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Interdisciplinarity: Bridging the University and Field of Practice Divide

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Abstract: Modeling inter-disciplinary teaching and learning practices within a critical pedagogical framework has produced powerful learning outcomes for graduates of the Primary/Middle Bachelor of Education degree at the University of South Australia. This paper explores the notion of how best to prepare beginning teachers to work with students in their middle years of schooling in Studies of Society and Environment. Of particular focus are teacher education courses that model interdisciplinary ways of working. The inquiry found that interdisciplinary course work was replicated and built upon by beginning teachers and where schools encouraged the notion of interdisciplinarity beginning teachers flourished as designers of curriculum. The authors argue that Studies of Society and Environment is currently well placed to be incorporated into interdisciplinary curriculum frameworks and assist in meeting the goals of middle schooling philosophy.

Introduction

Organisation of knowledge and teaching and learning pedagogy are central concerns of teachers. The relationship between the organisation of knowledge and pedagogy and their connection with student's life worlds is a challenge assumed by teachers. This paper describes the journey of a group of university educators who structured a suite of interdisciplinary courses across three disciplinary areas, adopted a critical pedagogical approach that connected with the life worlds of pre-service teachers. Although this study is contextually specific it sheds light on the application of an interdisciplinary approach and related pedagogy in the higher education sector.

Interdisciplinarity has an embattled history. The nature of knowledge and its organisation has been contested since the earliest forms of knowledge came into being. Debates will continue into the future about the ways in which knowledge is best organised and in many ways it is participation in the debate that pushes the boundaries and encourages new conceptions of knowledge organisation. Renowned child centred theorists, including Rousseau, Froebel and Dewey, proposed that the child was the centre of educational interest rather than the curriculum (Boyd 1963). Inspired by the works of these great theorists, supporters of an integrated approach to knowledge organisation found voice. Those voices impacted on the international stage in the 1920's, 1960's and 1990's. Opponents to an integrated approach to knowledge organisation saw this as 'an attack on the subject-

structured curriculum' (Hirst 1974 p. 33) and sought to vigorously defend their 'ground'. While the middle school reform movement has supported subject integration, it has been the current formulation of a National Curriculum Framework in Australia which supports a disciplinary way of organising knowledge, that has re-ignited debate and supporters of subject integration have again found voice. This paper contributes to the current debate.

The term interdisciplinary and interdisciplinarity (as adopted here), is situated within the broader field of subject integration and advocates use research and practice to argue that interdisciplinary approaches provide opportunities for learning to connect to big issues and real life questions, potentially increasing student engagement and achievement (Beane 1997; Wallace, Venville & Rennie 2005). And there is a growing body of literature which investigates various approaches to interdisciplinary curriculum design (Groundwater-Smith, Mitchell & Mockler 2007). These studies show that teachers need a range of sophisticated capabilities and skills if they are to design curriculum utilising both disciplinary and interdisciplinary ways of knowing. Pre-service teacher education is a key arena for the development of this professional knowledge, yet there is little research which explores practice in this area and even less that evaluates the outcomes of such practice.

This paper aims to address this significant gap by focusing on the impact of interdisciplinary course work in a pre-service teacher education program on the practices of beginning teachers. It is the belief of university staff involved in the initiative, that pre-service teachers participating in interdisciplinary course work will take the essence of those practices with them into the field therefore bridging the university and field of practice divide. The object of our research report is a suite of courses that model interdisciplinary approaches incorporating the disciplines of Mathematics, Science and Studies of Society and Environment. Our investigation focuses particularly on Studies of Society and Environment - comprising the disciplines of history, geography, economics, anthropology, political science and sociology - taught in middle school settings.¹ First though, we will describe our understandings of some of the (contested) terms to be used, starting with the central concept of interdisciplinarity.

Defining Interdisciplinarity

Interdisciplinary approaches integrate knowledge across multiple disciplines. In this extensively theorised field definitions are numerous and contested. This section will elaborate on definitions that are well supported and documented in the literature while proposing a working definition for the purposes of this paper.

UNESCO, through its draft of the International Implementation Scheme for the United Nations Decade of Education for Sustainable Development (2003) describes the centrality of an interdisciplinary and holistic learning curriculum that is values driven, locally relevant and prioritises critical thinking and problem solving. UNESCO, in its support for interdisciplinary curriculum, identifies key attributes that such a curriculum is seeking to achieve. This citation provides a base for the working definition of interdisciplinarity adopted here. The attributes identified by UNESCO are supported by James Beane (1993), a prodigious writer in the middle school reform movement and a vocal proponent of curriculum integration, who makes the claim that curriculum should reflect the concepts of democracy, human dignity and cultural diversity. Beane (1996) proposes a curriculum that is issues-

¹ Whilst the focus of our research is on pedagogy, it is hoped that the paper will also contribute to illuminating some of the unhelpful contemporary debates that criticise Studies of Society and Environment for its multi-disciplinary construction and critical constructivist approaches. Public debate in Australia has reclaimed history education as a return to disciplinarity.

based, where knowledge from multiple disciplines are accessed and applied to real world situations where young adolescents can appreciate their application in other circumstances of interest to them. A coherent understanding of the world cannot be gained through the fragmentation of knowledge (Macedo 2006). This holistic approach to the organisation of knowledge is seeking to meet the needs of young adolescents through an issues-based, relevant and values driven curriculum. UNESCO has described problem-solving as a key attribute of interdisciplinary approaches. This is supported by renown Climatologist, Stephen Schneider (1997), co-director of the Interdisciplinary Program in Environment and Resources, who describes interdisciplinarity as ‘the combination of knowledge, methods or paradigms from multiple disciplines that together help to explain some systems phenomena that cannot be understood by single disciplinary ways of knowing or help to solve a real problem’ (p. 457).

Critical thinking underpins the interdisciplinary approach used within the study. Shor (1993), drawing on the work of Freire states ‘In the liberating classroom...teachers pose problems derived from student life, social issues, and academic subjects, in a mutually created dialogue...inviting students to think critically about subject matter, doctrines, the learning process itself, and their society’ (p. 25). The interpretation of interdisciplinarity proposed in this paper is closely tied to critical pedagogy made explicit by staff through their thinking and practice. Interdisciplinarity is defined as the integration of knowledges from multiple disciplines that seek to construct curricula that is values driven, issues-based, relevant to student’s life worlds and fosters critical thinking and problem-solving. This working definition of interdisciplinarity draws heavily from the citations above and reflects its contextual usage within the study described in this paper.

A further dimension of an interdisciplinary approach held to be important was the degree of collaborative effort of staff from different disciplines. Learning is centred on issues of personal and social significance, and teachers from different disciplines work together to construct curriculum that transcends traditional discipline boundaries. This feature of interdisciplinarity is also well supported in the literature. In the Beyond the Middle Report (2003), an empirical study of literacy and numeracy development of students in their middle years, Luke and Elkins et al. (2003) claim, participating effectively in an interdisciplinary team is seen as an essential course of study for middle years pre-service programs (p. 60). And Carrington (2006) supports this claim, citing interdisciplinary teacher teams as being ‘broad-stroke signature practices’ of middle schooling (p. 71), and based on a study of adolescence and digital literacies, argues that interdisciplinary teacher teams have become the baseline criteria for initiating a middle schooling agenda. Middle schooling is a key component of the Bachelor of Education Program within which this initiative is situated. The Program is specifically tailored to meet the needs of students from Years 3 to 9.

The study bridges the divide between academic discipline and school subject. Stengel (1997) states, ‘academic discipline might connote accumulated wisdom, a way of knowing, or the logical formulation of the practical inquiry. School subject may suggest the product of pedagogical reasoning, the developmental moment, a way of knowing, the process of inquiry, or the means for developing caring and competence’ (p. 598). In everyday life, Stengel (1997) proposes that the school subject is a *negotiation* between the academic discipline and the experience of teachers and students living the everyday life of the curriculum. From a critical constructivist perspective, Kincheloe (2005) explains that the skill of the teacher involves nurturing the synthesis of personal experience and academic knowledge. With the goal of bridging this divide between the academic discipline and the school subject the beginning teachers in this study have completed pre-service disciplinary course work where the process of curricular transformation has been modeled using an interdisciplinary approach. Disciplines are a source for curriculum content, however it is the issues contained

within a topic, the concepts and underpinning values that overlap or cross the traditional disciplinary boundaries. Studies of Society and Environment, is a prime example of disciplines being brought together to form a school subject. It is through their co-existence within a school subject that relationships and connections are found and notions of interdisciplinarity emerge.

Middle schooling curriculum reform and UNESCO's advocacy of Education for Sustainability have seen interdisciplinary approaches vigorously promoted. In Australia however, interdisciplinary approaches in teacher education across the fields embraced by Studies of Society and the Environment and across multiple disciplines is found only in small components in single courses. The site for this inquiry is one of the few programs in Australia that models interdisciplinary approaches as part of its teacher preparation.

Studies of Society and Environment – The Context

While the historical roots of this key learning area can be traced to the 1970's, its birth was in 1994 through the National Curriculum Statement of Studies of Society and Environment (Australian Education Council 1994). The curriculum statement provided a conceptual framework for the key learning area, establishing an approach to social education inclusive of culture (Gilbert 2003). In response, the Australian states and territories have constructed teaching and learning frameworks for Studies of Society and Environment that are distinct and diverse in their organizing attributes and methods of implementation. In South Australia the key learning area is one of eight compulsory areas of learning for all students up to Year 10 completing their formal education and is driven in ideology by the three core values of sustainability, social justice and democratic process (Department of Education and Children's Services 2004). Queensland has included the value of peace in addition to those listed above. While tensions exist around the definition of values and the degree of political control over their interpretation (Fien 2001), they encourage the inclusion of education for sustainability that 'integrates goals for conservation, social justice, cultural diversity, appropriate development and democracy into a vision and mission of personal and social change' (Department of the Environment and Heritage 2005). It is important to note that the core values of sustainability, social justice and democratic process are themselves contestable and open to examination as part of the learning area's socially critical framework. This approach is supported and encouraged in the values education curriculum literature in South Australia, described in their most recent discussion paper (DECS 2008).

Based on Freirian education that seeks to develop a critical consciousness, curriculum construction in Studies of Society and Environment is concerned with 'the development of critical thinking which enables one to read the world critically and to understand the reasons and linkages behind the facts' (Macedo 1994). Critical thinking and inquiry is also drawn from the work of Habermas' (1971) theory of knowledge interests and individual empowerment. Habermas' emancipatory interests and Freire's critical pedagogy seek to identify power and privilege with the aim of emancipation from disadvantage and marginalisation. Gilbert (2004), an advocate for Studies of Society and Environment, argues strongly that a critical approach to curriculum construction enables students to learn how to participate in social systems, and importantly, how to make those systems fairer and more democratic. Taking social action is a feature of this critical perspective. As mentioned in the previous section, critical pedagogy underpins the interdisciplinary approach used in the study, strongly influencing the organisation of knowledge and the teaching and learning theories and practices. Topics are selected that relate to the student's every day life both locally and globally; issues and their related concepts are drawn from across the disciplines and a critical

constructivist approach shapes the teaching, learning and assessment processes. A more detailed description of the constructed course curriculum follows.

Consistent with the centrality of Studies of Society and Environment in schools, the learning area is a core curriculum component in the Bachelor of Education teacher education program at the University of South Australia. In 2004 three interdisciplinary courses were constructed that worked across the disciplines of Science, Mathematics and Studies of Society and Environment offering pre-service teachers learning experiences in the three areas. Using a critical constructivist approach, topics, values and concepts formed the central organising constructs through which the disciplines were related. Topics included, Poverty, Interdependence, Indigenous Australians, Fibres and Fabrics, Refugees and A Place in Time. Each topic would focus primarily on one of the disciplines and include conceptual understandings from the supporting disciplines and learning areas. For example, the topic focusing on Indigenous Australians made explicit all three values (social justice, democratic process and sustainability) through an historical simulation activity unique to the South Australian Indigenous peoples, an exploration of the measurement of time across traditional, transitional and contemporary indigenous society (Sarra 2003), and early indigenous science (Mitchie and Linkson 1999) focusing on seasonal changes in one Australian indigenous cultural group's 'calendar'. The concepts of traditional culture, changing social environments and sustainability crossed disciplinary boundaries. In the unit of work focusing on Interdependence, the value of ecological sustainability was critiqued through a study of threatened ecosystems, foot-printing, globalization, wealth distribution and personal perspectives of consumerism in everyday life. The concepts of environment, habitat, critical numeracy, micro-credit and fair-trade crossed disciplinary boundaries. While Studies of Society and Environment was the primary learning area of focus in the examples described, the topics integrated issues, concepts and values across the fields of Mathematics and Science as well. By using a critical social inquiry approach, the core Studies of Society and Environment values which underpin the disciplinary conceptual understandings and learning experiences within each topic reveal a diversity of perspectives of the issues.

The courses have been designed and taught by an interdisciplinary team including Science, Mathematics and Studies of Society and Environment teacher educators and each course comprises approximately 30 hours of intensive workshop contact across six to ten sessions. Balance across the disciplines was constantly negotiated by the interdisciplinary team as topics and issues shifted in response to pre-service teacher needs, curriculum and disciplinary demands and global and community initiatives. The team needed to draw on deep levels of collaboration and commitment to realise the ideal of interdisciplinarity.

Methods

This practitioner inquiry (Cochran-Smith & Lytle 1999; McWilliam 2004) describes the experiences of one cohort of pre-service teachers prior to graduation and again after one year of employment. The inquiry provides rich contextual descriptions that shed light on the preparation of the pre-service teachers, which raises new questions and research interests that will continue to impact on the Bachelor of Education program.

Data was collected in two stages; the first being at the conclusion of the graduates' final professional experience, and then in the second stage, twelve months after the pre-service teachers had graduated. The authors believed that the two stages provided powerful new perspectives as participants were interviewed both as pre-service educators and then as beginning teachers. Stage 1 of the inquiry invited them to complete a questionnaire and participate in a semi-structured interview. The interview and questionnaire sought to find out

pre-service teachers' perspectives of interdisciplinary approaches to teaching and learning in Studies of Society and Environment, after having completed their interdisciplinary course work and their final professional experience in schools. Stage 2 invited the same cohort of participants to undertake a semi-structured phone interview twelve months after graduation. This stage sought to gain the participants' perspectives of interdisciplinary approaches to the teaching and learning of Studies of Society and Environment as beginning teachers.

The participants comprised the first cohort of graduates from the Bachelor of Education Primary/Middle Graduate Entry Program, University of South Australia. Participants have a recognised prior three year degree. As part of their pre-service course work, all participants had completed three interdisciplinary core curriculum courses: Studies of Science, Mathematics, Society and Environment Education 1, 2 and 3 (described previously). Of the twenty eight students in this cohort, twenty three completed the questionnaire in Stage 1, fifteen were female and eight male and the participants were aged between 21-44 years of age. Six volunteered to take part in a follow-up interview, five were female and one male. In Stage 2, twelve beginning teachers from the same cohort participated in a semi-structured interview by phone.

Emergent themes and conceptual insights gathered from the data describe the powerful learning outcomes of this group of pre-service teachers. The participants reflect upon the interdisciplinary approach to teaching and learning in Studies of Society and Environment, and how this approach influenced their curriculum transformation and construction as beginning teachers.

Findings: Stage 1

Preliminary Views of Interdisciplinarity

Having completed three core interdisciplinary courses and a final seven week professional experience in schools, the pre-service teachers were asked to reflect on their experiences of interdisciplinary teaching and learning and to consider if they would adopt such an approach. Responses were overwhelmingly positive toward interdisciplinarity. One comment reflected a pragmatic justification for the approach,

I absolutely support interdisciplinarity because as a year 6/7 teacher there is so much to cover and so little time – this approach means you can integrate a range of learning experiences together and provide more real learning experiences.

Another pre-service teacher described a deeper justification for using an interdisciplinary approach,

I think it doesn't really matter in my lessons whether I'm a Maths teacher, I'll be able to bring Studies of Society and Environment and Science in to make the Maths learning much more rich.

This pre-service teacher continued to describe how she made sure a 'wow factor' was introduced in the learning experiences to maintain learner interest and encourage deeper understanding. This occurred in an outdoor Studies of Society and Environment unit that involved freshwater studies where the learners thought they were collecting water to investigate the habitat of the yabby. When they returned to the class to view the water specimens under the microscope they found the water included 'lots of things' and they even witnessed one creature 'lay an egg and give birth'. This intended Studies of Society and Environment inquiry became a scientific investigation. This comment indicates an appreciation of working at the interface of the disciplines. One pre-service teacher, in

pondering the separation of disciplines, described Studies of Society and Environment as being the cake, and elaborated:

..it's almost like saying no, that's the cake, you're not allowed to have it yet, you've got to have your peas and beans first.

'Peas and beans' referred to the school subjects of Language and Mathematics that occupied the greater percentage of curriculum space in this pre-service teacher's class.

Nineteen of the twenty three participants were positive about interdisciplinary approaches and could project forward and 'see' themselves designing curriculum using such approaches. While the pre-service teacher's reasons for using an interdisciplinary approach varied from coping with curriculum clutter to accepting that 'this is the way the world works', they still demonstrated a commitment toward holistic learning. Three stated a preference for a separate-subject curriculum. They were placed with mentor teachers that planned and taught using a segregated structure and commented that they felt more comfortable with what had been modeled and promoted by the mentor teacher in a school context. One pre-service teacher was ambivalent about the approach but did show a willingness to consider the approach if opportunities arose when they were teaching their own class. Five of the participants, positive about interdisciplinarity, believed the approach was a motivational technique to engage learners and commented that it helped them to be more creative teachers enabling them to teach current and real social issues more successfully. Topics that they planned and taught in their final practicum included: Migrants and refugees; Water catchments; Team building and cooperation; Environmental sustainability; Human rights; Introduced species; Poverty and wealth; Cultural foods; Australian climate/Antarctica; Place and space; Physical health; Local environment; Land care; 19th century Australia. The pre-service teachers were able to integrate school subjects with Studies of Society and Environment and these included: English, Information Technology, Drama, Visual Arts, Science, Health, Physical Education, Outdoor Education, and Mathematics. The authors found that this group of pre-service teachers, influenced by University coursework and their professional experience in schools, overwhelmingly supported their evolving interpretation of an interdisciplinary approach to designing curriculum and recognised its positive impacts on student learning. Of most importance was the fact that their interpretations affirmed foundational definitions of interdisciplinarity that highlighted connections to issues of personal and social significance.

Core curriculum Design Attributes

The pre-service teachers reflected on their curriculum design in their final professional experience and specifically, what attributes or qualities were at the centre of their design. These reflected foundational notions of interdisciplinarity, such as values, conceptual understandings, local and world issues.

Those who taught a planned topic clearly nominated values and concepts as being at the core of their curriculum design. One pre-service teacher related the value of environmental sustainability to their experience, where the learners participated in outdoor learning opportunities. Connections were made between understanding environmental sustainability and working together towards ethical action. An indigenous focus to the environment included learning about a cultural perspective on sustainability,

...looking for artifacts, finding some bush tucker trails in the park, building traditional type shelters and going on a dreaming trail that was a true story about the Park that talked about survival by working together, using what was around the environment, and things like not

taking more than they need, environmental sustainability. So the kids got things out of it like if they fished all the fish out of the pond there wouldn't be any more food.

Other pre-service teachers described the value of democracy taught through a unit on Indonesia and another, the value of social justice taught through the topic of human rights. Another value, empathy, was identified by three pre-service teachers as being central to their curriculum design. One pre-service teacher had designed curriculum around challenging stereotypes and focused on the value of 'fairness'. It was found that the teaching of these topics sometimes raised moral dilemmas for the participants. They felt confronted when they were placed in situations where they were expected to form opinions, make decisions, argue for right or wrong, and consider action. One unit of work focusing on 'children's rights' demonstrated this,

...my aim was that I wanted the kids to be aware that we have human rights and children's rights and I also wanted them to understand that organisations that are committed to human rights can actually make changes and that they themselves can also participate in that. When the kids asked me about this I wasn't sure how far to go.

This highlights the complex area of values education and the extent to which teachers enhance learners' thinking and feelings in regard to values and what makes a value worthy.

Interestingly, those pre-service teachers who used an interdisciplinary approach were very clear about the core components of their curriculum design. They seemed to become aware of their importance during the teaching of the topic and this was clearly expressed on reflection. Values and concepts were important attributes and formed the basis for interdisciplinary learning experiences by these pre-service teachers, affirming Applebee, Adler and Flinhan's (2007) claim of shared concepts being an integral component of interdisciplinarity.

Findings: Stage 2

Re-interviewing the same participants as beginning teachers twelve months after graduation provided different perspectives of interdisciplinarity including:

- Connections with the real world
- Critical constructivism
- Conducive school environments and interdisciplinary teacher teams

Connections with the 'Real World'

All the beginning teachers spoke of the need to relate learning to the 'real world', and preferably the real world that students know. While this view was mentioned twelve months earlier, it was further emphasised after participants had had their first year of classroom experience. One beginning teacher stated:

Rich learning happens when the kids connect their learning with other real world situations.

This indicates a deeper or richer understanding of what it means to learn and such understanding, expressed so simply, indicates the value placed on the relevance of learning in real world situations. Another beginning teacher, who was employed in a Studies of Society and Environment contract position in a country setting, explained:

Students love Society and Environment, they relate it to everyday life. I use the media a lot and kids always have questions. We look at articles in the newspapers and this is the way kids learn about the world around them.

A beginning teacher described how she had designed her English curriculum for the year. I have incorporated Studies of Society and Environment into English. We looked at Migrants in term one, then Refugees in term two, and now we're looking at The Power of the Human Spirit. This approach has just evolved and the kids are really engaged. We focus on life stories, even of the locals. It's important to empathise and know other's struggles. Hardships are bigger than you.

This student explained how she had connected with the local Sudanese community who participated in her English unit, sharing life stories and living the theme of how ordinary people can be extraordinary. Students wrote to those who shared their stories, finding connections with their own lives. This experience led to ongoing tutoring with the Sudanese community. Implicit in this account is the grounding of English in real world issues and phenomena. The curriculum design uses interdisciplinarity to engage students and relate learning to local and global issues. Another teacher, employed as a short term contact, explained:

I tap into kids' curiosity. It's all about curiosity. Kids have lots of questions about the world around them. We don't **do** science, we **are** scientists operating in the world. When we went to the museum, the kids were scientists with a SOSE/Science brief. They just loved that.

This shows that the beginning teachers' were committed to student learning outcomes, reinforced they are listened to students, were aware of their life worlds and looked for close connections between those life worlds and curriculum, thus attesting to the negotiation between subject content and the everyday life of student and teacher (Stengel 1997).

Real world connections are an integral component of middle schooling philosophy, and integrative approaches provide opportunities for learning to connect the learners to big issues and real life questions (Wallace et al 2005). The learning area of Studies of Society and Environment provides opportunities for such connections. Teachers that take a critical perspective to becoming informed about societal or environmental issues, culminates when the learners take social action in the world, either as an individual or as part of a collective. One example of taking social action from our cohort of beginning teachers was the tutoring experience with the Sudanese community, while another of the cohort described what started as a small golf project had become the planning and construction of an ecologically sustainable mini golf course for the community, totally supported by the school. In this context Studies of Society and Environment challenges traditional practice and seeks ways of acting on values such as democracy, social justice and ecological sustainability (Gilbert 2004).

Critical Constructivism

Critical constructivism became a recurring theme in the beginning teachers' descriptions of their curriculum design. While this was evident in the Stage 1 data, it became more apparent in Stage 2 as one teacher explains here:

We look at every angle of a topic, every aspect. You need that for good decision-making. It's about problem-solving. Who is it good for? That's the whole story about human impact. Who is it good for?

It's a life skill to be interdisciplinary.

Similarly, another beginning teacher stated:

'There are different ways to analyse the world'. We extend out and across, rather than in a straight line.

Yet another beginning teacher demonstrated her commitment to higher order thinking skills through her comment:

I like to teach at a deeper level and I use Studies of Society and Environment to do that.

When asked to elaborate she continued:

Underneath it's always about self respect and respect for others. Being equal-minded. It's the values.

The beginning teachers' comments make explicit a key understanding of critical constructivism, that 'the role of schooling involves engaging students in the knowledge production process. A central dimension of teaching in this context involves engaging students in analysing, interpreting and constructing a wide variety of knowledges emerging from diverse locations' (Kincheloe 2005 P. 3). Gilbert (2004) also explains that students need opportunities to express and enact their own views of the world and its future.

The consideration of values and ways of acting on values in the world are an integral component of Studies of Society and Environment and raises ethical and moral dilemmas. Students in the middle years have a strong sense of fairness, are highly curious and relate to real world problems and situations (Carrington 2006), attributes that would seem to work well with a socially critical approach to Studies of Society and Environment.

Conducive School Environments and Interdisciplinary Teacher Teams

Surprisingly, beginning teachers who employed an interdisciplinary approach talked frequently about the degree of collaboration and support experienced with other staff. One beginning teacher working in a secondary school setting with staff from different disciplines explained:

The school wants international accreditation and is really supportive of interdisciplinary work. We need to provide a rigorous global curriculum and international perspectives.

Two other beginning teachers also cited accreditation for international status as being a supporting factor for interdisciplinary work within their school, one of whom explained that her school was reviewing all curricula with the aim of constructing interdisciplinary units of work for students that teachers would manage in interdisciplinary teams. Another beginning teacher in a country school described his experiences of interdisciplinarity:

There are four year 7 classes and we work as a team. The school is strong on working this way and really positive about interdisciplinary planning. This is my preferred teaching style and year level.

And a beginning teacher who was filling short term contract positions concurred.

In my previous school I planned and worked with the environmental education teacher. It was fantastic!

While nine of the twelve beginning teachers interviewed had or were using an interdisciplinary approach, those working with other teachers in the school, planning and/or teaching as a team, were the most enthusiastic about their experiences. This phenomena is well supported in the literature by Luke and Elkins et al (2003) and Carrington (2006) citing interdisciplinary teams as integral components of middle schooling. In contrast, the despair

of a beginning teacher denied opportunities to work collaboratively is evident when she shares:

I feel really isolated. They have left me out there running a solo show. This beginning teacher lamented working on her own and was not comfortable in her perceived isolation.

Those beginning teachers using an interdisciplinary approach, highlighted that negotiating the curriculum and implementing authentic assessment strategies was paramount, as explained here:

The school has accepted my way of planning and designing. I am fully supported. I like to have a detailed planner to work from so I know where I'm going. How we get there, we work out along the way. Kids choose their own assessment items and peer mark. The whole school uses this approach and parents are supportive.

This beginning teacher values the level of school and parent endorsement for their approach. Another beginning teacher in a country secondary school reported they negotiated student assessment through the topic of Refugees and Power of the Human Spirit. Students were provided with choice in the means of demonstrating their learning across units of work. This beginning teacher added that other staff had shown an interest in the unit and wanted to know what she was planning next. This interest provides the seed-bed for powerful social change.

Interdisciplinarity and Pre-service Coursework

The circle has turned in this inquiry. Investigating the impact of pre-service interdisciplinary course work on beginning teachers' practice, the authors began by asking pre-service teachers, prior to their graduation, to reflect on how the interdisciplinary coursework approach influenced their planning and practice in their final professional experience. Stage 1 found positive influences of the approach and how it successfully translated into curriculum design and practice in schools for pre-service teachers. The beginning teachers in Stage 2 who had completed one year of teaching experience, confirmed that an interdisciplinarity approach had deep and powerful outcomes for learners and the potential to contribute to whole school change.

One beginning teacher reflected on her interdisciplinary practice:

At Uni doing the interdisciplinary courses, I was scared, but excited. I still feel like that. I feel excited about teaching in this way. We need to teach curriculum that is values based. That develops self-respect and respect for others, being equal-minded. They need to be optimistic.

Interdisciplinary curriculum can do this; it's a life skill.

This deep reflection of both her learning and teaching conveys considerable emotional energy. This beginning teacher, using an interdisciplinary approach, engaged students at a deep level with the aim of building positive student belief in themselves, in others and their place in the world, affirming a critical social understanding underpinned by deep seated values (Gilbert 2004). Orr (1992), sixteen years ago, concurred with this teachers' view, by stating urgency exists for innovative education approaches that 'mimic' life in the community and in the natural environment, so that the boundaries between education and community life become less defined and therefore more integrated.

Further affirmative statements from beginning teachers alluded to unlimited teaching and learning possibilities,

The interdisciplinary courses at Uni just sparked off ideas. You knew where you could go-the possibilities.

And,

The interdisciplinary courses? They were great. They modeled what you should be doing in the classroom.

Sherren (2005), in her study of disciplinary mix in Universities within the context of sustainability, states that modeling interdisciplinarity is critical, particularly via team teaching, if students are to understand and integrate the approach into their practice. Experiencing the approach first hand, being a part of its enactment and seeing it work 'from the inside' would appear to these beginning teachers to be more powerful than purely intellectualising the approach. Interestingly, one beginning teacher working in an interdisciplinary team teaching situation, who prior to graduation had some reservations about the approach during coursework, stated:

The courses have influenced me now but not at the time. I use the readings and workshop notes now. I teach through the one topic and integrate the disciplines. It captures the students' interest and relates to the real world.

Opportunities for pre-service educators to engage in interdisciplinary approaches via team teaching experiences are rare in universities, however Stage 1 and 2 of this inquiry, strongly indicates that where those experiences have occurred, the learning has been valued and has influenced beginning teachers' curriculum translation and transformation.

Conclusion

This inquiry has investigated the impact of pre-service interdisciplinary course work on beginning teachers' practice and found the conceptual framework of interdisciplinarity has been embraced and applied in middle school settings. The school subject, Studies of Society and Environment, has been a recurring feature of the beginning teachers' interdisciplinary designs, taught through a critical perspective with a focus on values, real world application and peer collaboration. Interestingly, in the light of current public debate and pressure to return to disciplinary ways of organizing knowledge in schools, it is a melded school subject that these beginning teachers valued in their process of curriculum transformation. The beginning teachers' lived experience of curriculum transformation attests to Stengel's (1997) claim of school subject being a negotiation between academic discipline and everyday life.

Values, conceptual understandings and issues connecting with student life worlds underpinned the beginning teachers' interpretations of interdisciplinarity, attributes that are described in foundational definitions cited in this paper. The findings also indicate that the interdisciplinary grounding the beginning teachers had experienced in their pre-service course work provided the foundation on which to build interdisciplinary ways of teaching and learning in their school settings. In this paper the argument is made that graduates with an experience of interdisciplinarity in their coursework are well suited to implement this approach in their school settings and have the potential to play a key role in further encouraging this signature practice of middle school reform. To achieve this end, universities need to adopt measures to enable the construction of interdisciplinary courses that pre-service teachers can experience and build their practice around. Such measures would provide flexibility for staff to collaborate on multiple levels (including opportunities for team teaching), time and space for creative energies to work and resource support enabling research to underpin and enrich the initiative. It is our belief that university educators have the will to develop interdisciplinary curriculum and with the support of affirmative measures they can push the boundaries of possibility and engage on new levels.

A pre-service teacher referred to Studies of Society and Environment as being the cake, and questioned whether students needed to have 'their peas and beans' (other disciplinary subjects) before they could have their 'cake'. The authors propose that with an interdisciplinary approach the 'peas and beans' can be contextualized and students can ultimately have their cake and eat it too!

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