

HIGHER EDUCATION: CONTRIBUTION OF CIVILIZATIONS

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Abstract

This paper is the result of an effort to validate US presidential candidate (2016 election cycle) Carly Fiorina's strong assertions made during a speech she delivered on September 26, 2001, when she was the CEO of HP, Inc., about the Islamic civilization's intellectual contributions to society. The findings of this study show the exact nature and magnitude of these contributions and confirm the correctness of Ms. Fiorina's statements that the works and institutions from the Islamic civilization did serve as precursors to present-day higher education. Additional follow-up research, however, would be beneficial in establishing the overall contributions of the Islamic civilization beyond higher education.

INTRODUCTION

The contributions of past civilizations to higher learning are revealed through the discoveries made, knowledge developed, and institutions founded during the centuries of life and work within those civilizations. This work is a study into those contributions, as sparked by a speech delivered by Carly Fiorina delivered on September 26, 2001 in Minneapolis, USA in the capacity of Hewlett-Packard's CEO, in which she shared this:

There was once a civilization that was the greatest in the world. It was able to create a continental super-state that stretched from ocean to ocean, and from northern climes to tropics and deserts. Within its dominion lived hundreds of millions of people, of different creeds and ethnic origins.

One of its languages became the universal language of much of the world, the bridge between the peoples of a hundred lands. Its armies were made up of people of many nationalities, and its military protection allowed a degree of peace and prosperity that had never been known. The reach of this civilization's commerce extended from Latin America to China, and everywhere in between. And this civilization was driven more than anything, by invention. Its architects designed buildings that defied gravity. Its mathematicians created the algebra and algorithms that would enable the building of computers, and the creation of encryption. Its doctors examined the human body, and found new cures for

disease. Its astronomers looked into the heavens, named the stars, and paved the way for space travel and exploration. Its writers created thousands of stories. Stories of courage, romance and magic. Its poets wrote of love, when others before them were too steeped in fear to think of such things.

When other nations were afraid of ideas, this civilization thrived on them, and kept them alive. When censors threatened to wipe out knowledge from past civilizations, this civilization kept the knowledge alive, and passed it on to others. While modern Western civilization shares many of these traits, the civilization I'm talking about was the Islamic world from the year 800 to 1600, which included the Ottoman Empire and the courts of Baghdad, Damascus and Cairo, and enlightened rulers like Suleiman the Magnificent.

Although we are often unaware of our indebtedness to this other civilization, its gifts are very much a part of our heritage. The technology industry would not exist without the contributions of Arab mathematicians. Sufi poet-philosophers like Rumi challenged our notions of self and truth. Leaders like Suleiman contributed to our notions of tolerance and civic leadership. (Fiorina, 2001)

In 2015 when Carly Fiorina declared her candidacy to become the President of the United States, there was suddenly a huge interest in all her past speeches. This particular speech provoked an immense amount of negative online feedback mostly challenging the accuracy of its contents. This research paper is, therefore, an attempt to fact-check her speech, which, if verified, would not only confirm that the Islamic civilization did serve as a precursor to present-day higher education but also give broader understanding about the exact nature of contributions made by the Islamic contribution.

CONTRIBUTION OF HIGHER LEARNING INSTITUTIONS

A distilling of the term *civilization*, finds it to be a culture that is characteristic of a particular place or a particular time (Merriam-Webster, 2009). The “golden age” of Suleiman the Magnificent, as mentioned by Fiorina, for example, lasted 50 years during the middle of the 16th century (Dodge, 2003) was characterized by the cultural influences of Islam. Yet, the Islamic civilization began centuries earlier and saw in its beginnings the establishment of higher learning institutions, several of which remain today. This can be seen in Table 1, showing the oldest universities still in existence, still developing learning and transferring knowledge. The oldest three were founded in the northern Africa and Middle East regions.

The earliest of these institutions of higher education were formed during the expansion of Islamic civilization and serve still as degree-conferring schools of higher learning. A brief write-up on the three earliest extant Universities follows.

TABLE 1
The World's 10 Oldest Extant Universities

Rank	Institution	Founded	Location
1.	University of Al-Qarawayyin	859 CE	Fes, Morocco
2.	Al-Azhar University	970-972	Cairo, Egypt
3.	Nizamiyya University	1065	Dhu'l Qa'da, Iran
4.	University of Bologna	1088	Bologna, Italy
5.	University of Paris	~1096	Paris, France
6.	University of Oxford	~1096	Oxford, UK
7.	University of Montpellier	1150	Montpellier, France
8.	University of Cambridge	1209	Cambridge, UK
9.	University of Salamanca	1218	Salamanca, Spain
10.	University of Padua	1222	Padua, Spain

(collegestats.org, 2015; Deriwala, 2014)

University of Al-Qarawayyin

Located in Fes, Morocco, the University of Al-Qarawayyin was originally a mosque founded in 859 by Fatima al-Fihri, who spent the inheritance from her father to create the university for her local area (Al-Hassani, 2012). Over the centuries it developed into a leading university for natural sciences, bringing in students from other nearby countries. In 1957, the university added mathematics, physics, chemistry, and foreign languages to its curriculum. Today, it is considered the oldest continuously-operating degree-granting university in the world by the Guinness Book of World Records (Guinness, 2015).

Al-Azhar University

Al-Azhar University, located in Egypt, is the world's second oldest surviving degree-granting institute. Founded circa 970-972, it was known to attract the "cream of intellects" (Al-Hassani, 2012, p. 68) and serves as a center for Arabic literature and Sunni Islamic learning, concentrating on a religious syllabus that pays special attention to the Quranic sciences and traditions of the Prophet Muhammad, while teaching all modern fields of science. Among the university's alumni were polymath Ibn al-Haytham, inventor of the pin-hole camera, and Ibn Khaldun, 14th century sociologist.

Nizamiyya University

As a series of universities, Nizamiyya University was established by Nizam al-Mulk in the eleventh century, in what is present-day Iran. As the most notable of the Nizamiyya institutes, Al-Nizamiyya of Baghdad, established in 1065 in Dhu'l Qa'da, is operational in Isfahan still today. Other Nizamiyya schools were founded in Nishapur, Amul, Mosul, Herat, Damascus, and Basra – all serving as models for future universities established within the region. Nizam Al-Mulk is

considered responsible for the era of brilliance, with his schools eclipsing other contemporary learning institutions.

These three oldest universities in the world – as beacons of higher learning from a past civilization – serve today’s society in the same capacity, even though much of the world has changed around them. This constancy of purpose is, however, only one of their legacies to the world of higher education: These earliest universities formed *the institution* of higher education. As Samuel Huntington (1965) explained, “Institutionalization is the process by which organizations and procedures acquire value and stability” (p. 394). Over time, they acquire adaptive capabilities – much like customs, norms, culture, and ethics do (Miles, 2012) – so that they are able to survive for generations. *Prolonged* institutionalization, as seen with these oldest universities – is a result of *even greater* adaptability (Huntington, 1965). Having been created to “perform very specific functions” (p. 304), that singular focus aids institutions’ adaptability. This is markedly different from individuals, who develop a wide variety of behaviors and responses over a time, before settling into familiar, less adaptable ones (Huntington, 1965).

With the institutionalization of higher learning, then – which at that time included, as Al-Hassani (2012) found, “entrance exams, challenging finals, degree certificates, study circles, international students, and grants” (p. 71) – other cities and regions followed suit for the remainder of the Islamic civilization, and beyond.

CONTRIBUTIONS BY SCIENTISTS

Notable scientists and their accomplishments coming out of this learning and knowledge-based Islamic civilization became recognized not only by their contemporaries, but throughout history for their contributions in furthering progress in the various fields of science (Ead, 1999). Such pursuit, according to Allawi (2009), “was conducted within a frame of reference which was specifically Islamic – that is, the pursuit of scientific goals was encouraged as part of the overall quest of Man to see and affirm the signs of God in nature” (p. 231). Table 2 provides a listing of many of those men of science and their contributions to the fields of mathematics, astronomy, medicine, geography, chemistry, and physics.

In his work on science and culture, Iaccarino (2003) had in mind these many contributors to scientific knowledge, when he wrote:

Muslims were the leading scholars between the seventh and the fifteenth centuries, and were the heirs of the scientific traditions of Greece, India and Persia. After appropriation assimilation, they built on these discoveries, and developed a truly Islamic science that led worldwide knowledge

TABLE 2
Muslim Scientists and Their Contributions

Time	Scientist (aka)	Field/Contribution(s)
??-777	Muhammad Al-Fazari	builder of world's first astrolabe
722-c815	Jabir ibn Hayyan (Geber)	"the father of chemistry," discoverer of sulfuric and nitric acids, inventor of alembic still for distillation
780-850	Muhammad ibn Musa Al-Khwarizmi (Algrithmi, Algaurizin)	inventor of algebra; mathematics, geographical data; wrote <i>The Form of the Earth</i>
801-873	Al-Kindi	chemist, contributor of geometric components for compound medicine, philosopher
810-887	Abbas ibn Firnas	first aviator; cryptographer, astronomer, physicist; inventor of crystal glassware
836-901	Thabit bin Qurra	mathematics
858-929	Muhammad al-Battani (Albategnius)	astronomer; invented measurements for accuracy
864-925	Abu Bakr al-Razi (Rhazes)	physician, alchemist, chemist, and philosopher
872-950	Abu Nasr Al-Farabi (Alpharabius)	scientist, cosmologist
898-980	Ibn al-Jazzar al Qayrawani	pediatrics
936-1013	Al-Zahrawi (Albucasis)	created the science of surgery; chemist; invented surgical instruments and apparatus for distilling rose water; wrote first illustrated book on surgery
950-1009	Ibn Yunus	astronomer
965-1039	Ibn al-Haytham (Alhazen)	physicist, mathematician, astronomer, optics; invented pin-hole camera
973-1048	Al-Biruni	physicist, astronomer, mathematician, astrologer, geologist, historian, physician, scientist, geographer
980-1037	Ibn Sina (Avicenna)	physician, polymath, wrote <i>Canon of Medicine</i> , philosopher
1048-1131	Omar Khayyam	maths, astronomer, philosopher
1099-1161	Muhammad al-Idrisi	geographer, cartographer
1136-1206	Ismail al-Jazari	mathematician; creator of the crank-shaft connecting-rod system
1201-1274	Nasir al-Din al-Tusi	astronomer, biologist, scientist
1213-1288	Ibn al-Nafis	physician, discoverer of pulmonary circulation

(Al-Hassani, 2012; Iaccarino, 2003; Syed, 2002; Valley, 2006)

in all scientific fields, including medicine. These activities were cosmopolitan, in that the participants were Arabs, Persians, Central Asians, Christians and Jews, and later included Indians and Turks. The transfer of knowledge of Islamic science to the West through various channels paved the way for the Renaissance, and for the scientific revolution in Europe (p. 220).

These scientific minds, whose own work would eventually be translated into Latin, had, themselves, “synthesized and further elaborated the knowledge they had gathered from the ancient manuscripts, adding their own experience” (Falagas, Zarkadoulia, & Samonis, 2006, p. 1583). They became scientific innovators with originality and productivity and transformed Baghdad into the center of the scientific universe (Syed, 2002).

CONTRIBUTION BY PHILOSOPHERS

Views of the world during this time were shaped not only by scientists, but by philosophers as well, as shown in Table 3 below. The Caliphs’ House of Wisdom in Baghdad fostered an environment of scientific and philosophical inquiry (Al-Hassani, 2012) that, according to Law (2012), “Islamic scholars were concerned to harmonize the revealed truths of their faith with the flame of philosophical inquiry from Greece and spread through the known world” (p. 32).

TABLE 3
Muslim Philosophers and Their Contributions

Years	Philosopher (aka)	Field/Contribution(s)
870-950	al-Farabi	political philosophy, metaphysics, ethics and logic
994-1064	Ibn Hazm	logician, ethicist; sense perception tied to knowledge
1126-1198	Ibn Rushd (Averroes)	philosopher, innovative mathematical, medical and theological thinker
1304-1369	Ibn Battuta (Shams ad-Din)	traveler of Asia and Africa

(Al-Hassani, 2012; El Diwani, 2005; Law, 2012)

CONTRIBUTION BY OTHER NOTABLES

The expansive nature of the Islamic civilization, across lands and time, further demanded the talents of travelers, writers, historians, architectural designers, and others – to observe, record, create, build, and teach. Prominent figures in such areas are shown in Table 4 below:

TABLE 4
Other Prominent Contributors

Years	Name, Field	Field/Contribution(s)
789-857	Ali Ibn Nafi (Ziryab) <i>Musician</i>	poet, musician, cosmetologist, astronomer,
877- 9??	Ahmad ibn Fadlan, <i>chronicler</i>	travel chronicler, author of <i>Risalah</i>
893- 956	Al Masudi, <i>historian</i>	historian of geography
1304-1369	Ibn Battuta (Shams ad-Din) <i>traveler</i>	traveler of Asia and Africa
1332-1406	Ibn Khaldun, <i>social scientist</i>	historian, authored <i>Al-Muqaddimah</i> ; studied civilizations; “father of sociology,” economist, judge, university scholar, diplomat
1489-1588	Mimar Sinan, <i>architect</i>	chief architect of the Ottoman state

(Al-Hassani, 2012)

Polymaths

Within the many contributors of knowledge and innovation in the civilization, a number of the scholars already identified as scientists, scholars, and philosophers, there existed those possessing universal genius – immense knowledge on a wide variety of subjects. These were the polymaths within the Islamic civilization. Just as the Greeks had Archimedes, Pythagoras, and Aristotle, the Islamic civilization had its ibn Hayyan, Al-Khwarizmi, Al-Biruni, and other polymaths, as seen in Table 5. The fields and work of these polymath individuals is further evidenced in Tables 5 and 6 below.

H.G. Farmer (1971) writes: “In the Islamic colleges in Cairo under the Fatimids, the doctors in the various faculties wore distinctive gowns (*khila'*), and it is said that the ordinary gown of British universities retains the original form of the Arabic *khil'a'*”.

CONCLUSIONS

This paper has validated what Carly Fiorina said in her 2001 speech regarding the contributions of the Islamic civilization. It has opened our eyes to the reality of vast contributions not only towards global higher education but also for the overall improvement of society.

TABLE 5
Prominent Polymaths

Years	Polymath (aka)	Fields of Contribution
722-c815	Jabir ibn Hayyan (Geber)	chemist, alchemist, astronomer, engineer, physician, pharmacist, philosopher, physicist, scientist
780-850	Muhammad ibn Musa Al-Khwarizmi (Algrithmi, Algaurizin)	inventor of algebra; mathematics, geographical data; wrote <i>The Form of the Earth</i>
789-857	Ali Ibn Nafi (Ziryab)	poet, musician, singer, cosmetologist, fashion designer, astronomer, botanist, and geographer
801-873	Al-Kindi	chemist, contributor of geometric components for compound medicine;
864-925	Abu Bakr al-Razi (Rhazes)	physician, alchemist, chemist, and philosopher
965-1039	Ibn al-Haytham (Alhazen)	physicist, anatomist, physician, engineer, psychologist, astronomer, inventor, scientist, mathematician, ophthalmologist, philosopher, theologian
973-1048	Al-Biruni	scientist, physicist, astronomer, astrologer, physician, geographer, geologist, historian, mathematician, pharmacist, anthropologist, philosopher
980-1037	Ibn Sina (Avicenna)	astronomer, chemist, geologist, logician, physicist, mathematician, psychologist, scientist, poet, wrote <i>Canon of Medicine</i>
994-1064	Ibn Hazm	law, logician, ethicist, historian, wrote on comparative religion; theologian; tied sense perception to knowledge
1126-1198	Ibn Rushd (Averroes)	philosopher, innovative mathematical, medical and theological thinker
1201-1274	Nasir al-Din al-Tusi	astronomer, mathematician, philosopher, historian, physicist, logician, physician, chemist, scientist, biologist
1213-1288	Ibn al-Nafis	physician, discoverer of pulmonary circulation; anatomist, biologist, lawyer, physiologist, historian, philosopher, logician, psychologist, scientist, linguist, astronomer, cosmologist, geologist, sociologist

TABLE 6
Polymaths: Fields and Works of Contribution

Field	Inventor	Inventive Work
Mathematics	Muhammad Al-Fazari	builder of the astrolabe
Chemistry	Jabir ibn Hayyan (Geber)	sulfuric and nitric acids; the alembic still for distillation
Physics	Abbas ibn Firnas	crystal glassware
Astronomy	Muhammad al-Battani (Albategnius)	measurements for accuracy
chemistry, medicine	Al-Zahrawi (Albucasis)	surgical instruments; first illustrated book on surgery; apparatus for distilling rose water
Geography	Al-Biruni	measuring the world
mathematics	Ismail al-Jazari	the crank-shaft connecting-rod system
mathematics, optics	Ibn al-Haytham (Alhazen)	pin-hole camera
medicine	Ibn Sina (Avicenna)	<i>Canon of Medicine</i>

The focus of this study was limited to higher education - it would be interesting to try to understand the overall magnitude and impact of the Islamic civilization beyond higher education. It would also be worthwhile to conduct a follow-up research on how and why the pace of intellectual enrichment slowed down.

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