Science Education International
Vol. 24, Issue 3, 2013, 361-376

Narratives of place: Provisional teachers' experiences in science

Steven S. Sexton*, Joy Atkinson, Richard Goodson†

ABSTRACT: Over the past decade, there has been a significant reduction for New Zealand initial teacher education student teachers to experience education through a science context. This paper presents the stories of two graduates from a large New Zealand university and their journeys into the classroom. Richard graduated with a Bachelor of Teaching (Primary Education) and Joy with a Graduate Diploma in Teaching (Primary). Using narratives of place, these two provisionally registered (beginning) teachers discuss why they took science in their initial teacher education programmes and how they are teaching science. Specifically, Richard and Joy discuss what obstacles they faced and how they are overcoming them. Through their narratives, they raise questions, issues and concerns about their practice of teaching that would be beneficial for school leaders not only in education through science but also in the wider primary educational sector.

KEY WORDS: primary education, science education, narratives, teacher education

INTRODUCTION

"While there are a number of primary teachers who teach science with enthusiasm, the general impression is that this is the exception rather than the rule. A common reason given for this situation is that primary school teachers lack confidence in teaching science" (Yates & Goodrum, 1990, p. 1). Yates and Goodrum (1990) made this statement 23 years ago about 170 primary teachers in Australia. Lewthwaite (2000) reported similar findings about the 122 New Zealand primary teachers in his study. With teacher confidence in science low, it was not surprising that a report on the 2006/07 Trends in International Mathematics and Science Study (TIMSS) (Caygill, 2008) noted New Zealand primary teachers spent "significantly lower" (p. 55) hours teaching science in 2006 than in 2002. This trend is, however, not limited to New Zealand or Australasia. For example, Colucci-Gray and Fraser (2012) report on how they are attempting to bring Scottish student teachers who enter initial teacher

* Corresponding Author: steven.sexton@otago.ac.nz
† The University of Otago, New Zealand

education with "experience of alienation from science" (p. 176) around to co-constructors of knowledge rather than the knowledge consumers.

LITERATURE REVIEW

As a former New Zealand primary classroom teacher who now works in initial teacher education and teacher professional development, I hear many primary teachers and student teachers saying they do not have the content knowledge to teach science. It has been reported that increasing a teacher's confidence in science teaching increases the amount of science taught in the classroom, as well as increasing appropriate pedagogical practices (Appleton & Kindt, 1999; Harlen & Holroyd, 1997). Similarly, research has also highlighted the need for teachers to continue in professional development once they enter the classroom (Duschl, Schweingruber, & Shouse, 2007). Most importantly, there is the, "emerging consensus that science learning and teaching ought to be grounded in and informed by conceptual, epistemological, and social structures and practices" (Duschl & Hamilton, 2011, p. 86) or put simply make science relevant, useful and meaningful. However, in 2011, New Zealand's Chief Science Advisor to the Prime Minister, Sir Peter Gluckman, released *Looking Ahead: Science Education for the Twenty-First Century. A report from the Prime Minister's Chief Science Advisor* (2011) in which he stated:

> A well-prepared primary school teacher will integrate excitement about the natural world and scientific forms of thinking into literacy and numeracy teaching, and into general educational processes. The challenge is how to provide primary school teachers with the skills to do so. (p. 4)

Sir Gluckman's report noted that this was the challenge but did not present any solutions to how this challenge could be meet. The following year, Hipkins and Hodgens (2012) highlighted that approximately 55% of the New Zealand primary teachers they surveyed were either 'unsure' or 'disagreed' that *The New Zealand Curriculum's* (Ministry of Education, 2007) overarching strand of the Nature of Science changed the way they taught science. This would seem to indicate they these teachers still used the 'possible' teaching experiences of the 1993 curriculum documents (see for example, Ministry of Education, 1993). The recent New Zealand Education Review Office's (2012) report on science in Years 5-8 supports this assertion as only 27 out of 100 schools in their study effectively delivered education programmes in science. Duschl, Schweingruber and Shouse (2007) highlighted that many of the key ideas of and about science may be impossible without the classroom teacher. They reiterated that for science learning to successfully engage students, it must be meaningful to the students and the teacher must support these students. This does not

mean that teachers have to be scientists in order to teach science or turn their students into scientist. Primary teachers are working to teach their students how to learn in science not practice science. Kirschner (2009) raised this distinction as he noted, students should be learning how to learn in science not how to 'do' or 'perform' in science. A relevant, useful and meaningful approach to teaching science in primary schools means that teachers need to know how to make the New Zealand's overarching science curriculum strand of the Nature of Science explicit and authentic (Sampson & Grooms, 2008). That is the purpose of this paper; this paper seeks to highlight some of the obstacles that two newly registered teachers in New Zealand faced in their science teaching as they entered the classroom.

These stories are narratives and as such are powerful tools for expressing identities that are widely shared, for example, both are examples of provisionally registered teachers. Stephanie Taylor (2010), in her book *Narratives of identity and place,* reports how narratives linked to place provide rich and flexible resources of people's work. For her, the personal and social identity is inseparable. She highlights that this focus does not seek a total account of experiences, but explores how what a person says and how this contributes to one's own understanding. Specifically, how the temporal aspects of narratives link back to the past and suggest potential links to the future. These narratives then act as a cultural or discursive resource that enables one not only to make sense of one's experiences but also to shape one's expectations of the future.

Narratives have been used by Hobbs and Davis (2013) as a means for students to make connections both within and beyond the subject. Hobbs and Davis (2013) highlight how narratives draw out personal responses in which personal meaning is attached. Most importantly for this paper, Hobbs and Davis (2013) report how students are able to, "build narratives about, and through, their learning, and as they construct narratives from their lived experiences" (p. 1290). For them it is through narratives that one is able to undergo identity formation while positioning themselves within the setting. This notion of positioning is also important in how Norris, Guilbert, Smith, Hakimelahi and Phillips (2005) support the use of narrative explanation in science education. Norris et al.'s narrative explanation (2005) also supports Taylor's (2010) temporal aspect of narrative links. For Norris et al. (2005), narrative explanations not only use unique events form one's past as explanatory of other unique events but also some events are causes of others.

Methodology

This paper is part of a larger three-year study into perception of teachers and teaching under the ethical guidelines of the University of Otago. The intent of this larger study was to explore how various stakeholders saw the role of teachers and teaching. These stakeholders included primary, intermediate and secondary students, student teachers, current classroom teachers and school leaders about their perception of teachers and teaching. The larger study allowed for multiple collection points of qualitative analysis through interviews and follow-up emails concerning authentication of interview data. Each narrative was returned for clarifications and authentication by each adult participant (an adult is legally defined as a person over the age of 18 in New Zealand). The researcher used analysis of narratives and narratives of analysis (Polkinghorne, 1995, 1997) to analyze the data. This means these teachers' interviews were analysed for stories to be told and then written as a story of their telling.

Specifically for this paper, the qualitative data is in the form of narratives of place (Taylor, 2010). The researcher took the verisimilitude of what these teachers reported as truth for them at that time (Denzin, 1989; Dhunpath, 2000). These multiple collection points, which occurred during 2011, 2012 and 2013 allowed the researcher to highlight, explore and investigate anomalies, contradictions and similarities. However, the researcher respected that this was a collaborative process with these teachers and as such, the researcher had an obligation to respect the teachers' ownership of the raw data. The researcher continuously informed the teachers about the collected data. As stated, each participant reviewed their qualitative data interviews to allow for its authentication and the researcher respected any editing or omissions requested before using any material for possible publications.

NARRATIVES

This paper presents the stories of Richard and Joy who began their teaching careers in 2012. Both completed an initial teacher education (ITE) degree in primary education at a large university in New Zealand. In New Zealand upon completion of an initial teacher education programme, teachers apply for provisional teacher registration. They then spend two to five years gaining the classroom experience necessary for full teacher registration. These are their stories. First, they discuss why they wanted a science focus in their initial teacher education programme. Then they discuss their experiences in teaching practice, finding work, getting started, what has been helpful, and finally obstacles they have come across in their teaching of science in the classroom.

Richard

Richard graduated with an undergraduate degree. He was to begin his teaching career as one of the foundation teachers in a newly built school. Like many teachers, however, there was a change in his living circumstances that required him to resign from this position before the 2012 school year started. He began 2012 working as a relief teacher to gain teaching experience and was successful in obtaining a full-time position during the 2012 school year. This is how he saw his initial teacher education programme and entry to the teaching profession:

I decided to train as a teacher, partly out of necessity in that I needed to choose a career path when I finished high school, and partly because it had been the only career I had ever seriously considered. I remember having an excellent teacher by the name of … in Form 1 (Year 7), and looking at him and thinking I would like to do what you do. As well as this, I have always enjoyed working with young people in a variety of age groups in kids clubs, youth groups, etc.; which may stem from being part of a large family of eight and always surrounded by young people. I chose the primary teaching level as it was specifically a teaching course, as opposed to high school, which starts as a degree {*At this University, students who wish to enrol in Primary Teaching may do so as an undergraduate while those seeking Secondary Teaching qualification must enrol in a Post-Graduate Diploma after completing an undergraduate degree*}. I had also heard that it was possible to teach at lower age in high schools with a primary degree so also thought it may be the most effective way to have the 'best of both worlds.'

I am one of those people who has a tendency to be a little vague about the future and making plans so as such my expectations of the programme were limited by the amount of time I actually spent thinking about what was to come. As simplistic as it sounds, I guess my main expectation was to train to teach in the New Zealand classroom. I expected time on postings learning what a day of teaching looked like, how to plan lessons and how to teach children how to learn and what they needed to know. Did I get it? Yes and no. Yes in that I am qualified, have had experience in teaching a class for an extended period, assessing students' prior knowledge, planning activities, adapting and carrying them out and noting student progress. Yet also no as I do feel like there are still significant gaps in my knowledge and in my ability to teach my own class for an entire year. Although I am sure such doubts and feelings of inadequacy are common in all individuals seeking to begin work in a new job.

Why did I choose science as a curriculum subject area of interest? {In this undergraduate degree's final year, students select two subject areas in

addition to Literacy and Numeracy to gain additional experience in teaching and planning} To be honest, the main reason I chose Science as a subject was that I was yet to cover it in my training. I began my time at university in 2007 in the final year of the now terminated University Bachelor of Teaching course. I then had a gap year and transferred into the 2nd year of the new college course, meaning that I did not cover Science as a curriculum area as did everyone else in my first year. As well as this, Science has always been a subject of interest to me and I was eager to see how it to incorporate it into the classroom.

Yes, I do feel ready to take on my own class, but with a lot of support and assistance from other staff in a school in which I will be teaching. I feel like I will be able to teach but it is still quite an unknown as to what it will all look like, where to start and what happens once a job starts. I definitely think taking the science curriculum subject made a difference to how I am prepared to teach science. Obviously, the resources, units and activity ideas were a great bank from which to draw from but I guess the biggest thing I took from it was the importance of the higher concepts behind the activities and using them as a tool in exploring these concepts rather than a science activity. It also reinforced for me the need to make science interactive and to help scientific ideas come alive for students who build a lot of their attitude toward scientific learning in their early years.

{At the s*tart of the 2012 school year*} I worked as a relief teacher at first and did not get to teach regularly in the same class but from what I could see there was a huge emphasis on literacy and numeracy learning that though important crowded out other equally important learning areas. That I think is one of the obstacles to bringing more science into the classroom. Other teachers were also hesitant to partake in science areas and concepts that they themselves felt ignorant or inept in. Right now, I just do what I can, when I can.

{Richard participated in this study as a relief teacher. When appointed to a full-time position, he found the day-to-day operation of his new classroom took more of his time than was allowed to continue in this study. He subsequently pulled out of the study. The researcher did meet up with him at a school-aged science challenge event where he was the supervising teacher for his school. He was enjoying his time in the class, but once again said the crowded curriculum was a bigger issue than he thought. He agreed to continue his involvement in the study year.}

After almost a year in the classroom now, I feel like although our time at college did prepare us for teaching we could have benefited from a lot more practical time in the classroom. No matter how good the theory is

you are learning about it is hard to take it in when you cannot apply it. Yes, I do feel ready to take on my own class, but with a lot of support and assistance from other staff in the. I feel like I am to teach but it is still quite an unknown. I would say the majority of what I now know has been learnt 'on the job' by trying things, researching, talking to other teachers etc. Much of what we learned at college seems so far off now.

Having taken science as a curriculum area in my final year definitely made a difference. Obviously, the resources, units and activity ideas were a great bank from which to draw from but I guess the biggest thing I took from it was the importance of the higher concepts behind the activities and using them as a tool in exploring these concepts rather than just a science activity. It also reinforced for me the need to make science interactive and to help scientific ideas come alive for students who build a lot of their attitude toward scientific learning in their early years. Topic work such as science seems to come around in cycles here at school and so there has not been a lot of room made for active science teaching since I have started. As a result, much of my learning is yet to be applied. I still see that there is a huge emphasis on Literacy and Numeracy learning. I also still see other teachers are hesitant to partake in Science areas and concept that they themselves feel ignorant or inept in.

In my school, Literacy and Numeracy are the major focus with the other curriculum subject areas having a glimpse in the classroom every now and then. This is also reflected in our school reports as well as the majority of resources. Science sometimes seems to be more of an afterthought. That being said some of the science related things taking place include: Science badges for year 6-7 students; option rotations including a science/technology option; a weekly water study with a group of year 6 students from my class with an outside expert, solar system term focus and report writing.

What I would like to ask my principal and senior teachers about teaching science: How can science be included at school in a consistent and meaningful way? What importance does Science have besides literacy and numeracy responsibilities? and What is our overall school goals for science teaching.

Joy

Joy was a mature-aged student who graduated of a graduate diploma teacher education programme. In the following, she describes her background; why she chose teacher education; her student teaching placement; and how all of this has influenced her perception of teachers and teaching. Appointed to a full-time position after a period of relieving,

Joy discusses three obstacles she sees to teaching science in New Zealand classrooms:

I have been involved in science education for a number of years. My first job was working as a field study tutor in Scotland. This involved lots of environmental and ecological work. Because I am an ecologist first and foremost, I had lots of work with places like the Scottish Wildlife Trust bringing people in to teach children about the ecology and wildlife. I have had that theme all the way through my career, and before I enrolled {*name of her university}* I worked at a Marine Studies Centre, and so I wanted to keep going with a focus on science education.

Why primary education? I like the fact that you can explore, and you can go off into different tangents. You can see where the children are interested and you can make it run into the day-to-day life. You can pick another topic as the years go by, whatever the covered theme is, so I think it gives you a little bit more freedom to get children really excited about science rather than focusing on content and passing exams.

I knew there would not be a huge amount of time for science in a one-year initial teacher education programme. I guess I wanted to know what the expectation was in science, access to resources, what are the current resources, how are teachers accessing science, and a bit of understanding of how science was perceived in the curriculum. I wanted to know whether it is like a subject or whether taught across the curriculum. Therefore, I wanted to see how schools perceive science and how schools manage science. Then I just wanted some more ideas because I have an environmental background, I get excited about the material world, physics and chemistry and how can we bring those areas down to a primary level, and I got quite a lot of that from the course.

When I was on teaching placement, it was quite different from how they {*her students*} normally did science because I know most of the teachers at that school were not science specialists. I think they would tend to take a science topic for example they might do space in the science context but I do not think they were quite hands on as I am. When I first went they had been doing ecology eco systems, so I did poo; how much would you poo, how much would one eco system poo in a day? We made this huge pile of 'poo', and asked where did it all go? Therefore, I think I am a bit more hands on than they are. We did a lot of doing, we did not write many things down, but they were Year 3s. I think they liked that they retained quite a lot. They seemed to retain it anyway, and be able to give logical answers to questions so, yeah; I am definitely used to doing it that way.

When I am out in schools, how did I see the implementation of *The New Zealand Curriculum*? It depends on the school. One of the schools I have done some relieving in and I did one of my practica in, takes the topic across a term and the whole school has this integrated theme. They will do a science perspective and social studies perspective and they will pull the literacy and maths into it so they have a much more integrated approach. Then there are other schools, which I have done a bit of relieving in; we do our core areas and then it is up to each teacher how much we access the other curriculum areas. They have just done a curriculum review and realised they have quite a few gaps, so they were very subject based and they realised because of the limited experience of the teachers, they were not addressing some subjects as much as others. Therefore, I think it varies from school to school still quite a bit.

I remember when I was relieving in this school, I said we are going to do science this afternoon, what do you think we are going to do, what does science mean to you? All they came up with was about technology rather than science. They told me science was about things, about computers, and about scientists doing hard stuff. They had this idea of science as a very hard subject. They did not go "we love science", and when I went back to a school I did my teaching practice in, I said shall we do some science this afternoon and because they had me before they all went, YEAH!

So what would I think would be the obstacles to having more science in the classroom? The crowded curriculum, because I mean there is just so much to fit in. I think the perception is the curriculum is very crowded and that we can only fit it in wee {*little*} chunks. I think it is more the idea that this is something we have to cover and we will cover it in this way, and resources - people think you need so many resources. I have talked to a few teachers and they say, "Oh we haven't got the resources to do that." You think well actually, you know it is not that hard. There is the idea that it is going to be challenging because they have this idea of how are we going to cross everything off {*A reference to the previous curriculum documents that listed 'possible' learning experiences students at each year level 'could' experience. This resulted in many classroom teachers ticking off these experiences as they occurred throughout the year*}. I mean you could cover some of it. For example, you can plan your writing around that whole sun smart topic. In addition, for your maths, you could bring into it as well, like the time, what time did we go out, we could chart some graphs. Moreover, you could do technology, and you could do social studies about it as well. Mainly, the idea is to make it flow more easily so you would not feel that you were that rushed. If I know that I have four weeks and at the end of the third week we needed to be at a certain place

where we could do an assessment, we could see what the children had learnt over that period. However, it is three weeks, which gives us lots of time, so we could; do a bit there and then do a bit more the next week in a slightly different context.

I know you hear teachers say they need resources for science or that science is expensive. Then some say it is dangerous with burners and all sorts of dangerous chemicals. There is maybe a perception that science is hard, and again once you stop to talk to teachers, some teachers have certain things that they do they are confident with but they are really reluctant to go out of the comfort zone and think about new things. That is were working as a community of learners is important. We all have areas that are stronger than others are and when we work together, it makes it easier for everyone. Just because I am new to teaching does not mean I cannot help or even lead other teachers in how to bring science in the classroom better.

What do I do to help them overcome this lack of confidence or capability? I think, I suppose, make it easier to use accessible resources I mean I have an iPad and I have found quite a few resources, which the kids can use. I found a detector that will log into your local area and tell you what you have used today. The kids know this resource and you do not really need any training to use it. Resources like that that are easy to access and are understandable, rather than some big recipe that you do this, then this, then this and then it gets complicated. I know I use my iPad a lot, there are so many you-tubes and I have discovered a website called 360, which if you want to find out about penguins you log on and there is a whole film. I use it to start a conversation and because you are seeing it, you have not had to read a whole lot of material. That certainly helps me to get them fired up with ideas and then it directs you to new resources, so I think many new media could help put things in quite quickly. I know schools just do not have enough to function, and unfortunately literacy and numeracy takes the bulk and everyone else fights for it, and it is getting worse now as well. Nevertheless, giving them {*students*} stuff they can use you know, something that they do not normally get their hands on they just get so excited.

Narratives of place – An evaluation of Richard and Joy

Dewey (1938) long ago noted that current experiences are the foundations of future experiences. Both Richard and Joy's narratives support Dewey's assertion. Specifically, Richard and Joy appear to evidence what Hobbs and Davis (2013) report as both outward and inward-looking narratives. Outward-looking narratives allow students to go beyond the classroom's context while inward-looking creates meaning from experiences within

the classroom. Richard's narrative as a less-experienced teacher focuses more on outward-looking as he seeks to make connections between his own personal experiences in education and now his own teaching. Joy as a more experienced teacher appears to focus more on inward-looking as she reports on her own transformative connections of learning and then how she seeks transformative connects in her student's learning. Similarly, both Richard and Joy support Norris et al.'s (2005) narrative explanation as their stories indicate how their present is a result of their experiences.

DISCUSSIONS

Richard and Joy both began their teaching careers after coming into this profession with two different histories. These new teachers are forming their teaching identities from what they have experienced as students and student teachers and what they are now experiencing as classroom teachers (Norris, et al., 2005; Taylor, 2010). This paper sought to present a perspective of what they see as helpful, a hindrance to teachers, and the teaching of science. But why? Osborne and Monk (2000) highlighted that education like any other profession requires someone to ask critical reflective questions of what they see. They then stated, "Teachers can certainly gain much personally from research that offers a valued opportunity for reflective examination of their own practice" (Osborne & Monk, 2000, p. 3). That is the intent of this paper.

Richard and Joy raise several points that need reflection. First, students often do not even know they are doing or have done science. Teachers need to be explicit in what they are doing and why they are doing it. Science is not just the 'WOW' activity that ends with a noise and flames but more importantly 'Why did we do this?' and 'How is this relevant to my world?' This is where many teachers stumble. Saying it is too hard or the easier excuse of it is too expensive allows teachers to push science to the back of the curriculum, if taught at all. What they really mean is more likely to be I do not think I know how to teach science, so I will not.

Both Richard and Joy both make comments about what they refer to as the 'crowded curriculum' and how this influences their abilities to include science in their teaching. As Joy has come from a much stronger background in science with personal experience in science education, she offers ideas and support to her colleagues as to how they can integrate science into other curriculum areas. Richard, like many New Zealand primary teachers, comes to teaching with a weaker background knowledge base and reported that while his ITE programme supplied him with some ideas and resources his own personal content knowledge is inadequate and he is expecting support from his colleagues. Each teacher brings his or her

own strengths and weaknesses to their classroom. Both Joy and Richard, as provisionally registered teachers, should expect support as they: settling into the profession; learn the day-to-day running of their classes; and, fit into their school's culture. Richard, however, raises an additional concern. He stated he expected support from his colleagues as he continued developing specific subject content knowledge learning. While the focus of this study was the science learning area, Richard is expecting his colleagues to help fill other gaps in his content knowledge areas not just the science learning area.

Sir Peter Gluckman in his 2011 report noted that every New Zealand primary school needs both the resources and a champion to assist other teachers in learning through science. Richard and Joy offer two distinct examples of what provisional registered teachers bring with them to the profession. Richard enters the profession like many of his colleagues with a weaker background and self-reports a lack of science content knowledge. He is expecting his school to support him. Joy brings a wealth of knowledge and confidence in her abilities in this learning area. It would seem that she has begun to take on the role of champion in her school by supporting her colleagues in how to use available resources and her depth of content knowledge.

IMPLICATIONS

There is a body of research literature on science education (Appleton, 2007; Brandt & Carlone, 2012; Kelly, 2007; Linn & Eylon, 2006); education through a science context (Colucci-Gray & Fraser, 2012; Duschl & Hamilton, 2011; Hoy, Davis, & Pape, 2006; Korthagen, Kessels, Koster, Lagerwerf, & Wubbels, 2008; Sexton, 2011); and, science in primary education (Bolstad & Hipkins, 2008; Brandt & Carlone, 2012; Education Review Office, 2010; Leach & Scott, 2000; Simon, 2000). This research highlights obstacles to both teachers and students in this curriculum area. Joy and Richard talk about obstacles of: the crowded curriculum with a focus on literacy and numeracy; a perceived lack of resources; teachers' perceived lack of content knowledge; and, some teachers see science as just too hard a subject. In light of these obstacles, it is not so surprising that New Zealand's Education Review Office (ERO) (2012) reported that only 27 out of the 100 schools they investigated were effectively delivering education through science, of which only three were highly effective. This report highlighted what these 27 schools' programmes were doing that was seen as being effective, namely: the principals actively promoted science teaching and learning; there were clear expectations about curriculum design and programme planning; senior teachers were actively involved in

their schools' programmes; and there were agreed school-wide approaches to science learning. This paper argues that for many schools, the resources teachers have within themselves and that they can use would help overcome many of the obstacles that are self-imposed.

Since Joy has been in the classroom, she has been able to provide storied evidence for ERO's (2012) report. Specifically, Joy was able to discuss a school she was in that had neither a school-wide focus on learning through science nor any guidance from any of the school's leadership team. As a result, a review of this school's programme identified, "quite a few gaps … they were not addressing some subjects as much as other." This would seem to indicate that this school's lack of coherence between staff resulted in many students only experiencing learning deemed appropriate by the classroom teacher no matter how experienced/inexperienced or confident/unconfident in the subject material the teacher may be. Fortunately, Joy was also able to talk about a school that has direct leadership input in the school's programme planning. This school uses whole school planning for the topic across the term integrating it into their literacy and numeracy. It appears that this school's leadership is actively involved in what the teachers' plan, how it is planned, as well as how it is implemented across the school for a more coherent approach to education. As a result, this school would more likely fall into ERO's effective to highly effective category for learning through science.

Sir Gluckman (2011) raised the issue that schools need a science champion and that all primary teachers need the skills to integrate science into the educational process. What he did not provide in his report was how this is supposed to happen. This paper highlights how schools hold a wealth of knowledge and experience that is, unfortunately, not always utilised. Fortunately, this paper does highlight how some schools are supporting their colleagues when appropriate leadership comes from the top. Richard and Joy support both the international and national literature that identifies common obstacles to learning through science, namely: crowded curriculum; lack of resources; and, teachers' lack of content knowledge. Richard and Joy discussed how they encountered these obstacles and how they are attempting to overcome them. Richard with a weaker science background is expecting more support from his colleagues while Joy with her strong background is attempting to support her colleagues. More importantly, for senior teachers and school leaders, there are two implications from this study. First, Richard raises a concern as to just how much support provisionally registered teachers should expect to receive in overcoming curriculum learning area content knowledge deficiencies. Second, Joy reports how both strong and weak leadership in curriculum programme planning and delivery influences teachers and

students experiences in school. These two teachers and their experiences suggest schools with not only strong leadership but also whose teachers work as a community of learners that are more effective in science education. Further study is needed to investigate how effective schools would be in science education if they were explicitly guided through a process of building up their own school as a community of learners around science education.

REFERENCES

Appleton, K., & Kindt, I. (1999). How do beginning elementary teachers cope with science: Development of pedagogical content knowledge in science (paper). ERIC. (ED448998). Retrieved 16 February 2012. http://www.eric.gov/contentdelivery/servlet/ERICServlet?accno=ED448998

Brandt, C. B., & Carlone, H. (2012). Ethnographies of science education: situated practices of science learning for social/political transformation. *Ethnography and Education, 7*(2), 143-150. doi: 10.1080/17457823.2012.693690

Caygill, R. (2008). *Science trends in year 5 science achievement 1994 to 2006. New Zealand results from three cycles of the Trends in International Mathematics and Science Study (TIMSS)*: Wellington, New Zealand: Comparative Education Research Unit, Ministry of Education.

Colucci-Gray, L., & Fraser, C. (2012). From science as 'content' to science as 'interpretive key': experiences and reflections from a science course in teacher education. *Ethnography and Education, 7*(2), 175-195. doi: 10.1080/17457823.2012.693692

Denzin, N. K. (1989). *Interpretive biography*. London, England: Sage.

Dewey, J. (1938). *Experience and education*. New York, NY: Macmillan.

Dhunpath, R. (2000). Life history methodology: 'narradigm' regained. *International Journal of Qualitative Studies in Education, 13*, 543-551.

Duschl, R., & Hamilton, R. (2011). Learning science. In R. E. Mayer & P. A. Alexander (Eds.), *Handbook of research on learning and instruction* (pp. 78-107). New York, NY: Routledge.

Duschl, R. A., Schweingruber, H. A., & Shouse, A. W. (Eds.). (2007). *Taking science to school: Learning and teaching science to grades K-8*. Washington, D.C.: The National Academies Press.

Education Review Office. (2012). Science in the New Zealand Curriculum: Years 5 to 8. Wellington, New Zealand: Eduction Review Office

Gluckman, P. (2011). Looking ahead: Science education for the twenty-first century. In Office of the Prime Minister's Science Advisory

Committee (Ed.). Auckland, New Zealand: Office of the Prime Minister's Science Advisory Committee.

Harlen, W., & Holroyd, C. (1997). Primary teachers' understanding of concepts of science: impact on confidence and teaching. *International Journal of Science Education, 19*(1), 93-105. doi: 10.1080/0950069970190107

Hipkins, R., & Hodgen, E. (2012). Curriculum support in science: Patterns in teachers' use of resources. Wellington, New Zealand: New Zealand Council for Educational Research.

Hobbs, L., & Davis, R. (2013). Narrative pedagogies in science, mathematics and technology. *Research in Science Education, 43*(3), 1289-1305. doi: 10.1007/s11165-012-9302-5

Hoy, A. W., Davis, H., & Pape, S. J. (2006). Teacher knowledge and beliefs. In P. A. Alexander & P. H. Winne (Eds.), *Handbook of educational psychology* (2nd ed., pp. 715-737). Mahwah, NJ: Lawrence Erlbaum Associates, Publishers.

Kelly, G. J. (2007). Discourse in science classrooms. In S. K. Abell & N. G. Lederman (Eds.), *Handbook of research on science education* (pp. 443-470). Mahwah, NJ: Lawerence Erlbaum Associates, Publishers.

Kirschner, P. A. (2009). Epistemology or pedagogy, that is the question. In S. Tobias & T. M. Duffy (Eds.), *Constructivist instruction: Success or failure?* (pp. 144-157). New York, NY: Routledge.

Korthagen, F. A. J., Kessels, J., Koster, B., Lagerwerf, B., & Wubbels, T. (2008). *Linking practice and theory: The pedagogy of realsitic teacher education*. New York, NY: Routledge.

Leach, J., & Scott, P. (2000). Children's thinking, learning, teaching and constructivism. In M. Monk & J. Osborne (Eds.), *Good practice in science teaching: What research has to say* (pp. 41-56). Buckingham, UK: Open University Press.

Linn, M. C., & Eylon, B.-S. (2006). Science education: Integrating views of learning and instruction. In P. A. Alexander & P. H. Winne (Eds.), *Handbook of educational psychology* (2nd ed., pp. 511-544). Mahwah, NJ: Lawrence Erlbaum Associates, Publishers.

Ministry of Education. (1993). *Science in the New Zealand curriculum*. (93375). Wellington, New Zealand: Learning Media.

Norris, S. P., Guilbert, S. M., Smith, M. L., Hakimelahi, S., & Phillips, L. M. (2005). A theoretical framework for narrative explanation in science. *Science Education, 89*(4), 535-563. doi: 10.1002/sce.20063

Osborne, J., & Monk, M. (2000). Introduction: Research matters? In M. Monk & J. Osborne (Eds.), *Good practice in science teaching: What research has to say* (pp. 1-4). Buckingham, UK: Open University Press.

Polkinghorne, D. E. (1995). Narrative configuration in qualitative analysis. In J. A. Hatch & R. Wisniewski (Eds.), *Life history and narrative* (pp. 5-23). London, England: The Falmer Press.

Polkinghorne, D. E. (1997). Reporting qualitative research as practice. In W. G. Tierney & Y. S. Lincoln (Eds.), *Representation and the text: Re-framing the narrative voice* (pp. 3-22). Albany, NY: State University of New York Press.

Sampson, V., & Grooms, J. (2008). *Science as argument-driven inquiry: The impact on students' conceptions of the nature of science inquiry*. Paper presented at the Annual International Conference of the National Association of Research in Science Teaching (NARST), Baltimore, MD.

Sexton, S. S. (2011). Revelations in the revolution of relevance: Learning in a meaningful context. *The International Journal of Science in Society, 2*(1), 29-40.

Simon, S. (2000). Students' attitudes towards science. In M. Monk & J. Osborne (Eds.), *Good practice in science teaching: What research has to say* (pp. 104-119). Buckingham, UK: Open University Press.

Taylor, S. (2010). *Narratives of identity and place*. Hove, East Sussex, England: Routledge.

Yates, S., & Goodrum, D. (1990). How confident are primary school teachers in teaching science? *Research in Science Education, 20*, 300-305.