

Lessons Learned from a Cross-cultural Study on the Theory of Evolution

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Why Investigate Evolution?

- The renowned biologist Dobzhansky stated: “Nothing in biology makes sense except in the light of evolution.”
- UK “curriculum beyond the year 2000” has considered evolution one of the theories essential for students to learn because of its well-connected “explanatory story” of the natural and living world

Acquiring a scientific viewpoint

- The acquisition of a scientific viewpoint is not at heart an epistemological issue, nor is it a simple matter of rational conceptual change
- Research has shown 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 rooted in a “cluster of prior ideas, beliefs, values, and emotions [that] serves as the initial set of interpretive categories”

Acquiring a scientific viewpoint (2)

- 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
- Several researchers in science education have tried to capture this cluster of ideas.
- Cobern defined an individual's worldview as “the culturally-dependent, implicit, fundamental organization of the mind which is composed of assumptions which predispose one to feel, think, and act in predictable patterns”

Acquiring a scientific viewpoint (3)

- Most of the revolutions in the history of science involved challenges to existing **worldviews**.
- The Darwinian revolution is an example of a paradigm that met (and is still meeting) strong resistance.

Acquiring a scientific viewpoint (4)

- Darwin's *Origin of species* and the assumptions it endorsed for explaining the diversity of life forms **did not just present a new explanatory framework.**
- His propositions “**demanded a complete rethinking of man’s concept of the world and of himself**”
- The explanation of life from a purely materialistic approach presented a **dramatically different worldview** from the prevalent one at the time.
- The vigorous response to Darwin’s theories was the result of their philosophical implications, which **shook major beliefs shared by the general culture of his time.**

Acquiring a scientific viewpoint (5)

- Darwin's ideas challenged four "pillars of the Christian dogma":
 - A belief in a constant world,
 - A belief in a created world,
 - A belief in a world designed by a wise and benevolent creator
 - A belief in the unique position of man in the creation.
- The dominant Judio-Christian account of origins, based on the book of Genesis in the Bible, states that God created the heavens and the earth and what is in between.

Acquiring a scientific viewpoint (6)

- For Moslems, a similar account is also present in the holy Qur-aⁿ.
 - Many chapters of the Qur-aⁿ include verses about creation. The following are two verses that contain the creation of earth, humans, and animals:
 - “We have indeed created man in the best of mold” (Surah At- Tin, Ayah 4), and
– *ولقد خلقنا الإنسان في أحسن تقويم*
 - “Allah has created every animal from water: Of them there are some that creep on their bellies; some that walk on two legs; and some that walk on four. Allah creates what He wills, for verily Allah has power over all things” (Surah An-Nur, Ayah 45).
– *والله خلق كل دابة من ماء فمنهم من يمشي على بطنه ومنهم من يمشي على رجلين ومنهم من يمشي على أربع يخلق الله ما يشاء إن الله على كل شيء قدير لقد أنزلنا آيات مبينات والله يهدي من يشاء إلى صراط مستقيم*

Studies on which the Presentation is Based

- Dagher, Z., & BouJaoude, S. (1997) Scientific views and religious beliefs of college students: the case of biological evolution. *Journal of Research in Science Teaching*, 34, 429-455.
- Dagher, Z., & BouJaoude, S. (2005). Students' perceptions of the nature of evolutionary theory. *Science Education*, 89, 378-391.
- Hokayem, H. & BouJaoude, S. (2008). College Students' Perception of the Theory of Evolution. *Journal of Research in Science Teaching*, 45, 395 – 419.
- BouJaoude, S., Ashagr, A., Wiles, J., & Alters, B. (2009). *Biology professors' and teachers' positions regarding biological evolution) and evolution education in a middle eastern society*. European Science Education research Association.
- BouJaoude, S. (2009). *Lebanese secondary school students' conceptions' of biological evolution and their relationships to religious beliefs*. Paper to be presented at the International symposium on evolution and religion, sponsored by Social Sciences and Humanities Research Council (SSHRC) and the Evolution Education Research Centre (EERC) at McGill University).
- BouJaoude (2009). *Muslim Egyptian and Lebanese students' conceptions of biological evolution*. Paper presented at the symposium on Darwin and Evolution in the Muslim World. A conference at Hampshire College, Amherst, MA October 2–3, 2009.

Selected Results

- *Personal Positions toward Evolution.* The four major positions that emerged reflect views of students who
 - Accepted evolutionary ideas using arguments from an evolution or reconciliation perspective;
 - Did not accept evolutionary ideas presenting arguments from a religion or antievolution perspective;
 - Reinterpreted the theory presenting arguments from a compromise perspective; and
 - Were neutral, reflecting either a non-committed or a confused perspective.

Selected Results

Table 2

Students' personal positions toward the theory of evolution represented in relation to their religious affiliation

Position	Christian		Moslem		Total/Position	
For evolution	82%	(n = 14)	35%	(n = 16)	48%	(n = 30)
Against evolution	0%	(n = 0)	47%	(n = 21)	34%	(n = 21)
Compromise	6%	(n = 1)	18%	(n = 8)	15%	(n = 9)
Neutral	12%	(n = 2)	0%	(n = 0)	3%	(n = 2)
Total/religion	100%	(n = 17)	100%	(n = 45)	100%	(n = 62)

Secondary School Biology Teachers

- Nine out of the 20 teachers accepted the theory of evolution. They were either Christian or Druze. Five rejected the theory and were Muslims.
- Three Muslim teachers reinterpreted the theory arguing from a compromise perspective and suggesting that evolution did not include humans, citing verses from the Quran to support their positions.
- Three teachers did not want to commit to any position regarding the theory.

Results: University Biology Professors

- 4 out of the 7 university professors accepted the theory of evolution; 2 were Christian, 1 Shiite, and 1 Druze.
- 3 of the 7 professors reinterpreted the theory arguing from a compromise perspective. Two of them were Muslims and argued that evolution did not include humans.

Results: High School Students

	Disagree				Undecided				Agree			
	All	M	D	C	All	M	D	C	All	M	D	C
Accurate science includes religious explanations	39	29	49	53	21	19	22	25	40	52	29	22
Evolution is best learned from the holy book of your religion	34	22	48	47	31	28	28	38	35	50	24	15
The scientific model regarding biological evolution is correct, and it does not conflict with your religion	38	42	35	33	37	33	40	42	25	25	25	25
The holy book of your religion and science conflict on their explanations about human origins	18	19	19	17	30	32	43	23	52	50	38	60

Results: High School Students

	Disagree				Undecided				Agree			
	All	M	D	C	All	M	D	C	All	M	D	C
Biology classes should include your religion's explanations of animal history on Earth	40	34	41	50	18	17	19	16	42	48	40	33
Biology classes should include your religion's explanations of human history on Earth	41	34	45	54	18	18	18	17	41	48	37	29
God created human beings pretty much in their present form at one time within the last 10,000 years or so	30	27	35	34	40	36	48	41	30	38	18	25
My religion influences how I think about the science of evolution.	32	23	45	40	20	18	23	22	48	59	32	38

Lessons Learned from the Research

- Many students had misconceptions about the theory of evolution, even college students who had studied evolution.
- Biology Teachers and university professors had alternative conceptions about evolution.

Lessons Learned from the Research

- Students', high school teachers', and university professors' conceptions about evolution are influenced by their religious affiliations.
- Conceptions of evolution are influenced by students' religiosity (even though they had not studied evolution at school!).

Implications

- What are the implications of the research results on educational matters?
 - What do the results suggest about the quality of teaching and the nature of learning, especially in the sciences?
 - Are there indicators that students are autonomous and reflective thinkers?
 - Are there indicators that school and university education is having a profound impact on how students think and act or only what they know?
 - Is education fostering a culture of dialogue and understanding

Implications

Should teaching be a **conserving** or a **subversive** activity?

PRINCIPLES OF SUBVERSIVE TEACHING

- The teacher rarely tells students what he/she thinks.
- Generally, he/she does not accept a single statement as an answer to a question.
- He/she encourages student-student interaction as opposed to student-teacher interaction
- Generally, he/she avoids acting as a mediator or judging the quality of ideas expressed.

PRINCIPLES OF SUBVERSIVE TEACHING

- He/she rarely summarizes the positions taken by students on the learnings that occur. He recognizes that the act of summary or "closure" tends to have the effect of ending further thought.
- Generally, each of his/her lessons poses a problem for students.
- His/her lessons develop from the responses of students and not from a previously determined "logical" structure.