Mainstreaming Education for Sustainable Development in Initial Teacher Education in Australia: A review of existing professional development models.

Jo-Anne Ferreira, Lisa Ryan and Daniella Tilbury

Jo-Anne Ferreira
Faculty of Environmental Sciences
Griffith University
Nathan QLD 4111
Australia

Lisa Ryan
Australian Research Institute of Education for Sustainability (ARIES)
Graduate School of the Environment
Macquarie University
North Ryde
NSW 2109
Australia

Daniella Tilbury
Australian Research Institute of Education for Sustainability (ARIES)
Graduate School of the Environment
Macquarie University
North Ryde
NSW 2109
Australia

Abstract

Initial teacher education provides a strategic opportunity for ensuring that all teachers are ready and able to teach for sustainability when they begin their teaching careers. However, it is also widely recognised that this strategy has not been used to its full potential. Efforts in education for sustainable development (ESD) at this level have tended to engage with prospective teachers and teacher educators already interested in this area of learning – preaching mostly to the converted. This paper reports on a study undertaken by the Australian Research Institute of Education for Sustainability (ARIES) for the Australian Government Department of the Environment and Heritage, which sought to appraise the models of professional development underpinning a range of initial teacher education initiatives. Its intention was to learn from these experiences and identify effective models for mainstreaming ESD in pre-service teacher education.

Three main models of professional development were identified: the collaborative resource development and adaptation model, the action research model, and the whole-of-system model. This paper concludes by arguing that a systemic approach that engages the whole of the teacher education system is necessary if ESD is to be successfully mainstreamed in initial teacher education.

1: Introduction

Teachers hold the key to change in schools. This has been recognised by international agencies such as the United Nations Educational, Scientific and Cultural Organisation (UNESCO) who have identified the professional development of teachers in education for sustainable development (ESD) as 'the priority of priorities' (UNESCO-UNEP, 1990, p. 1). Indeed, over the past fifteen years many documents have been written about the need to reorient teacher education towards sustainability (UNESCO, 1997, 2004, 2005; UNESCO-UNEP, 1990). UNESCO's Guidelines and Recommendations for Reorienting Teacher Education to Address Sustainability state that:

> [i]nstitutions of teacher education fulfil vital roles in the global education community; they have the potential to bring changes within educational systems that will shape the knowledge and skills of future generations. Often education is described as the great hope for creating a more sustainable future; teacher education institutions serve as key change agents in transforming education and society so that such a future is possible (UNESCO, 2005, p. 11).

The United Nations Decade of Education for Sustainable Development (UNDESD) also identifies the need to reorient teacher education towards sustainability:

> [e]ducation systems will need re-shaping so … that teacher education prepares teachers for active/interactive learning processes, rather than a one-way transfer of knowledge (UNESCO, 2004, p. 22).

Teacher education is thus recognised as a key strategy in achieving a sustainable society. Initial, or pre-service, teacher education provides a strategic opportunity for ensuring that all teachers are ready, willing and able to teach for sustainability when they begin their teaching careers. However, it is also widely recognised that initial teacher education has not been used to its full potential (Fien, 1993; Fien and Tilbury, 1996; Spork, 1992; Tilbury, 1992, 1993; UNCED, 1992; UNESCO-UNEP, 1990; UNWIN/UNESCO, 2000).

There has been much effort in the environmental education field to reorient education towards sustainability. However, these efforts have tended to engage with teachers already interested in or committed to ESD. This has been the case with the UNESCO Reorienting Teacher Education towards Sustainability initiative (UNESCO, 2005); the UNESCO and Griffith University Teaching and Learning for a Sustainable Future initiative (UNESCO, 2002) and the OECD ENSI Teacher Education and School Development Project (ENSI, n.d.). Although these initiatives have taken an interdisciplinary approach and built the knowledge and skills of a select group of teachers, they have not succeeded in reorienting initial teacher education or

mainstreaming sustainability across initial teacher education programmes. The mainstreaming of ESD in initial teacher education is currently limited because ESD remains the concern of only a few and tends to be addressed in a piecemeal fashion (Oulton and Scott, 1995; 1997; 1998). Mainstreaming here refers to the incorporation of ESD philosophy, content and activities within an initial teacher education system to such an extent that ESD becomes embedded within all policies and practices. Mainstreaming change necessitates going beyond the mere addition of ESD into the curriculum, and implies a wide scale reorientation of the whole initial teacher education system towards sustainability.

Both the UNDESD (UNESCO, 2004) and the UNESCO Guidelines and Recommendations for Reorienting Teacher Education to Address Sustainability (UNESCO, 2005) reiterate the need for mainstreaming sustainability in teacher education. For example, the UNESCO Guidelines address the need to work across the teacher education system by engaging with ministries of education, boards of teacher certification, text book writers and publishers, professional organizations, non-government organizations (NGOs), and teachers unions (pp. 33-58). Although the UNESCO Guidelines recommend a 'Strengths Model', which advocates an interdisciplinary approach to pre-service and in-service teacher education, neither the UNDESD nor the UNESCO Guidelines outline possible models that would facilitate the system-wide engagement needed to mainstream ESD. It is this gap that our research, reported on in this paper, aims to address.

Initial teacher education programmes provide a unique opportunity for developing teachers' competence and confidence in implementing ESD in Australian schools. This opportunity has unfortunately not yet been taken up in Australia (Tilbury, Coleman & garlick, 2005). Our research was unable to find a teacher education institution in Australia that has mainstreamed ESD approaches across its initial teacher education programmes. Indeed, there have been relatively few initiatives targeted at teacher education for sustainability in Australia, and these have been aimed mainly towards continuing professional development (CPD) or in-service rather than initial teacher education audiences. Most notable of these were the National Professional Development Program offered by the Australian Government and the Australian Association for Environmental Education (AAEE) in the mid-1990s, and the Teaching for a Sustainable World initiative (AAEE/AIDAB (Australian international Development assistance Bureau), 1993). These efforts have resulted in pockets of good practice; however, they have not led to the mainstreaming of ESD in initial teacher education, which has been the focus of our

research. A better understanding of how to mainstream change is thus required. Our research reflects upon the variety of generic approaches – or models of professional development - underpinning contemporary ESD initiatives in initial teacher education in order to examine their assumptions about curriculum, institutional and systemic change. In identifying and examining the models of professional development, we hoped to reveal each model's approach to effecting change, as an understanding of how to effect change is essential in efforts to mainstream sustainability in initial teacher education.

1: Research focus and methodology

Our research sought to identify and appraise the models underpinning a range of initial teacher education initiatives developed in Australia and internationally. Its intention was to both learn from these experiences by identifying effective models for mainstreaming sustainability in initial teacher education programmes in Australia, and to examine the factors that impact on each model's level of success in effecting fundamental and widespread change across the initial teacher education system.

The research was undertaken through a systematic review of relevant literature, including journals, theses, evaluations, initiative websites and programme documentation. Correspondence also took place with the leaders of the initiatives featured in the study as well as with related stakeholders in order to source further information. It is important to note that this research did not collect empirical data but instead reviewed programme documentation and articles associated with these initiatives.

The research does not represent an exhaustive study of all initial teacher education professional development initiatives that exist throughout the world but instead captures a range of efforts. For example, it does not review – or evaluate - all such environmental education or ESD programmes. Nor does it include all initiatives that attempt to mainstream concepts across teacher education. Instead, it identifies and showcases the different models underpinning a range of initiatives.

The research is limited by the degree to which programmes have documented their experiences in print and what is available for public access. Many programmes have extensive information available electronically or in hard copy but this is often aimed at a general audience or serves a particular funding agency's agenda. Few programmes have undertaken extensive evaluation or research into their achievements and long-term impacts, which made it difficult to evaluate the

effectiveness of the model. The research was also limited to easily accessible, English-language documents and by the short timeframe for undertaking the research project.

1: Professional development models identified

Our study undertook a detailed examination of seven professional development initiatives seeking to bring about change in teacher education programmes and systems, both in Australia and internationally. These initiatives were:

- UNESCO's Teaching and Learning for a Sustainable Future project (International);
- The European Commission's School Development through Whole-School Approaches to Sustainability: The Sustainability Education in European Primary Schools project (European);
- Greenwich University's Teaching and Learning at the Environment, Science and Society Interface project (United Kingdom);
- UNESCO-ACEID and Griffith University's Learning for a Sustainable Environment project (Asia-Pacific);
- Macquarie University's Action Research for Change towards Sustainability project (Australia);
- The University of Wales at Bangor's Embedding Global Citizenship and Sustainable Development in Initial Teacher Education and Training project (United Kingdom); and
- The Sustainable Teacher Environmental Education Project (Jamaica).

Our examination focussed on how each of these initiatives aimed to bring about change in initial teacher education. As result of this analysis we were able to identify three broad approaches to change that are utilised in efforts to reorient initial teacher education towards sustainability. We have named these (i) the Collaborative Resource Development and Adaptation model; (ii) the Action Research model; and, (iii) the Whole-of-System model. These models are not pure replications of any of the initiatives we examined. Rather, they reflect the three main approaches to effecting change that we identified through our examination of the various initiatives.

2: The Collaborative Resource Development and Adaptation model

The Collaborative Resource Development and Adaptation model has been widely used in professional development in teacher education. Three examples of this are the *Teaching and Learning for a Sustainable Future* initiative, the *School Development through Whole-School Approaches to Sustainability: The Sustainability Education in European Primary Schools*

initiative, and the *Teaching and Learning at the Environment, Science and Society Interface* initiative.

In its simplest form, the Collaborative Resource Development and Adaptation model assumes that change can occur through the provision of curriculum and pedagogical resources and adequate training in the use of these. Many professional development programmes develop resources, often in the form of teaching kits that address a range of issues. Generally, the resource is developed along with professional development courses that are provided to assist teachers in implementing the materials in their particular setting.

While the development and dissemination of resources could be considered as the default model of professional development within teacher education generally, environmental education has had a history of innovating upon this model. In the field of environmental education, this basic model has often been improved through collaborative development processes that target not only curriculum but also pedagogical and philosophical change. Such initiatives thus often incorporate a collaborative materials development phase, which engages teacher educators in the process and increases their uptake and commitment to the initiative. Some initiatives based on this model also use the resource as a stimulus for further, more specific, adaptations to suit a local context. Such innovations provide a variety of professional development opportunities which both demonstrate good practice and act as a stimulus to further dissemination, adaptation, development and in-service. These innovations are outlined in Figure 1 and are reflected in the naming of the model as the 'Collaborative Resource Development and Adaptation model'.

(INSERT FIG 1 ABOUT HERE)

This model has a number of advantages; it has the ability to reach a large target audience and it is relatively cost effective because in most instances, once the resource is produced and disseminated there is little ongoing cost (although in some cases this perception works to limit the funding of further adaptations). The Collaborative Resource Development and Adaptation model generally seeks to bring about change at the level of curriculum by developing resources that may assist in re-orienting the content and processes of curriculum towards sustainability. Initiatives based upon this model seek not only to develop new, cutting-edge resources but also to provide the stimulus for further adaptation and innovation. They seek to provide new content and approaches to teaching and learning through the take-up of new resources and pedagogical approaches. Their key goals are effecting curriculum change in schools and teacher education

institutions, demonstrating what is possible within institutions and providing capacity-building opportunities for teachers and teacher educators. They do this through engaging practising educators and teacher educators in the process of developing materials. Some of the initiatives we reviewed had encouraged target institutions to adapt the materials to suit local contexts and undertake further professional development. Such an approach also encourages those who need to implement the change to engage in the process of developing the resources, thereby ensuring a sense of ownership of the resources.

The model has a number of drawbacks, however. It has a relatively narrow target audience, in that it tends to appeal to teacher educators who already have an interest in environmental education or sustainability issues and who take up the opportunity to be involved in the development or adaptation of the resource. If possibilities exist for engaging stakeholders in the collaborative development of the resource, be they internal to an institution, or across multiple institutions, the impact of the programme is likely to increase. In addition, if possibilities exist for high level support and broad dissemination, then the uptake of the initiative is also increased. Another limitation of the Collaborative Resource Development and Adaptation model is that it requires that resources are current. Some of the initiatives we reviewed mitigated this limitation through the use of the Internet as a medium, thus ensuring the resources remain useful, relevant and up-to-date.

This model generally seeks to bring about change at the level of individual programmes by adding new content or improving pedagogy, not to broader teacher education systems and structures. An assumption underpinning this model is that curriculum and pedagogical change will lead to wider systemic change. However, the model tends to work within and through current systems and structures and isolated individuals and does not directly aim for a system wide change.

Very few long-term evaluations of initiatives based on this model have been undertaken, thus making it difficult to accurately argue for their success or failure. However, research points to the more likely outcome being that such resources may often become out-dated and forgotten as newer resources compete for space (Shallcross, 2004). A limitation of this model is thus that there is often no process of evaluation of the initiative's effectiveness 'built-in' as well as no process for ongoing updating of the resource that has been developed. While those initiatives that have a long-tem planning process often do build evaluation in as part of an iterative cycle of reflection, some of the initiatives we identified were resources that were developed and then

never revised. If evaluations of these occurred, they were largely undertaken to satisfy funding agencies, not to be used as reflective tools for improving the resource or the process of dissemination.

2: The Action Research model

Initiatives that use the Action Research model, such as the *Learning for a Sustainable Environment* and *Action Research for Change towards Sustainability* initiatives, aim to do more than introduce new curriculum to the initial teacher education system. They are different from initiatives based upon the Collaborative Resource Development and Adaptation model because they seek to deeply engage - through a process of action research - with educators and others in the initial teacher education system such as policy and curriculum planners and developers who were identified as key agents of change.

Initiatives based on the action research model aim to build capacity in educators so that they see themselves as competent developers and deliverers of curriculum and policy. While action research is most commonly thought of as a research method, it can also be used as a process of professional development. Action research's four-phase cyclical process of critical enquiry - plan formation, action, outcome observation and reflection - provides the opportunity for practitioners to reflect upon their practice with the aim of improving and innovating upon it (Tilbury, Coleman & Garlick, 2005, p. 85). The action research process can therefore be used as a form of professional development.

The Action Research model seeks to bring about change by engaging directly and deeply with those practitioners who have control over the content and teaching processes of particular courses. It seeks change though linking curriculum and organisational innovation, professional development and innovative pedagogy through a process of reflective action. For example, one of the initiatives we reviewed involved teacher educators across the Asia-Pacific in a combined process of curriculum development, action research and networking. This initiative targeted teacher educators who would be able to act as agents of change within their respective teacher education institutions. One of the aims of the initiative was to build capacity for these teacher educators to be leaders in their institution, advancing the sustainability agenda, while also being supported through an international network.

A positive feature of this model is that it engages with participants as researchers. Participants can thus tailor the focus of the project to suit their needs thereby retaining a high level of control

over the processes. While the model relies on someone to initiate it, it is not expert-led. Rather, the experts sit to the side of the model, as illustrated in Figure 2. Evaluation and reflection are also strengths of the action research model. The evaluation and reflection that occurs through the action research process feeds back into the process, thus ensuring immediate and ongoing improvement. Such ongoing and iterative cycles of evaluation and reflection were unique to the Action Research model.

(INSERT FIG 2 ABOUT HERE)

In the initiatives we reviewed that used this model, change was effected in (a) curriculum and course structures through the inclusion of ESD principles, and (b) in the immediate institutional climate, to make it more receptive to sustainability. The action research model assumes that deep engagement by key stakeholders and supported action is critical as a deep level of engagement increases the competence of and propensity for research participants to act for change over a longer period of time.

The initiatives that used the Action Research model have been successful at bringing about change in organizations, curriculum and pedagogy even after the closure of the projects. One of the reasons for this may be the strong support network that develops between research participants when they engage through such a model. By undertaking action research as part of a network of researchers, participants were able to be part of a community of enquiry. In the initiatives reviewed, this facilitated ongoing collaboration and peer support.

Limitations of this model are that it is very time intensive and requires an ongoing commitment from participants. This may be more problematic the higher up the hierarchy the intervention is seeking change. One way to 'soften' this problem is to offer incentives to participants, for example, the possibility of improving research quantum by engaging in a research project or publishing one's findings. Another limitation of the model is that it is difficult to "sell" to funding agencies because it is difficult to prescribe tangible outcomes as it is process driven, rather than outcomes driven. In addition, the model requires longer-term commitments from both funding agencies and participants. While current interpretations of the model have focussed on higher education institutions and curriculum or organisational change, the action research model has great potential for engaging deeply across a whole system and may thus prove useful in the re-orientation of initial teacher education systems towards sustainability.

2: The Whole-of-System model

The Whole-of-System model of professional development has a significantly different approach to change than the models described above. Initiatives that we identified as being underpinned by the Whole-of-System model were the *Embedding Global Citizenship and Sustainable Development in Initial Teacher Education* initiative and the *Sustainable Teacher Environmental Education Project*. The Whole-of-System model demonstrates a richly contextual understanding of the nature of change. The model assumes that change towards sustainability will only occur if all levels and contexts within the system are aligned in their efforts to work towards sustainability. The model's complexity is reflected in Figure 3. Its success depends upon its ability to leverage top-down and bottom-up approaches to change simultaneously in a multi-faceted and system-wide manner. This complexity also means that the model is not prescriptive in the activities that are undertaken but, instead, enables contextually specific strategies to be developed. A systematic approach will ensure that all areas where change is being attempted are equally dealt with in a coherent and consistent fashion.

(INSERT FIG 3 ABOUT HERE)

There are very few examples of this model and we were only able to identify the two initiatives referred to above that utilised it. One of these attempted change within their local area, the other across the nation. The small number of examples using the whole-of-system model may well be because the approach is complex and requires a clear and comprehensive understanding of the particular context within which initial teacher education operates. The whole-of-system model includes working at the interface of every contextual layer of initial teacher education from students and practicum school principals and teachers to programme directors and external agencies, so that the organisational culture and processes of each can be influenced. While such a broad approach is difficult to coordinate, the initiatives using this model demonstrated the greatest degree of long-term and system-wide change. Indeed, evidence gathered from project evaluations found that these initiatives had built bridges within and between a range of teacher education institutions, related government departments, and community groups. These initiatives also showed evidence of continuing to embed ESD activities despite funding for the initial project having ceased. This demonstrates that this model was the most effective in embedding long-term and system-wide change within these particular initial teacher education systems.

This model also demonstrates the importance of involving a broad base of stakeholders in initiating and guiding the project. A range of internal (students, administration, ancillary and academic staff) and external (practicum schools, relevant government departments, national environmental education councils, and NGO staff) stakeholders was engaged from the conception of the projects, in the initiatives we reviewed. In this way, the initiatives were driven by this large group and gave a sense of ownership to all stakeholders from the beginning. Such a participatory approach is well aligned with the principles of ESD.

The model's reliance on a broad base of support, including high-level support may, however, be seen as a limitation. Such support is often difficult to obtain, not least because of a range of equally important but competing interdisciplinary demands, such as those of integrating technology. While this is a limitation, such support is also essential to the model's success at mainstreaming ESD, not only in initial teacher education institutions, but also across a range of institutions and agencies.

The Whole-of-System model is also limited in that it is difficult to co-ordinate the range of changes occurring and thus to monitor success. One solution to this may be to have such a project 'managed' by a high-level group such as a national environmental education council, with dedicated coordinators appointed at all levels at which change is occurring, along with a mechanism that facilitates ongoing communication amongst these coordinators, and between these coordinators and the project management group.

1: A New Model

Based upon the evaluations of initiatives and models described above, our research recommended and described a new model, one that combines the best features of the whole-of-system and action-research models. This new 'mainstreaming sustainability' model incorporates a multi-lateral approach to engaging stakeholders to ensure whole-of-system support. This, in combination with an action-research method, offers a powerful means for developing a practitioners' sense of autonomy, ownership, and ability to bring about change within one's own particular setting.

Our recommendation to the Australian Government to take up a 'mainstreaming sustainability' model is based upon the innovation and success of the Whole-of-System and Action Research

initiatives that we reviewed. In all of these initiatives, the change effects have persisted after the funding ceased[1]. Changes filtered though to other departments and institutions and individuals felt empowered and able to act. Our research indicates that this is because of the unique support and individual professional development offered by an action-research process, and the multi-lateral engagement that allows all stakeholders to jointly develop a set of common aims and strategies.

A 'mainstreaming sustainability' approach in initial teacher education facilitates:

- seeking change at a number of levels in the teacher education system (e.g. teacher education accreditation, policy, planning and practice);

- involving the agents of change from each or the key stakeholder groups in a process which enables them to see the relevance of sustainability to their work in teacher education. This approach is important to attain commitment to, and ownership of, the innovation and change across the system; and,

- effecting multi-dimensional change. It is important to embed the change within various components of a system so that there is compatibility and thus less resistance to the innovation and change (e.g. policy development, professional development, curriculum development and resource development are tackled simultaneously).

There are, however, a number of difficulties inherent within the 'mainstreaming sustainability' model. It is, for example, very time and labour intensive. It does not offer a quick fix but instead requires ongoing commitment from participants across a range of institutional and organisational settings. Our research also identified a range of additional factors critical to the success of the 'mainstreaming sustainability' model. These factors relate to the nature and length of funding; the range and quality of partnerships and networks; the curriculum focus and the teaching and learning processes used; the levels and incentives for engaging participants in the process of change; the use of evaluation as a tool for learning and on-going improvement; and the context in which the initiative occurs. Attending to these factors – preferably simultaneously - will improve the scope and longevity of change that occurs through the 'mainstreaming change' model.

---

[1] The time for this varies between 10 years (Learning for a Sustainable Environment) and 2 years (Sustainable Teacher Environmental Education Project (STEEP), and Action Research for Change Towards Sustainability (ACTS).

1: In Summary

This paper has reported on a research study that sought to identify and appraise the models underpinning a range of initial teacher education initiatives developed in Australia and internationally. Its intention was to learn from these experiences and identify effective models for mainstreaming sustainability in initial teacher education programmes in Australia.

Three main models of professional development that seek to effect change within teacher education institutions have been revealed from an examination of these initiatives. The Collaborative Resource Development and Adaptation model generally attempts to influence change through the development and adaptation of high quality curriculum and pedagogy resources, usually targeted at teacher educators. It assumes that teacher educators already have an interest in using ESD resources. The model appears to have limited ability to bring about widespread change because it does not seek to change structures but operates instead within the current system. It has been made more effective in the initiatives reviewed through an understanding of resource development as a part of professional development for teacher educators. Such an understanding improves the relevance of resources and ensures they are seen as demonstration projects rather than as 'kits'. All the initiatives we reviewed here innovated substantially upon the generic model and had varying degrees of success as a result of their innovations.

The Action Research model attempts to engage participants deeply in a professional development process, which can build skills and action competence for a variety of change efforts. Most commonly, this model targeted teacher educators and tended to result in curriculum and some institutional innovation. However, the Action Research model is not restricted to this audience and may be used with other key players. The initiatives reviewed attracted stakeholders who did not already have an interest in ESD. However, the model is quite time-intensive and often difficult to 'sell' to potential funding agencies. Anecdotal evidence suggests that long-term outcomes may be more sustainable than the Collaborative Resource Development and Adaptation Model.

The Whole-of-System model has a richly contextual approach to change and attempts to align and engage all elements of the system in reorienting the initial teacher education system towards sustainability. Initiatives that were based upon this model negotiated partnerships with and engaged not only teacher educators, but also educational policy makers, such as NGOs, boards of teacher registration, teacher education institution executives, administrative and

ancillary staff, and students. This model is extremely complex, difficult to coordinate and time-consuming, however, evidence from the two institutions utilising the model shows that it has had a great degree of success in embedding ESD within initial teacher education systems because the cross-institutional approach has lead to multi-lateral support and initiative longevity. A systemic approach such as that demonstrated by the Whole-of-System model is necessary if ESD is to be successfully mainstreamed in initial teacher education.

Our study recommended that a hybrid of the action research and whole-of-system model be adopted in future efforts to mainstream ESD in initial teacher education. This systemic approach would engage agents of change from key stakeholder groups within the education system in a process of reflective action research in order to effect multi-dimensional change. To this end, it would be important to engage stakeholders from within each faulty of the education institution, as well as stakeholders from related organizations such as boards of teacher registration, professional associations, in-service providers, teacher unions, Departments of Education and Environment and schools. This systemic approach is recommended because it takes a contextual approach to change and offers opportunities to align the efforts of all key stakeholders in working collaboratively towards sustainability. This approach would also allow stakeholders to determine what it is that is needed – be this new curriculum, new policies, or a complete overhaul of the delivery of initial teacher education - and what would work best within their particular contexts. The Australian Government, for whom the research on which this paper reports was undertaken, is currently studying the recommendation for an action research based whole-of-system model and considering the next steps for reorienting initial teacher education in Australia towards sustainability.

References

Australian Association for Environmental Education (AAEE) and the Australian International Development Assistance Bureau (AIDAB) (1993) *Teaching for a Sustainble World: Environmental and Development Education Project for Teacher Education*, Brisbane, Australian Association for Environmental Education.

ENSI (n.d.) *Defining ENSI*, [Accessed 24 January 2006]. Available at: http://www.ensi.org/index.php?modul=10&folder=30270

Fien, J. (1993) Environmental Education: An Agenda for Pre-Service Teacher Education in Queensland, Toowong, Queensland Board of Teacher Education.

Fien, J. and Tilbury, D. (1996) *Learning for a Sustainable Environment: An Agenda for Asia and the Pacific*, Bangkok, UNESCO Asia Pacific Centre for Educational Innovation and Development.

Oulton, C. and Scott, W. (1995) 'The environmentally educated teacher: an exploration of the implication of UNESCO-UNEPs ideas for pre-service teacher education programmes', *Environmental Education Research*, 1 (2): 213-231.

Oulton, C. and Scott, W. (1997) 'Linking pre-service and in-service teacher education and environmental education', in P.J. Thompson (Ed.) *Environmental Education for the 21st Century: International and interdisciplinary perspectives*, New York, Peter Lang.

Oulton, C. and Scott, W. (1998) 'A realistic model for educating the "environmentally educating teacher"', in J. Palmer (Ed.) *Environmental Education in the 21st Century: Theory, practice, progress and promise*, London, Routledge.

Shallcross, T. (Ed.) (2004) *School Development through Whole School Approaches to Sustainability Education: The SEEPS (Sustainable Education in European Primary Schools) project*, Manchester, Manchester Metropolitan University.

Spork, H. (1992) 'Environmental Education: A Mismatch between Theory and Practice', *Australian Journal of Environmental Education,* 8: 147 - 166.

Tilbury, D. (1992) 'Environmental Education within Pre-Service Teacher Education: The Priority of Priorities', *International Journal of Environmental Education and Communication*, 11(4), pp. 267-280.

Tilbury, D. (1993) Environmental Education for Sustainability: A Model for Pre-service Teacher Education. Unpublished PhD Thesis, Cambridge, University of Cambridge.

Tilbury, D., Coleman, V. and Garlick, D. (2005) *A National Review of Environmental Education and its Contribution to Sustainability in Australia: School Education*, Canberra, Australian Government Department of Environment and Heritage and Australian Research Institute in Education for Sustainability (ARIES).

UNCED (1992) 'Chapter 36: Promoting education, public awareness and training', in UNCED *Agenda 21: Programme of Action for Sustainable Development, Paris*, United Nations Conference on Environment and Development (UNCED).

UNESCO (1997) *Educating for a Sustainable Future: A Transdisciplinary Vision for Concerted Action*, EPD-97/Conf.401/CLD.1.

UNESCO (2002) Teaching and Learning for a Sustainable Future, Available at: http://www.unesco.org/education/tlsf/ [Accessed 6 August 2005].

UNESCO (2004) *United Nations Decade of Education for Sustainable Development: Draft International Implementation Scheme 2005-2014*, Paris, UNESCO.

UNESCO (2005) *Guidelines and Recommendations for Reorienting Teacher Education to Address Sustainability*, UNESCO Education for Sustainable Development in Action, Technical Paper No. 2, (Prepared by UNITWIN/UNESCO Chair on Reorienting Teacher Education to Address Sustainability [Charles Hopkins, Chair and Rosalyn McKeown,

Secretariat] and the International Network of Teacher-Education Institutions), Paris, UNESCO.

UNESCO-UNEP (1990) 'Environmentally Educated Teachers: The Priority of Priorities', *Connect,* XV(1), pp. 1 - 3.

UNITWIN/UNESCO (2000) Reorienting Teacher Education to Address Sustainability, Available at:
http://www.edu.yorku.ca/?DocNum=resProj&CurrInclude=resProj/UNITWINUNESCO.cfm [Accessed 24 May 2005].

Biographical Statements:

Jo-Anne Ferreira convenes the Master of Environmental Education programme at Griffith University, Brisbane, Australia. She has taught in initial teacher education and mid-career environmental education programmes in Australia and internationally.

Lisa Ryan is a lecturer in the Faculty of Science, Health and Education at the University of the Sunshine Coast and is on the Steering Committee of the Queensland Environmentally Sustainable Schools Initiative - Sunshine Coast Hub.

Daniella Tilbury is Associate Professor of Environmental Education and Sustainable Development at the Graduate School of the Environment at Macquarie University. She is the Director of the Australian Research Institute in Education for Sustainability (ARIES) which is funded by the Australian Government Department of the Environment and Heritage.

FIGURES

Figure 1: Collaborative Resource Development and Adaptation Model

Practitioner collaboration

Teacher educators identify need for resource development to address a particular concern or issue and seek funding

Funding body provides funding for project

Has been made more effective through commissioning practitioners (teacher educators in other or within home institution) to collaboratively write materials as a form of professional development

Practitioners write resource materials

Has been made more effective through an outreach programme that sees the resource trialled in other institutions

Resource trialled and adapted (in some instances a number of times)

Some variations of this model conducted further research upon the uptake of the resource and utilised the opportunity to contribute

An important stage in this particular model which depends greatly on the wide dissemination of the resource. Some of the initiatives utilised the Internet to assist in this, others targeted other teacher education institutions and ministries of education.

Dissemination of resource

Further innovation and locally specific adaptations of professional development resource

Figure 2: Action Research Model

Funding provided (usually for one cycle)

Need for change identified and funding sought

In both initiatives this need was identified by an expert or an expert group.

Initiative developed to address this issue and begin their action research spiral

Key agents of change in a number of institutions are invited to participate in research process

The process was improved by built-in action research processes for the experts (in grey).

Expert Action Research Cycle

Action Research Expert

Evaluation fed back to experts /initiative developers to improve model

Management support

Identify potential focus for innovation

Professional development workshops for agents who then become participant researchers

support from and network

Outreach to other institutions and identify /form new networks, which continue to support each other

Action Research Process

Refine and revise

Critical Friends/Mentors

Drafting of materials/actions

Reflection of process / Trial of materials/actions

Reflection and refinement of process/ research on model

Change to orgsanisation, curriculum, pedagogy and/or materials
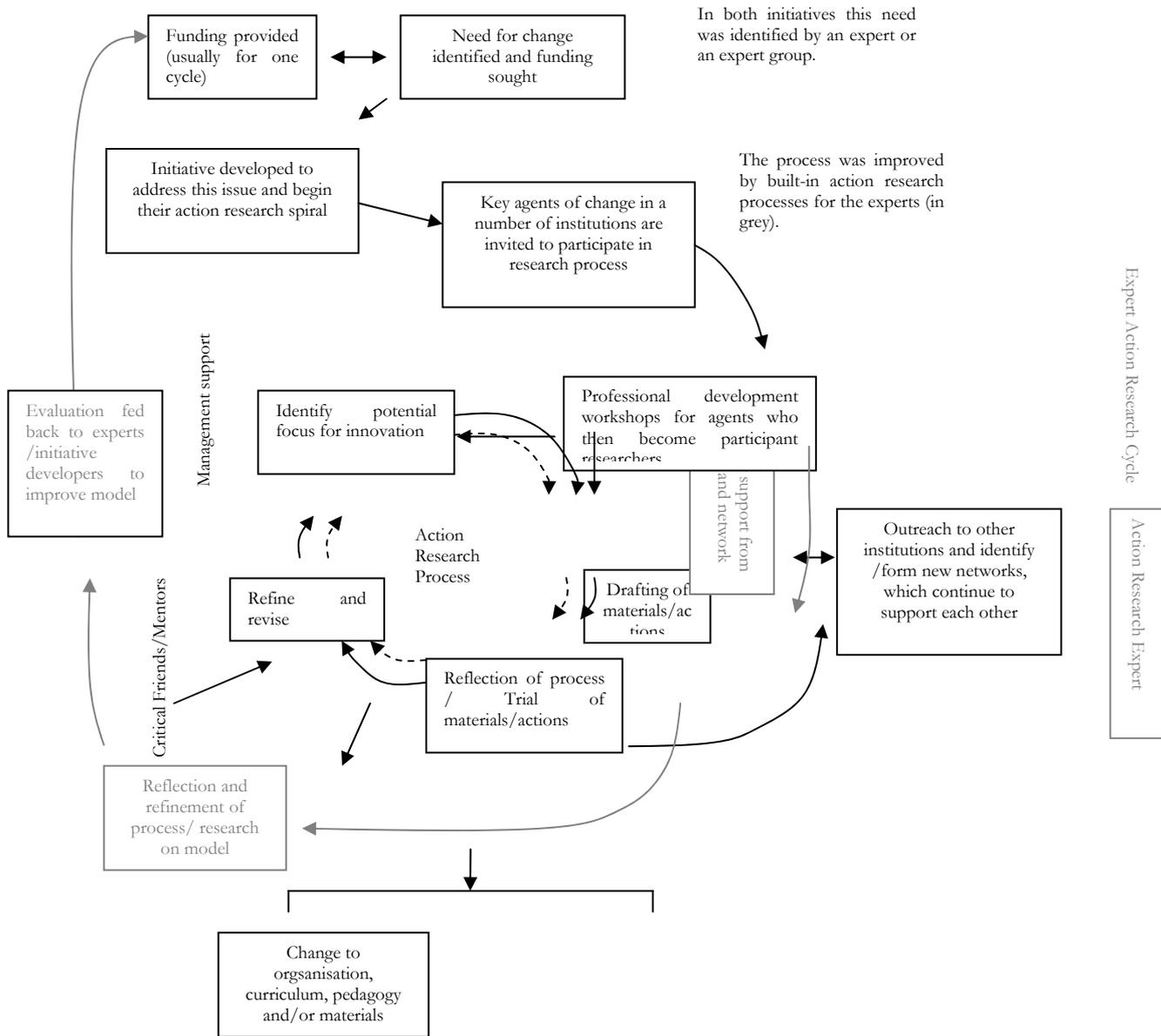
19

Figure 3: Whole-of-System Model

Project initiated through broadscale agreement by a number of stakeholders

In the two initiatives this occurred through a multi-stakeholder council such as NEEC.

Multi-stakeholder steering committee formed to guide process.

Coordinator appointed to manage the process (could come from within steering committee or from outside)

School Context (Practicum and Systemic)

Prac placements in sympathetic schools to ensure there are opportunities to follow up in practicum situations

Working partnerships between teacher education institution and schools

Teacher Education Institution/ University Context

Sustainability policy enacted and modelled within whole institution

Event s that focus the whole institution on sustainability

Institutional practices from grounds maintenance to procurement informed by culture of sustainability

Support from the top

Faculty/School Context

Professional Development workshops for teacher education staff

Support provided from project officer for curriculum reorientation and integration

Opportunities and support provided for interdisciplinary approaches and other pedagogical innovations consistent with sustainability

Resources provided to assist with curriculum integration

Student Context

Students have opportunity to participate in environmental activities such as clubs and resource monitoring

Exposure to curriculum

Opportunities for Education *for* Sustainability

Projects evaluated and findings fed back into the process for improvement for next pilot institution or other outreach institution, or for improving practice in the initial institution