

RALPH LEVINSON

Formatted: Centered

## TEACHING EVOLUTION IN SCHOOLS: A MATTER OF CONTROVERSY?

Formatted: Font: 13 pt

**Ralph Levinson**

### INTRODUCTION

Formatted: Font: Not Bold

Formatted: Centered

In a clip from YouTube Richard Dawkins says “Who cares about creationists? They don’t know anything”

Formatted: Font: 10 pt

(<http://www.youtube.com/watch?v=R9uhE4CT2xM>). Like Dawkins, I agree that creationism has nothing to

Formatted: Font: 10 pt

offer as an explanation for the origins and diversity of life on this planet. Although I am not a professional biologist everything I have read and heard, including Darwin’s *Origin of Species*, has so far convinced me that evolution is a fact, and that while there are different explanations to account for evolution none have to date undermined it. But I wonder whether the more one rails against creationism and creationists the more likely that the latter will feel impelled to push their case. Ruse (2007) suggests that comments such as Dawkins’ tend to alienate young people coming from a creationist background grappling with the complexity and enormity of the change of worldview that the fact of evolution offers. If those to whom you are closest, who you love and who have sustained you are called ‘ignorant’ and worse, it is hardly likely to endear to you those who see you as ignorant as you try and ‘cross the border’ (Aikenhead, 1996) into a different way of thinking about nature.

Formatted: Font: 10 pt

This chapter focuses on the nature of controversy in teaching evolution. In so doing my sights are set on young people at school whose beliefs are challenged, rather than those creationists fighting a cynical battle to make their views heard (Pennock, 2007). To take another quote from Dawkins in the same YouTube clip about Darwinism. “It’s not a controversial issue. It’s absolutely certain. It’s about as certain as the fact that the Earth and other planets orbit the Sun”. From one perspective, that of the scientific community, Dawkins is right. But from an everyday perspective it seems odd that people like Dawkins spend much of their working lives writing books, appearing on the media, dedicating websites to a matter which is uncontroversial. To understand whether teaching evolution in schools and dealing with creationist viewpoints is controversial or not I want to explore what is meant by controversy to shed light on this dispute. This has, I will argue, pedagogic implications.

### THE NATURE OF CONTROVERSY

Formatted: Font: Not Bold

Formatted: Centered

Controversy presupposes different points of view or perspectives on a matter under consideration. At a basic level almost all conversations are controversial; it would hardly be worth talking to each other at any length if we agreed on everything; such

Formatted: Font: 9 pt

interchanges would be tiresome. Most conversations do not necessarily reveal deep differences because people tend to keep company with those whose views they are sympathetic to. But it is often when people are most perturbed by something someone says that they start to examine more closely their own viewpoints. For example I listen occasionally to a programme on BBC Radio 4 called *The Moral Maze* where contemporary issues are discussed by a panel whose members have different perspectives. I like this programme partly because one of the panellists expounds views (including, incidentally, those in defence of creationist teaching) which are almost always completely antithetical to mine and which I often find repellent. Occasionally she says something which challenges an unexamined belief which forces me to reconsider or more thoroughly justify that belief. Part of that process involves an inner conversation which goes something like this:

Inner voice 1: What X has said is ridiculous.

Inner voice 2: Perhaps. But why did you say that it's ridiculous?

IV1: Because for all right-thinking people such and such is the case and X says that it's not true.

IV2: So why do *you* think it's true?

And so on. In other words conversations which involve differences can be inner dialogues often prompted by what others have said.

Such a provocation is therefore educational, although uncomfortable. Hand and Levinson (2012) have argued that participants taking extreme positions in a controversial issue help others to think carefully about where their views might appear on the spectrum. From another research perspective, studies in cognitive psychology demonstrate that when individuals disagree about solutions to a problem and both get it wrong they make greater cognitive gains than those who agree about the solution to the problem whether wrong or right (Schwarz et al., 2000).

Most definitions of controversy take a normative view. For example, take the following depiction: controversial issues are those " ... about which there is no one fixed or universally held point of view. Such issues are those which commonly divide society and for which significant groups offer conflicting explanations and solutions" (Crick, 1998:56). Hess (2009) teases out her definition of controversy in the context of controversial political issues (i.e. those predominantly in the public domain and of public importance). She identifies some key pre-requisites of controversial issues: that they are open questions with answers that are both strikingly different and legitimate. There are problems, however, with these descriptions of controversy. They assume that what is at question is commonly and publicly known. But that is not always the case even in broadly open and democratic societies. There may be marginalised groups who are unwilling to make their views public. Consider the case of a young person brought up in a fundamentalist religious community (plenty of these exist, of course, in the midst of highly secular societies) who, having been able to listen to views outside their own community, doubts the existence of God or indeed that all life was created in a week about 6000 years ago. It would require enormous courage, and

**Commented [MR1]:** Can you check the whole thing is Times New Roman and as close as possible to the Sense format. If you would like me to send you the Sense formatting instructions again, do let me know.

**Formatted:** Font: 9 pt

possibly recklessness, to put forward such ideas to their own community for deliberation. The same could be said about someone with decidedly creationist views sitting in a meeting of a humanist association although one might speculate why they were there in the first place. In other words, it is not enough to say that controversy is where we see or hear it (witness also my point above about *inner* dialogue), there need to be certain conditions present such as tolerance, respect, openness and honesty for such views to be aired and to be made public, what have been referred to as appropriate dispositions (Bridges, 1979) or communicative virtues (Burbules and Rice, 1991). Conditions like these do not always arise naturally; frequently, they have to be taught and nourished.

**Commented [DB2]:** Use of where is perhaps confusing. You mean you choose to see it?

**Formatted:** Font: 9 pt

But these accounts of controversy lack an epistemic dimension. To say that a view is legitimate is to allow that the view is acceptable not just because lots of people believe in it but because there are good reasons for it. This is the view of controversy as expounded by Dearden (1981): “a matter is controversial if contrary views can be held on it without these views being contrary to reason” (Dearden 1981:38). ‘What is controversial’, argues Dearden, is “precisely the truth, correctness or rightness of view, which presupposes that at least it makes sense to search for these things even if we do not attain them” (Dearden 1981:40). What follows from Dearden’s view is that an exchange is controversial, or has the potential to be controversial, if reasons are given (i.e. evidence drawn from attested theoretical foundations which are consistent with a given point of view). Controversial issues can be taught – students can learn how reasoning supports a particular perspective, something which can be drawn from pedagogies associated with critical thinking (Bailin & Siegel, 2003). For a controversy to take place there needs to be sound and different reasons proposed, as well as an appropriately receptive but critical social atmosphere.

#### DIFFERENT LEVELS OF CONTROVERSY

**Formatted:** Font: Not Bold

**Formatted:** Centered

These, then, are the basic conditions that operationalise controversy. In Levinson (2006) I pointed out that there are different types of controversy. Briefly these differences can be summarised as follows:

**Formatted:** Font: 9 pt

1. Differences where matters can be settled one way or the other when sufficient evidence can be available.  
Sometimes this evidence might be uncertain and difficult to interpret.
2. Differences of priority or significance
3. Differences through meaning of a concept or term
4. Differences of personal, communal or social interest
5. Differences about a whole range of fundamental value positions.

What comes to mind in the last case is Thomas Kuhn’s (1962) theory of scientific revolutions. Kuhn argues that a shift occurs in theory about such matters as an Earth-centred/Sun-centred universe, Divine creation/evolution, oxygen/phlogiston. These shifts are so fundamental in explaining the world that thinkers of the old schools and new schools use ideas and language which are incommensurate and incompatible, the new concepts simply don’t fit into the conceptual frameworks

and language of the old-school thinkers. These different ways of thinking are called paradigms. Language, concepts and evidence are interlinked within each paradigm but cannot be used in the paradigms that have come to replace them. Explanations of species diversity from a literal biblical creationist point of view are simply incompatible with those of an evolutionist. You cannot be an evolutionist and a literal creationist. However, differences of view can lie within paradigms, for example, different explanations for mechanisms of natural selection.

A prominent example of a recent controversy within the natural selection paradigm is the explanation for the formation of new species. Darwin maintained that evolutionary change takes place gradually over time but some biologists have challenged this explanation. Palaeontological evidence shows that trilobites barely changed morphologically over tens of millions of years much less than might be expected through a gradual change. Punctuacionists (Eldredge & Gould) claim that speciation occurs only in rapid bursts in terms of geological time, followed by long periods of morphological stasis, or *stasis*. If the mutation rate had been steady during this period then one might have expected to have seen this exhibited in phenotypic variation. The stasis exhibited by many fossil species has also been used to challenge the 'selfish gene' theory (Dawkins, 1986) or gene-centred theory in which evolutionary survival is driven by the success of genes to replicate themselves through phenotypic carriers, i.e. organisms. The evolutionary role of the organism, therefore, is to ensure the success of competing genes through reproduction. Opposition to this theory has come from biologists who conceive of it as far too reductionist, with evidence and arguments to show that selection acts at various levels of complexity, not just at the level of the genotype (Rose, 1997). Much of the controversy surrounding these differences revolves around the interpretation of evidence and the meaning of concepts, for example, Daniel Dennett, has written expansively defending and qualifying reductionism.

Formatted: Font: 9 pt, Not Highlight

Formatted: Font: 9 pt

Formatted: Font: 9 pt, Not Highlight

Formatted: Font: 9 pt

### CREATIONISM/EVOLUTION DIFFERENCES

Formatted: Font: Not Bold

Formatted: Centered

Formatted: Font: 9 pt

The examples I briefly described above are controversies between protagonists in explaining mechanisms of evolution and natural selection which relate to explanations about natural selection but do not call evolution into question. These controversies are based upon agreed scientific criteria; to put it colloquially the protagonists agree on what they disagree about, hence there are mutually agreed starting points, language and concepts in which to frame disagreements. The problem when science teachers are faced with students who subscribe to creationist perspectives is very different. In this case there is "no agreement about whole frameworks of understanding relevant for judgment" (Levinson, 2006: 1212).

In my experience there are two main strategies often employed by science teachers when confronted with a refusal by students to countenance evolution as an explanation for the diversity of life. The first is to avoid active teaching of the topic altogether and remind students of relevant parts of the textbooks to read. The second is to announce that this has to be learned for the examination and avoid any discussion. Both are understandable responses but unsatisfactory.

Some years ago I attended a meeting at a school for about a hundred young people aged between 14 to 16 where a debate was presented between two creationists and two scientists on evolution. Almost all the young people ended up supporting the creationist position which highlighted closeness to God and the uniqueness of the human condition, and was framed in rousing language. The scientists presented good compelling scientific arguments which largely fell on deaf ears; the choice was one between a warm inspiring glow and a self-conscious, challenging and stark landscape. The challenge faced when teaching evolution in many cases is not only a scientific one but a metaphysical one. To focus on the scientific argument may well only result in a short term gain with sullen acquiescence of the student.

The above episode illustrates the problem for science teachers when introducing evolution in schools. But an episode from my experience as a teacher educator has taught me that the dividing line between creationist perspectives and evolution is not always clear; it can be complex and diffuse (Alexakos & Pierwola, 2013). In a session I was running for student teachers on teaching evolution a young woman, Orla (not her real name), who had demonstrated a profound and convincing understanding of Darwinian evolution approached me after the session. Her problem, she said, was that at one level natural selection made sense to her but despite reading everything she could on evolution (far more widely and deeply than I had read, and I suspect more than the other student teachers in the group) she had doubts, she couldn't quite convince herself that it was a plausible explanation. She had no religious belief she could claim and she was sceptical about non-materialist explanations of the origin and diversity of life. But she had existential doubts which she found difficult to articulate precisely. Addressing creationist positions she felt put her in a pedagogic dilemma because she empathised with some of the pupils' doubts.

There are two points to make here: first, there are a wide variety of creationist (or rather, non-Darwinian) positions ranging from literal and rigid readings of the bible to views that are a reflection of uneasiness at Darwinian theory; secondly, that to have an understanding of evolution is not to dismiss creationist positions and to have creationist sympathies is not to disparage evolution. There is, if you like, a fuzzy border between the paradigms in which people can live with incompatible concepts and meanings simultaneously, a pre-requisite for passing from one conceptual framework to another.

How then to support young people in coming to an understanding of evolution in the face of a creationist background? As evidenced by Orla, understanding evolution does not necessarily presuppose wholehearted acceptance. Aikenhead and Jegede (1999) have likened challenges of cultural and religious backgrounds to learning accepted science as crossing borders. They identify four types of crossings: smooth, managed, hazardous and impossible. The first two occur when there are minimal differences between microcultures (that of the cultural background of the student and the culture of science) so that crossing the border is barely noticeable or can be managed with a little adaptation. It is the latter two that often face science teachers from creationist students. Some of the conditions for being able to cross borders that are deemed hazardous or impossible are flexibility, playfulness and ease, i.e. that we can be comfortable adopting different roles in different cultures. This can be achieved through collateral learning (Aikenhead and Jegede, 1999). Collateral learning involves students holding on to

Commented [MR3]: ?

Formatted: Font: 9 pt

Commented [MR4]: ? needs a bit of expansion – surely their point is about the challenges of teaching / learning science when the learner(s) have cultural / religious beliefs that conflict with accepted / mainstream science

Formatted: Font: 9 pt

discrepant explanations about a particular concept. There are a number of different ways in which this can take place, either students retain different explanations side by side without any overlap or conflict (parallel collateral learning). Such learning may occur when students who have creationist beliefs are able to learn about evolution so the two explanations are compartmentalised without any overlap. On the other hand, students may hold contrasting and conflicting ideas about evolution but one of the ideas influences the other so that a shift in conceptions begins to take place (dependent collateral learning). How this shift is handled by the teacher is crucial and relies on the teacher being able to envisage and empathise with the student in terms of the shift in conceptions that is taking place. In some cases it is perfectly possible, and even desirable, to compartmentalise different ways of thinking, so that we can get on with life. Most people use language which is contextually sensitive. For example, almost everyone knows what is meant when someone says 'Shut the door to keep out the cold. It's freezing in here'. It is unscientific language since 'cold' is not a physical entity and it's very unlikely that the conditions are freezing. But such a plea is likely to bring about the required action of closing the door. Scientifically you would have to say 'Shut the door because there is a large temperature gradient between the internal environment within the walls of the house and everything outside it'. Anyone who used the latter form of language would be scientifically correct but most reasonable people would avoid such a pedant like the plague. Understanding evolution, however, is quite different because what is at stake is not just normal everyday communication but fundamental ideas about who we are, i.e. worldviews. At some point it is unavoidable that there will be a conflict of ideas.

That is where the fuzzy border between the two worldviews of science and creationism comes into play. It is an area where collateral learning can take place for hazardous and impossible border crossing. But it can only be achieved by negotiation and dialogue so that those struggling to cross the border can feel at ease; it means communicating using language and concepts which are meaningful to different parties. Listening is therefore an important aspect of supporting this border crossing.

The purpose of listening is both to understand what the other is saying and to grasp the motive for saying it so that concepts are constructed which make communication possible. For John Dewey (Waks, 2011) listening enhances mutual co-operation where all voices are heard so that the act of learning can be carried out. Both parties, teachers and students, need to make every effort to grasp what the other is saying. There is a special onus on the teacher because s/he can best draw on experiences of the student to identify the most appropriate way of doing this. Hence Dawkins' dismissal of creationism would be unproductive to border-crossing.

One strategy for enhancing listening and hence dialogue in a group is to give time to parties to explain what their view is of, for example, human origins. This might be with a class of 14 year olds where there is an atmosphere of mutual respect between teacher and students and between students. The teacher might ascertain that there are diverse views in the classroom. This could be done, for example, by getting students to write down on a card how far they felt that the human species was created in one act by a divine being and asking them to arrange the cards along a line from those close to

Darwinian perspectives to those with literalist creationist perspectives. Students could be grouped in pairs where they have similar views and then grouped with a pair of students with very different views. Call the first pair 1 and the second pair, 2. Pair 1 has then to explain their ideas to pair 2 in a certain amount of time, say, three minutes. Pair 2 has then to respond to pair 1, not with a rebuttal, but to try and amplify and explain pair 1's position even better than pair 1 has done. The purpose of this exercise is to make sure that pair 2 understands what pair 1 is trying to say in terms which both parties understand. Then the exercise is now reversed with pair 2 explaining their position to pair 1. Only when both pairs have clarified each others' position can they begin to critically analyse each others' ideas in a respectful way. It is important to recognise that students may be going through an inner struggle and to reach a position where students can identify this struggle in a conducive and respectful atmosphere is an important step forward.

How the class moves on lies in the skill of the teacher and their knowledge of the class. But when faced with students with ardent creationist beliefs it may be better to discuss the origins of variation within non-human species and leave the origin of human species for the time being, although there is no reason why human variation and its underlying biology cannot be discussed. It may need to take time for ideas to come together but if concepts such as variation, gene, selection and speciation are commonly recognised and understood the conditions for controversy and consideration of evidence and theories come into play.

#### SOME PRACTICALITIES

Enhancing listening and dialogue in the context of teaching evolution comes with certain qualifiers. The idea of crossing borders is to recognise that borders can be crossed in both directions. The DCSF guidance to teachers that:

there is a real difference between teaching "x" and teaching about "x". Any questions about creationism and intelligent design which arise in science lessons, for example as a result of media coverage, could provide the opportunity to explain or explore why they are not considered to be scientific theories and, in the right context, why evolution is considered to be a scientific theory (<http://humanism.org.uk/wp-content/uploads/1sja-creationism-guidance-180907-final.pdf>)

seems to me to expect a lot of science teachers, particularly in a world where performance targets and examination results are prioritised. Given the particular realities and constraints in schools and the importance of supporting the teaching of controversies within science, it may well be better to create a space for discussion of creationist-evolution worldviews beyond science lessons at first. While doubt and uncertainty have to be embraced in understanding science such doubts should not lead to undermining validated scientific explanations at school, whether wholly materialist or not.

Formatted: Font: Not Bold

Formatted: Centered

Formatted: Font: 9 pt

Formatted: Font: (Default) Times New Roman, 9 pt

Formatted: Font: 9 pt

Consider the dilemma. Suppose that facilitating a discussion about creationism-evolution led to some very persuasive literalist creationist students beginning to convince others of the creationist position. Despite the teacher clearly explaining the difference between evidence and belief such a movement began to take place. One option is to accept that this is the risk of opening up any discussion; another is that it would be wrong to suppress such views but that explanations drawing on evidence and theory have validity within science lessons.

Nor need this space be Religious Education lessons; historical aspects of evolution, or lessons based on Philosophy for Children (Lipman) could provide a grounding before starting a course in science lessons on evolution. There is an important distinction between theoretical explanations of natural selection which come within the accepted Darwinian framework and creationism-evolution as controversies. The former rely on critical and agreed modes of supplying evidence and examining arguments as controversies, the latter is a very different type of disagreement; it is not a scientific controversy, but it is a difference that has to be taken seriously pedagogically. And if pupils do have doubts that Darwinian biology lacks the dimension of wonder and speculation, reading the last few pages of *The Origin of Species* should at least remediate that misapprehension.

#### REFERENCES

Aikenhead, G.S. (1996). Science education: border crossing into the subculture of science. *Studies in Science Education*, 27,1-52.

Aikenhead, G.S. & Jegede, O.J. (1999). Cross-cultural science education: a cognitive explanation of a cultural phenomenon. *Journal of Research in Science Teaching*, 36(3), 269-287.

Alexakos, K. & Pierwola, A. (2013). Learning at the “boundaries”: radical listening, creationism, and learning from the “other”. *Cultural Studies of Science Education*, 8, 39-49.

Bailin, S. & Siegel, H. (2003). Critical thinking. In N. Blake, P. Smeyers, R. Smith & P. Standish (Eds.), *The Blackwell guide to the philosophy of education*. Oxford: Blackwell Publishing. 181-193.

Bridges, D. (1979). *Education, democracy and discussion*. Slough: NFER Publishing Company.

Burbules, N., & Rice, S. (1991). Dialogue across differences: Continuing the conversation. *Harvard Educational Review*, 61(4), 393-416.

Dawkins, R. (1986). *The blind watchmaker*. London: Penguin books.

Dennett, D. (1995). *Darwin’s dangerous idea: evolution and the meanings of life*. London: Penguin books.

Hand, M., & Levinson, R. (2012). Discussing controversial issues in the classroom: Some helps and hindrances. *Educational Philosophy and Theory*, 44(6), 615-629.

**Commented [MR5]:** I don't know what you mean  
**Formatted:** Font: 9 pt

**Commented [MR6]:** Ah. Until I read this I didn't realise that you meant this phrase to be linked to 'theoretical explanations of natural selection'  
**Formatted:** Font: 9 pt

**Commented [MR7]:** ? do'  
**Formatted:** Font: 9 pt

**Commented [MR8]:** ? 'lacks'  
**Formatted:** Font: 9 pt

**Commented [MR9]:** Mmm. Depends what is meant by 'spiritual'.  
**Formatted:** Font: 9 pt

**Formatted:** Font: Not Bold

**Formatted:** Centered

**Formatted:** Font: 8 pt

**Formatted:** Space After: 10 pt, Adjust space between Latin and Asian text, Adjust space between Asian text and numbers



Hess, D. (2009) Controversy in the classroom. New York, Routledge.

Ioannidis, S. (2013). Regulatory evolution and theoretical arguments in evolutionary biology. *Science & Education*, 22, 279 – 292.

Levinson, R. (2006). Towards a theoretical framework for teaching controversial socio-scientific issues. *International Journal of Science Education*, 28(10), 1201-1224.

Pennock, R.T. (2007). How not to teach the controversy about creationism. In L.S.Jones and M.J.Reiss (Eds.) *Teaching about scientific origins*. New York: Peter Lang.

Rose, S. (1997). Lifelines.

Formatted: Font: 8 pt

Ruse, M. (2007) The warfare between Darwinism and Christianity: Who is the attacker and what implications does this have for education? In L.S.Jones and M.J.Reiss (Eds.) *Teaching about scientific origins*. New York: Peter Lang.

Schwarz, B. B., Neuman, Y., & Biezuner, S. (2000). Two Wrongs May Make a Right... If They Argue Together! *Cognition and Instruction*, 18(4), 461-494.

Formatted: Font: (Default) Times New Roman, 8 pt

Formatted: Font: 8 pt

Waks, L.J. (2011). John Dewey on listening and friendship in school and society. *Educational Theory*, 61 (2), 191-205.

Wray, G.A. (2007). The evolutionary significance of *cis*-regulatory mutations. *Nature Reviews/Genetics*, 8, 206 – 216.