve el modeli oluşturma, *19 Mayıs Üniversitesi Eğitim Fakültesi Dergisi, 22*, 95-108.

Apaydin, Z. & Surmeli, H. (2009). undergraduate students' attitudes towards the theory of evolution. *Elementary Education Online, 8*(3), 820-842.

Asghar, A., Wiles, J., & Alters, B. (2007). Discovering international perspectives on biological evolution across religions and cultures. *International Journal of Diversity in Organizations, Communities, and Nations*, 6, 81–88.

Balkı, N., Çoban, A. K., ve Aktas, M. (2003). İlköğretim öğrencilerinin bilim ve bilim insanına yönelik düşünceleri. *Uludağ Üniversitesi Eğitim Fakültesi Dergisi, 16*(1), 11-17.

Başıbüyük, H. (2007). Lisans ve lisansüstü öğretiminde evrim eğitimi nasıl olmalıdır? *Biyoloji Eğitiminde Evrim*. 3-4 Mayıs 2007. Malatya: İnönü Üniversitesi, 179-198.

Beardsley, P. M. (2004). Middle school student learning in evolution: Are current standards achievable? *The American Biology Teacher*, 66, 604–612.

Bishop, B. A. & Anderson, C.W. (1990). Student conceptions of natural selection and its role in evolution. *Journal of Research in Science Teaching, 27*, 415-427.

Crawford, B. A., Zembal-Saul, C., Munford, D., & Friedrichsen, P. (2005). Confronting prospective teachers' ideas of evolution and scientific inquiry using tecnology and inquiry-based tasks. *Journal of Research in Science Teaching, 42* (6), 613-637.

Dagher, Z. R., & Boujaoude, S. (1997). Scientific views and religious beliefs of college students: The Case of Biological Evolution. *Journal of Research in Science Teaching, 34*, 429-445.

Dagher, Z. R., Brickhouse, N., Shipman, H., & Letts, W. (2004). How some college students represent their understanding of scientific theories. *International Journal of Science Education, 26*, 735-755.

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

Deniz, H., Donnelly, L., & Yilmaz, I. (2008). Exploring the factors related to acceptance of evolutionary theory among Turkish preservice biology teachers: Toward a more informative conceptual ecology for biological evolution. *Journal of Research in Science Teaching*, 45, 420-443.

Dobzhansky, T. (1973). Nothing in biology makes sense except in the light of evolution. *The American Biology Teacher. 35*: 125-129.

Donnelly, L.A., & Boone, W.J. (2005). biology teachers' attitudes toward and use of indiana's evolution standards. *Journal of Research in Science Teaching, 44* (2), 236-257.

Erkunt, H. (2006). Evrim teorisini anlamazsak ne olur? *Evrim, Bilim ve Eğitim*. 27 Mayıs 2006. İstanbul: Nazım Kitaplığı. 193-200.

Gould, S.J. (1982). Darwinism and the expansion of evolutionary theory. *Science, 216*, 380-387.

Gould, S.J. (2005). *Darwin ve sonrası. doğa tarihi üzerine düşünceler*. (Çeviren, Temürcü Ceyhan). Ankara: Tübitak Popüler Bilim Kitaplığı.

Gross, E., & Simpson, R.D. (1982).Attitudes of introductory college biology students toward evolution. *J Res Sci Teach, 19,*15-24.

Graf, D., & Soran, H. (2011). *Evolutionstheorie-Akzeptanz und Vermittlung im europäischen Vergleich. Einstellung und Wissen von Lehramtstudierenden zur Evolution-ein Vergleich*

zwischen Deutschland und der Türkei. In Graf, D. (Ed.), Tagungsband Einstellung und Wissen zu Evolution und Wissenschaft in Europa (p. 141-161). Heidelberg: Springer.

Kahle, J.B. (1983). *The disadvanteged majority: Science education for women.* ERIC Document Reproduction Service No. ED 242 561.

Kim, S.Y., & Nehm, R. H. (2010). A cross-cultural comparison of Korean and American science teachers' views of evolution and the nature of science. *International Journal of Science Education*, 33 (2), 197-227.

Lawson, A.E., & Worsnop, W.A. (1992). Learning about evolution and rejecting a belief special creation: Effects of reflective reasoning skill, prior knowledge, prior belief and religious commitment. *Journal of Research in Science Teaching, 29* (2), 143-166.

Lawson, A. E. (1995). Science teaching of the Development thinking. *Belmont,CA: Wadsworth Publish Company.*

Lord, T., & Marino, S. (1993). How university students view the theory of evolution. *Journal of College Science Teaching, 22,*353–357.

Miller, J.D., Scott, E.J., & Okamoto, S. (2006). Science communication: public acceptance of evolution. *Science, 313,*(5788), 765-766.

National Research Council, (1996). *the national science education standarts.* Washington D.C: National Academy Press.

National Research Council, (1998). *teaching about evolution and the nature of science.* Washington, DC: National Academy Press.

Peker, D., Comert, G.G., & Kence, A. (2010). Three decades of anti-evolution campaign and its results: turkish undergraduates' acceptance and understanding of the biological evolution theory. *Science & Education, 19,*739-755.

Rutledge, M.L., & Sadler, K.C. (2007). Reliability of the measure of acceptance of the theory of Evolution (MATE) instrument with university students. *The American Biology Teacher, 69* (6), 332-335.

Schibeci, R.A., & Riley, J.P. (1986). Influence of students' background and perceptions on science attitudes and achievement. *Journal of Research in Science Teaching, 23*, 177-187.

Sinatra, G.M., Southerland, S.A., McConaughy, F., & Demastes, J.W. (2003). Intentions and beliefs in student's understanding and acceptance of biological evolution. *Journal of Research in Science Teaching, 40*, 510-528.

Smith, M.U. (2010). Current status of research in teaching and learning evolution: II. Pedagogical issues. *Science & Education*, 19, 539–571.

Somel, N. (2007). Türkiye'de Biyolojik evrim eğitiminin sosyolojik bir değerlendirmesi. *Biyoloji Eğitiminde Evrim*. 3-4 Mayıs 2007. Malatya: İnönü Üniversitesi, 199-213.

Somel, N., Somel, M. Tan, M., ve Kence, A. (2006). Türkiye'de evrim kuramı öğretimi üzerine tartışma ve öğretmenler. *CBT, 20* (1018): 20-21.

Southerland, S.A., Abrams, E., Cummis, C. L., & Anselmo, J. (2001). Understanding students' explanations of biological phenonema: Conceptual frameworks or P-Prims. *Science Education, 85*, 328-348.

Tolon, M., Kurt, S., Simge & Guner, G.(2008). *Public acceptance of evolution on a university campus in Turkey. Int History Philos Sci Teach Group Newsl.* Retrieved from http://ihpst.arts.unsweduwau//newsletters.html. Erişim Tarihi: 20 Kasım 2008.

Van Dijk, E.M., & Reydon, T.A.C. (2010). A conceptual analysis of evolutionary theory for teacher education. *Science and Education*, 19, 655-677.