



BIOLOGY STUDENTS' AND TEACHERS' RELIGIOUS BELIEFS AND ATTITUDES TOWARDS THEORY OF EVOLUTION

BİYOLOJİ ÖĞRETMENLERİNİN VE ÖĞRENCİLERİNİN DİNİ İNANIŞLARI VE EVRİM TEORİSİNE KARŞI TUTUMLARI

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ABSTRACT: Evolution has not being well addressed in schools partly because it is a controversial topic in religious views. In the present study, it is explored to what extent Turkish secondary school biology teachers and students accommodate the theory of biological evolution with their religious beliefs. Two-hundred fifty secondary school students and thirty-eight biology teachers were asked to complete a questionnaire addressing (1) their acceptance of evolution and reasons of their acceptance, (2) their attitudes towards evolution and creation and impact on their education curriculum, (3) teachers' educational backgrounds information. This research is descriptive, yet the study findings inform further studies. Findings reveal that the majority of the participants rejected the theory of evolution. Their rejection of evolution correlated strongly with their religious beliefs and for students, with their teachers' attitudes towards evolution and its teaching in schools. Students and teachers believed that they should believe in either of these views; theory of evolution as it is described in scientific text or in creationism as advocated by religious organizations. Our participants thought they should reject one if they accept the other.

Key words: biological evolution, religious belief, biology teachers, students.

ÖZET: Evrim dini inanışlarda tartışmalı bir konu olduğundan okullarda iyi bir şekilde ifade edilmez. Bu çalışmada, Türkiye'deki biyoloji öğretmenlerin ve öğrencilerin dini inanışlarıyla evrim teorisini hangi boyutta bağdaştırdıkları keşfedilir. 250 lise öğrencisi ve 38 lise biyoloji öğretmeninden (1) biyolojik evrimi kabul etme-reddetme ile bunların sebeplerini, (2) evrim-yaradılış teorileri ve biyoloji müfredatında onların etkileri hakkında tutumlarını, (3) öğretmenlerin geçmiş eğitim yaşantılarını içeren bir anketi tamamlamaları istenilmiştir. Bu araştırma betimsel olup ileride yapılacak olan çalışmalara yol göstermektedir. Sonuçlar araştırmaya katılanların çoğunun evrimi reddettiklerini ve evrimin reddedilmesinin sebebinin ise onların dini inanışları, evrime karşı öğretmenlerin tutumları ve okullarda evrimin öğretimi ile güçlü bir şekilde ilişkili olduğunu göstermiştir. Öğretmen ve öğrenciler ya bilimsel kitaplarda tanımlanan evrim teorisine yada dini organizasyonlar tarafından savunulan yaratılışçılık görüşüne inanmaları gerektiğine inanmışlardır. Onlar birini kabul ettiklerinde diğeri reddetmek zorunda olduklarını düşünürler.

Anahtar sözcükler: biyolojik evrim, dini inanışlar, biyoloji öğretmenleri, öğrenciler.

1. INTRODUCTION

One goal of science is to understand nature. "Understanding" in science means relating one natural phenomenon to another and recognizing the causes and effects of phenomena. Progress in science consists of the development of better explanations for the causes of natural phenomena. Scientific theories are constructed by scientists to explain and predict phenomena; they do not necessarily represent reality (Tao, 2002). The theory of evolution is one of these explanations. Teaching about the nature of science should be integrated with teaching about evolution. Inquiry and the nature of science are not entities separate from the development of scientific theories. Students should see the relationships between the scientific processes and development of a theory such as biological evolution (Bybee,2001).

Evolution concerns with changes in living things during the history of life on earth. Evolution theory says that all living things are related to one another through common ancestry from earlier forms that differed from the present forms and biological evolution, lasting many millions of years, has occurred on earth. The origins and evidence for the theory that today's living organisms are the result of a long period of biological evolution (Downie, 2004). Evolutionary theory is central to and an

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unifying theme of the discipline of biology. Its broad explanatory power allows for the investigation of a wide range of intriguing biological questions and serves as an underlying framework of the discipline. Because of its explanatory and unifying powers, scientific and educational organizations have called for instruction in evolution to be commensurate with its station in biology (Rutledge & Mitchell, 2002). Teaching about evolution has another important function. Because some people see evolution as conflicting with widely held beliefs, the teaching of evolution offers educators a superb opportunity to illuminate the nature of science and to differentiate science from other forms of human endeavor and understanding (NAP, 1998; see Websites).

More than a decade of research studies on student' alternative conceptions and conceptual change have contributed to the realization that the rationality commonly ascribed to inquiry in science learning is subject to other factors that determine how humans integrate knowledge from different sources into their conceptual framework. These factors are not necessarily rational but are rooted in a "cluster of prior ideas, beliefs, values, and emotions that serves as the initial set of interpretive categories and it is the potential match between these existing cognitive commitments and the new information which determines how the student will respond to the instructional inputs" (Dagher & Boujaoude, 1997).

A learner's conceptual ecology for evolution was found to include prior conceptions related to the evolutionary theory (both scientific and alternative), scientific and religious orientations, view of the biological world, and acceptance of evolutionary theory. Evolution has long been a controversial topic in schools because of its intersection with religious beliefs and not being appropriately addressed in instruction. Because of controversial intersection, evolution is an excellent content area in study the influence of a learner's conceptual ecology. Clearly, the aspect of a broader conceptual ecology for evolution that has received the most attention is 'belief'. Belief is a very difficult area to study, as no one definition has enjoyed a wide acceptance (Demastes, Good & Peebles, 1995).

Science educators working in the area of evolution education have focused their research on a number of areas. Evolution-related instruction is influenced by educational standards and a variety of other factors such as textbooks, the curriculum, and tests. However, the most important factor in student learning is the teacher (Moore, 2002).

Research has revealed that teachers' attitudes toward teaching it and views about a subject matter can impact their curricular and instructional activities for that particular subject matter. A biology teacher's acceptance or rejection of evolutionary theory as a scientifically valid explanation is potentially important to the situation that evolution takes in the biology curriculum. Additionally, student knowledge structures have been found to approximate those of their teachers. Thus, a teacher's conception and knowledge structure of evolution may impact student understanding of this powerful and unifying idea (Rutledge & Mitchell, 2002).

Research has shown that, many biology teachers avoid teaching about evolution because they know relatively little about the subject. Other teachers avoid teaching about evolution because they are creationists (They believe that God created the universe—including humans and other living things—all at once in the relatively recent past) or are afraid of reprisals from powerful parents or administrators. The result is sadly predictable: many students graduate from college with a poor understanding of one of the most powerful ideas in science. Compounding the problem is the fact that many of these graduates become teachers. 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).

Science magazine has just published the results of international polls assessing public acceptance of evolution around the world. A comparison of peoples' views across 34 countries reveals that the United States ranks near the bottom when it comes to the public acceptance of evolution. Only Turkey ranked lower, with about %25 of the population accepting evolution and %75 rejecting it (Miller, Scott & Okamoto 2006).

Turkey is a secular democratic state with a Muslim majority. Secondary school students study science in grades 9-11 in Turkey. Evolution is introduced to the 11 grade students as the terminating unit in secondary school biology textbooks and curriculum. Texts mention Lamarck' theory of the inheritance of acquired characteristic and Darwin' theory of survival of the fittest by natural selection

and significance of the adaptations in total two text pages. In addition, creationism is introduced to as an alternative “hypothesis” in textbooks and curriculum as a paragraph. Creation was explained in the biology textbooks as follows: “In creationism's opinion, all living entities and species were created by God separately. Although they may have undergone some changes since the day they were created, neither did any evolve into other species” (Sağdıç, Bulut, Korkmaz 2007; Berker, 2000).

This study' objectives were: (1) To assess the relative extents of biology students and teachers that accept or reject to evolution, (2) To investigate students' and teachers' reasons for either accepting or rejecting evolution, (3) To compare the levels of student and teacher acceptance of several scientific propositions, including the theory of evolution: intention in here was to assess whether students rejecting evolution had a general scepticism towards science, or whether their rejection was specific towards evolution, (4) To investigate students' and teachers' attitudes about evolution and creation in curriculum, (5) To compare think about evolution' acceptance of teachers' with taking a evolution lesson during biology teacher preparation programs and level of experience of the teachers.

2. METHODS

2.1. Sample

This survey has been carried out on the teachers (n=38) and students (n=250) in secondary schools across grades 11 in Erzurum, Turkey. The surveys conducted after coverage of evolution in session 2005-2006 for students. All teachers and students who were surveyed identified themselves as Muslim, when asking them their religious beliefs.

2.2. Data Gathering Tools

A questionnaire was used as data gathering tool. The questionnaire in Turkish is a means of eliciting the feelings, beliefs, experiences, perceptions, or attitudes of some sample of individuals. As a data collecting instrument, it is be structured. In this study, biology teacher and student questionnaire that consist three-part was developed for biological evolution. Part A consisted 4 items developed by Downie and Barron (2000) about the rejection and acceptance of evolution, not about how evolution may have happened. Part B consisted of 10 items for teachers and students requiring a response based on an AGREE-DISAGREE scale about their attitudes to evolution and creation in the curriculum. Part C gathered background information on academic qualifications for teachers. Three experts were consulted to assess the quality of each item in the context of clarity, ambiguity, generality, and to validate the content of the questionnaire.

The questionnaire was administered to 11 grade students in seven classes of three different secondary schools and teachers in different secondary schools near the end of the second semester (after 12 weeks teaching), and it took about 30 minutes to complete the questionnaire. The purpose of the study was explained to the participants. Students and teachers' names were never asked with their responses by questionnaire. All participants completed the questionnaires voluntarily and their responses were kept confidential. Any of the collected surveys were not deleted because they were appropriate to be included in the analysis.

2.3. Data Analysis

Completed questionnaires were analysed in detail. The data from each students and teachers were analyzed separately, because of their academic backgrounds' difference. The teachers' and students' responses to the survey items were tabulated and analysed statistically by using frequency, percentance and correlation in SPSS.10 programme.

3. RESULTS

3.1. Part A: Rejection and Acceptance of Evolution

3.1.1. Acceptors and rejectors: Proportions of students and teachers that accept or reject 'biological evolution has lasted millions of years' are indicated in Table 1. 183 students and 30 teacher rejected biological evolution. 67 students and 8 teacher accepted biological evolution. Rejector teachers and students were answer reasons for rejecting evolution. Acceptors teachers and students were answer reasons for accepting evolution.

Table.1. Proportions of Students and Teachers Who Rejected and Accepted Biological Evolution

	Acceptors (%)	Rejectors (%)
Students	%26.8	%73.2
Teachers	%21.1	%78.9

3.1.2. Reasons for rejecting evolution: Rejector students and teachers were offered three possible reasons and other reasons for rejecting evolution and asked to indicate all those that applied to them. The percentages choosing the different reasons are shown in Table 2. None of them answered "other reasons".

Table 2. Reasons for Rejecting Evolution of Students and Teachers

Reasons For Rejecting Evolution	Students(n=183)	Teachers(n=30)
The evidence for evolution is full of conflicts and contradictions	%40.4	%52.6
I accept the literal truth of a religious creation account that excludes evolution	%72.1	%70
I think that there are good alternatives to evolution that explain the origin and distribution of specie	-	%20
Other Reasons	-	-

Percentages do not total 100 because students and teachers were asked to tick all the reasons that applied to them.

3.1.3. Reasons for accepting evolution: Acceptors students and teachers were offered three possible reasons and other reasons for accepting evolution. The percentages choosing the different reasons are shown in Table 3. None of them answered "other reasons".

Table 3. Reasons for Accepting Evolution

Reasons For Accepting Evolution	Students(n=67)	Teachers(n=8)
The evidence for evolution is clear and unambiguous	%52.2	%62.5
I tend to accept what teachers and textbooks say: they show the evidence much better than I do	%44.7	%75
I do not think there are any good alternatives to evolution that explain well the origin and distribution of species	%56.7	%100
Other Reasons	-	-

Percentages do not total 100 because students and teachers were asked to tick all the reasons that applied to them.

3.1.4. A comparison with other scientific ideas: It was wished to discover how well established as a theory the students and teachers felt evolution were compared to some other well-known scientific ideas. The students and teachers were asked to give a rating on a 3-point scale (1 = very poorly established to 3 = very well established) to five scientific propositions, two of them related to evolution (tectonic plates and biological evolution), three on health and environment issues. The responses are shown in Table 4.

Table. 4. Students' and Teachers' Ratings on How Well A Range of Scientific Theories Are Established (Evolution Acceptors and Rejectors Given Separately).

Theory		Rejectors to evolution			Acceptors to evolution		
		Poor	Neutral	Well	Poor	Neutral	Well
The continents are not fixed in position, but move relative to one another as Tectonic plates .	Students	%12.7	%24.3	%64.5	%10.9	%24.8	%65.3
	Teachers	%11.6	%15.8	%70	%12.5	%15.5	%72
CFCs (chlorofluorocarbon gases), mainly from aerosol sprays, are seriously depleting the earth's atmospheric ozone layer.	Students	%10.8	%25.5	%62.5	%10.9	%25.8	%63.3
	Teachers	%10.8	%12.2	%77	%5	%13	%82
Sulphur dioxide from power stations causes damage to tree growth and kills fish in lakes by falling as Acid rain	Students	%10	%20.3	%68.1	%10.1	%20.6	%69.2
	Teachers	%16.3	%31.6	%75.7	%4	%15	%80
Cigarette smoke causes lung cancer.	Students	%10	%24.3	%64.5	%10	%24.4	%64.8
	Teachers	%5.8	%16.3	%77.9	%2	%20	%78
Biological Evolution , lasting many millions of years, has occurred on earth	Students	%39	%27.5	%32.3	%13.5	%25.8	%60.7
	Teachers	%36.8	%29.5	%31.1	%5.7	%25.8	%68.5

3.2. Part B: Attitudes to Evolution and Creation and Their Role in the Curriculum

Students and teachers responded to several questions regarding their attitudes to evolution and creation in the curriculum (Table5).

Table.5. Results of Students and Teachers Questionnaire (Part B)

Survey Item	Students (N=250)		Teachers(N=38)	
	Agree (%)	Disagree(%)	Agree(%)	Disagree(%)
-Evolution should be part of the secondary school biology curriculum.	%57,2	%42,8	%60,5	%39,5
-Creationism should be part of the secondary school biology curriculum.	%80,4	%19,6	%81,6	%18,5
-Evolution and creationism should both be presented in the secondary school biology curriculum.	%58	%42	%84,2	%15,8
-Someone can accept the validity of the theory of evolution and also believe in God.	%30,3	%69,7	%92,2	%7,8
-I accept all evolution theories except human' evolution	%39,2	%60,6	%63,1	%36,9
-Biological evolution explains the diversity and similarity of life, not how life first arose.	%74,1	%25,9	%68,4	%31,5

Table.5. Results of Students and Teachers Questionnaire (Part B)

Survey Item	Students (N=250)		Teachers(N=38)	
	Agree (%)	Disagree(%)	Agree(%)	Disagree(%)
-Biological evolution is an idea which has limited evidence or support.	%79,6	%20,4	%73,7	%26,3
-Biology teaching is impossible without evolution theory in biology classroom.	%33	%66	%39,4	%60,6
- I don't consider to evolution teaching important.	%59,6	%40,4	%57,8	%42,1
-Evolution teaching is effected by teachers' attitude across evolution.	%59,6	%40,4	%57,8	%42,1

3.3. Part C: Background Information on the Teachers

Teachers' academic background generated. Correlations between the results of teacher responses and acceptance of evolution are indicated in Table 6 and Table7.

Table 6. Correlation Between Taking Evolution Lesson During Biology Teacher Preparation Programs of Teacher and Acceptance of Evolution.

	Taking a evolution lesson during biology teacher preparation programs
Acceptance of evolution-Pearson Correlation	.544(**)
Sig.(2-tailed)	.000
N	38

** Correlation is significant at the 0.01 level (2-tailed).

Table 7. Correlation Between Level of Experience of The Teachers and Acceptance of Evolution.

	Level of experience of the teachers
Acceptance of evolution-Pearson Correlation	.643(**)
Sig.(2-tailed)	.000
N	38

** Correlation is significant at the 0.01 level (2-tailed).

4.DISCUSSION

This study is descriptive, yet the findings can serve as an impetus for additional research. Several conclusions can be made about the students and teachers in this study. Many students and teachers rejected the occurrence of biological evolution. A majority of the students (%73.2) and teachers (%78.9) do not accept evolutionary theory (Table 1) and defend that "evolution is an idea which has limited evidence or support" (%79.6 of students-%73.7 of teachers) and "not explain how life first arose" (%74.1 of students-%68.4 of teachers) (Table5). As the most common reasons for rejecting evolution are of a literal religious creation account (%72.1 of students-%70 of teachers), contradictions in the evidence for evolution generally second (%40.4 of students- %52.6 of teachers) (Table-2). These conclusions supported by other other studies. Dagher (1996) determined that 47% of muslim students are against evolution in Lebanon and the most common reasons for against evolution are of conflicts between evolution – creation. From study of Downie and Barron (2000), the relatively high proportion of Muslims is amongst the rejectors in Scotland.

Demastes et al. (1995) defend that, some facets can be very influential in rejectance of evolution: The learner's religious orientation reflects the degree to which the participant organized her/his life around religious activities, understood the world through theism, and interpreted personal and natural events through a religious lens. The learner's acceptance of evolutionary theory is understood to play

an important role in controlling conceptual change. As has been described, acceptance is closely tied to a learner's religious beliefs (Demastes et al., 1995).

Also, Findley, Lindsey and Watts (2001) thought that, good teaching involves the identification and removal of barriers to learning. In the case of evolution, one of the major barriers to learning appears to be the relationship between evolutionary theory and religion (Findley et al., 2001).

It was aimed to discover how well established as a theory the students and teachers felt evolution was compared to some other well-known scientific ideas. In other words, intention in here was to assess whether students rejecting evolution had a general scepticism towards science, or whether their rejection was specific towards evolution. According to rejectors' answer, biological evolution is more lower 'well established' ratings (%32.3 of students- %31.1 of teachers) than tectonic plates, CFCs, acid rain, and lung cancer. They show higher values on all propositions except for evolution. However, acceptors' answers are similar for five scientific propositions. Both of acceptors and rejectors had access to the same range of evidence on tectonic plates, CFCs, acid rain, and lung cancer (Table4). From this result of study, as well as others (Sinclair & Baldwin, 1996; Dagher & BouJoude, 1997; Downie & Barron, 2000; Findley et al., 2001; Blackwell, Powell & Dukes, 2003) it can be conclude that students' and teachers' beliefs interfere with the evolution idea.

A majority of the students (%80.4) and teachers (%81.6) accept that creationism should be part of biology curriculum. Some of them accept that evolution should be part of biology curriculum (%57.2 of students -%60.5 of teachers). Teachers (%84.2) defend that "evolution and creationism should both be presented in the biology curriculum", student (%58) defend it (Table5). According to Bergman' study (1999), the vast majority found about 90 % of the public desired that both creation and evolution or creation only be taught in the American public schools. A survey by Bland (1984) of degreed biology professors, many with years of teaching experience in accredited Bible colleges, found 81 % (N = 38) taught both creation and evolution and only 17 % (N = 8) taught evolution alone. Results from these items suggest that most of teachers and students feel that evolution should be given in a instructional curriculum that include creationism. Despite of rate on acceptance of evolution (table1), these rates clearly indicated that it was important to take part evolutionary theory in curriculum. In spite of this result, data from this study show that the topic of evolution does not receive appropriate emphasis in the secondary school biology curriculum: %39,4 of the teachers and %33 of students accepted that biology teaching is impossible without evolution theory in their biology classroom. Furthermore, %57.8 of the teachers and %59.6 of students accepted that "I don't consider to important of evolution teaching". Clearly, the status of evolutionary theory as the central and unifying theme of biology is not reflected in the teaching of a lot of biology teachers.

Students' and teachers' opinion rate is generally similar about in creation and evolution curriculum. But, while teachers (%92.2) defend that "someone can accept the validity of the theory of evolution and also believe in God", %30.3 of students defend it (Table5). Students believe there is a forced "either/or" choice between their religious faith and evolutionary theory. There is a forced dichotomy which requires that one reject the theory of evolution and accept a literal interpretation of creation. It could be because students think more logical and assume that one belief should support the other otherwise they should not believe in it. As another reason, it could be thought that students may not be educated enough to realize that there is no one absolute truth and things are subjective over the worldviews or paradigms. Lawson and Weser (1990), found that religious beliefs which were counter to scientifically accepted theories were difficult to alter and many students did not have the reasoning skills needed to the complex evidences and arguments presented by evolutionary theorists. According to national academies of sciences, many people believe that God works through the process of evolution. That is, God has created both a world that is ever-changing and a mechanism through which creatures can adapt to environmental change over time. Religions and science answer different questions about the world. Whether there is a purpose to the universe or a purpose for human existence are not questions for science. Religious and scientific ways of knowing have played, and will continue to play, significant roles in human history (NAP, see Websites).

Little of the students (%26.8) and teachers (%21.1) accepted evolutionary theory (Table 1). As the most common reasons for acceptance is the lack of good alternatives (%56.7 of students-%100 of teachers), quality of evidence for evolution (%52.2 of students- %62.5 of teachers) and "teacher and

textbook knows best” of option second (Table-2). It illustrates that an ‘acceptance’ of evolution can exist at different levels or in different degrees. % 39.2 of students and %63.1 of teachers accept all evolution theories except human’ evolution and %74.1 of students and %68.4 of teachers accept “biological evolution explains the diversity and similarity of life, not how life first arose”. (Table5). Creationist view has played most emotionally against a naturalistic origin of humans through evolution.

Darwin’s long thesis accounting for the development of species (humans included) embodied an implicit challenge to some religious accounts of creation (Dagher & BouJoude, 1997). For Muslims, account of origins is presented in the holy Quran. Many verses of the Quran include verses about creation. The following are three of those verses that contain the creation of earth, humans, and animals: “He it is who created the heavens and the earth in six days” (Chapter Al-Hadid, Verse 4), “We have indeed created man in the best of mold” (Chapter At- Tin, Verse 4), “God has created every animate from water: Of them there are some that creep on their bellies; some that walk on two legs; and some that walk on four. God creates what He wills, for verily God has power over all things” (Chapter An-Nur, Verse 45), “Adam, who was made of clay and endowed with a divine soul by God’s breath” (Chapter Ali Imran, Verse 59; Chapter Secde, Verse 9).

It is important for teachers to consider an approach to evolution that does not require students in their perceptions to make a choice between acceptance of this theory and their religious beliefs. Modifications in acceptance of facts or theories may require only a minor adjustment in a person’s belief system. Some religious conservatives associated with the creationist movement entertain the spurious notion that the teaching of evolution is somehow associated with a decline of moral values in society (Blackwell et al., 2003).

Numerous factors shape students’ attitudes about evolutionary theory. The most frequently mentioned factor was religion. The second most frequently mentioned factor was personal relationships parents, teachers, friends, and school itself. Other factors mentioned were the media, evidence for evolutionary theory, and flaws or lack of proof for evolution (Woods & Scharmann, 2001).

Teacher’ academic background and personal religious beliefs may be a contributing factor to acceptance of evolution as well as the teaching of evolution. Teachers who lack an understanding of evolution and the nature of science may be incapable of making informed decisions of acceptance or rejection of evolutionary theory, as well as professionally responsible curricular and instructional decisions regarding the teaching of evolution. There is a correlation between the teachers’ nonacceptance of evolutionary theory, students’ the rejection of evolutionary theory. The students’ %59.6 defend that their teachers’ attitude effect for evolution teaching (Table5). The teachers’ %57.8 defend that evolution teaching is effected by teachers’ attitude across evolution (Table5). Blank and Andersen (1997), argued that many adults accept creationism partly because a large number of teachers accept this worldview. The authors then discussed the ethics of teacher training programs that deliberately try to change students’ beliefs by use of more intensive indoctrination programs.

There is a significant difference between the teachers’ nonacceptance of evolutionary theory and teachers’ background ($p < 0.01$). The results show that there is positive correlation both between taking a evolution lesson during biology teacher preparation programs of teacher and acception of evolution and also between level of experience of the teachers and acception of evolution (Table 6-7). Teachers that not take a evolution lesson during biology teacher preparation programs and young teachers are rejecting to evolution and teachers’ service time and take a evolution lesson during biology teacher preparation programs are connect with acception of evolution. Somel, Somel, Tan and Kence (2006) were show that young teachers are going away from evolution and teachers’ service time is connect with acception of evolution. In a study with 989 Indiana public school teachers, Rutledge and Mitchell (2002) found a significant association between teachers’ acceptance of evolution and their exposure to biology, evolution, and nature of science issues. Further, teachers who don’t have a thorough understanding of the nature of science may not be able to differentiate between the scientific validity of evolution and strongly held religious views. Owing both to religious opposition to and common misconceptions about evolution, science teachers are in need of support and sometimes guidance (Branch & Scott, 2008).

5. CONCLUSIONS

The results of this study have shown that beliefs of many students and teachers can be in conflict with the evolution idea. It is important for students to learn evolution, because it is a major component of science. There is opposition to evolution education. Evolution education is fueled largely by the misconception that acceptance of evolution is incompatible with religious faith. It appears to be a forced dichotomy between religion and evolutionary theory for many students and teachers. They believe that if they accept theistic creation, they must reject evolutionary theory.

How might be solved the problem of acceptance of evolution? What can be done to improve the teaching of evolution? There are no definite answers. The problem could be approached in terms of belief acquisition and quality of instruction of teacher. It might be suggested belief expansion, approaches to teaching evolution and preparatory programs for biology teachers. Understanding and belief is, of course, not the same thing. A person may understand evolution without significant incorporation into students' belief. Therefore, "belief" is not really an appropriate term to use in science, because testing is such an important part of this way of knowing (NAP, see Websites). Science is not about belief; it is about how things work. One cannot "believe" in science or "believe" in evolution. Science is about the exploration of natural causes to explain natural phenomena. Religion is about belief, meaning, and purpose.

Research suggests that biology teacher preparation programs should, therefore, place a high priority on developing a comprehensive understanding of evolution and the nature of science in their students (Rutledge & Mitchell, 2002). Given the profound role of biology teachers in determining the quality of instruction, the strong associations between teachers' academic background and their teaching of evolution may inform efforts to improve evolutionary biology education. The results of study of Rutledge and Mitchel (2002) and others suggest that a critical evaluation and modification of the preparatory programs for biology teachers could serve to improve the teaching of evolution in high schools.

According to Woods and Scharrmann (2001), if teachers are to be successful in teaching evolution, they must take into account our students' worldviews as well as their individual understandings and misconceptions. It is important to know their students their cultures, personal histories, cognitive abilities, religious beliefs, and scientific misconceptions. It is also important to address directly the likely cultural/religious concerns with evolution and to do so early on so as to break down the barriers that keep many students from hearing what you say (Woods & Scharrmann, 2001). One goal of any biology teacher should be to attempt to infuse, into existing backgrounds, an understanding of and openness to consider evolutionary theory.

"How" we teach is often as important as "what" we teach. "Science is not just information; it is the expression of that information, and expression is seldom value-neutral". A recommendation to biology instructors is to take the religious beliefs of students seriously. They should be express their concerns and questions without fear of rejection or censure (Sinclair & Baldwin, 1996).

How should teachers approach the topic of evolution? Clearly, if we are going to teach students successfully about evolution and have them recognize and accept it as a well-supported scientific theory, then we need to address the widely held misconceptions students about evolution and the nature of science. One suggestion is to assess students' and teachers' prior beliefs and modes of thought as a first step in any unit on evolution (Cooper, 2001). The fostering of prospective biology teachers' understanding of evolution and the nature of science should be a priority of biology departments. Specific courses in evolution and the nature of science should be a requirement of the subject matter preparations of biology teachers, yet many biology departments do not offer or require such courses.

Science educators take a variety of approaches to addressing the classroom implications of the conflict between creationism and evolution. Some take on a crusading spirit and try to expurgate all mention of religious notions from the science classroom in the name of the higher principle of naturalistic explanation (Jackson, Doster, Meadows & Wood, 1995). To promote evolution literacy, it is important to teach evolutionary principles in introductory biology classes with an "active learning" approach in which students pose and answer questions, solve problems, and discuss and explain

issues. Nonetheless, there is not much literature on the use of active learning to present evolutionary principles (Staub, 2002).

Once the topic of evolutionary theory is initiated, activities should be included that encourage students to develop and share their personal perceptions and scientific explanations with classmates (Scharmann, 1990; Scharmann, 1993; Dagher & BouBoujaoude, 1997). This can be achieved with periodic group discussions in which all participants are allowed to present their views and compare them to both other students' as well as professional scientists' views. This approach does not seek, as a learning outcome, to change students' beliefs; instead, it aims to prepare students for future science courses and future dealings with evolutionary theory. Acquisition of knowledge is not a one step process rather it is long term (Woods & Scharmann, 2001).

Classroom teachers should be made aware that the understanding of a scientific conception is not always limited by the student's belief. Within the constructivist conception of learning, understanding and belief are distinct but related issues. In supportive classroom atmosphere, students can progress toward understanding a scientific conception even though it conflicts with their cultural beliefs (Demastes et al., 1995). Finally, religious belief is a factor that strongly shapes students' and teachers attitudes and acceptance of evolutionary theory. Teachers should educate students about the nature of science and develop their science inquiry abilities.

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GENİŞLETİLMİŞ ÖZET

On yıldan daha fazladır öğrencilerin alternatif kavramları hakkında yapılan araştırmalar öğrencilerin biyoloji ile ilgili birçok konuda alternatif kavramlara sahip olduklarının, bazı faktörlerin bu alternatif kavramların oluşmasında etken rol oynadığını ortaya çıkarmışlardır. Bu faktörlerden bazıları inançlar, değerler, tutumlar ve duygulardır. Bir öğrencinin evrim için kavramsal çevresini, evrim teorisi ile ilgili hem bilimsel hem de alternatif ön kavramlar, bilimsel ve dini yönlendirmeler, biyolojik dünyanın görünüşü ve evrim teorisinin kabulü oluşturur. Evrim biyoloji eğitim öğretiminde açık bir şekilde ifade edilmediğinden ve dini inanışlarla kesiştiğinden dolayı uzun süredir okullarda tartışmaya yol açan bir konudur. Evrimle ilgili eğitim öğretimi etkileyen en önemli faktörler ders kitapları, müfredat, dini inançtan kaynaklanan alternatif kavramlar ve öğretmenlerin evrime karşı tutumları ve bilgileridir. Evrim kuramının ortaya attığı görüşler insanın ve diğer canlı türlerinin ortak bir atadan evrimleştikleri görüşü, yaratılışın kutsal kitaplardaki öyküsü ile çelişir görünümündedir. Evrimi kabul etme düzeyini saptayan dünya çapında yapılan bir araştırmada Amerika ve Türkiye en son sıralarda yer almış olup bunun sebebi dini inanışla ilişkilendirilmiştir. Evrimi etkileyen diğer faktör olarak çoğu biyoloji öğretmeni evrim hakkında az bir bilgiye sahip olup, yaratılış görüşüne sahip olduklarından ya da çevrenin baskısından dolayı bu konuyu öğretmekten çekinirler. Yapılan araştırmalar gösterir ki öğretmenin tutumu ve bilgisi eğitim öğretimi etkiler ve öğrencinin bilgi yapısı ve tutumu öğretmenlerinki ile hemen hemen aynıdır. Bu yüzden bir öğretmenin evrimle ilgili tutum ve bilgisi öğrenci anlamasını ve kabulünü güçlü bir şekilde etkileyecektir. Bu şekilde çoğu öğrenci fakir bir bilgi ile mezun olurlar ve bu mezunların bir kısmı da öğretmen olurlar.

Türkiye' de ki biyoloji öğretmenlerinin ve öğrencilerinin var olan dini inanışları ile evrimi nasıl bağdaştırdıkları bu çalışmanın ana amacını oluşturmuştur. Bu amaç ışığında, (1) evrim yandaşı ve evrim karşıtı biyoloji öğretmen ve öğrencilerinin nispi ölçüsü tayin edilmiştir, (2) öğrenci ve öğretmenlerin evrimi kabul etme veya reddetme sebepleri araştırılmıştır, (3) evrimi reddeden öğrenci ve öğretmenlerin şüphelerinin genel olarak bilime mi karşı yoksa onların reddetmesinin sadece evrime mi özel olup olmadığını anlamak için evrim teorisini içeren birkaç bilimsel fikrin öğrenci ve öğretmenler tarafından kabul düzeyi karşılaştırılmıştır, (4) öğrenci ve öğretmenlerin müfredatta yer alan evrim ve yaratılışa karşı tutumları araştırılmıştır, (5) öğretmenlerin mesleki tecrübeleri ile ve üniversitede öğretmenlik eğitimi programları boyunca evrim dersi almaları ile öğretmenlerin evrimi kabulü arasındaki ilişki araştırılmıştır.

Araştırma Türkiye'de 2005-2006 eğitim öğretim yılında evrim konusunu almış, 11. sınıf 250 lise öğrencisi ve 38 lise biyoloji öğretmeni üzerinde yürütülmüştür. Bu çalışmada, öğrenci ve öğretmenlerden (1)biyolojik evrimi kabul etme-reddetme ile bunların sebepleri ve diğer bilimsel fikirlerle evrim teorisinin karşılaştırılmasını, (2) evrim-yaratılış teorileri ve biyoloji müfredatında onların rolü hakkında tutumlarını, (3) öğretmenlerin geçmiş yaşantılarını hitap alan bir anketi cevaplamaları istenilmiştir.

Anketten elde edilenlere göre öğrencilerin %26.8'i öğretmenlerin ise %21.1'i biyolojik evrimi kabul etmişlerdir. Evrimi reddedenlere reddetme sebepleri sorulduğunda hem öğrenci hemde öğretmenler için birinci sırayı dini bir yaratılışa inanmaları, ikinci sırayı ise evrimin çelişki ve uyumsuzluklarla dolu olduğu almıştır. Evrimi kabul etme sebebi olarak ise öğrenci ve öğretmenler türlerin dağılımı ve orijini hakkında daha iyi bir alternatif olmadığı için kabul ettiklerini söylemişlerdir. Evrimi reddeden öğrenci ve öğretmenlerin şüphelerinin genel olarak bilime mi karşı yoksa onların reddetmesinin sadece evrime mi özel olup olmadığını anlamak için evrim teorisi, tektonik tabakalar, kloroflorokarbonların ozon tabakasını delmesi, asit yağmurları ve sigaranın akciğer

kanserine neden olmasını içeren beş bilimsel fikrin öğrenci ve öğretmenler tarafından kabul düzeyine bakıldığında evrimi reddedenler içinde en alt düzeyde kabul gören bilimsel fikrin yine evrim teorisi olduğu görülmüştür. Evrimi kabul edenler arasında ise beş bilimsel fikrin kabul oranları birbirine yakın çıkmıştır.

Müfredatta yer alan evrim ve yaratılış görüşü için tutumlara bakıldığında ise çoğunluk olarak her iki grupta yaratılış görüşünün evrim teorisi ile birlikte sunulması gerektiğinden yanadırlar. Ancak öğrencilerin çoğunda Allah'a inanıp evrimi kabul etmenin beraber olamayacağı konusunda bir ikilem ortaya çıkmıştır. Yine hem öğrenci hem de öğretmenlerin çoğunluğu evrim teorisinin canlının ilk nasıl oluştuğunu ve insanın evrimini açıklamada yetersiz olduğunda hem fikirdirler.

Öğretmenlerin hizmet süreleri ve üniversite eğitimlerinde evrim dersi alıp almamaları ile evrimi reddetmeleri arasında pozitif bir korelasyon bulunmuştur. Evrim dersi almamış ve genç öğretmenlerin daha çok evrimi reddettikleri gözükümüştür.

Sonuç olarak bu çalışma betimsel olup ileride yapılacak olan çalışmalara yol göstermesi amacı ile hizmet etmektedir. Sonuçlar araştırmaya katılanların çoğunun evrimi reddettiklerini ve evrimin reddedilmesinin sebebinin ise evrim hakkında öğretmenlerin tutumları ve dini inanışlarla güçlü bir şekilde ilişkili olduğunu göstermiştir. Öğretmen ve öğrencilerin çoğu için evrim teorisi ve din arasında bir ikilem gözükür. Onlar birini kabul ettiklerinde diğerini reddetmek zorunda olduklarını düşünürler. 'Bu problem nasıl çözülür?' e cevap elbette net değildir. Ancak öğretim yaklaşımı ve öğretmen yetiştirme programları açısından bir takım tavsiyelerde bulunulabilir. Öğretmenler dersin başında evrim ve bilimin doğası hakkında öğrencilerin sahip oldukları yanlış kavramaları tespit etmek amacı ile öğrencilerin kafalarında oluşan ikileme ya da sorulara eleştirilmek veya kınanmak korkusu olmadan ifade özgürlüğü tanıyıp tartışabilmelidirler.