

IMPLEMENTING BOTH-WAYS SCIENCE EDUCATION TEACHING IN AN INDIGENOUS TERTIARY INSTITUTION

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Abstract

This paper examines the both-ways nature of science education courses in the undergraduate education program presented at the Bachelor Institute in 2010. Both-ways education refers to a philosophy and practice of education which merges Indigenous Australian and Western academic disciplinary traditions of knowledge. The underlying both-ways philosophy of the Institute is examined and how it was implemented in two preparatory courses (a science education course and a science content course) for primary and middle school teaching is described. The role of the author as a non-indigenous lecturer in implementing both-ways philosophy in these courses is examined using examples from his teaching and assessment.

Two alternative conceptions of both-ways are identified. Firstly it is conceived as a practice related to the steps of the teaching and learning process. Secondly, it can be seen through a sociocultural lens as involving the cultural identities of the students. For the lecturer, an identity learning model enables the theorising of meaning-giving and sense-making over time, leading to effective both-ways teaching and learning.

Introduction

Both-ways education refers to a philosophy of education which “brings together Indigenous Australian traditions of knowledge and Western academic disciplinary positions and cultural contexts” (Batchelor Institute, 2007, p.8). Both-ways as a philosophy has been promoted by the Batchelor Institute of Indigenous Tertiary Education (BIITE) for many years (Ober & Bat, 2007; White, 2005). It has been researched as tertiary-level policy at the Institute recently by Ober and Bat (Ober, 2009; Ober & Bat, 2007, 2008a, b), and this work is used extensively in this paper. Oldfield (2011) examined both-ways underlying philosophy as part of teaching science education at the Institute and her experience implementing it. A more experienced practitioner at Batchelor than this author, she analysed how she positioned indigenous knowledges and pedagogies at the centre of science studies.

Ober and Bat (2007) described three principles which underlie each facet of implementation of the both-ways philosophy at the Batchelor Institute, namely:

- Principle 1: Both-ways is a shared learning journey, with participation by students, their families and communities, the lecturers and the support staff.
- Principle 2: Both-ways is student-centred, so that “the principles of adult education are interwoven with the principles of Indigenous education to create a rich and powerful practice that is student-centred, is based on a tradition of real-life and problem-solving approaches to learning and makes use of an action research approach” (Bat & Ober, 2007, p.80)
- Principle 3: Both-ways strengthens Indigenous identity, as the two strands from the Indigenous and Western knowledge systems “become closer together, signifying a strengthening of skills and an increase in knowledge. Students become more ‘bi-cultural’.” (Ober & Bat, 2007, p.80)

The main focus of Ober and Bat (2008a) was how the both-ways philosophy is put into practice at the Batchelor Institute, including planning, teaching and learning, assessment, evaluation and reflection, and communication. I describe and analyse the work I undertook in terms of the principles and practices.

A similar idea to both-ways learning of Canadian Aboriginal origin, which is relevant particularly to the science discipline, is *two-eyed seeing* (Hatcher, Bartlett, Marshall & Marshall, 2009), in which “Two-Eyed Seeing refers to learning to see from one eye with the

strengths of Indigenous ways of knowing and from the other eye with the strengths of Western ways of knowing and to using both of these eyes together” (p.146). Two-eyed seeing was described there in the context of Integrative Science, a four-year degree program offered by the Cape Breton University (Nova Scotia) with inputs from both western science and primarily Mi’kmaq traditional indigenous knowledge from the main First Nation group in the area, including the spiritual element. Thus it differs from the situation at the Batchelor Institute where the both-ways philosophy is meant to be over-arching within the institution and not restricted to a single group of courses.

Implementation of both-ways learning in teaching science education at the Batchelor Institute

The students at the Batchelor Institute vary in several ways in comparison to students in other tertiary institutions in Australia. Batchelor is an institution for Indigenous Australians and offers both Vocational Education and Training and Higher Education (degree) courses. Students have a variety of backgrounds; some have urban backgrounds while others have lived primarily in remote Indigenous communities. Many students are mature-aged and come from a range of experiences. Often they have had poor experiences in formal education particularly in secondary school and few have standard university entrance. Often these experiences have left students with the sense that Indigenous knowledge is devalued compared to western science (e.g. Semali & Kincheloe, 1999). Many students select to attend the Batchelor Institute because of its reputation of providing support for its Indigenous students. Students are not only from the Northern Territory but can come from elsewhere in Australia.

On the other hand most of the lecturers at the Institute are non-Indigenous, including me. I identify as a westerner and was trained in science and science education from a western perspective. It is primarily through my experiences with Indigenous people that I have engaged in indigenous science education, particularly in the past 15 years. Prior to this teaching I had had limited exposure to the philosophy of both-ways and I attended a cross-cultural awareness workshop in the middle of my first semester there. This was when I became aware of the Ober and Bat papers listed earlier.

In 2010 I taught two Higher Education courses as part of the Bachelor of Education program, in science and science education. The science course is a science content course and is nominally a 2nd year course, although some of the students were only in their 1st year. The

science education course is a 3rd year course. Most formal teaching in these units was undertaken at week-long workshops; otherwise contact with students was maintained mostly by e-mail and telephone. Another group of students undertook the science education course as part of upgrading their qualifications as part of the Indigenous Teacher Upgrade Program (ITUP). I did not teach this group but interacted informally with them during their workshops and taking part in a seminar they presented from an Indigenous perspective, and finally assessed their assignments.

Both the science and the science education courses are primarily about western science. The courses were developed within the Bachelor Institute and approved by the institute's Council. Courses are also approved by the NT Teacher Registration Board (NT TRB) as being appropriate to the training of teachers. The science content course had recently been redeveloped and expanded on the recommendation of the NT TRB and was taught for the first time in 2010 in this new format. In the following I outline a number of instances in which I found myself engaged in both-ways science education. They were originally prepared as 'here's-how-I-do-it' instances, a genre common in science education. However they incorporate some reflection about both-ways methodologies as suggested in Ober and Bat (2008a).

The science education course

The science education course had been taught previously and focused on primary science, including use of an Australian teaching resource called *Primary Connections*. Although based in western science, one of the features of *Primary Connections* was that it included indigenous perspectives and had already developed professional development materials which considered using *Primary Connections* with Indigenous Australian students (AAS, 2008; Bull, 2008). Another feature is that *Primary Connections* makes use of the 5Es teaching and learning model (Hackling, 2008), which I use below.

It was in the western science context of *Primary Connections* that I was teaching at the workshop. I had allocated one session of the workshop to the topic of "Making science inclusive" where I intended to use resources such as the DVD *Connecting minds* (AAS, 2008) and *Intercultural understandings in teaching science* (NT DEET, 2006). Both of these resources are relevant to a both-ways approach; the DVD showed Indigenous learners involved in a trial of *Primary Connections* material who share their knowledge in a both-ways sense, while *Intercultural understandings* includes some Indigenous examples. By this

stage of the workshop I had already introduced *Primary Connections* and the 5Es teaching and learning model. However I was put on the spot by one of my students, the only one of the group who lived in a remote Aboriginal community. She made the point that the other students might find understanding science easier than she, because they lived in urban situations, whereas she lived a more traditional lifestyle with access to traditional knowledge forms. This led me to attempt to teach a lesson on the seasons structured around the 5Es and including seasonal knowledge from an Indigenous perspective. The main features of the lesson are set out below making use of the 5Es teaching-learning model.

1. *Engage:* This started with a discussion of the western models of the seasons that most of the students were aware, the two-season model for tropical areas (including the location of Batchelor) and the imported European four-season model used in temperate areas.
2. *Explore:* One of the local traditional calendars was examined and compared with the western models. It was examined for its depth of information which included not just the names of the seasons but information about weather features (winds, rain, humidity), plants and animals and other relationships.
3. *Explain:* I used a western scientific explanation of the weather patterns experienced in the tropical areas, which includes reference to major climatic zones.
4. *Elaborate:* This time in particular gave my remote community student an opportunity to describe the seasonal calendar for her language group, including plant use and relationships between plants and animals. Some of the other students were able to make contributions regarding their local weather descriptions.
5. *Evaluate:* The evaluation was more of the lesson rather than of the knowledge component. It had been a fascinating opportunity for her fellow students and me to explore the seasons from a both-ways perspective.

Making use of a both-ways perspective in this unit had a valuable outcome. I had modelled a both-ways approach in my teaching, using Indigenous knowledge as well as resource materials to promote its use in classrooms. I considered that taking a both-ways approach in the science area demonstrated to the students that they should consider a both-ways approach in their own teaching, as well as confirming that they could also do so. In this way it focused primarily on principle 3. The students had also become involved in the process in a both-ways sense, as they had been able to include Indigenous perspectives where I also

became a learner, so it became a shared journey as it allowed participation of the students with their understandings (principle 1).

The science content course

When I taught the science content unit in second semester I felt more confident in teaching from a both-ways perspective. This included indigenous knowledge in the content, as well as an assessment item which was specifically designed to be both-way. The inclusion of indigenous knowledge in the content was on an *ad hoc* basis; for example, discussing rock types led to talking about volcanoes which led to some discussion about indigenous stories about volcanoes. (It also led to using Google Earth to locate volcanoes world-wide.) Often there was no indigenous component to complement the western scientific story and this issue was also discussed. Students also spent one workshop session taking a bushwalk where they were able to discuss some the plants that were present and some of their indigenous uses. One problem experienced here was that some students came from other areas and were not aware of the local flora.

One of the assessment items was designed to have a both-ways component. In this assignment, students were asked to “Select a plant or an animal for which you are able to research, to get western scientific and indigenous knowledge. Design a poster where you can arrange the two sets of knowledge around a central photograph or drawing.” (Batchelor Institute, 2010). This assignment was undertaken as a workshop-based exercise and students had access to the library and the internet to gather information. Most students had already been on the bushwalk mentioned above. Each student chose a plant to research; some of the students were not from the region and the plants were foreign to them but they were able to find records of the indigenous plant use rather than apply their own knowledge or seek information from Elders.

All students were able to find information for their plants and prepared a poster. Some had specific Indigenous knowledge which they were willing to share. One student went beyond the criteria for the assignment and included a third column of shared knowledge. This does not represent both-ways knowledge according to the Batchelor model but rather it is shared knowledge. The idea of shared or common knowledge (Stephens, 2000) had been discussed previously in class. Similar work had been done by students and a lecturer at Batchelor (Batchelor College, 1997) who produced a Venn diagram to portray traditional knowledge, western knowledge and the intersection (overlap) as shared knowledge.

Science education in the teacher upgrade course

The third group of students were experienced Indigenous teachers upgrading their qualifications through the Indigenous Teachers Upgrade Program (ITUP). They had elected to do the same science education course as the first group of students I described earlier. My involvement was mostly informal although I did assess their assignments. Two of the students taught topics which explicitly involved both-ways learning. One of them had done a unit on digestion which included cooking and eating a marine turtle, a community event. She used the event to teach and describe the turtle's anatomy, particularly its digestive anatomy, in both language and English. In her assignment she showed photographs of the event and included scenes from it in a PowerPoint presentation she had prepared with the students. The second teacher had done a unit on weather with an early childhood group, which included drawing on family experiences and using both Yolngu (language) and English terms.

Practicum visit

On a separate occasion I went to supervise a student who was undertaking a teaching practicum in middle school science with a class of older, mostly Aboriginal boys. I watched as she gave a lesson about the water cycle. In our subsequent discussion I asked whether she had discussed with the boys any stories which they had regarding the Aboriginal way of understanding the water cycle. She hadn't but she told me later that she did discuss it in a subsequent lesson. This allowed her to use a both-ways approach as well as giving credence to the trope that teaching should lead students from what they know to what they don't know.

Discussion

In some ways my own practice as described above indicated that at the time I had a naïve sense of both-ways learning. This can be seen to evolve through the phases I went through in preparing the paper. I initially considered I was writing a 'here's-how-I-do-it' which I then modified to incorporate processes in both-ways learning (Ober & Bat, 2008a). Finally, the discussion has come to focus on identity learning, primarily by the lecturer. On reflection, what I had done was to focus on the knowledge components where I could see a both-ways relationship. In terms of principle 3 (Ober & Bat, 2007), I used this to validate for the students the idea that they could use both-ways themselves and including Indigenous knowledge may have enhanced the students' identity, but I probably didn't address directly a sense of strengthening Indigenous identity. Some of the situations can be seen as sharing the

learning journey between the students and lecturer (principle 1) but this was not necessarily anticipated beforehand. By comparison, Oldfield (2011) allowed the transmission of both traditional Indigenous knowledge and the construction of western scientific conceptual understandings and so insured the cultural safety, the maintenance of a strong Indigenous identity and western scientific understandings for current and subsequent generations.

Although the both-ways philosophy is espoused as an aspiration and an obligation to some degree by the Batchelor Institute there can be difficulties about implementing the policy. Both-ways is promoted at the Institute on its website and through the compulsory cross-cultural awareness programs for newcomers but implementation falls back on the interpretation by individual lecturers.

One problem is that the courses are written according to a western paradigm, in the same way as the courses in other Australian universities. As such, the notion of both-ways does not necessarily appear in higher level documentation and may stay invisible through the various layers of documentation down to the lecturer. Secondly, the course content may not specify any indigenous elements nor is there room allocated for them within the schedule. A visiting Australian University Quality Agency panel found:

a lack of clarity and understanding of both-ways learning, resulting in a variety of interpretations. These include staff and students learning from each other, curricula embodying various cultural perspectives, and student-centred learning. Staff do not know whether these (and others) are all equally valid and acceptable interpretations or whether there is a preferred BIITE model. Furthermore, none of these understandings is being widely implemented. Therefore both-ways is not the unifying concept BIITE hopes for. (AUQA, 2006, p.14)

AUQA recommended that BIITE investigate both-was learning further and circulate it further among staff members, which was apparently the rationale of the set of papers by Ober and Bat cited earlier. Thirdly, the individual lecturer may be inexperienced in both-ways teaching and feels unable to include indigenous elements or maybe lacks support from potential mentors to do so. This may lead to limited inclusion, perhaps addressing both-ways in a stereotypical fashion.

Ober and Bat (2008a) discuss comprehensively aspects of how both-ways can be put into practice at the Batchelor Institute, through the three implementation principles. The

practical aspects they discuss include program design, planning for delivery, teaching and learning, assessment, evaluation and reflection, and communication. These represent the implementation phase of the courses rather than the structural underpinning; they also represent the phases which I described above from my teaching experience. In considering what went on in the classroom, it is primarily the content of the courses which was described. Classroom practice can also be related to the aspects of pedagogy where appropriate, such as teaching and learning and assessment.

An alternative way of considering the three principles is from a sociocultural perspective of both-ways learning focusing on the students as indigenous learners. Principles 1 and 2 primarily promote an understanding of who the students are, why they come to the Batchelor Institute and what they bring with them. There needs to be an acceptance of the students as teachers, to make sense of their input into the both-ways process. Understanding this sense of both-ways creates awareness for the lecturer of the nature of their students that evolves over time and particularly enhances the lecturer's learning about the Indigenous cultures. Principle 3 relates particularly to strengthening Indigenous identity. As elements of both-ways learning, the principles are more difficult to implement and evaluate as they relate more to attitudes and values rather than the cognitive aspects.

Geijssel and Meijers (2005) provide a valuable way of theorising both-ways teaching through identity learning. They model identity learning by teachers as a process involving professional change around three elements: an initial *boundary experience*, such as coming to the Institute and being involved in working with Indigenous adults; *discursive meaning-giving*, primarily a cognitive explanation of the process the teacher is involved in; and *intuitive sense-giving*, where the teacher finds adequate emotional sense with their own life story. For many lecturers at the Batchelor Institute, particularly new staff, both-ways is a new experience, a boundary experience. Understanding both-ways takes place over a period of time, promoted through the cross-cultural program and needs to be supported by mentoring by other staff members, including Indigenous staff. However acceptance of both-ways on an emotional, identity-modifying level is a longer-term process, something which may not be achieved in some cases.

Seen from a different perspective, the two dimensions of both-ways can be identified as relating to each of the two aspects of Geijssel and Meijers' (2005) identity learning model. Discursive meaning-giving relates to the practical aspects of both-ways, *how* it is put into

practice. On the other hand, intuitive sense-giving relates to the emotional side of both-ways, understanding how it relates to the cultural identity of their students, the *why* both-ways is practiced. As in the original identity-learning model, intuitive sense-giving is an evolving, longer-term development than discursive meaning-giving.

Geijsel and Meijers (2005) also offered some suggestions regarding the management of professional learning. First, the boundary experience needs to be recognised as such by educational leaders; this is acknowledged in part through the induction processes at the Institute. Second, they recommended a ‘double dialogue’ to address meaning-giving and sense-making separately. Meaning-giving implies evaluating good practices and this should be achieved through discourse with educational leaders. Sense-making on the other hand implies involvement of the emotions in a professional rather than a therapeutical sense, and requires conversations with close friends and colleagues.

Two-eyed seeing

One element that Hatcher et al (2009) included in their *two-eyed seeing* is the spiritual connection between the Mi’kmaq people and their knowledge. This connection has in the past been offered as reason for avoiding indigenous perspectives in western science; in both-way teaching such linkages are not avoided but are left to the competence of the lecturer and the students whether it should be explored and the presence of elders who can direct the investigation. The spiritual may be an integral element in indigenous knowledge but its place in both-ways learning at Bachelor depends on the cultural identities of the lecturer and the students and the involvement of elders, and needs to be explored further.

Conclusion

In this paper I have reflected in my efforts to include Indigenous knowledge within the courses as well as trying to understand conflicts between Indigenous and western science knowledge systems through both-ways teaching and learning. I have indicated how I did this and suggested there are practical ways of implementing both-ways teaching and learning. However, I have indicated that both-ways is also a sociocultural process relating to the students’ indigenous identity. For the lecturer this can involve their own identity learning, as suggested by Geijsel and Meijers (2005) through discursive meaning-giving and intuitive sense-giving encompassing both understanding and emotional involvement, as part of their

life story. Both-ways can be shown to involve both of these aspects. Support for both-ways needs to come through mentoring both by educational leaders and colleagues.

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