

Expert Interview with Len Newton, Editor

Recorded on 3 March 2010 at the University of Nottingham

Journal Specific Questions

- 1. How would you describe [*Research in Science & Technological Education*](#) and what are its aims and scopes?**

Research in Science & Technological Education publishes peer reviewed articles and reports in science and technological subjects from around the world. Although articles can include sociological, psychological, economic and organisational aspects of science, many published articles are concerned with empirical research and curriculum development interventions and their evaluation. The journal aims to highlight the implications of research for educational practice and that reflects the interest of most of our readership.

- 2. Which areas does it primarily focus upon?**

Recent numbers of the journal have included articles on learners' conceptual understanding of science topics, aspect of teachers' professional knowledge, including subject matter knowledge, and the nature of educational practices in technology rich schools. Many articles have a strong inquiry orientation. They frequently adopt quantitative research designs, but there's a welcome and growing number of articles reporting qualitative and mixed methods research.

- 3. What is the range of issues and concerns that the journal aims to explore?**

Well science education is right at the top of the political and economic agendas of many countries across the world. At the same time, research evidence indicates that young peoples' interest in science and technology whilst often strong does not always translate into their active participation as students of science and technology subjects. Thus the journal continues to publish articles that explore pedagogy and practice in science and technological education, as well as articles that examine aspects of students' conceptual understanding.

4. What do you think are the most contentious issues in contemporary debate and research in education which your journal seeks to address?

I think levels of participation in science in schools, and in particular that of girls, remain a concern in many parts of the world. There continue to be debates about the balance between subject specialism and breadth and balance in science and technological education, particularly in the UK. And these debates extend into curriculum development about how students' experience of science learning can be made more meaningful and inclusive.

I think too there's stronger focus emerging in science and technological education on developing students' skills for learning and wider international recognition of the need for active learner engagement. Thus there's scope for more research into the implications of developments in the learning sciences for the theory and practice of science and technological education.

I think too, there's growing interest in inquiry based approaches to science and technology learning, and a need to develop pedagogies to support that kind of approach. Often such approaches call on skills and knowledge from various domains to be applied to pursuing inquiries, thus there's scope for more interdisciplinary work that can explore the synergies, the relationships between traditional school and college subjects. That too reflects contemporary approaches to scientific and technological research in which multidisciplinary teams are being formed to address big research questions in our research universities.

5. Who do you feel are your readership, your core audience?

Well as an education journal, the readership consists largely of educators, researchers and students working in these fields, thus the articles included for publication in the contexts of elementary, secondary/high school and further and higher education settings. Many of the articles published by the journal will be of interest to policy makers, but I think our core readership remains science education researchers.

6. What do you look for when considering articles and submissions?

Well it sounds obvious but good articles tend to have a clear title and an abstract, and they address topics that are timely or they address well established themes from a novel perspective. The best articles are strongly theorised and draw on contemporary international literature. They tend to be well written and well argued with conclusions and implications based on evidence, practice and theory. I think too that good articles need to recognise that the readership of the journal is international, and so perhaps sometimes a broader focus needs to be taken in the local context in which the research may have been conducted. The final thing I want to say is that articles become easy to process when they adhere closely to the journals style and referencing conventions etcetera.

7. What are the most common mistakes?

Well there are a few occasions when manuscripts are submitted that have parts missing, for example figures or table. But I think the best advice is for authors to closely follow the instructions that are on the [journal's web page](#). The most common technical errors are to do with conventions of referencing, including in-text referencing and mis-matches between those in-text references and the reference listings.

It's surprising how easy it is to miss things in articles that you've written yourself. So careful proof reading is obviously something that's worth pursuing in preparing articles, and not over relying on spell checkers in word processing packages that often fail to detect errors.

Sometimes articles are not really coherent articles at all; they read more like sections from a thesis or a project report. In other words they tend not to be self contained or coherent papers. And what we are really seeking to publish in [Research in Science & Technological Education](#) is papers that have something new to say to the readership. That might be a new take on an established issue, or an approach to examining an important question or a synthesis of ideas that takes contemporary research agenda forward in some way.

I think sometimes too authors make assumptions that local terms and expressions will be understood by an international audience – there's a need to be clear and to use clear written English. It is very gratifying to receive submissions to the journal from authors around the world, but all authors should pay close attention to the journal style and the need to produce manuscripts in British English.

In terms of substantive article content, I think authors are rightly cautious in making claims from research evidence, but I do think there's scope in many articles to develop the discussion of the work for the practice of science and technological education. In other words, to focus a bit more on the potential implications and ramifications of the work that's being reported in the article.

8. What are your aspirations for the future of the journal?

As I said earlier, I think it's gratifying to receive submissions to the journal from all parts of the world. The journal is receiving increasing interest from authors in the United States, from Australia and New Zealand. Recent articles included in the journal have reported work from Thailand and the South East Asia, and there's a lot of research work in science and technological education going on in Turkey. I think I would welcome contributions from authors working in mainland Europe, actually that's a part of the world that is arguably less well represented in the journal's submissions. There's a thriving community of science and technological education researchers in Germany, in The Netherlands and in the Scandinavian countries for example, and it would be good to receive more articles that report studies in these parts of the world and their implications for the wider research community.

I am also interested in receiving work that adopts mixed methods research designs, since that reflects some of the developments in educational research methods that are being used to inquire into questions, and also the use of design research methods in science and technological education I think has a potential application, particularly in relation to research into research into curriculum developments.

Topic Questions

9. In your opinion how similar and/or different is the study of science education to/from the study of technological education? Do you feel they are explicitly linked, or can researchers consider them as stand alone, disconnected areas?

In my view science and technology are closely linked. Technology I see as being about harnessing scientific understanding to meet particular needs and purposes. But equally, technological development or technological needs can drive scientific developments and basic scientific research. In the context of science education, we are really concerned with supporting learners to develop secure understandings of the substantive concepts of science, but it's also very much about developing learners' understanding of what science is and how scientific knowledge progresses and develops. Thus in many countries there's strong interest in developing learners' understandings of the Nature of Science itself, as a way of understanding natural phenomena, and a skill and understanding of inquiry processes in science is a part of that. Whilst there is the close relationship between science and technology, it's possible for researchers to consider them independently I think particularly in terms of basic research.

10. How do you see science and technological education developing in the future? Are there any particular areas which you feel will come to the forefront for researchers, academics and teachers?

I think we are likely to see more interdisciplinary research in science and technology and a stronger representation of this in science and technological education. It is already the case that inter-disciplinary approaches are being adopted to address big research questions in various domains, and indeed this is spawning new research disciplines such as the 'learning sciences'. I think too there'll be stronger account given of the social and affective aspects of teaching and learning science, as well as the cognitive and behavioural aspects. There'll be work done to explore the impact of new ways of communicating about scientific and technological matters and how these impinge on teaching and learning about science in formal and indeed in informal settings. All of these developments seem to me to present opportunities for researchers working in science and technological education and potential submissions to the journal.

11. What significant curriculum developments have there been over recent years which have had a direct impact on the direction of the journal?

I think some of the most important developments in science and technological education have been concerned with new approaches to curriculum design. In particular those approaches which have sought to make the curriculum more engaging, relevant and inclusive of young people in schools. We are seeing greater emphases on applied aspects of science and technology, and stronger recognition of the importance of the affective domain in engaging and sustaining student interest. Of these developments, well they do have their critics of course, who perhaps see them as in some way weakening the traditional subject base, so there's scope for more research and debate on these issues that can be represented in the pages of [Research in Science & Technological Education](#).

I think in the field of higher education, we are seeing greater interdisciplinarity between traditional subject disciplines, but there are also developments in higher education pedagogy that to some extent are a response to the changing nature of secondary or high school curricula and advances in understanding about assessment practices. But new technologies themselves bring opportunities for new pedagogical approaches across all phases of education. So I think there's continued potential for research in these areas in all stages of science and technological education that could lead to publications in the journal.

12. What are your own thoughts on/in those areas?

Well I think from the UK perspective, the requirements of the national curriculum have historically made it much more difficult for decisions about subjects that are studied in schools, to appear very gendered. In other words, there was a time when biology tended to be studied largely but not exclusively by girls, and physics largely but not exclusively by boys. And I think the national curriculum which enshrined an entitlement to breadth and balance in young peoples' experience of learning science, actually did a lot in the UK to, well in England in particular and Wales, to address that problem. But I think that other problems have emerged, particularly in the nature of the curriculum as it's taught and the extent to which the kinds of topics that are studied and the approaches to teaching those topics can meaningfully engage young learners.

What's interesting here is that to some extent the circle has almost turned full circle because there are developments now which will see opportunities again in England and Wales for young people, to study separate sciences to the age of 16. And I think whilst that's a development which is certainly going to hopefully increase the interest in the physical sciences that we currently see, I think it could play a game against that gender divide unless things are handled very carefully. But talking to academic colleagues in this university who

teach in chemistry and in physics, there are plenty of women expressing interest in those subjects as well as subjects such as pharmaceutical sciences. So, there's a healthy balance but broadly I think, the research evidence that we've got from the Rose Project for example, does indicate that there are issues around the nature of young peoples' experience of science learning that need to be addressed. Indeed that's one of the things of course that has driven recent curriculum developments in the UK.

13. Is there anything in particular that you think may have been missed in the developments? (In what ways do you think the curriculum can be developed further?)

I think that people are becoming to realise the importance of good careers advice for young people, particularly in relation to science and technologically orientated careers. I think that historically perhaps we have not done such a good job at selling science in terms of the range of potential careers that demand skills that are developed through the study and experience of science and technology in schools. I think that that has shifted a little bit with fashions in popular media; so everyone wants to be a crime scene investigator these days, so that does spurn an interest in those sorts of disciplines. There is evidence that suggests that young people by and large are very interested in big questions to do with earth, environment, sustainability, those sorts of agendas too. For that reason I think it makes sense that those sorts of topics and the debates about those topics are represented in mainstream school science, so that young peoples' interests in those areas and their understanding can be sparked and deepened, and perhaps support their interest to pursue study of science and technological subjects in their higher education.

14. Would you say that the curriculum should be more reactive to the events that are happening in the world at the moment, rather than prescriptive?

Well I think my answer to that really is a personal answer, though I think it is one that would have some support in the wider community of science educators; is that science does not take place in a vacuum, it's situated. The agendas that are researched in science and technology and engineering are the ones often that attract funding. And decisions about funding are essentially decisions which are made by a number of different stake holders so they have a political dimension, they have an economic dimension in play as well there. So I think it would be naive to think that one can develop science curricula or curricula in higher

education in science and technology without regard to those influences. On the other hand I think that science learning offers a great deal potentially to young people both in schooling and in higher and further education. Science is definitely not just about acquiring a confidence and fluency with a body of information, it is to do with understanding skills and processes and being able to develop habits of mind that look for answers to questions grounded in evidence rather than any other form of information.

15. Within a learning environment, how do you think other subject areas might be able to assist students going into science and technology who don't necessarily have a supporting mathematical background?

It's tempting for me to respond to that by posing another question. So let me pose the question and perhaps try to answer it myself. I think it depends for me on what you think science education and technological education are actually for, and indeed one can broaden that question out; what is education for, what are its purposes? I've always taken the view, and again I don't think I'm particular in taking this view, that education is not just about acquiring sets of skills or understandings for economic purposes. I think the practice of science is a cultural activity actually, its part and parcel of our contemporary society and its deeply imbedded in the culture. It may be pushed away by some sections of society, but they may embrace some of the awe and wonder that attracted me to science education when they sit and watch TV programmes, even science fiction programmes, or look at the literature, every day science fiction literature I'm talking about, they might find engaging and interesting. So I think there is something very fundamental about human beings that likes to ask questions, and I think science does afford young people the opportunity to begin to engage with questions and to puzzle about things and to think about what it means to find answers to questions in a particular kind of way.

So I take a broad view of what science education is about and I think that's quite an important perspective to share because the future is uncertain; the one thing we can say about the future longer term is that we don't know what it will hold for us, so actually what we need are young people who are curious, who are interested, to engage with solving problems both to satisfy intellectual curiosity as well as to find solutions to problems that are from a more technologically driven perspective. And I don't think we will create those sorts of habits of mind in our young people if we offer them curricula experiences which are sterile, passive, and aren't intellectually challenging.

One of the problems we've got at the minute is that we are working within a very, in the UK at least, or in England and Wales, we are working within a very highly regulated system and that is replicated in other parts of the world. If you think about the concerns over the future supply of scientists Europe wide, across North America, in virtually all parts of the developed world, there is a strong focus on the importance of science and technology in education. In some parts of the world that's not a contentious issue, particularly in the emerging economies, but in other parts of the world that are perhaps already very developed and industrialised economies, I think other issues are coming to the fore, and they are those big issues about environment and sustainability and so on, so the agendas are rather different in those parts of the world. But it would be interesting to explore why that is the case, what is it about some countries in South East Asia for example where young people readily embrace science, technology and mathematics, and countries say in some parts of Northern Europe or Northern America, for example, where the rhetoric is that young people are opting out of those sorts of disciplines. What's that about? I think it would be hard to answer that question without taking a cultural, sociological, political view, maybe even an economic view on those things as well.