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Expecting the unexpected: engaging diverse young people in conversations around science

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Abstract The issue of limited engagement with science for young people from Indigenous, minority and lower socio-economic groups in Australia appears to have been sidelined from the mainstream debate around falling rates of engagement with science at the secondary schooling level. The 'closing the gap' mantra of education policy in Australia has seen an extraordinary focus on improving literacy and numeracy outcomes for Indigenous students, which, while valuable, has subsumed the importance of other key learning areas including science. Teachers are soon to be expected to incorporate Indigenous Perspectives within the science subjects of the new Australian National Curriculum yet appear to be under-resourced to meet this challenge to traditional approaches to science teaching. The purpose of this paper is to explore the pedagogy of a teacher working at an alternative secondary schooling site in North Queensland Australia who volunteered to modify his teaching of science to explicitly incorporate Indigenous Perspectives. The qualitative data collected through classroom observation and teacher interviews demonstrates the complex and multi-faceted nature of the science education experience when traditional pedagogical boundaries are dismantled to allow for a drawing upon of the lived experiences of diverse young people. The teacher's ability to embrace this broader vision of science is linked to the inclusive culture of the alternative school environment that is brought into being through a 'common ground' philosophy of mutual respect and democratic relations.

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Introduction—The missing 'crisis' in science education

The draft national K-10 Australian Curriculum for Science (Australian Curriculum, Assessment and Reporting Authority 2010, p. 1) states that "an issue for science education in Australia is not so much the performance of our students on international tests, but rather student engagement and interest in science". This statement implicitly references the well-documented 'crisis' in science education that has charted the steadily declining interest and engagement of mainstream secondary students in the study of science (Tytler 2007; Fensham 2004; Schreiner and Sjoberg 2004). This emphasis on engagement of the majority of the student population has overshadowed the fact that a significant percentage of the Australian population of secondary students are neither engaged in science, nor are they meeting basic proficiency levels in international tests. Data from the OECD Program of International Student Assessment (PISA) demonstrates that nearly one quarter of students from low SES backgrounds and almost half of Australian Indigenous students are not meeting a very basic level of scientific literacy (Thomson and De Bertoli 2008). While "Australia remains committed to the principle of equity and social justice education" (Thomson et al. 2010, p. 21) it is evident that there is room to improve the science education outcomes for young people from low SES and Indigenous backgrounds in Australia.

Catering to the needs of diverse young people

While there is a move towards greater integration of diverse curriculum content through the incorporation of Indigenous Perspectives as a cross-curricula priority in the new Australian National Curriculum for Science, there is minimal recognition of diverse ways of knowing, nor advice to teachers in relation to what might constitute 'culturally affirming pedagogies' (Chigeza 2011). This is hardly surprising in that there is little empirical evidence available that explores what types of pedagogical practices work to effectively teach secondary science to Indigenous and other groups of marginalised young people in Australia. There is in fact only a small body of local work to draw upon to conceptualise a pedagogical approach suitable for the under-served population of Australian students who might be considered 'non-mainstream' (Lee and Buxton 2011) in that their particular needs are evidently not being met by traditional approaches to science education.

Chigeza (2011) has suggested that Australian educators might usefully adopt a Freirian derived 'capacity building perspective' in order to better engage non-mainstream students in science. He argues that "a capacity building perspective can empower minority and marginalised students by affirming their lived languages, experiences and knowledge in their learning" (Chigeza 2011, p. 406). This approach aligns with the work of international scholars in the field of engaging diverse young people in science who call for a reflexive approach to science education (Calabrese

Barton 1998) that focuses on both the intellectual resources of the learner and their cultural funds of knowledge (Gonzalez and Moll 2002). Central to this approach is placing emphasis on what students know and can do rather than on what they do not know and cannot do (Seiler 2001). According to Tobin (2006, p. 220), in the context of working with African American students from low income homes,"… it is possible that teachers perceive urban youth as lacking the culture they need to support the learning of science and do not recognize the potential of what they can do as a foundation for learning science." It is not too much of a stretch to imagine that educators in the Australian context may have the same limited perceptions of the capacities of non-mainstream students in relation to learning science. Tobin's (2006) empirical work has attempted to capture the ways in which successful teachers in diverse settings have been able to structure the participation of students by recognising and engaging with the cultural capital that young people bring from their life-worlds into the classroom. This adaptive approach calls for a new way of educating which emphasizes respect for young people's cultural and linguistic backgrounds and acknowledges the central role of relationships in engaging diverse young people in science teaching and learning.

In the tradition of Tobin's work, the purpose of the study reported in this paper has been to explore the pedagogical structures of a teacher working to engage diverse young people, in this instance at an alternative or 'flexible learning' secondary schooling site in North Queensland Australia. The place of science education in flexible or alternative settings is at best tenuous in that it is perceived as a difficult subject for students already struggling with the 'basics'. While studies demonstrate that students attending alternative settings undoubtedly experience greater barriers to academic success than the mainstream population (see, for example Foley and Pang 2006), the argument of this paper is that science education may play an important role in more fully realising the intellectual potential of non-mainstream young people.

The work of the Flexible Learning Centres

The Edmund Rice Education Australia Flexible Learning Centre schooling model was instigated in south-east Queensland, Australia, twenty-five years ago with the aim of providing an alternative learning pathway for young people who had, for a variety of reasons, found themselves completely disengaged from the mainstream secondary schooling system. As a result of high need and corresponding invitation from communities, the operation expanded from a single site in Brisbane to a network of 11 sites across urban, regional and remote areas of Queensland. In 2012, the Edmund Rice Education Australia Flexible Learning Centre Network (ERE-AFLCN) continues its expansion nationally to cater for young people in disadvantaged areas of Western Australia, Victoria, New South Wales and the Northern Territory.

Young people attending these centres have often experienced complex life circumstances including homelessness, contact with juvenile justice and child safety systems, young parenting and disability (EREA 2010). They have also generally

experienced large gaps in their schooling (due to school absence, suspension and/or expulsion) which has had a negative impact on the development of their basic academic skills, particularly in relation to literacy and numeracy. Young people across the network come from diverse cultural backgrounds and those who identify as Indigenous Australians comprise a large percentage of the student cohort in regional and remote locations.

Values

Key to the EREAFLCN approach is recognition of the strengths that students bring to the educational setting and an organisational philosophy that encourages teachers to be innovative in finding ways to foster these unique abilities. The key values that guide teaching and curriculum development are that of *Relationship*, *Community*, *Safety*, *Transformation and Eco-justice*. These are in turn connected to an internally developed four pathways enlightenment model—*widen your options for wonder*, *be courageous*, *dare to dream and make a difference* (Morgan 2009). Underpinning both of these models and in alignment with the recently developed Australian National Curriculum is a commitment to including Indigenous Australian Perspectives and Sustainability Education.

Respectful relationships

'Respect' is the first of four guiding principles (*Respect*, *Safety*, *Participation and Honesty*) that frame the common ground philosophy of the Flexible Learning Centres. The concept of 'common ground' emphasizes the democratic and relational (EREA 2004) and applies to both adult staff members and young people who choose to participate in the Flexible Learning Centre program. Respectful relationships are the core business of the Flexible Learning Centre and this is reflected through curriculum documents published on behalf of the EREAFLC Network:

> Relationships within the program are based on a respect for personal dignity and recognition of difference (EREAFLC 2008, p. 5).

Exploring the multi-dimensional nature of 'relationship' in the Flexible Learning Centre context is key to developing an understanding of the pedagogical practice that enables previously marginalised young people to find pathways of re-engagement within a program of science education.

Project methodology

The project described here forms part of a larger study exploring the role of science education in re-engaging disadvantaged youth. This four year project has involved working in partnership with teaching staff at a Flexible Learning Centre site in North Queensland to trial and self-evaluate units of work embedded within a socio-cultural perspective of science teaching and learning. Data sources have included classroom observation notes acquired through extended time in the field, semi-structured

interviews with teaching and support staff and a review of key organisational, policy and curriculum planning documents. Qualitative analysis of this data through a process of coding and progressive focusing (Simons 2009) has been directed towards producing case studies which illuminate the range of pedagogies employed by Flexible Learning Centre staff in order to engage diverse young people in science.

The North Queensland Flexible Learning Centre

The North Queensland Flexible Learning Centre is situated in a regional town of the tropics with a population of close to 200,000 people. The centre is registered as a secondary special assistance school and enrols up to 110 young people (attendance and enrolments fluctuate). There is a slightly higher ratio of male to female students and approximately 47 % of the young people attending the North Queensland centre identify as Indigenous. The centre aims to provide:

> …holistic learning experiences that address the social needs of young people, and promotes their emotional, cognitive, spiritual and academic development. The purpose of the learning experiences is to empower young people to take personal responsibility for their actions and learning, achieve greater autonomy and self-reliance and to engage in the transition to further education and/or employment (EREAFLC 2010, p. 2).

School description

The school is comprised of a series of brown brick buildings that form an L shape around a central courtyard. This courtyard acts as the heart of the school and is the place for whole school meetings and community celebrations. The walls surrounding the courtyard are brightly decorated with student paintings of totem animals that have personal and community significance. The school principles of Respect, Participation, Safety and Honesty are prominently displayed on a sign at the corner of the courtyard and close to an outdoor manual workshop area. Adjoining the courtyard is a large kitchen and eating area that acts as a communal space for preparing and sharing food. It is here that young people are often greeted for the day as they receive breakfast from teaching staff and from their peers working in the kitchen. The sliding glass doors of the kitchen are lined with curtains handmade by students and the walls inside the eatery are decorated with photographs of young people engaging in Flexible Learning Centre activities.

Teaching and Learning at the Flexible Learning Centre

The key to effective teaching at the Flexible Learning Centre is creating the optimum conditions to enable young people to participate in learning activities. This is in itself a challenging task as young people's attitudes towards learning are often apathetic—coloured by prior negative schooling experiences that might include significant academic failure, social isolation and school exclusion. Reconnecting

young people with education involves firstly identifying where each young person is at—both academically and socially—and then ascertaining what they need to build for themselves a 'good life', on their own and their community's terms. Teaching staff balance necessary remedial work in literacy and numeracy skill development with opportunities for young people to demonstrate their talents in thinking creatively and in completing performance based tasks. Curriculum content is chosen on the basis of relevance to young people's interests, connection to community and place, and scope for incorporation of experiential learning activities.

Teacher co-participant

The teacher co-participant in this study, Todd,[1] of white middle-class background, had recently commenced work at the Flexible Learning Centre after having spent 6 years teaching Physical Education, Science, Mathematics and IT at a secondary boys' college. Holding a Bachelor Degree in Exercise Science with requisite course content including the subjects of Physiology, Biology, Physics and Chemistry, Todd was confident in his own ability to teach science content and concepts. His teaching philosophy centred upon helping students to understand the conceptual underpinnings of science, a philosophy many times reiterated in conversations and interviews and exemplified in the statement—"if they know the concept, they can figure things out from there". In the Flexible Learning Centre context, Todd was dedicated to re-igniting a sense of curiosity in young people, explaining:

> A lot of the Flexi kids have gotten to the point where they don't ask 'why' anymore, they're not interested in anything that is going on around them. So to get them to ask the question 'why', I think is very important.

As an experienced teacher, Todd had a well-developed suite of pedagogical tools to engage young people in the teaching and learning of science. However, his prior teaching experience and training had not provided a great deal of scope for the integration of the social and cultural aspects of science related topics. Todd was keen to trial the integration of Indigenous perspectives in science and hoped to broaden his own traditional delivery repertoire to better reflect the historical, cultural and social elements of science as a field of human inquiry (Lemke 2001).

The solar oven/alternative energy unit

The unit of work from which the following lesson micro-analysis derives was intended as an exploration of the science concept of energy. The key concept was contextualised through an alternative energy focus with the primary practical activity being the construction of a functioning solar oven. The topic was selected on the basis of pragmatics, in that the teacher had taught a similar unit of work in his previous school and so was familiar with the necessary content, as well as for the affordance of the topic to breadth of inquiry and the potential integration of both Indigenous and sustainability perspectives. Physical resources to support the

[1] The teacher participant, Todd, as co-author of this paper, has chosen to be identified.

inclusion of diverse perspectives were provided by the research team including hard copy materials detailing traditional Indigenous stories of sun and fire, and digital resources to enable exploration of alternative energy and related sustainability topics. While Todd made use of, and appreciated, the provision of educational resources to support the topic, the actual integration of diverse perspectives that occurred throughout this unit of work ended up being more of a result of Todd's ability to engage his students in conversations around culture and their own lived experiences, rather than through the addition of culturally appropriate content to the curriculum. It appeared that once Todd had set his mind to grounding the unit from a social/cultural/historical perspective, he was then able to move back and forth between exploring these elements and making explicit connections with science to enhance student learning and engagement. The following description of the very first lesson of the unit of alternative energy work demonstrates how opening a dialogic space in the science classroom both engages young people and simultaneously allows for a more natural and authentic inclusion of diverse cultural perspectives.

Lesson vignette

The lesson described here was in the fact the very first 'formal' science lesson for junior students that had taken place in the Flexible Learning Centre within a timetabled slot dedicated especially to science. Todd's original intention for this introductory lesson was to assess students' background knowledge of the unit topic, connect to their real world experiences and foreground a sense of purpose for the unit. However, his opportunity to cover these aspects in depth was somewhat constrained by the truncation of his science lesson due to a whole school morning meeting running considerably over time. With young people at the centre prone to noting the exact minute when morning tea and lunch were due, extending the lesson into break time was not a viable option and so Todd was forced to compress his 40 min teaching sequence into a 15 min timeframe.

The lesson took place in a computer room due to a lack of a designated science or open learning space in the school at that time. The setting was not ideal as students were distracted by the presence of the computers, which they intermittently played with or, in one instance, accidentally toppled onto the floor. The room itself was narrow and seemed overcrowded with computers, desks, chairs and fourteen restless students. Todd compensated for the shortcomings of the setting by forming a circle of chairs in the centre of the room creating a sense of connection through proximity. He maintained a continuous dialogue with the young people throughout the lesson and did not move from the circle to write on the available white board—a move which may have resulted in a breaking of the flow of conversation. The student group itself comprised of three female students and eleven male students. Although outnumbered, the girls in the group appeared more confident than the boys in contributing to the class talk and did in fact dominate much of the discussion. Through the course of the lesson, it was made evident that the students had limited previous experiences with school science with only two students out of fourteen

recalling any science experiences whatsoever—one having obtained a 'bunsen burner licence' and another having completed a unit on meteorology.

Todd introduced the unit to students by posing the open-ended question—What is science? While student responses ranged from 'experiments and stuff' to some of the boys yelling out 'I don't know', one young Indigenous girl, Kira,[2] offered that 'science is literacy' and 'science is history'. Building on Kira's response, Todd advised the class that the unit of work for the term would include looking at history and culture in relation to science. His reference to culture prompted Kira to then ask 'Do white people have culture?' In a typical classroom, this type of question might be shut-down by the teacher in that it would seem outside the boundaries of a science discussion. However, Todd saw the potential of this student question in relation to creating an entry point to interest the class in exploring the connections between culture and science. He proceeded to engage in a discussion about culture with students, explaining that everyone has culture and that culture is not static—a concept then further explained by referencing the traditional and the here-and-now. Having captured the students' attention, he then broadened the discussion to include reference to the divergence in Indigenous culture related to place and geography and the development of different ways of being for different groups of peoples. This provided an opportunity for a hitherto uninvolved male student to participate in the discussion in the form of advising that 'at one stage there were 140 different groups of Aboriginal peoples.'

In the meantime, Kira continued to persist with her original line of inquiry in relation to whether there is such a thing as white culture. She regained Todd's attention and demanded to know exactly what constituted white culture. This sparked an animated class discussion highlighted in the excerpt from the lesson observation notes below:

> Kira asks Todd directly what his culture is. He states that he is Australian. Kira argues that his family hasn't been here very long whereas her family has been here 'generation after generation after generation' (indicated also with cyclic hand movement). Todd discusses that people can be included in many cultures so that Kira is part of Aboriginal Australian culture as well as wider Australian culture that he (Todd) is also part of. Kira still wants to know where White people's culture comes from. Other students try to help out. They talk about people all over the world coming from one place originally. Geraldine mentions that the world was 'all together' and then it split up. One boy asks if everyone spoke the same language then? (when the world was all one place). Another boy asks 'why people got black?'

Todd attempts to answer the last question posed in this quickly flowing conversation by providing a brief overview of the theory of human evolution and environmental adaptation, but, compressed for time, is forced to move the conversation onto introducing the unit topic of solar ovens. He proceeds to ask the group how they think solar ovens might work. Kira and Geraldine explain the solar oven process in terms of making electricity and taking energy from the sun. Todd builds on this

[2] All student names are pseudonyms.

discussion of energy and begins using the term more frequently in the following discussion. He inquires of the group as to whether they have had any previous experiences with solar ovens and Geraldine offers 'that's how they might cook the snake in the desert'. Jerry joins into the discussion for the first time by explaining how kangaroos are cooked, contributing a fairly graphic description of taking the legs off a kangaroo and putting it on a spit. This provides a lead in for Todd to discuss traditional cooking methods in different cultures and to add a sustainability slant to the conversation.

In relation to environmental sustainability and cooking, Todd begins a discussion about totems and skin groups. He explores the idea of cultural restrictions on hunting totem animals that, as well as a spiritual purpose, serves an environmental purpose of protecting different species from over-hunting. Kira offers that her totem animal is the dugong. Davey, a non-Indigenous student, asks Todd if he has a totem animal. Todd explains that the use of different totems and even the concept of totems is specific to particular peoples and their places in that, some groups of Indigenous peoples may not have 'totems', they may have different spiritual beliefs. As the lesson comes to a close, Todd states that, for homework, students need to have a chat with people at home about cooking and what family members might know about traditional cooking methods.

Analysis—The nature of student/teacher interactions in the classroom

In Jay Lemke's exploration of language and communication in the classroom (1990), he describes the typical course of dialogue in the science classroom as following a triadic dialogue pattern: Teacher Question—Student Answer—Teacher Evaluation (or Question–Answer–Evaluation). The purpose of such dialogue is to establish student mastery of the science content delivered and to check for student understanding. This form of dialogue pattern is also understood as a form of closed questioning in that the teacher is aware of the answer before the question is proposed. In the FLC case study, the teacher naturally asks questions of students but these are more open-ended and rarely have prescribed responses. Whereas the first science lesson of the year in a typical secondary classroom might commence with an introduction to the basics of school science, Todd began his unit by asking a contestable question in the form of 'What is science?' He immediately created a space for different interpretations of science and opened the door to an unexpected line of inquiry that serendipitously followed his intended path of exploring culture in the context of science. The question of 'what is science?' evidently piqued the ongoing interest of some students who, throughout the course of the unit, continued to pursue connections to the nature of science, often asking the teacher 'so, this is science too?'

Further exploration of the role of questioning in this particular classroom reveals that teachers and students appeared to have equal status in relation to posing questions. The teacher would put forward questions to stimulate discussion but would also 'take questions from the field', so to speak, and would adjust his own course of action for the lesson to incorporate the needs and interests of students.

This is exemplified in the case of the student asking the teacher 'Do white people have culture?' Rather than redirecting the student to the topic at hand, ostensibly discussion of the nature of science, the teacher instead allowed space for a new line of inquiry. The class group as a whole then became highly engaged in this peer initiated discussion and the ensuing dialogue provided useful teacher information in relation to topics of interest for future science inquiries. In relation to Todd's own teaching aim of overcoming student apathy towards learning in the FLC context, students' willingness to participate and contribute towards this discussion evidenced the value of broadening the boundaries of dialogue in the science classroom.

An additional important element of the nature of teaching interactions in this study is that student questions are treated as legitimate inquiries and are responded to comprehensively and in depth, as exemplified in Todd's response to the young person who posed the question 'Why people got black?'. The content of the teacher response is not in any way dumbed-down and students are positioned as capable learners (Seiler 2001) who are capable of grappling with complex concepts. Todd confirmed in a post-unit interview that he engages in dialogue with students at the Flexible Learning Centre in the same manner as he would in any other educational setting and that the concessions he makes for learning to meet the needs of FLC students relate to literacy rather than intellectual demands. Overall, while this short lesson excerpt cannot capture the breadth of the teaching and learning activities that occurred over the course of the entire alternative energy unit, it does reflect the key elements of Todd's pedagogical practice that allowed him to go on to develop further successful science-related interactions with the diverse young people in his classroom.

Transferability to other contexts

Seiler (2011, p. 1) poses a pertinent question in asking:

> How can teachers enact a curriculum that is responsive to students and emergent from them when teachers are under enormous constraints to cover specific course content and to prepare students for standardized tests?

It is the case that teachers and young people at Flexible Learning Centres are not constrained by the demands of standardized testing due to their classification as a Special Assistance School. However, teaching staff in this context face multiple other stressors including limited resources, extremely negative student attitudes towards schooling, aggressive behaviours, high rates of absenteeism and the presence of learning disorders and disabilities. Enacting a quality curriculum is a daily challenge in this particular milieu yet teachers strive to be responsive to young people's complex needs and to provide a sufficiently broad curriculum to allow for the diverse career pathways that students may choose to follow.

The intention of this article has been to demonstrate that it is indeed possible to engage non-mainstream young people in science but it requires a different way of educating and the opening up of participative spaces for diverse voices and experiences. It provides a brief snapshot of a different classroom dynamic where:

> Through dialogue, the teacher-of-the students and the students-of-the teacher cease to exist and a new term emerges: teacher-student with student-teachers. The teacher is no longer merely the one-who-teaches, but one who is himself taught in dialogue with the students, who in turn while being taught also teach. They become jointly responsible for a process in which they all grow (Freire 1993, p. 265)

As the brief lesson analysed within the paper indicates, such dialogue does not necessarily take up a great deal of time but instead requires consideration of how teachers and students are positioned in the classroom and whose voice is privileged the most. Aligning with a socio-cultural approach to science education, such pedagogical practice requires reflexive consideration of the "…kinds of personal identity and cultural values our science teaching accepts, respects or is compatible with" (Lemke 2001, p. 300).

Conclusion

It is not acceptable to have a large proportion of the Australian student population leaving school with rudimentary science knowledge and a potential life-long apathy to science learning. As educators, we need to continue to explore ways and means of bringing marginalised young people back into the centre of science learning. This paper is a short exploration into the practices on one teacher who has demonstrated a willingness to expand his practice repertoire to make room for student voice and dialogue. It is intended to act as encouragement to other teachers who hope to continually reinvent their pedagogy to better meet the needs of all of their students.

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References

Australian curriculum, assessment and reporting authority (ACARA). (2010, March). Australian curriculum information sheet science. Sydney: ACARA.

Calabrese Barton, A. (1998). Reframing "Science for All" through the Politics of Poverty. *Educational Policy, 12*(5), 525–541.

Chigeza, P. (2011). Cultural resources of minority and marginalised students should be included in the school science curriculum. *Cultural Studies of Science Education, 6*(2), 401–412.

Edmund Rice Education Australia. (2004). *Centre education programme*. http://www.learningplace.com.au/defaulteqa2.asp?orgid=72&suborgid=482. Accessed 18 March 2008.

Edmund Rice Education Australia. (2010). *A new beginning flexible learning and youth*. http://www.erea.edu.au/educational-leadership/dsp-story.cfm?loadref=148. Accessed 30 October 2010.

Edmund Rice Education Australia Flexible Learning Centre Network. (2008). *National working paper 2*. http://www.ereflc.org.au/docs/NationalWorkingPaperWEB.pdf. Accessed 1 July 2008.

Edmund Rice Education Australia Flexible Learning Centre Network. (2010). *Annual report 2010*. http://www.ereflc.org.au/annual_reports.html. Accessed 2 February 2011.

Fensham, P. (2004, September). *Engagement with science: an international issue that goes beyond knowledge*. Paper presented at the Science and Mathematics Education Conference (SMEC), Dublin, Ireland.

Foley, R., & Pang, L. (2006). Alternative education programs: program and student characteristics. *The High School Journal, 89*(3), 10–21.
Freire, P. (1993). *Pedagogy of the Oppressed* (*20th anniversary edn*). New York: Continuum.
Gonzalez, N., & Moll, L. (2002). Cruzando El Puente: building bridges to funds of knowledge. *Educational Policy, 16*(4), 623–641.
Lee, O., & Buxton, C. (2011). Engaging culturally and linguistically diverse students in learning science. *Theory into Practice, 50*(4), 277–284.
Lemke, J. L. (1990). *Talking science: language, learning, and values*. Norwood: Ablex Publishing Corporation.
Lemke, J. L. (2001). Articulating communities: sociocultural perspectives on science education. *Journal of Research in Science Teaching, 38*(3), 296–316.
Morgan, A. (2009). *The four paths and four values*. EREAFLC Network: Brisbane.
Schreiner, C., & Sjoberg, S. (2004). *Sowing the seeds of Rose*. Oslo: Unipub AS.
Seiler, G. (2001). Reversing the "standard" direction: science emerging from the lives of African American students. *Journal of Research in Science Teaching, 38*(9), 1000–1014.
Seiler, G. (2011). Reconstructing science curricula through student voice and choice. *Education and Urban Society,*. doi:10.1177/0013124511408596.
Simons, H. (2009). *Case study research in practice*. Thousand Oaks: SAGE Publications.
Thomson, S., & De Bertoli, L. (2008). *Exploring scientific literacy: How Australia measures up*. *The PISA 2006 survey of students' scientific, reading and mathematical literacy skills*. http://research.acer.edu.au/ozpisa/2. Accessed 3 February 2012.
Thomson, S., De Bertoli, L., Nicholas, M., Hillman, K., & Buckley, S. (2010). *Challenges for Australian education: results from PISA 2009*. Camberwell: ACER Press.
Tobin, K. (2006). Aligning the cultures of teaching and learning science in urban high schools. *Cultural Studies of Science Education, 1*(2), 219–252.
Tytler, R. (2007). *Re-imagining science education: engaging students in science for Australia's future*. Camberwell: ACER Press.

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Todd Alloway holds a Bachelor in Exercise Science degree as well as postgraduate qualifications in Education. He has taught in the secondary subject areas of science, mathematics, information technology and physical education. Todd currently holds the Head of Campus position of the North Queensland Edmund Rice Education Australia Flexible Learning Centre.