Classroom teachers' experiences of Science through courses delivered online by distance.

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Breaking the boundaries of time and space.

Abstract

This paper reports a thematic analysis of Primary and lower Secondary school teachers' experiences of professional learning and development via distance learning in Science. Teachers gain a graduate Certificate as a specialist Science teacher. Courses are designed to model that science can be fun and hands-on, providing authentic contexts for learning.

If STEM subjects are a Government priority, PLD must be more than 'bringing in an expert' or attending workshops in order to get sustained improvement in outcomes.

The science courses analysed in this study were found to support teachers by providing a prolonged 16 week opportunity in each course to engage in professional development, and trial new strategies to develop confidence. Teachers reported that other curriculum were prioritised over teaching science, and the '5 science capabilities' were causing confusion in schools. Science practical skills and confidence to teach science was very low at the start of courses, but practical investigations significantly improved confidence to teach science in all context strands.

There was some evidence that teachers and pupils are shallow users of technology and important science concepts are poorly taught using technology alone.

In summary, teachers report that this model of distance learning for Science PLD provides more equitable access to PLD where geographical isolation and lack of release time in school are an issue.

Method

This research used existing data collected and archived from 2012 – 2016 as part of the Open Polytechnic's assessment submission process.

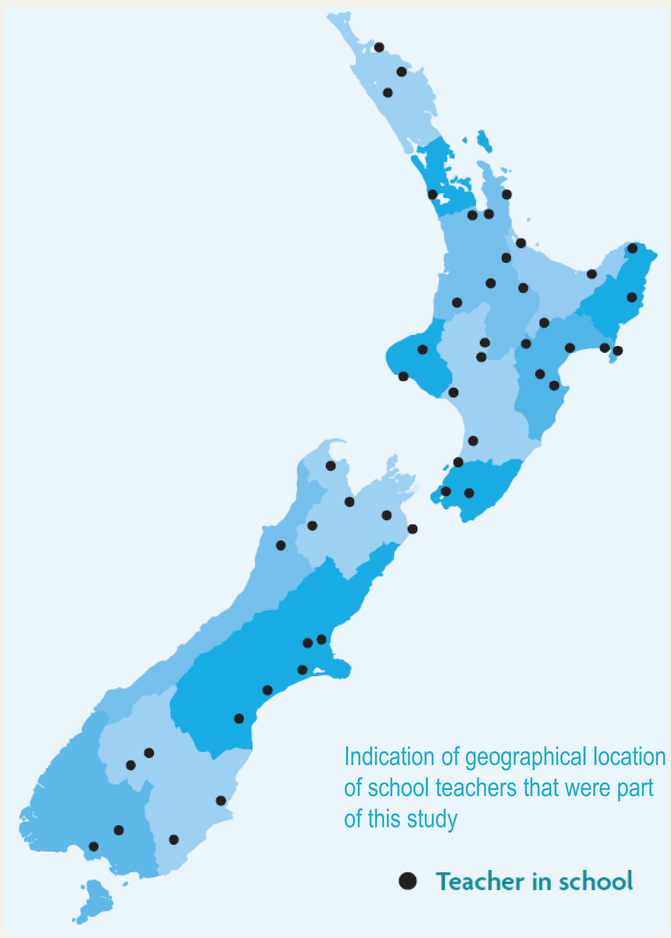
Over 200 samples of work from a total of 182 teachers from around New Zealand was analysed using both quantitative and quantitative methods to explore the demographics, beliefs and attitudes about science and science teaching, as well as content knowledge of the various science disciplines.

A grounded-theory approach identified common themes arising from forum comments, reflective journals, and written assignments.

Quantitative data from real-time assessment quizzes was pooled to permit entire cohort analysis and preserve the anonymity of individuals. Trends were identified for content knowledge in Biology (Living World), Chemistry (Material World), Physics (Physical World) and Earth and space science (Planet Earth and Beyond).

The Teaching Perspectives Inventory tool (Pratt & Collins, 2001) was used by the teachers that had to apply their learning from previous courses in an action research project. The 5 perspectives are Transmission, Apprenticeship, Developmental, Nurturing, and Social Reform. This tool provided data to explore what it means to be an 'expert' science educator.

Any time, any where professional development



Results – why study online?

An analysis of 182 individuals indicated that the reasons teachers wanted to participate in professional development via online learning could be grouped into 6 categories.

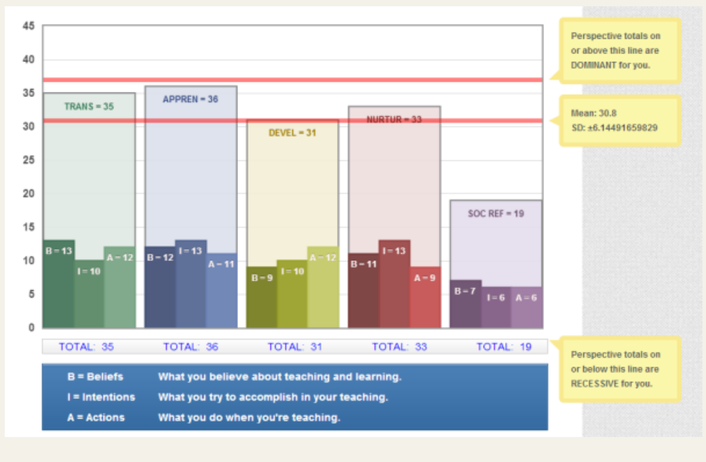
- To gain confidence to do practical work
- To gain content knowledge
- School focus on raising profile of science
- Learn about the Nature of Science strand
- Learn about the "5 Capabilities" (Ministry of Education, 2014)
- Career progression

Results – Teaching perspectives inventory

All teachers in the action research course provided evidence that there is no single 'right' way to teach science. Each teacher has a different set of perspectives, as defined by Pratt & Collins, based on their attitudes and beliefs about teaching. This suggests when time is limited, an 'expert' may have little impact working with teachers of a different dominant perspective in a science PD workshop situation.

Teacher A: *Over all the perspectives, the greatest changes were in my Intentions scores. All of these increased. This suggests to me that this paper may have made me more aware of what my intentions are when planning science activities.*

Teacher B: *As a result of the TPI inventory it was highlighted for me that I have certain strengths and perspectives and this can influence how I approach my teaching; yet these perspectives and viewpoints may not always be best for my students*



Results – Health and Safety concerns

Health & Safety awareness in New Zealand schools is low; mouldy bread 'experiments' are common, there was one case of scaring children with popped balloon and measuring heart rate (as young as 3!)

Most teachers reported some resistance to following guidelines and policies; "we have always done this" mentality with regards to potentially hazardous demonstrations / investigations.

Pattern seeking investigations exploring changes in time are seen as 'easy' but most teachers failed to spot the risks associated with these; example risky or hazardous activities included - mass consumption of energy drinks & caffeine (effect on heart rate), physical stress on heart rate, swabbing toilets to culture microbes, generating antibiotic resistant microbes.

Poor practice appears to be perpetuated by Science Fairs, an attitude of 'if everyone else is doing it, it must be OK'. Stuff.co.nz article about "Foul-mouthed Coppers and their dogs" is an example
http://www.stuff.co.nz/national/10234737/Science-shows-police-foul-mouthed

However, as teachers gained content knowledge (as indicated by pre- and post- testing) and carried out practical investigations at home, there was a significant increase in the awareness of Health and Safety requirements. This was demonstrated in the unit plans for a sequence of lessons to be taught as part of an action research project.

References

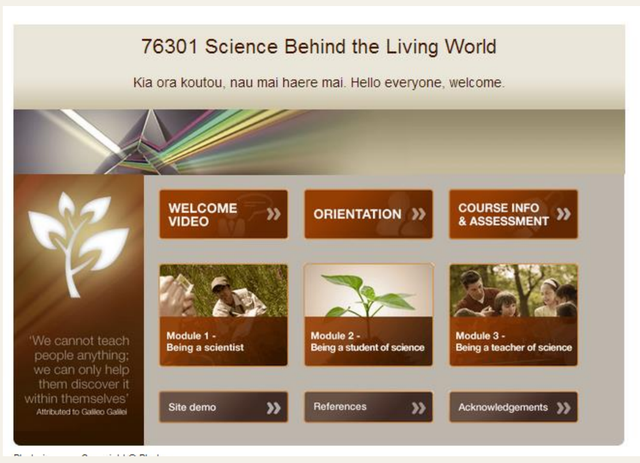
Ministry of Education (2014). Introducing five science capabilities. Retrieved from: http://scienceonline.tki.org.nz/Introducing-five-science-capabilities

Pratt, D. D., & Collins, J. B. (2001). The Teaching Perspectives Inventory (TPI). Paper presented at the Adult Education Research Conference, Vancouver, BC. Retrieved from: http://www.adulterc.org/Proceedings/2000/prattd%26collinsj-final.PDF

Confusion with the "Science Capabilities"

Many of the teachers carrying out classroom action research projects or school leadership activities indicated the 5 Science Capabilities (Ministry of Education, 2014) were viewed as replacing the Nature of Science strand of the New Zealand curriculum.

The previous 4 courses leading up to the action research course highlighted the Nature of Science as a compulsory part of the New Zealand curriculum. Each of the four courses modelled "Being a scientist" in the appropriate context strand, eg the Living World.



However the publicity about the 5 Science Capabilities appears to have taken the focus way from the curriculum, as the New Zealand Council for Education Research is viewed as leading best practice in education. It would be helpful for the NZCER to clarify the situation for teachers and school leaders.

Conclusion

This research using existing data collected from 2012 – 2016 helped answer three key questions:

1. Rather than using 'experts', is becoming a better science educator something that needs to be experienced and personalized?
2. Does online learning support teachers in remote or isolated communities?
3. How does the Teaching Perspectives Inventory tool inform us about the 'right' way to teach science?

Traditional PLD in Science is based on bringing in an 'expert' or attending workshops. Neither option supports teachers over a prolonged period to develop new teaching perspectives and skills.

In contrast, the evidence indicates courses delivered by the Open Polytechnic enable working teachers to personalise their professional development experiences with their own classes during the year. Teachers also build up their own expertise and confidence to lead authentic science activities. Teachers also report that this model of distance learning for Science PLD provides more equitable access to PLD where geographical isolation and lack of release time in school are an issue.

The lack of planning for Health and Safety risks and hazards in teaching science appears to be a significant issue of concern, and the 5 Science Capabilities appear to be distracting teachers away from teaching the Nature of Science strand.

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