

Influences of Some Philosophical Approaches in the Historical Development of Turkish Science Education

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ABSTRACT *The last one thousand years or more of Turkish science educational development have numerous historical similarities to other parts of the world. While documentation of historical educational developments are important to those whose ancestors are being described, the true value of this regional- and country-specific evolutionary historical journey has even greater value when compared and contrasted with similar investigations from around the world. Only then do we see the critical events clearly and isolate the influences of our past intellectual growth as a society. The past is the key to our future. This paper highlights several major periods of science education change and the influences that led to those reforms. Until the middle of the 18th century, science education was limited and almost always tied to Islamic religious philosophy. By the 1830's, western influence, with France providing the greatest impact, resulted in curricular changes in both the kinds of science courses taught and expanded positivist approaches. The collapse of the Ottoman Empire and the emergence of the Republic of Turkey in 1923 led to society-wide reforms, especially in education. John Dewey's visit to Turkey in the 1930's created another science education curricular shift as elements of experimentalism and pragmatism were added to Turkish science curriculum. The next major science education development occurred after the Second World War, when Turkey became a full member of NATO and expanded its connections with western countries, especially the USA. This influence helped to create what was called modern science curriculum, especially in the area of biology, but the traditional positivist approach remained imbedded. And lastly the paper reflects on the current courting with the European Union and the shift to include more of a foundation to science curriculum by including the nature of science.*

KEY WORDS: *Curricular change, historical development, reform, science education, Turkish education.*

Introduction

Science is taught as a core Elementary through High School subject around the world. While the content and subject sequences are similar, every country has developed along different paths, due to unique cultural and political influences. It is important to study not only the present international science education content and pedagogy curriculum, but to understand the developmental path that has led each country to this point. Like many countries, Turkey has given special attention and importance to the teaching of science. But it is interesting to note that the teaching of science to the general public does not have a very long history.

Around the second half of the 18th century, the European industrial revolution created a migration from rural areas to these newly formed industrialized cities and

created a new social class called workers. As worker numbers grew, so did their political and economic power, which contributed to the formation of nation states and the decline of the previous European empires. The French Revolution is a perfect example of this trend. This same trend led to the development of the Turkish public education system. During this same period of time, the public was confronted with many new and exciting scientific discoveries and inventions.

Due in part to these events, science first entered the general school curriculum during the second half of the 19th century (Aikenheads, 2003). Each country's curriculum development responded to these worldwide discoveries in slightly different ways based on the country's philosophical, political and religious influences. For these reasons, it is crucial to reflect on these developments in the context of each country. In this case we will describe these factors as they related to the development of Turkish science education.

To form a basis for these developments, it is necessary to provide a brief historical context of Turks and Turkey. Chinese sources have documented their interactions with Turks going back to 2000 BC (Gungor, 1997). Turks established early States and regional empires by 200 BC. As a result of immigration from Central Asia to neighboring regions, Turkish tribes expanded into western Asia, the Indian Peninsula, and into the Caspian Sea Region. During the 9th and 10th centuries, Turkish history was marked by an important event, the conversion to the Islamic faith. This conversion to Islamic faith separates Turkish history into two distinct eras, each creating unique influences on the formal education system.

Turkish Education Prior to Islamic Faith Conversion

While there is very little information about the formal education system of Turks prior to conversion, we do know that their nomadic life style required skills such as, horseback riding, war arts, care of domesticated animals, and transfer of occupational skills from one generation to another, such as Blacksmithing (Akyuz, 1993; Ogel, 1971, 1979, 1984).

Prior to the conversion to Islam, the Turks' religion was dominated by Shamanism, the worship of nature. The Shamans were religious clerics, storytellers, and poets, as well as parents. They controlled and conveyed the customs and traditions of the tribes to the younger generations. It was during the time that the first Turkish alphabet was created and used in the Turkish State of Gokturks. The Gokturks left written texts on tombstones located in the Orhon River region (presently northern Mongolia), dating to around 700 AC. Akyuz (1993) suggests that this finding marks the beginning of formal education for Turks.

On the tombstone of the king of Gokturks, Bilge Kagan (Wise or Knowledgeable King) is found a poem that provides insights into the importance of education during this period of history. The poem reads, "When a knowledgeable person ties a stone to his belt, the stone becomes gold, but when an unknowledgeable person ties gold to his belt, the gold becomes a stone" (Sayili, 1994). This example provides clues to the importance given to knowledge by early Turks. While pre-Islamic history tells us little about science education specifically, it is important to note the respect for nature shown in their religion, as demonstrated by the fact that their Gods were named for soil, sky, and lakes or the sea. As a result of these beliefs, we find a culture that was able to accredit daily

events in the physical world to nature. This paradigm emulates the foundations for developing the nature of science as it relates to natural events and natural causes. This belief system stands in stark contrast to the supernatural explanations found in parts of western Europe during the same time period.

Developments in Education under the Influence of Islamic Religion

As previously discussed, early Turks spread across many parts of Asia and, as a result, expanded their culture and beliefs to these newly conquered lands. Because of the Muslim Arab Army defeating the Chinese army in the Talas in 751 AC, the Turkish population came under the influence of Arabic culture or, more to the point, Islamic Religion. By the end of the 11th century, most Turks had converted to the Islamic faith (Tanyu, 1980). After this conversion, the Turkish people became known as Muslim Turks. This conversion to Islam impacted every aspect of life, including education. Currently, the use of Turk or Turkish refers to the people of Turkey (Lewis, 1961). The present Republic of Turkey occupies a region formally known as the Near East or historically referred to as Asia Minor or Anatolia.

This regional Islamic influence requires an examination of the philosophical development of science education after the acceptance of Islamic faith, using the Great Seljuk Empire, Anatolian Seljuk State, Ottoman Empire, as well as the present Republic of Turkey as an historical backdrop.

The Islamic world in many ways reached a new peak during the 9th and 10th centuries as texts and other books written by early Greek philosophers were translated into Arabic. This Greek idealism found favor among many Islamic scholars, including the noted Turkish scholar, Avicenna (Ibn-i Sina). However, just as in parts of the world today, we find examples of prominent Islamic Scholars, such as Ghazali, who concluded that this idea of rational thought as science would be harmful to religion and the words of God. Ghazli stated that perfect (absolute) knowledge belonged to God, and it was only found in the holy book Qur'an. Yildirim (1991) refers to Ghazali's stance as religious idealism.

As a result of this religious idealism, Ghazali and others limited the studies of natural, physical, and rational thought within the Turkish Islamic world. It was not until the 19th century Ottoman Empire that we see the philosophies of science gaining significant societal impact. However, we do find pockets of a rational philosophy such as the book *Kutatgu Bilig* (Gaining and giving Happiness through conscience thought) written by Yusuf Has Hacip in 1070.

This poetic stylebook offered suggestions to the heads of state of the time pertaining to the value of knowledge and how scholarly studies could contribute to society and the State. The book represents one of the early indicators of rationalism. Arslanoglu (1996) points out that the book offered advice on how the mind could illuminate the way of a person.

The 10th through the 19th centuries, within the Turkish Seljuk and Ottoman Empires, were characterized primarily by religious studies with periodic reference to this evolving natural studies paradigm and the development of formal education.

During Great Seljuk Empire and Anatolian Seljuk State

After the Seljuks had conquered most of the Caspian Sea region and neighboring regions, they established a State called Seljuks with Baghdad as the capital. The new State was greatly influenced by Islamic culture, which in turn influenced the education of the time. This is also the period when Arabic characters in writing emerged. The Islamic scholars of the time, based almost entirely on their interpretation of the Koranic verses and other religious doctrine, agreed on the importance of education in Islamic civilization development. For example, the first revealed Koranic verse states, "Read, with the name of God" and the Prophet Mohammed writes, "Whenever there is science, or study, go and find it even if it is in China." Such religious readings drove this early Nation State toward greater awareness for education.

Seljuk Turks, after establishing their State, needed educated people especially for state businesses who knew writing, reading, calculation, and Islamic knowledge. Consequently, Seljuks began to open schools influenced heavily by Islamic religion, and that also covered elements of Arabic and Persian cultures and other civilizations of the time. The major functions of most of these schools, called *Medrese (Madrasa)* and *Mektep* (low level schools or a kind of elementary school), was to provide basic reading and writing, religious lessons, and basic calculation. To educate and foster bureaucrats and religious clerics, high level Medreses (-schools) were established in Baghdad, Nizamiye Medrese (Akyuz, 1993). These schools were first opened in 1067 and mark the beginning of Turkish formal education.

When the curriculum of these schools is examined, the courses can be divided into four groups: religious (Islamic), language and literature, philosophy, and logic. This last focus is a result of several old Greek books being translated into Arabic by the Syrian and Egyptian orthodox scholars of the time and included mathematics and natural science material (Akyuz, 1993; Sarikaya, 1997). However, it is also important to note how religious education permeated every aspect of these early educational experiences.

At the end of the 13th century, the Anatolian Seljuk State collapsed as a result of Mogul attacks. Over the ensuing years, a series of dynasties emerged and fell across different parts of Anatolia. One of these dynasties, the Ottoman Dynasty finally emerged as the Ottoman Empire, which encompassed most of Southeastern Europe, Balkans, Near East, Middle East, Caucasus, Arabian Peninsula, and Northern Africa. This empire also fell at the end of the First World War, but not until it had influenced this vast area with a common government and spread cultural norms, including the educational system and the approaches to natural studies.

During the Beginning of the Ottoman Empire

As mentioned above, Ottoman Empire was the inheritor of Anatolian Seljuk State in Asia Minor. At the end of the 13th century, Ottoman was a small dynasty; but with new conquests and expansions, she became an empire that survived almost 650 years. In 1920, as one of the consequences of the First World War, the Empire collapsed; and in 1923, the Republic of Turkey was founded. But these six and a half centuries of influence left a lasting impact.

The early Ottomans were the followers of Anatolian Seljuk and therefore borrowed Seljuk traditions and governmental systems. As the dynasty expanded additional influences altered the original underlying philosophies, especially once the Ottomans became an empire. But the basic approaches and emphasis of their educational system retained much of the original composition. Like the Seljuks before them, the Empire schools included introductory levels called Mektep adjacent to Mosque schools. The concept of Mosque schools could be found throughout the Empire. One interesting characteristic was that the empire did not ultimately control these early schools. Most of the schools were founded and supported by public endowments through foundations.

The purposes of education, especially at the Mektep level, was very similar to the original Seljuks and included the teaching of basic religious knowledge, reading as well as writing. Special attention was given to memorization of key verses from the holy book, the Koran (Akyuz, 1993; Sarikaya, 1997). However, in some high level schools across the Empire, natural studies were being taught. These courses were not related to Islamic religion and therefore not part of the regular curriculum of the Empire but were none-the-less taught and thus laid the groundwork for natural studies educational development.

The following are examples from these courses that will help us see the development from the teaching of logic to its application to natural phenomenon (science). By the end of the 16th century, the Ottoman Empire had expanded its control over a huge area. Even though Islam was the dominant religion of the region, the Empire contained numerous cultures, religions, and pockets of self controlling governments. As a result, the Ottomans were influenced by Arabic, Persian, and Islamic cultures, as well as many European cultures.

This led to isolated cases of high level schools in the Ottoman Empire offering courses related to mathematics, medicine, and natural studies. According to Izgi (1997), calculation was essential for people for daily life and state business in basic levels. Therefore, many scholars at that time thought that after basic religious education, students certainly had to learn calculation.

During the same time, we find examples of high-level schools called Schools of Medicine or the Place of Medicine. These schools were a kind of hospital that offered medical education and prepared physicians. Local foundations supported them and many times they provided free medical treatments to people. However, many times the physicians were not trusted and were viewed more magicians than our present perception of a physician. The roots of these perceptions can be traced to the religious beliefs of the time, which proclaimed that the ultimate treatment came for God and that physicians could be providing wrong treatments. But it is important to note that these medical schools fostered early natural studies in chemistry, botany, and zoology (Izgi, 1997; Adivar 1970).

The early period of the Ottoman Empire also marked the development of studies related to physics or philosophical physics in a few high level schools. Generally, these courses were interested in the properties of light and substance, movement, and balance, etc. One of the important books related to physics was *Physica* by Aristotle translated to Arabic to form the basis for these classes.

At first, the rationale for studying physics was to understand the reasons that God had created substances in the world for human kind. Of course, there were

religious scholars of the time that did not welcome this study of physical philosophy. They pointed out that human beings were not able to understand the reasons of substances being in the world by studying philosophy and physics, and that only God was able to know and understand those reasons (Izgi, 1993).

We also find chemistry among the oldest areas of science to be studied and taught. As metallic substances such as copper, iron, silver, and gold began to be used by humans, it became important to not only understand these new found tools, but to pass on this knowledge. The concepts behind chemistry developed quickly during the middle and early ages as people attempted to make gold by mixing other metals and to make medicines by mixing various substances or extracting material from various plants. The word Chemistry as a word, originated from the Hebrew language; and later it was also used in the Arabic language according to Izgi (1993). The study of chemistry was plagued by the same stigma as medicine. People did not like the idea of humans manipulating nature and changing what God had made (Izgi, 1993).

Botany and zoology studies were also not regular courses but there were scholars who were interested in these areas. We also find other areas of science, such as agriculture and geology but not frequently (Izgi, 1993). All of these studies have one thing in common. They all were based on the belief that human kind should know and understand the real reasons for all plants and animals, especially those important to day-to-day life.

As a result of these goals, a number of books related to science areas were developed during the early and middle Ottoman Empire period (between the 14th and 16th centuries). However, at the end of the 17th century, the Ottoman Empire entered a period of not only intellectual stagnation but also political. Religious studies became once more the dominant focus and natural studies and philosophy were viewed as not necessary. Scholars, and thus the public, viewed such studies as diversions from one's religious belief. It became progressively more difficult to find any courses related to science in the Ottoman *Medreses* (Izgi, 1993; Akyuz, 1993; Uzuncarsili, 1965).

Although this period of stagnation had few regular courses related to science, there were pockets of scholars who continued to study science and mathematics areas, including physics, chemistry, botany, astronomy, geography, calculation, and geometry in the Ottoman *Medreses*. But even these pockets of science study were influenced by religious and philosophical classic idealism. These underpinnings came from the Islamic faith that places God as the creator and controller of all living and non-living things in the universe. This approach toward worldly studies of science and mathematics was accepted throughout the early and middle periods of the Ottoman Empire and continued through the end of the 18th century.

The Beginning of Reform Movements in the Education Area in the Ottoman Empire

The era covering 18th and 19th century showed some important reforms in social, political, and educational areas toward the late times of the Ottoman Empire. Some of these reforms include:

- (1) The first military schools opened under the western influence in 1773,
- (2) Instead of handwriting, the printing-press machine began to be used widely

and increased the number of books,

- (3) The decree of imperial reorganization in 1839,
- (4) The number of middle and secondary western styles schools opened, although traditional schools continued,
- (5) The first constitution accepted in 1876, followed by the 1908, second constitutional term,
- (6) In terms of education, we find development of veterinary, agriculture, and teacher preparation. We also see expanded opportunities for girls, although nonofficial, and the creation of graded levels, middle, high school, and college levels (Ergun, 1996),
- (7) Entering the First World War in 1914 which led to the collapse of the Ottoman Empire, and
- (8) The foundation of the Republic of Turkey in 1923.

When the Ottoman Empire began to see its decline against Europe and to accept the superiority of Western European States, the search began to find the reasons for this decline. It was determined that one of the major factors was the military superiority of Western Europe. As a result, the first secular military school was opened in 1773 and was called the Imperial School of Naval Engineering Sciences. This marked the first time that education was not directly affiliated with religion and the beginning of a new phase of schooling in the Ottoman Empire (Lewis, 1961).

During this time, we find both the continuation of the traditional *Medreses* schools and the expansion of military and other differentiated educational offerings. This all coincides with an imperial decree that expanded the rights given to Ottoman citizens and the creation of civil servants and the level of bureaucrats within the empire. This 1839 decree is now viewed as a turning point in Turkish history and the beginning of the westernization (the Noble Rescript, *tanzimat fermani* in Turkish).

This also marked the beginning of Middle Schools, (Rusdiye), where reading and basic religious education was the focus. The most important difference of this school was that they created different grade levels, usually three years, and that subjects went beyond religion to include subjects such as mathematics and geography. The upper level middle schools were called *Idadi* and many times included formal science and natural science courses. These middle levels were followed by generally three years of high school. High school classes of the time might include French and other science related courses.

In 1863 a modern style university was established with branches that included the natural sciences. This also marked the founding of the Association of Ottoman Science who published the first scientific journal called the Journal of Science (Akyuz, 1993; Ergun, 1996). To staff these new educational levels, foreign instructors and specialists were hired, especially from France.

After the 1836 decree of reorganization (*the Noble Rescript*), closer relationships were established with several western countries, specifically France and Great Britain. Students from the Ottoman Empire began to send students to be educated abroad, especially to France (Sisman, 1983). Many of these foreign educated

students returned to play important roles in the transformation of the country. The expanded relationships also resulted in the translation of many foreign books; in particular military, medicine, and the sciences were translated into Turkish and found their way into the classrooms. For example, Hoca Ishak Efendi, as an instructor in the school of mathematics, translated four volumes covering the European knowledge of mathematical and physical sciences (Lewis, 1961). The decree of reorganization also led to the opening of a number of foreign schools within the Ottoman Empire (Ergun, 1996; Sisman, 1983). Thus the time between the 18th and 19th centuries was a transition era from its traditional to the western structure. The introduction of secular schools was a major transition, even though these new schools still covered traditional cultural elements and taught religious courses.

Toward the end of the 19th century, we find the first formal science courses, such as, chemistry, physics, and natural sciences, began to be taught in middle and high schools. Most of the books related to science and that were taught in schools during this period were translated from French (Lewis, 1961), and thus the essence of science instruction began to change in a positivist direction. For example, in the first university library of Istanbul, there are many translated books from French, which reflect this positivist philosophical approach (Akyuz, 1993; Ergun, 1996).

As previously mentioned, the traditional schools, *Medreses*, did not offer formal science; and when science was taught, the course material was used to understand the existence of all-living and non-living things created by God. In contrast, the new secular schools taught sciences to understand natural phenomena controlled by the natural laws (Sarıkaya, 1997; Albayrak, 1990; Adivar, 1945; Akyuz, 1993).

For example, in the medical schools, students who later were involved in the Union and Progress Movement of the Ottoman Empire came away from their schooling with the understanding that life was the consequence of biological progresses and changes (Mardin, 1994) and not simply dismissing phenomena as being created by the God. Such educational reforms toward the end of the Ottoman Empire created a philosophical shift toward a positivist approach to science courses and curriculum. Some historians believe that the attempts to hold on to the Medrese or traditional school system ultimately lead to the collapse of the Ottoman Empire (Albayrak, 1990).

While these changes were happening in education, there were opposition movements and condemnations related to the newly formed schools and courses, especially natural and physical science courses. Attacks came from the public, religious scholars, and even the ministry of education and other administrators (Albayrak, 1990). For instance, the first university in the Ottoman Empire was opened in 1863 and began to offer courses in the sciences, but was burned, thus forcing it to cease its activities. It later opened again in 1869, but once more was forced to shut its doors because of the continued outcry by religious groups activities groups and activists (Kocer, 1971).

Science Education in the Republican Era (after 1923 to Present)

The Ottoman Empire collapsed as a consequence of the First World War and in 1920 the liberty movement, under the leadership of Mustafa Kemal, began in Anatolia. By 1922, the Ottoman Empire became history when the power and

authority of the Sultanate was abolished. The Republic of Turkey was promulgated on 29 October 1923. With the selection of Mustafa Kemal as the first president of the Republic of Turkey, the previous two centuries of educational reform entered a new era. Some of the more important reforms completed in the new Republican era include:

- (1) The acceptance of Latin characters as the official script in 1928 instead of Arabic characters,
- (2) Expansion of secularism in the social, educational, and legal areas,
- (3) Acceptance of the western calendar and measurement scales,
- (4) The abolishment of the Caliphate, as the spiritual head of all Muslim people,
- (5) All schools and educational activities were brought under the control of the Ministry of Education and the abolishment of religious schools and *Madrese*),
- (6) Gradual removal of religious courses from elementary, middle, and secondary level school curriculum,
- (7) Instead of traditional dress codes, western dress codes were accepted,
- (8) Secularism was put in the constitution in 1936, thus completing the transformation to westernization and secularization in Modern Turkey (Lewis, 1961; Akyuz, 1993).

Along with these reforms came nationwide reading and writing courses developed to decrease the level of illiteracy and the number of school (as elementary, middle, and secondary level) was increased. We also find, for the first time, science courses as part of curriculum in all school levels (Lewis, 1961).

The approach and philosophy to the education (especially in science education) was a positivist approach. For example, the founder of the Republic, Mustafa Kemal Ataturk, clearly stated in some of his speeches that

in the life, there is only one real path which is science. To search other paths and guidance is meaningless. Wherever there is science, we will find it and put it to the heads of every citizen of our nation and there is no condition for science and technology. The Turkish nation is ready and resolved to advance, unhalting and undaunted, on the path of civilization. In the path of civilization and progress of the Turkish nation, the torch held in her hand and head is positive science (Akyuz, 1993, p: 294-295, Lewis, 1961, p. 401).

These quotes reflect the essence of the new republic educational reform.

On the other hand, the educational scholars of the time were not in total agreement with the educational philosophy of Ataturk. Some of them found Ataturk's education philosophy idealist and pragmatist while others classified his philosophy as a combination of idealism, pragmatism, naturalism, and humanism (Budak, 2003; Dogan, 1982; Giritli, 2001). While scholars in general understood that Ataturk's philosophy was for the good of his nation, they were concerned that his reforms focused on a positivist approach to education reform.

As a result of these early Turkish republic educational reforms, science courses were added to the curriculum in all grade levels. Due to continued westernization and the spread of secularism, special attention was given to positivist philosophical

approaches. However, the resulting courses focused on teaching scientific facts through memorization with little or no application or experimentation. There were some who criticized these instructional methods but were unable to have much influence.

During the early years of the Republic, foreign educators were invited to Turkey, including John Dewey who came to Turkey twice and submitted two reports related to educational problems and their solutions, with special attention to Village School Teacher Preparation Schools. In these reports, Dewey recommended that science curriculum employ a more pragmatic and experimental approach. His suggestions got some attention and, as a result, teacher preparation and some science courses increased the use of experiments, problem solving, and practical applications of scientific knowledge, instead of heavy memorization (Turkmen & Bonnstetter, 1997). Governmental influence of the time also added in this transition. For example, in the first Turkish Economy Conference held in 1923, Ataturk said that education should give the nation's kids necessary and useful things to maintain their daily lives. Elements of Nationalism also worked their way into education as the nation's educators searched for Turkish words for scientific concepts and mathematical terms (Budak, 2003). After the death of Ataturk in 1938, we find a philosophical shift in education toward humanism. This new focus continued until around 1950. The effect of humanism on education led to the development of more theoretical courses and a return to memorization of upper level scientific knowledge, with less importance given to daily applications (Budak, 2003).

In 1951, Turkey was accepted as a member of NATO. This membership helped develop a closer relationship with the USA. Since the 1950's many Turkish students have been sent to the USA for higher education in order to complete their master and doctoral studies. Also, the competition between the USA and former Soviet Union after the Sputnik Era spurred the modern science curricula (PSSC, BSSC, the CHEM study, etc). These modern science curricula and books were translated to Turkish and began to be applied in some secondary schools. These schools became known as modern science curriculum schools. These schools differed in their focus on laboratory experiments, problem solving, and cooperative learning. It is interesting to note that the translated BSSC Modern Biology textbook was criticized for covering human evolution. By 1969, the elementary and middle level school science curriculum was also changed with more attention given to lab experiments and problem solving approaches. However, many elementary school science courses were combined with the social science courses and called life science. This was the norm from first grade to third grade and as a result science content in the life sciences was for the most part ignored (Kaptan, 1998). During the 1960's and 1980's, the influence of American science curriculum increased and philosophical approach shifted to experimentalism, while still keeping its essence as positivist.

Like many other countries around the world, Turkish religious scholars, and even some scientists, began to question the exclusive inclusion of evolutionary theory in secondary biology. As a result, in 1988, creationism was added to the biology curriculum. This marked the first time in the Republican era that Turkish Science education had deviated from the positivist approach.

This trend toward more religious overtones in education took another step forward after military intervention in 1980. With the new constitution in 1982, religious culture and a conscience course became compulsory from 4th grade through 11th grade. While the change was strongly criticized, it was defended as necessary to provide religious and cultural knowledge. By approaching the change in this manner, reformists were able to stay within the boundaries of the constitution that requires separation of Mosque and State, including education. So while these additional classes were added, the main philosophical approach of secularism and positivism have been maintained.

For example, during the 2001 and 2002 educational term, another modified science curriculum has been applied in schools (Tebliġer Dergisi, 2000). However, the essence of this new science curriculum is basically the same as the previous. For instance, the new curriculum reaffirms that science curriculum is to provide students with an understanding of how science is used to solve every day problems in every aspect of life. The new science curriculum includes the latest pedagogical developments of science education, such as, hands- and minds-on science, student-centered learning and teaching, project-based scientific activities, scientifically literate citizens, science for every one, positive attitudinal development toward science, and science-technology and society.

However, even this latest curriculum seems to ignore some tenets of the nature of science such as science being a human endeavor to explore the universe and that science knowledge is constantly being revisited and revised as we learn more. This idea of science being a process of revision through continuous experimentation and observation is still not driven home in this latest curriculum. (Turkmen & Yalcin, 2001). If a next step could be identified at present, it would be the need to address inquiry-based learning as a means to expand the understanding of the nature of science.

This latest Turkish Science Curriculum for primary schools was begun nationwide during the 2004-2005 school year. The major philosophy behind this latest science curriculum is post-modernism, according to the Ministry of National Education (MEB, 2004). The rationale for this latest update is that previous science curricula presented scientific facts as certain and not changeable, as the Newtonian positivist approach. For example, the current science curriculum for primary schools points out that there is no 100% certain fact in science. This presentation of science as changeable is viewed as a post-positivist approach (MEB, 2004). This, along with the latest curriculum changes in elementary and middle school science education that offers greater opportunity for students to construct and reach understanding by doing hands-on experiments, problem solving, and project-based learning activities, is evidence of educational reform progress.

Results and Discussion

This review has found that historical events and philosophical approaches of any given time have greatly influenced Turkish science education development. Over the last one thousand years, the following represent some of the most important educational developments.

- (1) When Turks became Muslim, they were greatly influenced by the Arabic, Persian, and Islamic Civilizations. In the beginning of formal education,

science was not a core subject and was not respected in the traditional religious schools of the time, called Medrese.

- (2) As the Ottoman Empire showed signs of stagnation, and loss of power and territories against the western countries, their influence brought many changes, including westernization of education. This reform began in the middle of the 18th century with the creation of secular schools that coexisted with the traditional schools of the time. Much of the curriculum found in these secular schools was transferred and translated to Turkish from western counterparts and, as such, employed positivist approaches and secular views of science.
- (3) After the collapse of the Ottoman Empire as a consequence of the First World War, the republic of Turkey was founded under the leadership of Mustafa Kemal Atatürk. The young republic was greatly influenced by westernization and secularizations, especially in education, thus resulting in some of the most important reforms in Turkish educational history. At the beginning of these reforms, the major philosophical approach toward science education was primarily positivist, although early signs of experimental and pragmatist approaches can be found.
- (4) As a result of increased American influence after 1950, a new modern science curricula began to be applied that expanded experimental, pragmatist, and problem-solving approaches.
- (5) Currently Turkish science educational approaches are undergoing yet another transition, as they move from a positivist to a post-positivist emphasis. At the core of this most recent change is a desire to go beyond teaching science concepts and include an accurate vision of the nature of science. This refocus on the tenets on science as a process is an effort to help society understand not only science content, but how science evolves and grows as new insights are gained.

In conclusion, the last one thousand years or more of Turkish educational development and related philosophical approaches to the teaching of science are found to have numerous historical similarities to other parts of the world. We have examined how regional cultures, philosophies, as well as religion has altered how early natural studies and later science content was taught. While documentation of historical educational developments are important to those whose ancestors are being described, the true value of this regional- and country-specific evolutionary historical journey has even greater value when compared and contrasted with similar investigations from around the world. Only then do we see the critical events clearly and isolate the influences of our past intellectual growth as a society. This manuscript lays the groundwork for future world-wide investigations. We challenge each and every region of the world to document the educational development of science education so that in the future these pieces of the puzzle can be assembled into a clearer vision of past growth that may well help us see beyond the present and better prepare for the future. This is becoming even more important with current accelerated globalization. We need to contemplate and be far more proactive regarding future influences from political, economic, and religious factors. How will the expanding European Union impact our science education curriculum? What impact will various religious groups have on our

teaching? And how will emerging societies, such as China influence global intellectual development. The past is indeed the key to the future.

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