



FUTURE OF EVOLUTION EDUCATION IN TURKEY: DOES ACADEMIC STAFF IN BIOLOGICAL SCIENCES ACCEPT EVOLUTION?

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Abstract:

The recent studies conducted in Turkey show that the theory of evolution still has not been accepted by the vast majority although the positive progress in science. Despite all the scientific studies on evolutionary education, evolution education has not been improved progressively over the time. It is the responsibility of the academic staff in biological sciences to teach the theory of evolution in the class effectively, and additionally the academic staff trains both today's students and the teachers of the future. Therefore, the views of academic staff in biological sciences will affect the next generation and the future teachers' perception of the evolution. This study uses embedded design of mixed methods of research design that includes qualitative and quantitative approaches in order to analyze the ratio of the acceptance of the evolution theory by the academic staff in biological sciences. 245 academic staff answered an online questionnaire form. Considering the results, the academic staff in biological sciences should be the last ones who have doubts about accepting evolution, but the findings reveal that almost half of the academic staff in biological sciences does not have an absolute attitude towards the evolution theory. Their rejection of evolution strongly correlated with their religious beliefs. The future of evolution education in Turkey is not a positive one.

Keywords: academic staff; biology education; biological evolution

1. Introduction

Evolution is the central and unifying theme of the discipline of biology (National Academy of Sciences, 1999). It has broad explanatory power on the investigation of

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biological questions, and serves as an underlying framework for this discipline. Therefore, scientific and educational organizations have called for an instruction in evolution to be commensurate with its station in biology (Rutledge & Mitchell, 2002). Generally, biology teachers avoid teaching about evolution because they know relatively little about the subject, or they are creationists or are afraid of reprisals from parents or the administrators (Köse, 2010). As a result, many students graduate from the biological sciences without comprehending evolution, one of the most powerful ideas in the field of science. The fact that many of these graduates will be teachers in the future makes the problem even worse. Their poor understandings of biology, combined with state-imposed doubts about the validity of evolution, are powerful incentives for these and other teachers to discredit, ignore, or do a poor job of teaching evolution (Moore, 2000).

A study published in the *Science Journal* reveals that the United States and Turkey are the two foremost countries where the theory of evolution is the least welcomed (Miller, Scott & Okamoto, 2006). Especially, the studies held in Turkey in recent years show that the theory of evolution hasn't been accepted by the vast majority. While inspecting some of these studies, it can be seen that in accordance with the study of Özyeral Bakanay (2008) that was conducted with 125 biology teachers, the evolution theory is recognized on a very low level. Apaydın and Sürmeli's (2009) study that was conducted with 849 science, math, primary school, pre-school, social studies and biology teacher candidates indicate that the acceptance rate of the evolution theory is remarkably low. In the study of İrez and Özyeral Bakanay (2011), only twenty percent of the 75 biology teacher candidates accepted the evolution as a theory that is supported by clear evidence. Kahyaoğlu's research in 2013 found that 236 science and primary school student-teachers had a low attitude toward evolution. Kozalak and Ateş (2014) indicated that 88 freshman student-teachers in biology, physics and science education had a low acceptance to the theory of evolution. Köse (2010) also found that in 250 high school students and in 38 biology teachers; only 26,8% and 21,1% accepted the theory of evolution. In Taşkın's (2013) study, within the 93 science studies teacher candidates, only 27% accepted the evolution theory.

All these studies clearly indicate that the evolution theory is still not a theory that is widely accepted in Turkey. Unfortunately, there hasn't been much more progress at all even though the studies and analysis held on the individuals about how to teach evolution theory effectively based on the data from those analyses, and about why people do not accept the evolution theory so far. It is a wonder to see what is going on next. One may ask whether all these studies will have a positive impact and make a change on the evolution perception of the people. In order to understand this, a close look to the teachers that are going to train the future generation should be examined. Various studies indicate that belief and attitudes of the teachers affect their instructional decisions on a subject (Carlesen 1991; Deniz, Donnelly & Yilmaz, 2008; Grossman 1989; Hashweh 1987; Lester 2007; Moore, 2007; Shulman 1986; Wilson, Shulman & Richert 1987). Whether a biology teacher is accepting the evolution theory as a scientific and valid explanation, also affects where the evolution theory will be located in the class.

Some studies indicate that information structure of the students parallels their teacher regarding a subject (Bates, 1976; Diekhoff, 1983).

No doubt, teachers are the ones who will ensure the theory of evolution to be taught correctly and change the misconceptions of students with valid information. It is the responsibility of the academic staff in biological sciences to teach the theory of evolution in the class effectively. They are not only guiding the next generation, but also guiding the future teachers. Therefore, the views of academic staff in biological sciences will affect the next generation and future teacher's correct understanding of evolution, and the correction of their misconceptions as well as their views about the evolution theory in general (Rutledge & Mitchell 2002).

This study is important for the continued development of the future path of evolution education in Turkey. There is much on-going research about evolution education, and most of this research is composed of sample lecture plans. A great number of this research consists of exemplary lecture plans regarding the evolution education (Luttikhuizen, 2018; Stomberg, Walder and Darner, 2018; Zurita, 2017). While a good lecture plan for class is important to transfer this information to the students, in the education system, it is also vitally important to what degree the teacher is accepting of the evolution theory. However, despite the remarkable lecture plan, if the teacher does not accept the evolution theory, it is certain that the teacher will not correctly transfer the theory to his/her students.

1.1 Aim

Since it is the responsibility of the academic staff of the biological sciences to teach the theory of evolution effectively to the next generation and future teachers, the main purpose of this research is to analyse their acceptance level towards the theory of evolution. Therefore, knowing the teachers approach to evolution is equal to knowing the future of evolution education. For this reason, this study is important to determine the future of the evolution education and take the necessary precautions beforehand correctly.

2. Methods

2.1 Research Design

This study uses embedded design of mixed methods research design that includes qualitative and quantitative approaches in order to analyze the ratio of acceptance of the evolution theory by the academic staff of the biological sciences. The purpose of the embedded design is to collect quantitative and qualitative data simultaneously, or sequentially, but to have one form of data play a supportive role to the other form of data (Creswell, 2008).

2.2 Sample

The population of this study is within all academic staff of the various biological sciences of the all universities in Turkey. In this study, it has been aimed to reach the

entire population via e-mail. Web pages of all universities have been checked, and a total of 1,725 e-mail addresses were collected and a questionnaire form was sent all of them. 101 of the e-mails returned back because e-mail addresses of the individuals that had been submitted were either full or there was error arising from the servers at the universities. 245 academic staff answered the questionnaire (response rate=15.09%). According to literature, data obtained from sampling is reviewed for its representative value of the entire area of study. The difference between the instantly answered questionnaires and the questionnaires that were answered after the reminder e-mail were compared (Modi & Mabert, 2007). Based on results, there was no statistically significant differences between groups that instantly answered and those that answered after the reminder e-mail. With this result, it can be said that the sampling may represent the entire population. Academic title and study fields of the 245 participants are shown in Table 1 and Table 2.

Table 1: Academic title of the participants

Academic Title	Frequency	Rate
Professor	66	26,9
Associate Professor	61	24,9
Assistant Professor	46	18,8
Research Assistant	72	29,4
Total	245	100,0

Table 2: Study fields of the participants

Study fields	Frequency	Rate
Biology Education	20	8,2
Botany	38	15,5
Ecology and Environmental Biology	20	8,2
General Biology	28	11,4
Hydrobiology	15	6,1
Microbiology	17	6,9
Molecular Biology and Genetics	42	17,1
Zoology	48	19,6
Others	17	6,9
Total	245	100,0

2.3 Data Gathering Tool

An online questionnaire which has 7 items with multiple choice were used by the researchers considering the relevant literature on the subject (Table 3). 3 experts from biological sciences checked out the questionnaire for its validity and reliability and they all agreed to use the questionnaire form as it. The forms submitted to academic staff via e-mail. In order to increase the response rate and to ensure staff is getting the mentioned email, one a week after first submission a reminder e-mail was being submitted. Therefore, the data was collected between the dates of May 14th –June 14th 2015.

Table 3: Questionnaire form

Item Number	Items
I-1	Is evolution supported by evidence, a scientifically valid and generally accepted theory?
I-2	Do you accept that humans, chimpanzees, bonobos, gorillas and orangutans evolved from a common ancestor?
I-3	Do you think that the theory of evolution conflicts with your religious beliefs?
I-4	Do you think that evolution is driven by people with a certain world view?
I-5	Can biology be taught without any mention the theory of evolution?
I-6	Do you hesitate to share your thoughts about evolution with people around you?
I-7	Do you see yourself qualified enough to give evolution course at undergraduate level?

2.4 Data Analysis

While analysing the responses of the academic staff, rate and frequency distribution were used. Chi square statistics method was used to analyze the relationship between variables. For each Chi square test, if less than 20% of the cells have an expected frequency of less than 5 then Pearson chi square test has been used and if more than 20% of the cells have an expected frequency of less than 5, then Fisher's Exact Test has been used (Mehta & Patel 1983).

3. Results

Responses to the questionnaire forms that are being given by the academic staff are stated in the Table 4.

Table 4: Frequency and rate of the responses given to the questionnaire form

Items	Yes		No		Partly yes		Sometimes		Undecided	
	f	%	f	%	f	%	f	%	f	%
I-1	133	54.29	40	16.33	72	29.39	-	-	-	-
I-2	135	55.10	100	40.82	-	-	-	-	10	4.08
I-3	59	24.08	138	56.33	37	15.10	-	-	11	4.49
I-4	103	42.04	119	48.57	-	-	-	-	23	9.39
I-5	47	19.18	189	77.14	-	-	-	-	9	3.67
I-6	11	4.49	195	79.59	-	-	39	15.92	-	-
I-7	142	57.96	80	32.65	-	-	-	-	23	9.39

N=245

As it is seen from the Table 4 54.29% of the participants accept the evolution theory as a theory that is supported by evidences, a scientifically valid and generally accepted. Also, 55,10% of the participants accept that humankind, chimpanzee, bonobo, gorilla and orangutan have evolved from a common ancestor. However, 56,33% of the participants don't think that the evolution theory contradicts with their religious beliefs. It can be foreseen that 42,02% of the participants are thinking that the evolution theory is being managed by a group that have a certain world view. A great number of 77,14% of the participants think that without evolution theory, biology cannot be taught. 79,59% of the participants think that they are not abstaining from sharing their thoughts

about the evolution theory with the other people around them and 57,96% of the participants consider themselves to have sufficient knowledge in order to lecture about the evolution theory on the undergraduate level.

The statistical relationship at 0.05 confidence levels between I-1 and the other six items were shown in Table 5.

Table 5: The statistical relationship between I-1 and the other six items

Items	I-1 (N=245)			Chi-Square	df	p	
	Yes	No	Partly yes				
I-2	Yes	120	0	15	181.123 ^b	-	0.000
	No	10	40	50			
	Undecided	3	0	7			
I-3	Yes	15	34	10	131.829 ^a	6	0.000
	No	103	3	32			
	Partly yes	9	3	25			
	Undecided	6	0	5			
I-4	Yes	21	38	44	113.420 ^a	4	0.000
	No	102	2	15			
	Undecided	10	0	13			
I-5	Yes	5	30	12	92.568 ^b	-	0.000
	No	126	9	54			
	Undecided	2	1	6			
I-6	Yes	6	2	3	6.854 ^b	-	0.127
	No	109	35	51			
	Sometimes	18	3	18			
I-7	Yes	87	25	30	12.348 ^a	4	0.015
	No	36	13	31			
	Undecided	10	2	11			

a=Pearson Chi-Square

b=Fisher's Exact Test

Between I-1 and I-2 there is a statistically significant difference. The 90,23% of the participants whom also said yes to the question of 'Is the evolution theory supported by the proofs and well accepted by scientifically?' they also accept humans, chimpanzees, bonobos, gorillas and orangutans evolved from a common ancestor. 69,44% of the participants that partially accept the theory also refuse the common ancestor. And 100% of the participants who refuse evolution theory also refuse humans, chimpanzees, bonobos, gorillas and orangutans evolved from a common ancestor.

There is a statistically significant difference between I-1 and I-3. 85% of the participants who refuse the evolution theory also state that the evolution theory contradicts with their religious beliefs, too.

There is a statistically significant difference between I-1 and I-4. 95% of the participants that refuse the evolution theory also state that the evolution theory is driven by people with a certain world view.

Between the items I-1 and I-5 there is also a statistically significant difference. It can be seen that the participants that accept the evolution theory are defending the

biology cannot be taught without teaching the evolution theory in a greater number than the participants that refuse the evolution theory. 75% of the participants that refuse the evolution theory also state that biology can be taught without mentioning the evolution theory.

There is no statistically significant difference between I-1 and I-6. Between the items I-1 and I-7 there is also a statistically significant difference. 65,41% of the participants who accept the evolution theory feel qualified enough to give evolution course at undergraduate level and 62,50% of the participants that refuse the evolution theory feel qualified enough to give evolution course.

Aside from comparison of the first item of the questionnaire that have mentioned above, when other items and demographical data have been compared, only statistically significant differences that have been found between items are shown in the Table 6, Table 7 and Table 8.

Between the items I-2 and I-3, whether there is any statistically significant differences or not can be seen in Table 6.

Table 6: The statistical relationship between I-2 and I-3

		I-2 (N=245)			Chi-Square	df	p
		Yes	No	Undecided			
I-3	Yes	14	44	1	85.504 ^a	-	0.000
	No	108	25	5			
	Partly yes	7	3	2			
	Undecided	6	28	2			

a=Fisher's Exact Test

There is a statistically significant difference between the items I-2 ile I-3. The participants who refuse common ancestor, state that the evolution theory is contradicting with their religious beliefs. The percentage for these participants is 44%, whereas 10.37% for the participants who accept common ancestor.

Whether there are any statistically significant differences between the academic title of the participants and I-1 or not can be seen in the Table 7.

Table 7: The statistical relationship between academic title and I-1

		I-1 (N=245)			Chi-Square	df	p
		Yes	No	Partly yes			
Academic title	Professor	38	17	11	12.979 ^a	6	0.043
	Associate professor	36	9	16			
	Assistant professor	22	6	18			
	Research assistant	37	8	27			

a=Pearson Chi-Square

There is also a statistically significant difference between academic title of the participants and I-1. As the academic title of the participants get higher, then the acceptance of the evolution theory also increases. Professors that have accepted the

evolution theory are at 57,38%, associate professors are at 59,02%, assistant professors are at 47,83% and research assistants are at 51,39%.

There is also a statistically significant difference between academic title of the participants and I-7 (Table 8). As the academic title of the participants get higher, participants start feel qualified enough to give evolution course at undergraduate level. Professors that feel themselves qualified are at 77,27%, associate professors are at 60,66%, assistant professors are at 54,35% and research assistants are at 40,28%.

Table 8: The statistical relationship between academic title and I-7

		I-7 (N=245)			Chi-Square	df	p
		Yes	No	Undecided			
Academic title	Professor	51	12	3	19.883 ^a	6	0.003
	Associate professor	37	19	5			
	Assistant professor	25	16	5			
	Research assistant	29	33	10			

a=Pearson Chi-Square

There are not any statistically significant differences between other variables.

4. Discussion

Only 54,29% of the academic staff of the biological sciences of universities accept the evolution theory as a theory that is supported by evidences, a scientifically valid and generally accepted. 85% of the participants who refuse the evolution theory as a theory that is supported by evidences, scientifically valid and generally accepted also state that the evolution theory contradicts with their religious beliefs. This information shows that religious beliefs are the most essential reason behind the acceptance of the evolution theory. Again, participants that partially disagree that the evolution theory is a theory that is supported by evidences, a scientifically valid and generally accepted, also state the contradiction in the religious beliefs. Therefore, the power of the religious beliefs on the acceptance of the evolution theory can be clearly seen here. Then again, the participants that refuses the evolution theory as a theory that is supported by evidences, scientifically valid and generally accepted state the conflict on the religious beliefs partially or in whole. This demonstrates that the religious beliefs are affecting the acceptance of the theory. There are various studies that show religious issues are one of the reasons rejecting the theory of evolution (Downie, and Barron, 2000; Findley, Lindsey and Watts, 2001; Gould, 2005; Özyeral-Bakanay, 2008)

Another finding of the research is 100% of the participants that refuse the evolution theory and 69,4% of the participants that accept the evolution theory are also not accepting that humans, chimpanzees, bonobos, gorillas and orangutans evolved from a common ancestor. Also 53% of the participants that refuse the common ancestor also state that this statement contradicts with their religious beliefs clearly states the powerful effect of the religious beliefs, especially Muslim religion regarding the thought of creator that creates each species separately. According to Derayeh and Turgay (2009)

some Muslim teachers did not want to commit to any position regarding evolution or harmonize it with their religious beliefs about creation.

Another finding of this study is that the 61,1% of the participants who refuse that humans, chimpanzees, bonobos, gorillas and orangutans evolved from a common ancestor also think that the evolution theory is being managed by a group that have a certain world view. This point attracts attention since Turkey is mostly a Muslim country and citizens of Turkey mainly thinks that the evolution theory is been supported by individuals without any religion. For this reason, people that are accepting the evolution theory often thought of as people without any religion. Therefore, evolution is leading people in order to put people off the religion on purpose by the individuals without any religion.

75% of the participants that refuse the evolution theory a theory that is supported by evidences, scientifically valid and generally accepted theory are defending that the biology can be taught without even mentioning the evolution theory; this can be accepted as a result with the context of the contradiction of the evolution with the religious beliefs. Individuals who are thinking evolution contradicts with their religious beliefs and thinking evolution is managed by the people without any religion naturally lead them to exclude evolution in their lectures.

57,96% of the participants see themselves as qualified enough to give evolution course at undergraduate level. The reason why academic title of the participants get higher people are thinking themselves as more capable to give lectures is that the evolution is a sub-science branch of the biology and in order to get a better comprehension and an extensive knowledge regarding the biology is required. The reason why 62,50% of the participants that refuse the evolution theory find themselves as capable of lecturing on the evolution theory is that they reject the evolution theory in a quite simple logic and as a resolute they think the evolution studies are a simple event.

When evaluating the relationship between the academic title of the participants and their acceptance rate; professors and associate professors' rate of the acceptance of the evolution is a little bit higher than the rate of assistant professors and research assistants. The reason for this is comprehensive knowledge of evolution is required in order to comprehend the evolution. Therefore, professors and associate professors have higher rates on acceptance of the evolution theory. Another interesting result is the ratio of the professors and associate professors that partly accept the evolution theory is at lower rates. A great number of the professors or associate professors either accept or refuse the theory. The reason for this can be summarized as if their accumulation of knowledge regarding the biology and their experience are higher; then; they accept the evolution theory and if their religious beliefs are out weighs other aspect then they refuse the evolution theory. However, assistant professors and research assistants lack of the necessary extensive knowledge and experience and therefore they are unsure regarding this subject. Again, when academic title of the participants gets higher, the people consider themselves as much more capable of giving lectures about evolution. It

can also because of their self-confidence regarding their extensive knowledge and experiences.

5. Conclusion

In accordance with the result of this study, almost half of the academic staff of the biological sciences of the universities do not have an absolute attitude towards the evolution theory. One of the most essential reasons of this can be underlined as the religious beliefs that the people have. Like the students they teach, teachers bring set of beliefs about teaching and learning that are shaped through years of personal experience into their classrooms (Britzman, 1998). It is important to point out that belief is cognitive and inherently difficult to change because the mind naturally adapts observations to confirm already held belief, instead of changing beliefs to align with new observations (Lester, 2007). If the teachers' beliefs are inconsistent with the foundational belief of the curriculum, the teachers do not use that curriculum as intended (Lester, 2007). Ultimately, these belief and expectations interact and may influence science teachers' planning and delivery of instruction and student achievement (Love & Kruger, 2005). The teachers' classroom practices may be more aligned to the teachers' beliefs about the subject than about the teachers' beliefs about teaching and how students learn best (Raymond 1997). Teachers who do not accept the science of evolution may not be able to make informed decisions about teaching evolution, thus limiting their students' ability to develop a comprehensive understanding of evolutionary biology (Rutledge and Mitchell, 2002; Sanders, 2010).

Academic backgrounds and religious beliefs of the teachers may affect their opinions on their acceptance of the evolution theory, affecting the teachers as well at the same time. The teachers that not are not able to comprehend the evolution and the nature of the science completely, they will not be able to transfer those to the education environment naturally. However, teachers that do not have the correct information regarding the nature of the science and evolution while having some strong religious beliefs; easily refuse the evolution theory.

Recent studies clearly indicate that teachers are the pioneers and implementers of the significant changes to enable the education reforms (Pajares, 1992). While thinking the determinant role of the teachers on education; they should be competent to make decisions on the syllabus and education subjects. When the subject is biology, teachers must be able to comprehend the powerful role of the evolution and have the extensive knowledge regarding the evolution theory in order to be able to have the ability to make decisions regarding the syllabus (Rutledge & Mitchell, 2002).

It seems that central and unifying role of the evolution theory within biology is not reflected in the education at the universities of Turkey in reality. Considering Dobzhansky's (1973) "*nothing in biology makes sense except in the light of evolution*" quote, education regarding the evolution is problematic in Turkey.

In order to determine the misconceptions of students regarding the evolution, the only individual is without any doubt is the teacher to develop and apply

appropriate methods and techniques to replace the misconceptions with the correct information. If the teachers themselves have contextual misconceptions, then finding a solution will be even more difficult. Providing better learning and professional development opportunities in teacher preparation and continuing education programs would enable them to develop a deeper and sophisticated understanding of biological evolution. Evolution education should be given by academic staff who are more knowledgeable and have positive attitudes towards evolution. As a result, the future of the evolution education in Turkey does not seem pleasant clear or straightforward.

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