Observed problems and proposed solutions for science education in global universities

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The issue at hand and my own contribution

Recent decades have seen substantial increases in the number of universities worldwide, in the courses they provide and in the international movement of students for their university education. Such developments provide exciting opportunities for the next generation to learn, including learning about other countries and cultures and to contribute towards societal goals at both national and international levels.

At the same time, such developments have caused many to question what the role of a university should be (Barnett, 2011). Nowhere are these issues more pressing than in universities in the Muslim world. Those responsible for the education that such universities provide may seek to do so in ways that seem to pay little attention to Islam or in ways that are consonant both with Islam and with the ideals of the university movement, always remembering that the university movement had its origins in the Muslim world.

It is this issue – the relationship between Islam and the university movement – that I wish to address in this short essay and because I am providing a contribution to the task force on 'Science Education in Universities of the Muslim World', my context is the teaching of science. At the same time, I write as someone who is not a Muslim. Any worth in the contribution that I seek to make is therefore largely provided by virtue of the fact that I write as someone who, while familiar with generalist arguments about the role of today's universities and how best to teach science while being respectful of religious sensibilities (I am a professor of science education based in a university and I am a Christian minister), is not a Muslim.

What is the problem?

Focusing on problems can be a negative way of approaching issues. Nevertheless, there is a growing problem in how global universities understand their role. Put simply, the days have gone when the faculty and students in a university shared a common cultural viewpoint. Today's universities, especially if they are academically successful, increasingly draw their faculty and students not only from a number of countries but from countries where individuals differ in their personal values, in their religious affiliations and in the importance they attach to religion.

Often this diversity can be ignored in terms of any consequences this has for the functioning of the university – or simply dealt with via informal discussions in the

time-honoured ways that universities have allowed, even encouraged, discussion and debate (Andrews, 2009). However, in certain circumstances issues arise that are core to the teaching of a subject where to ignore the different attitudes, perceptions and interpretations that individuals hold is to inhibit learning and even risk inflaming the situation. A classic instance of this is the teaching of evolution and I will now concentrate on this, after some preliminary remarks on the relationship between science and religion, partly because it is something of a cause célèbre, partly because there is an academic literature on which one can draw and partly because I am not convinced that the way we currently deal with issues raised by the teaching of evolution is as good as it could be.

The relationship between science and religion

The sociologist Robert Merton characterised science as open-minded, universalist, disinterested and communal (Merton, 1973). For Merton, science is a group activity; even though certain scientists work on their own, science, within its various sub-disciplines, is largely about bringing together into a single account the contributions of many different scientists to produce an overall coherent model of one aspect of reality. In this sense, science is (or should be) impersonal. Allied to the notion of science being open-minded, disinterested and impersonal is the notion of scientific objectivity. The data collected and perused by scientists must be objective in the sense that they should be independent of those doing the collecting (cf. Daston & Galison, 2007) – the idealised 'view from nowhere'.

Other philosophers of science and sociologists have built on such notions of scientific knowledge. Karl Popper emphasised the falsifiability of scientific theories (Popper, 1934/1972): unless one can imagine collecting data that would allow one to refute a theory, the theory isn't scientific. Lakatos (1978), informed by Thomas Kuhn's (1970) work on scientific paradigms, argued that scientists work within research programmes. A research programme consists of a set of core beliefs surrounded by layers of less central beliefs. Scientists are willing to accept changes to these more peripheral beliefs so long as the core beliefs can be defended. So, in biology, we might see in contemporary genetics a core belief in the notion that development proceeds via a set of interactions between the actions of genes and the influences of the environment. At one point, it was thought that the passage from DNA to RNA was unidirectional. Now we know (reverse transcriptase, etc.) that this is not always the case. The core belief (that development proceeds via a set of interactions between the actions of genes and the influences of the environment) remains unchanged but the less central belief (that the passage from DNA to RNA is unidirectional) is abandoned.

There is now a very large literature on the relationship between science and religion: a major overview is provided by Clayton and Simpson (2006) and the journal *Zygon* specialises in this area. Consider, first, the question of 'authority' and the scriptures as a source of authority. To the great majority of religious believers, including university students, the scriptures of their religion (the Tanakh, the Christian bible,

the Qur'an, the Vedas, including the Upanishads, the Guru Granth Sahib, the various collections in Buddhism, etc.) have an especial authority by very virtue of being scripture. This is completely different from the authority of science. Newton's *Principia* and Darwin's *On the Origin of Species* are wonderful books but they do not have any permanence other than that which derives from their success in explaining observable phenomena of the material world and enabling people to see the material world through Newtonian / Darwinian eyes. Indeed, as is well known, Darwin knew almost nothing of the mechanism of inheritance despite the whole of his argument relying on inheritance, so parts of *The Origin* were completely out of date over a hundred years ago. Equally, for all its power, the Newtonian understanding of the world is a partial one, one that breaks down, in particular, over small distances and at high speeds.

The theory of evolution

As with any large area of science, there are parts of what we might term 'front-line' evolutionary theory that are unclear, where scientists still actively work attempting to discern what is going on or has gone on in nature. But much of evolution is not like that. For the great majority of the scientific community, evolution is a well-established body of knowledge that has built up over 150 years as a result of the activities of many thousands of scientists. The following are examples of statements about evolution that lack scientific controversy (Reiss, 2013):

- All of today's life on Earth is the result of modification by descent from the simplest ancestors over a period of several thousand million years.
- Natural selection is a major driving force behind evolution.
- Evolution relies on those occasional instances of the inheritance of genetic information that help (rather than hinder) its possessor to be more likely to survive and reproduce.
- Most inheritance is vertical (from parents) though some is horizontal (e.g. as a result of viral infection carrying genetic material from one species to another).
- The evolutionary forces that gave rise to humans do not differ in kind from those that gave rise to any other species.

There is much about the theory of evolution that is intellectually attractive. For a start, a single theory provides a way of explaining a tremendous range of observations; for example, why it is that there are no rabbits in the Precambrian, why there are many superficial parallels between marsupial and placental mammals, why monogamy is more common in birds than in fish and why sterility (for example, in termites, bees, ants, wasps and naked mole rats) is more likely to arise in certain circumstances than in others. Indeed, I have argued elsewhere that evolutionary biology can help with some theological questions, including the problem of suffering (Reiss, 2000).

The theory of evolution is not a single proposition that a person must either wholly accept or wholly reject (Scott, 1999). However, for religious reasons many people reject much of evolution, although considerable diversity exists within Muslim countries as to how the theory of evolution is presented in textbooks (Asghar *et al*., 2014) and understood in society (BouJaoude *et al*., 2011). For many Muslims, the Qur'an precludes a full acceptance of evolutionary theory, in particular the ideas that all of today's life on Earth is the result of modification by descent from the simplest ancestors and that the evolutionary forces that gave rise to humans do not differ in kind from those that gave rise to any other species. For other Muslims, the theory of evolution is compatible with their Islamic faith and understanding of the Qur'an. The various positions are discussed at some length by Negus (2005), Edis (2007) and Guessoum (2011).

Worldviews

One approach that has found favour in recent years as an educational way of dealing with contrasting understandings about the world, when these are deeply held by individuals, is the approach of worldviews. The essence of a worldview, as the word itself implies, is that it is a way of conceiving and understanding the world that one inhabits (cf. Aerts *et al*., 1994). So, someone with an atheistic worldview is likely to believe that the world is morally neutral and that there are no ultimate purposes in life beyond those that we decide for ourselves, whereas someone with a religious worldview is likely to understand the world and our purpose in it very differently.

The rejection, on religious grounds, of the standard scientific theory of evolution can profitably be seen not as a simple misconception that careful science teaching can correct, as careful science teaching might hope to persuade a student that an object continues at uniform velocity unless acted on by a net force, or that most of the dry mass of a plant comes from air as opposed to the soil. Rather, a student who rejects the standard scientific theory of evolution can be seen as holding or inhabiting a worldview that has a very different way of seeing the world compared to the perspective of evolutionary biology. The pedagogical significance of this comes largely from the observation that one very rarely changes someone's worldview, whether at school or university, as a result of a short sequence of teaching, however well taught, whereas one may indeed replace a misconception with an alternative understanding after a brief teaching sequence (Chinsamy & Plagányi, 2007; Reiss 2008). A learner is likely to have far more of personal significance invested in a religious worldview than in a scientific misconception.

Contrary to others (e.g. Williams, 2014), I do not think that the aim of teaching about evolution should be to attempt to persuade students to *accept* the theory of evolution. Rather, I think it should simply be to enable students to *understand* the theory. Furthermore, the argument is not that the theory of evolution, or indeed any other aspect of modern science that the learner may feel conflicts with their religious beliefs, is the truth; rather the argument is that the theory of evolution, or whatever aspect of modern science is at issue, is widely (not necessarily universally)

accepted by the scientific community and so it is worth learners having an understanding of it, even if they themselves do not accept it. Indeed, a good understanding of the theory, when taught sensitively, can aid acceptance (cf. Winslow *et al*., 2011).

Conclusion

Universities, both in the Muslim world and elsewhere, are increasingly multicultural institutions. The tension for today's university is how to take account of learner diversity – every good educator needs to be sensitive to differences in thinking among their students – while remaining faithful to the knowledge that the various disciplines have built up over time. The best education challenges learners but it does not undermine them. University education is a place to help students to thinking rigorously and critically and to introduce them to new ideas and, above all, to knowledge that is robust.

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