NZCER CONFERENCE

BUILDING FUTURE-ORIENTED SCIENCE EDUCATION IN AOTEAROA NEW ZEALAND

TUESDAY 21 OCTOBER IN WELLINGTON

Summary

This conference brought together the knowledge and thinking of 140 people passionate about strengthening the quality of science education. As with all NZCER conferences, our intention was to make a contribution to practice, policy and research.

Throughout the day there were opportunities for attendees to record their issues, questions and comments, and in the afternoon we organised groups around a series of discussion questions. Some groups canvassed several questions, others focussed more deeply on one or two. We asked individuals and groups to take notes to try to capture the essence of those discussions. In some cases the notes were a list of questions or points. We have sought to identify the recurring themes and key points recorded in the groups and on the walls.

The day was intended not only to share and build ideas but also to establish—or re-establish—connections with other professionals working in science education. Our hope is for ongoing conversations. The science education team at NZCER is keen to assist with connections if there are ideas and issues that participants would like to pursue. In preparing this summary we have made links to resources that provide useful information relevant to the ideas recorded by groups.

What is science and why is it important to learn science

"Science is a way of thinking about a problem."
"Science should be seen as part of everyday life – not separated out."
"Science is everything we do!"

There was a great deal of discussion about the purpose of science education. A recurring idea was that students needed to make connections with science so it became part of their everyday life. Many groups commented on the need for scientifically literate citizens who are confident in using evidence to make decisions and tackle an issue or problem. There was a view that teaching about citizenship was integral to learning science, not an add-on. It meant offering something new or different to what we would expect a quality science education programme to include, to encourage critical thinking and help build a disposition for citizenship. Others mentioned the importance of being able to access relevant information, critique evidence, evaluate the validity of data and not accept information at face value.

The New Zealand curriculum

"Awakening awe and wonderment through science, getting kids to think and wonder."

We posed a number of questions about the role of science in the primary and secondary curriculum. Participants talked about how, in order to achieve the aims of the New Zealand Curriculum, schools needed to do some things the same and some things differently. They identified a tension between depth and breadth. Content was seen as important and needing to focus on the big powerful ideas of science.
(See http://www.interacademies.net/File.aspx?id=25103)
The contexts should be selected to reflect the interests and resources of the community, and the interests of the students. The aim is to develop a connected curriculum that will engage students and provide knowledge they need for everyday life. Driver education or healthy eating are examples of contexts in which these types of rich connections could potentially be made.
Several groups mentioned the power of the 'library of experiences' idea.
(http://www.nzcer.org.nz/system/files/Library%20of%20experiences2_1.pdf)
At primary and intermediate level, the curriculum should foster a love of science and curiosity about the world. "Could you teach the breadth of the curriculum in primary through science?," one participant mused. Another discussed their school's realisation that they needed to be more explicit with the students about the science knowledge they had embedded in their curriculum.
Several groups mentioned the science capabilities and how they could be used across the school to teach science more effectively. (http://scienceonline.tki.org.nz/Introducing-five-science-capabilities)
The point was also made that a future focussed view relied on using multiple perspectives.
One group summarised their essential messages as:

- Preserve the New Zealand Curriculum but use it to do things differently
- Purpose: citizenship
- Do the same things in different ways
- Ask different questions

Māori and science

We posed questions about the relationship between Māori knowledge, science, school science and language, and how, if at all, to bring together different ways of knowing. The groups who

discussed these questions puzzled over a number of big challenges for practice. Weaving a Māori world view with scientific ways of looking at the world was seen as important and it would be helpful to have resources to guide teachers. The pressure from standardised approaches to curriculum implementation was seen to limit the scope to enrich science programmes with other cultural ways of seeing the world. Linking science investigations to the cultures of the students' lives was viewed as important, as was using teaching approaches known to be engaging to a diversity of students. Links to Māori scientists were also raised as a way to provide a rich cultural component within science programmes.

Opportunities for science programmes

"Putting fun back in science."

These factors were raised as important in the primary sector:

- Engage then explore;
- Messy, hands-on play;
- Student-led
- Making connections with prior knowledge and what students actually really know

Some discussed the need to 'voice' when science is covered, e.g. during literacy or numeracy with science as context or in investigations with science as context. Developing the nature of science strand can be done through any topic. "We need discussions as a syndicate about what is expected from students," was one comment.
Others voiced concern that science had been hijacked by National Standards, and there was criticism of a lack of resources for primary science. There were questions about whether all primary schools were even teaching science.
There was some discussion about how to better align primary and secondary approaches to science, and to try to alleviate uncertainty from kids arriving from many different schools. The comment was made that secondary schools shy away from fun or messy play although one group mentioned role playing experiences in Year 12 Physics. Teachers want their students to be engaged and active but say they are constrained by NCEA.

Leadership

How important is the role of school leadership in providing enabling conditions for these ideas and practices to happen? One group suggested it was easier to make changes in smaller schools and that it was always important for the principal to be engaged.
There was discussion about barriers created within school, e.g. using digital technology to do networked science coming up against an IT person saying they can only do a blog with a single author.

Students' experiences of science

"How do we develop students willing to debate science?"
"How are they going to care for their world if they don't have connections with real world experiences?"

Key questions:

- Who do we want the student to be?
- What skills do we want them to learn?

Giving students a voice and agency in what they are doing was seen as crucial. They need to feel a part of what is happening in the classroom, with responsibility to share information and ask critical questions.

It would be more helpful to keep a collective focus on the journey of the students through school, seeking to design science programmes that aligned with their interests at the time and the demands of the NZC.
One group discussed the place of practical work. Do we need labs? Some teachers felt yes and were concerned about modern learning environments getting rid of labs. Practical work is part of a "library of experiences". While the new environments still enable practical work, the physical space is very different. This puts new demands on teachers as different pedagogical approaches are required.

Teachers and teaching

"If we are going to implement the curriculum we need to teach in different ways."

Teaching in different ways requires a lot of scaffolding and opportunities for experimentation and discussion. It also requires time – time and headspace for planning, gathering resources, making connections and processing what they find.
One group raised the idea of having specialised science teachers similar to technology teachers, based in intermediates and shared by the local full primary schools. This was seen as facilitating a smoother transition to secondary school. However it would not work if it simply involved bringing a secondary education person—with a secondary science curriculum perspective—into the primary environment. What is needed are people with a good knowledge of science and the science curriculum and the ability to design programmes for the intermediate age group. In the paper *Inspired by science* we suggested the main focus of science in Years 7-10 could be socio-scientific issues.
(http://www.nzcer.org.nz/system/files/inspired-by-science.pdf)
Teachers who are motivated are motivating for students. And students need to understand the value of the exercise or they will find it difficult to continue long term projects.
Participants identified a big paradigm shift: teachers with confident content knowledge need to also be confident with the nature of science approaches.
A number of groups raised the importance of questions – how teachers ask questions and how students learn to ask questions. It used to be 'can the teacher tell me the right answer?' but there needed to be a shift to open ended, "why" questions:
"So how can we find out?"
"What makes you think that?"
"I've got no idea – how can we find out?"
It was clear that teachers had to be active learners themselves if they were to successfully support the learning of their students.

E in science

Groups talked about the huge range of resources available, many of them digital, and the scope of the science community. Access to technology and keeping up to date with it were seen as key challenges. E in science provided opportunities to make regional, national and global connections – student to student, with science partners or projects with other communities and sharing data. It opened doors and increased student engagement.
Technology also provided data that students could work with and apps could open up the opportunity to explore concepts that would be inaccessible otherwise. "Students don't need to know how to process data – they need to engage with it," was one comment. (See http://www.nzcer.org.nz/research/publications/e-science-future-oriented-science-learning)

Assessment

"We need to know what students know and can do; if we don't assess we don't know how we are going."
"Assessment should reflect what we value in science and it needs to be formative."

Groups talked about the need for assessment to be formative and context relevant for students. Over time—as students move through schooling—the complexity of task and the demand on students to engage in "doing stuff" would increase.
One group grappled with ideas about assessing "citizenship", noting it was not a subject to be assessed but a disposition, so it required a way of showing progress along the development of the disposition. At the heart was the ability and interest to make informed decisions. Again, contexts needed to be relevant to the students and students needed to be engaged in the assessment. "We need to assess the skills needed to engage in citizenship – can't assess broad citizenship."

Professional support and PLD

"Invest and develop differentiated resourcing and access and professional development."

There was a call for more opportunity and support to try things out, rather than just providing more online resources. One teacher commented: "Seems like a lot of talk, writing and research but very little doing."
The new Teacher-Led Innovation Fund is a possible avenue for experimenting with new approaches.
(http://www.nzcer.org.nz/system/files/Rethinking%20professional%20learning%20and%20development%20in%20primary%20science.pdf)

Linking with the community

"Amazing how large a science community there is out there."

There were indications that people were on a journey in terms of developing links with scientists and science organisations. "We have one-offs and visitors – they aren't partnerships yet," was one comment. There was an interest by teachers in having scientists visiting schools to work with students as well as providing resources and professional support from them.
The difference between collaboration and cooperation was raised. Partnerships were seen as valuable for broadening experiences but it took time to make and sustain the connections, and there were costs involved, such as travel. The comment was made that it could be difficult to maintain partnerships when the Ministry of Education continually changed its focus. A longer-term, more strategic approach would be helpful.
Groups wanted conversations with their communities – parents and the wider public - about how science education could change. They felt parents' expectations needed to shift.
Students needed the opportunity to be creative and that meant the community needed to be open to change. It would be important to show communities the impact of creating different ways of learning.

Constraints in secondary schools

A number of groups felt a university-driven curriculum was inhibiting the ability of secondary schools to interpret the front of the curriculum. Schools were under so much pressure to get students through NCEA that there was little encouragement and no time for teachers to try new things, such as focusing on the development of metacognitive and analytical skills.

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