



MAINSTREAMING EDUCATION FOR SUSTAINABILITY
IN PRE-SERVICE TEACHER EDUCATION
IN AUSTRALIA

Enablers and constraints



Australian Government
Department of the Environment,
Water, Heritage and the Arts



MACQUARIE
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Preface

The study reported here is the third stage in a project to mainstream education for sustainability (Efs) in pre-service teacher education. The project began with a review of change processes to identify an effective model. The whole-of-system/action research model of effective change was then piloted in the Queensland education system. This report presents the findings of a further pilot project to test this model and to identify enablers and constraints to mainstreaming Efs in New South Wales (NSW) and the Australian Capital Territory (ACT) teacher education systems. The program brought together representatives of education-related institutions to discuss barriers and plan action that might be undertaken. Four sub-projects within teacher education institutions were facilitated, and these investigated enablers and constraints to the integration of Efs within their teaching programs. Five actions enabling change were identified: collaboration; development of an ethos of sustainable practice; connecting existing Efs content; provision of experiential learning; and creating opportunities for integrated programs. Individual teacher educators were largely motivated to change and had the ability to incorporate Efs. The greatest constraint was providing overall systemic support for this action to happen.

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Abbreviations

AAEE	Australian Association of Environmental Education
ACARA	Australian Curriculum Assessment and Reporting Authority
ACT	Australian Capital Territory
ACU	Australian Catholic University
ANU	Australian National University
ARIES	Australian Research Institute in Education for Sustainability
AuSSI	Australian Sustainable Schools Initiative
BEd	Bachelor of Education
CSIRO	Commonwealth Scientific and Industrial Research Organisation
CSU	Charles Sturt University
DEEWR	Australian Government Department of Education, Employment and Workplace Relations
DET	NSW Department of Education and Training
DEWHA	Australian Government Department of the Environment, Water, Heritage and the Arts
EfS	Education for Sustainability
EOI	Expression of Interest
HSIE	Human Society and its Environment
KLA	Key Learning Area
NSW	New South Wales
NSWIT	NSW Institute of Teachers
PDHPE	Personal Development, Health and Physical Education
SOSE	Studies of Society and Environment
SSNSW	Sustainable Schools NSW
UC	University of Canberra
UNE	University of New England
UTS	University of Technology, Sydney

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Executive summary

Scientific evidence now shows that humanity has significantly underestimated the extent of our interconnectedness to each other and our natural environment. We are now suffering the effects of our neglect and are confronted with the challenges of creating a more sustainable world. This will require an education system which has at its core the sustainability principle of intergenerational equity. Skills associated with sustainable living, such as critical thinking, systems thinking and participatory action will need to be mainstream, not marginal. Mainstreaming sustainability into education will mean embedding its core values into policy, processes and curriculum.

At the present time Australian schools have begun to develop whole-school programs dealing with sustainability learning. These are supported by national and state education policy, and professional development programs such as the Australian Sustainable Schools Initiative (AuSSI). Pre-service teacher education lags behind in developing programs that will enable new teachers to initiate and implement such whole-school programs. Mainstreaming sustainability in teacher education is now a vital component of ensuring that all parts of the education system work together for a sustainable future.

This report details the findings of the third stage of a research program to bring about change toward mainstreaming education for sustainability (Efs) in teacher education. In Stage 1 effective models of change were reviewed and a whole systems approach combined with action research was recommended. This model was piloted in Queensland in Stage 2. Key agents of change within the education system of that state were identified. These agents of change, located in five teacher education institutions, undertook action research to mainstream Efs within their system. Each participating group increased their capacity to bring about systems change. Outcomes of the project included development of departmental policies, student involvement in Efs fora and enhanced skills amongst fellow teacher educators. The Stage 3 project built on Stage 1 and 2 to implement mainstreaming of Efs in teacher education in New South Wales and the Australian Capital Territory.

The research question investigated in Stage 3 was: How to engage key stakeholders within teacher education systems to directly influence and mainstream Education for Sustainability within pre-service teacher education and improve opportunities for trainee teachers to develop knowledge and competence in this area?

The Stage 3 project had the following specific objectives:

- Map the teacher education systems in the ACT and NSW.
- Identify enablers and constraints to mainstreaming Efs in those systems.
- Facilitate conversations within systems to bring about change toward mainstreaming Efs.
- Support ongoing systems change in Queensland.

The project followed a similar methodology to Stage 2. Key agents of change were identified and invited to participate in the ARIES study. Four sub-project teams within teacher education institutions were supported to develop their own project relating to mainstreaming of Efs in their system. The aims of each project differed according to context, but each identified enablers and constraints to mainstreaming Efs. ARIES facilitated fora that brought together sub-project participants and representatives of other bodies involved in school or teacher education. Data gathered on enablers and constraints to embedding Efs were then combined and analysed by a team of ten participants from across the four groups and ARIES. The synthesised findings of this analysis are reported here. This report also presents the outcomes of the combined efforts of the project teams to bring about change within their institutions and systems toward mainstreaming Efs.

Five enabling actions for mainstreaming Efs in pre-service teacher education were identified across the projects, namely:

- collaborating for curriculum change
- developing an ethos of sustainable practice
- connecting existing Efs content
- creating time and opportunities for integrated programs
- providing experiential learning.

Collaboration between education-related bodies that have an interest in Efs and those involved in the wider education system (such as curriculum developers, policy makers and teacher accreditation bodies) is enabling. Three areas where collaboration can be effective were identified:

- Primary importance was given to developing NSW and national teacher accreditation standards that **both** highlight the importance of Efs and allow space for its development within university curricula.
- Greater prominence of Efs within the school curriculum in NSW would increase visibility of Efs for teacher educators.
- Collaboration to establish Efs as a core element of a national curriculum would influence Efs visibility in state curricula.

The silo nature of bodies responsible for policy and curriculum was a significant constraint to collaboration leading to mainstreaming.

An **ethos of sustainable learning** is increasingly being enabled by university policy, leading to development of campus programs for sustainable facilities and practices. However, policy had not yet filtered into teaching programs. EFS remains only one of many policy streams and does not yet appear to be a dominant discourse. It was important to 'walk the talk' at all levels of the system, from classroom to national policy.

Examination of existing teacher education programs found that EFS skills and content were present but were there in a fragmented fashion. **Connecting this content** and reducing fragmentation is a priority. This research suggests that in the first instance this will involve conversations between teacher educators about creative means of integrating EFS. These conversations will then need to be extended so that new programs are endorsed and accredited by relevant university and outside bodies.

Lack of **time** was a constraint to the conversations and collaborations needed to **embed EFS** in policy and develop holistic integrated teaching programs that draw together EFS content. Policy supporting EFS inclusion was not accompanied by increased resources to reduce the workload currently experienced by university executive, educators of pre-service teachers and their students. Specification of unit content by the NSW Institute of Teachers (NSWIT) and the crowded Key Learning Area (KLA) syllabuses in NSW added to the time burden.

Individual teacher educators could exert considerable influence over courses and student experiences. A perception of empowerment and strong motivation to act was necessary to overcome current systemic constraints. Participation in **experiential learning** programs may assist teacher educators to focus on EFS and develop their personal understanding of its relevance.

As well as identifying enablers and constraints this project initiated a number of actions to facilitate mainstreaming of EFS. It has:

- mapped the teacher education system in NSW/ACT
- enabled conversations for change within five participating teacher education institutions
- increased knowledge and skills amongst agents of change
- facilitated conversations amongst representatives of education bodies
- fostered collaborations across teacher education institutions
- developed and delivered a workshop on change for whole-school approaches to teaching EFS
- supported efforts to disseminate Stage 2 findings within the Queensland system.

Together the Stages 2 and 3 projects have engaged stakeholders in 10 teacher education systems across three states/territories. They have substantially increased networks for collaborative change and increased the capacity of (at least) 15 key change agents.

Recommendations for future actions are:

- Support school curriculum change so that the syllabus reinforces the possibility of whole-school EFS, with participatory and systemic and critical thinking skills at the forefront of pedagogy.
- Support the development of teacher accreditation standards that both reduce the crowding of university curricula and make the need to teach pedagogies consistent with EFS explicit. This would mean actively supporting pre-service teacher learning about whole-school approaches to sustainability.
- Continue conversations with individual teacher educators to empower them to make change and overcome remaining constraints to EFS being taught in a holistic manner within the various teacher education courses.
- Encourage the trend toward sustainable campuses and university policy in support of EFS teaching, and raising the profile of sustainability policies amongst the plethora of policies that impact on teaching within the university.

Some specific suggestions include:

System level

- Coordinate a national seminar on mainstreaming EFS in teacher education.
- Enable a network of mentors that would support change efforts by individual organisations.
- Signpost sustainable campus developments.
- Incorporate sustainability skills in graduate attributes.
- Discover which rewards and incentives would result in attitude change; for example, the relationship between EFS and excellence in teaching.
- Create whole-of-university projects in which pre-service teachers and teacher educators could participate.
- Develop workshops offering experiential approaches to teaching and learning for EFS.
- Increase capacity for systems thinking, organisational change strategies or EFS teaching skills.
- Host student fora to increase active involvement and empower new teachers.
- Develop a teaching unit involving collaboration with AuSSI coordinators, community groups and sustainable schools.
- Develop a capstone unit that draws together the fragmented EFS learning acquired during degree programs.
- Convene sustainability committees or networks.
- Align teaching units with graduate attributes consistent with EFS.
- Develop a graduate professional development program in EFS.

Individual level

- Initiate conversations with peers about EfS.
- Role-model the practical, such as car pooling to outings or practicum visits, and turning off lights.
- Take responsibility for the individual role as a social unit in a whole collective responsible for unsustainable practices.
- Find out about school-systems policy relating to EfS teaching and AuSSI.
- Incorporate EfS content and skills into current units, including assessment tasks.
- Consider ways to collaborate with peers to develop cross-disciplinary units or whole department projects.
- Publish or disseminate research relating to EfS in pre-service teacher education.
- Use the environment and visits to parks, schools and local sites.

Sustainable practice is a perspective that involves caring for others, ourselves and our natural environment. This perspective must underpin all our efforts to bring about change for sustainable living. The participants in this study would like to state strongly and clearly their belief that education for sustainability is now urgent.

1 Sustainability and pre-service teacher education

1.1 A national priority

The aim of this project was to further the policy of the Australian Government set out in the *National Action Plan on Education for Sustainability*, namely:

Consistent with the systemic approach to sustainability in schools adopted by AuSSI, the Australian Government will work with state and territory governments to ensure sustainability is appropriately embedded in policies, programs procedures and systems (Commonwealth of Australia, 2009).

The project will also contribute to the implementation of *Educating for a Sustainable Future: A National Environmental Education Statement for Australian Schools*, which has been endorsed by Australian Government and state/territory education ministers through the Ministerial Council on Education, Employment, Training and Youth Affairs. This policy emphasises the importance of a whole-school approach to sustainability, which requires 'the development of a shared vision, goals and objectives' (Commonwealth of Australia, 2005, p. 7) not just curriculum change.

ARIES has undertaken to develop awareness and change within the pre-service teacher education system, so that new teachers will be prepared to support whole-school approaches to Efs. The Stage 3 project implemented the whole systems/action research model developed in Stage 1 and trialled in Stage 2. This involved identifying key agents of change, supporting dialogue between and within education systems and reporting on enablers and constraints to embedding sustainability principles in teacher education curricula. The overarching question to be addressed was: How can we engage key stakeholders within teacher education systems to directly influence and mainstream Education for Sustainability within pre-service teacher education and improve opportunities for trainee teachers to develop knowledge and competence in this area?

1.2 The need for pre-service teacher education for sustainability

Based on his analysis of the best scientific evidence available, Garnaut (2008) concludes that 'without strong mitigation, the melting of the Greenland ice sheet, sooner or later, becomes something close to a sure thing' (p. 592). Melting of this ice sheet would lead to catastrophic sea level rises. The impact would be felt globally. Garnaut (2008) remains optimistic that if action is taken now the effects of rising carbon dioxide levels can be mitigated. All will have a role in bringing about awareness and action for change in the way humanity deals with the natural environment. Formal education systems will have to contribute to this effort. Education for sustainability will need to be the core of student learning if we are to build a sustainable future.

Within Australian school education systems there is increasing recognition of the importance of Efs. The Australian Government has produced the *National Education Statement for Australian Schools*, which emphasises the need for a whole-school approach (Commonwealth of Australia, 2005). The AuSSI program was implemented in 2002 to support sustainable schools initiatives in states and territories. The new national curriculum will also support the inclusion of Efs as a cross-curriculum perspective (National Curriculum Board, 2009).

The NSW Department of Education and Training (DET) has a policy of Efs inclusion (NSW DET, 2001). Schools are asked to develop management plans for energy and water efficiency as well as integrate sustainability programs into the curriculum. DET is currently devising a curriculum support document to assist teachers to implement Efs as a cross curriculum subject. Reports on sustainable schools initiatives in Victoria and NSW indicate that successful whole-school programs are being developed in these states (Chodkiewicz & Flowers, 2005; Gough, 2005). The ACT curriculum framework for schools includes the essential learning: 'the student acts for an environmentally sustainable future' (ACT Government, 2007, p.13).

The Catholic school system endorses care for a sustainable world through its policy *On Holy Ground* (Catholic Earthcare Australia, 2009). Overall, there are encouraging signs that the situation has changed since Tilbury, Coleman and Garlick (2005) found little evidence of integrated Efs in school education.

1. Sustainability and pre-service teacher education

Changes in pre-service teacher education will need to keep pace with changes in policy and action in schools. Students now leaving university to teach in these school environments will need to be aware of policy, and able to initiate and participate in whole-school sustainability activities. The Stage 1 report (Ferreira, Ryan and Tilbury, 2006, p. 25) states 'pre-service teacher education programs provide a unique opportunity for developing teachers' competence and confidence in implementing whole-school approaches to sustainability in Australian schools'.

It was also noted that while some individual units dedicated to learning for sustainability could be found, there were no teacher education institutions where this learning was mainstreamed. Mainstreaming is defined as 'the inclusion of the content and practice of a particular idea (such as learning for sustainability) within an organisation, institution or system (such as pre-service teacher education) to such an extent that it becomes embedded within its policies and activities'. (Ferreira, Ryan & Tilbury, 2006, p. 99). That report argues that EfS needs to be mainstreamed within pre-service teacher education and not just added on through the teaching of single units or marginalised content.

Teacher education then needs to be linked strategically to all parts of the teacher education system. Power (2006, p. 165) likewise suggests that to educate for the future, we need an education vision that 'restores harmony in human development by giving greater emphasis to the social, cultural and moral dimensions of education'. He argues that as a society and as members of colleges, schools and universities, we need to 'build a strong local and regional education community supporting the efforts of local and multilateral organizations committed to improving the quality of education for all' (Power, 2006, p. 173). Pre-service teacher education is one part of that vision.

There have been some reports of effective EfS teaching at university level, but none have been part of a system-wide approach to change. A team at the University of New England analysed the impact of a 14-week unit for primary teachers on their understanding of sustainability (Taylor et al, 2006). This course was designed to teach the pre-service teachers about how they might use the local environment in their teaching. Students conducted water and energy audits, investigated Landcare and biodiversity projects and learnt about programming for whole-school approaches.

The study found that knowledge and attitudes improved as a result of the course, although the authors point out that it is not possible to guarantee a transfer of this knowledge into teaching. A theoretical basis for development of a transdisciplinary approach to teaching Science and Mathematics with a sustainability focus is provided by Paige et al (2008). This teacher education unit incorporated a strong futures-visioning component, in accord with the EfS principle of teaching about inter-generational equity. A constructivist pedagogical approach was common between the linked disciplines and served to underpin the transdisciplinary course. Themes of interdependence, taking action and systems

thinking were incorporated. Paige et al (2008) describe the difficulties of establishing such a program in a system which does not support such efforts.

Development of such transdisciplinary approaches may be an important component of EfS, but as yet it is not supported by the institutional structures. McMillin and Dyball (2009) have reported success in their attempts to introduce a whole-of-university approach to EfS at the Australian National University (ANU). This university does not have a teacher education faculty, but may provide an interesting example of how the whole-school approach can be modelled at university level, thereby impacting on the next generation of teachers.

The Stage 2 project endeavoured to bring about mainstreaming of EfS in five Queensland universities (Ferreira et al, 2009). Some of the outcomes that are listed are:

- At one university sustainability was adopted across the faculty as a cross-disciplinary theme.
- At another, sustainability was embedded into courses on curriculum design, assessment and learning management through use of environment and sustainability related case examples.
- At some universities teacher educators attended workshops run by the team to increase their knowledge and awareness of sustainability.
- A number of teacher educators were interviewed and awareness was raised.
- At one university sustainability was adopted as a transdisciplinary priority.
- Team members now act as mentors to many staff in their departments, increasing EfS skills and providing resources.
- A new core unit on sustainability is being approved at one university.
- Students participated in a conference on sustainability.
- Students designed a forum on sustainability.

This study indicated that there are multiple sites of impact for action undertaken by a dedicated group. Student teachers can be exposed to learning about EfS in diverse ways, and changes can occur at policy and individual-student level. This work is ongoing and, while progress was made, it is not possible to claim that mainstreaming has yet been achieved.

Overall, the teaching of EfS to pre-service teachers in Australian teacher education institutions remains the province of isolated units. There continues to be a need to incorporate efforts to develop resources and units for EfS teaching into a holistic systems-based approach to change. However, there remain significant constraints to this sort of change within higher education systems. Some of these are discussed in the following section.

1.3 Enablers and constraints to embedding EfS in higher education

There are many factors that may influence how we can engage systems stakeholders to improve pre-service teacher competence for EfS delivery. Some enabling and constraining factors that have been found to be important are summarised here.

Moore (2005) examined her university from the perspective of sustainable practice and found four main barriers to inclusion of EfS into course work. These were:

- the discipline structure
- competitive nature of the environment
- multiple priority setting
- misdirected methods of evaluating progress.

Even though this university had set goals of inter-disciplinary and transdisciplinary course delivery, its methods of assessment and reporting reflected the competitive ethos of the traditional university organisation. It was therefore difficult to develop transdisciplinary programs.

There were signs that the university was changing. It may be that in the future the goals and policies currently being espoused will enable change away from competition between subject areas toward cross-curriculum initiatives such as EfS. The barrier of subject divisions is also reported by Dale and Newman (2009). The challenge of developing transdisciplinary units in EfS was corroborated by Pearson, Honeywood and O'Toole (2005). These authors argue that major restructuring of university teaching is needed if education for sustainable living is to be integrated.

Paige et al (2008) report on the design and teaching of a transdisciplinary unit in EfS. The Science and Mathematics staff of their university worked together to create a sequence of three core units that used ecological sustainability as their theme. One factor they regard as helping with this process was their relocation to a new campus. These groups were also building on a history of collaboration. The authors note the difficulties of timetabling and staffing. There was also a cost in terms of time taken to match the theoretical approaches of discipline teams. In getting the transdisciplinary courses up and running 'the key issue here is having the time and opportunities to meet, plan, research and evaluate projects that do not take us beyond our negotiated workload' (Paige et al, 2008, p. 30).

The busy nature of teacher educators' lives may act as a barrier to EfS integration (Scott & Gough, 2007; Ferreira et al, 2009). The competitive nature of the university environment contributes to this issue with workload. There is also a link to the crowded nature of the school curriculum. If each discipline area has to support pre-service teachers to learn a very dense content then staff will necessarily be focused on syllabus outcomes at the expense of design of innovative cross-curriculum units.

As Pearson et al (2005) have stated, the curriculum in NSW is very crowded. The extent to which this is a barrier may vary between education systems, depending on the degree to which content outcomes are specified. In Australia the new national curriculum may offer an opportunity to limit content and reduce the crowding of syllabus documents. This in turn may facilitate a focus on cross curriculum perspectives such as EfS.

One barrier to embedding EfS may be the complexity of the subject matter itself. Corney (2006) interviewed student Geography teachers and found that they struggled with ways to teach the wide range of issues they had grappled with. If this is true for Geography teachers it may also be true for those teaching teachers at university level. Even for those teacher educators who become aware of the need for more EfS there is a lack of research that illustrates successful teaching strategies. The *National Action Plan* (Commonwealth of Australia, 2009) describes EfS as a set of generic skills, including systems thinking, critical thinking and futures envisioning. Teaching with generic skills may reduce the sense of confusion created by a potentially diverse set of issues and knowledges related to specific environmental issues. However, one criticism of this approach is that it continues to fragment ecological sustainability at a time when holistic approaches are required (Sterling, 2009).

Corney (2006) and Summers (2005) find that the lack of EfS in schools has a feedback effect on pre-service teachers. If students do not encounter any EfS during their professional experience, either as trainee or initial teachers, they may not continue to develop and implement EfS initiatives. This would suggest that school education systems and university teacher education departments need to collaborate. Historically this has been complicated in Australia by higher education being administered federally while education systems are the prerogative of the states. The ARIES study of effective whole-school change emphasised the need to bring together the whole system and to identify and work with key agents of change to overcome these barriers of separation (Ferreira, Ryan and Tilbury, 2006).

Policy initiatives at education systems and university level may have a positive impact on sustainability inclusion in higher education. In Australia the effect of the National Action Plan for Education for Sustainability is yet to be estimated. The Talloires Declaration, a ten-point plan promoting action for environmental literacy in teaching and research, and sustainable campus management, had been signed by the universities participating in this project.

1. Sustainability and pre-service teacher education

This declaration is administered by the Association of University Leaders for a Sustainable Future and according to the organisation's website, (www.ulsf.org) currently has 350 signatories in 40 countries. McMillin & Dyball (2009) report that signing this declaration influenced the development of whole-of-university initiatives at the Australian National University. By contrast, Bekessy, Samson & Clarkson (2007) suggest that such non-binding declarations have failed to achieve the desired outcome of sustainability at Royal Melbourne Institute of Technology after 15 years of effort to implement action.

Two surveys of academics, selected through attendance at higher education workshops, were conducted by researchers from Royal Melbourne Institute of Technology (De la Harpe and Thomas, 2009). The respondents ranked facilitators of curriculum change leading to embedding of EfS. The items for ranking were determined by analysis of the literature. The conditions that were ranked as important all stemmed from action within rather than external to the university environment. This suggests that the participants construed themselves as empowered to change curriculum.

The conditions they regarded as important were:

- developing both informal and formal support to form a powerful guiding coalition
- developing an agreed vision or policy program to guide the institution's change
- providing resources for development and implementation
- developing an implementation strategy
- providing staff development opportunities
- modifying administrative systems and structures and perhaps individual work roles to assist lasting change
- including a monitoring program to assess the degree to which the desired change has occurred (p. 82).

Adopting top-down change was seen as not important by the participants in that study. The resultant desired process of change that these authors infer is very similar to the sub-project pattern adopted for the ARIES trial of the whole-school systems/action research model of Ferreira, Ryan and Tilbury (2006). That is, that change needs to occur at many levels. The process De la Harpe and Thomas (2009) propose is that key stakeholders form small groups, and develop a vision for action. Resources are then provided and a program of change is implemented. Professional learning needs of other staff are identified and resources are allocated accordingly. They see the aim of this intervention as embedding the changes, which requires a lasting modification of administrative structures. In a final step, a process of monitoring change is developed. This is an internal, led from within monitoring, rather than an externally imposed and monitored change. Such a process places responsibility on academics in teacher education departments to lead change towards EfS inclusion.

In summary, identified barriers to embedding EfS into teacher education include the lack of time to develop teaching units, the inhibitory nature of the university structure and the crowded nature of the curriculum. Despite these undoubted problems, the finding is that while more support to overcome these obstacles would be welcome, teacher educators are empowered to develop a teacher education course that will embed EfS. It is also worth noting that any barrier identified as being a problem in higher education appears to find a parallel in school education. Ultimately, with creativity, teachers and teacher educators can overcome constraints and find ways to incorporate EfS. The contribution of education related systems, and those who create policy, may be considered to be one of making this less of a challenge.

2 About the project

This report details the outcomes and recommendations of an action research project which aimed to embed education for sustainability into pre-service teacher education. This project, located in New South Wales and the Australian Capital Territory, was the third stage of an Australian Government funded program to support and improve uptake of whole-school models of teaching and learning EfS. This section provides an overview of the previous stages, and introduces the systems/action research methodology. This study is much more comprehensive than those previously undertaken. Most have focussed on university-level barriers and drivers, whereas this study sought to engage with the wider teacher education system. Application of the complex systems approach is also novel. We believe this report makes a significant contribution to understanding about further action that will need to be taken if we are to mainstream EfS in pre-service teacher education.

2.1 Whole-school approaches to sustainability

2.1.1 STAGE 1: MODELS FOR CHANGE

The first stage of this project reviewed models for professional development in pre-service teacher education (Ferreira, Ryan and Tilbury, 2006). Three models of professional development were identified, namely:

- the collaborative resource development and adaptation model
- the action research model
- the whole-of-system model (p. 9).

From this study a synthesised model that combines action research with whole-of-system approaches was developed. This model seeks to engage key stakeholders across the whole system so that change happens concurrently, leading to less resistance. Ownership by stakeholders is encouraged through the iterative action research process.

2.1.2 STAGE 2: IMPLEMENTING THE SYSTEMS CHANGE/ ACTION RESEARCH MODEL

The Stage 2 project piloted the whole system/action research model in the Queensland Education system. This project mapped the system and identified key agents of change. These stakeholders then implemented systems change in their institutions. A range of outcomes were reported (see section 1.2). The finding of this study was that the model was 'able to facilitate organisational and systemic change over time' (Ferreira et al, 2009, p. 1). Effective change was dependent on the key agents of change having knowledge of systems change processes. Systems change was found to take time, and it may be necessary to provide funds to buy time if such broad ranging change is sought.

2.1.3 STAGE 3: ENABLERS AND CONSTRAINTS TO SYSTEMS CHANGE

The Stage 3 project uses the same whole system/action research model to initiate mainstreaming of EfS in pre-service teacher education in NSW and the ACT. Due to the short time frame of this study the emphasis was on mapping systems, identifying key agents of change and establishing the baseline conditions under which system change could occur. This report focuses on the enablers and constraints to mainstreaming EfS that were identified. It is anticipated that ongoing action research will facilitate further change in 2010. Further action in Queensland was also supported as part of the Stage 3 project.

2.2 Project objectives

Within the overarching guideline set out in the *National Action Plan* (Commonwealth of Australia, 2009) the aim of this project was to:

- Map the education systems in the ACT and NSW.
- Identify enablers and constraints to mainstreaming education for sustainability in those systems.
- Facilitate conversations within systems to bring about change toward mainstreaming EfS.
- Support ongoing systems change in Queensland.

The research question to be investigated was: How to engage key stakeholders within teacher education systems to directly influence and mainstream Education for Sustainability within pre-service teacher education and improve opportunities for trainee teachers to develop knowledge and competence in this area?

2. About the project

2.3 Methodology: Action research and education for sustainability

2.3.1 THE SYSTEMS/ACTION RESEARCH MODEL

The model for effective change developed by ARIES in the Stage 1 review and trialled in the Stage 2 project formed the basis for the Stage 3 study. Individual agents of change who might engage in action research and exert influence on the wider system that impacts on teacher education were identified. A map of the Queensland system that impacted on teacher education, showing potential agents of change, is shown in Figure 1 (Ferreira et al, 2009, p. 4).

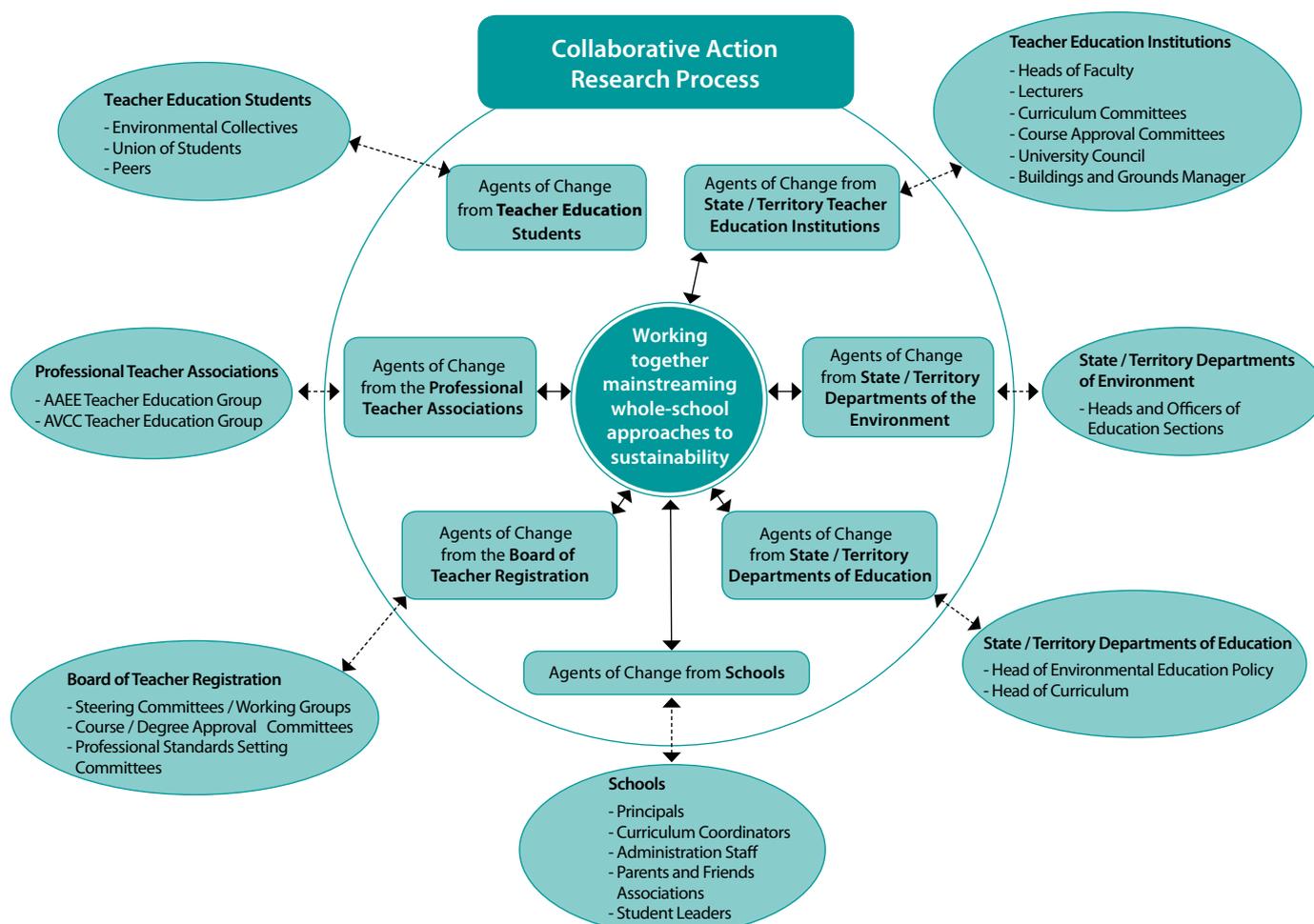
Teacher education is conceptualised as a self-organising complex system. These types of systems exist in the natural world and are inherently difficult to explain or control. An example is an

ecosystem, where the intervention of removing an insect can affect a food chain that eventually leads to the loss of major predators and a rearrangement of the entire ecosystem. In other circumstances a new species may enter a habitat, be absorbed relatively easily and a new equilibrium be established without there seeming to be a negative or positive effect.

Features of self-organising complex systems are that they:

- are derived from simple structures
- contain feedback loops that modulate emerging structure
- are nested hierarchies, leading to a need to continually interrelate global and local effects
- show remoteness of cause and effect
- initiate and respond in such a way that small changes can cause large effects
- operate far from equilibrium
- are open to the environment (Steele, 2009).

Figure 1. Mainstreaming EfS model



In such systems cause and effect are hard to recognise and measure. Influences and actions undertaken may have unexpected results, and these manifest in non-linear ways. For example, a communication undertaken at one point in time may seem to have no impact on change, yet years later may trigger an action that has a profound effect. This makes the success of any action or intervention in the system very difficult to estimate. However, all actions have potentially large consequences.

2.3.2 ACTION RESEARCH

Within the complex system model, change is initiated through action research. This project adopts a similar model of action research to that explained in depth in the Stage 2 report. The model is based on the work of Kemmis and McTaggart (2000). It is not the aim to reproduce that discussion here. In brief, participatory action research involves cycles of action followed by reflection (Figure 2). Participants define a problem, plan and evaluate action, then reflect on the action. A second or third cycle of action may then be initiated that incorporates the learning from previous action/reflection cycles. Action research is collaborative, social and reflexive (Kemmis and McTaggart, 2005).

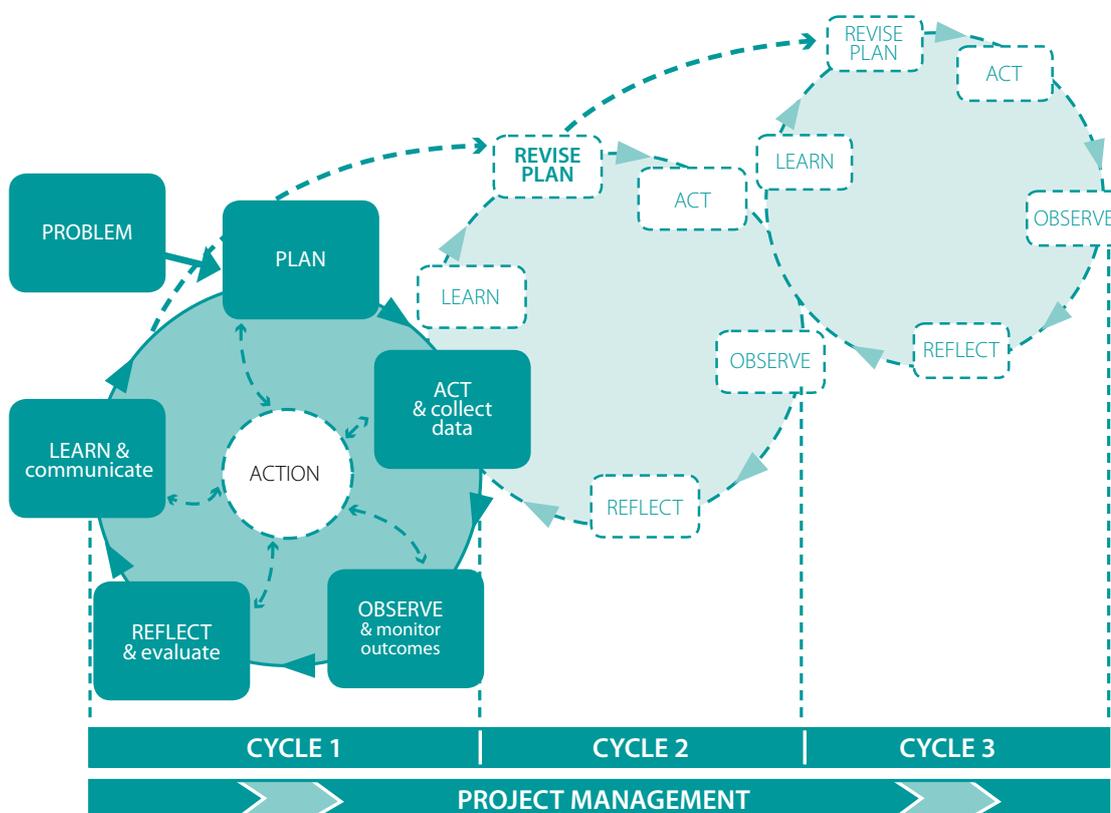
As noted by Thomas and Benn (2009, p. 21):

In practice the phases are not neatly sequential or as clearly defined as the cycles above portray, but this model provides a useful structure for the process of learning, tied to more effective action. An action learning approach to systemic practice in complex sustainability issues can provide a basis for informed, flexible adaptive thinking for managing 'messy' or complex problems.

This action research approach was applied to the complex problem of change in the teacher education system. In a more recent article, Kemmis (2008) reviews the original model in the light of Habermas's theories of the collision between lifeworld and system. He argues that:

Action research must work in the conversations and communications of and with participants about crises and difficulties confronted by social systems and lifeworlds in which people find meaning, solidarity and significance. (Kemmis, 2008, p.2).

Figure 2. ARIES action research cycles



2. About the project

He acknowledges the complex processes that underpin praxis when action is carried out in the real world and involves many interacting lifeworlds and systems. In his view participatory action research must become critical in the sense of examining these complex interactions. He states:

In critical participatory action research, participants aim to be 'critical' in this way – trying to find how particular perspectives, social structures and practices 'conspire' to produce untoward effects, with the aim of finding ways to change things so these consequences can be avoided – acting negatively against identified irrationality, injustice and suffering, rather than for some pre-determined view of what is to count as rational or just or good for mankind. (Kemmis, 2008, p.8).

This resembles the destabilising approach recommended by Plowman et al (2004) and Hill (2009). In order to reach a new (better) equilibrium we must disrupt an accepted way of behaving, reach a new perspective. EFS, by its nature, is about asking all of us to develop a new perspective on how we interact with the natural world. This study critically reflects on factors that impact on change toward incorporation of EFS into teacher education. Initiating and developing conversation was the primary form of action. This report recommends further action to minimise constraints and enable effective change.

The Stage 3 project can be conceptualised as the third cycle in an action research process that began with the literature review of Stage 1. In Stage 3 the action taken by ARIES was to assemble a collaborative group to investigate enablers and constraints to embedding EFS in teacher education. Within that group four distinct sub-projects were established, each based in teacher education institutions in NSW and the ACT. The sub-project leaders can be conceptualised as participating in collective action through the mediation of ARIES. Individual sub-projects implemented qualitative research projects with the core aim of identifying the enablers and constraints to embedding EFS within their teacher education programs. This third stage of the research identified the context and conditions for future action, but did not attempt to implement teaching strategies or revision of policy. The reason for this was the short time frame of the funding for sub-projects (four months).

2.3.3 ACTIONS IN DEPTH: ARIES

Key agents of change

Sub-project participant teams (2) were first recruited from amongst those who had responded to the Expression of Interest (EOI) conducted for Stage 2. Two other teams were identified through networks of ARIES contacts. The aim of this process was to recruit agents of change from among those already active in their institutions. Each team included researchers with an established reputation in the field. Other agents of change were identified by web searches and by consultation with practitioners located through ARIES networks.

Participants included representatives of:

- ACT Department of Education and Training (2)
- ACT Australian Sustainable Schools Initiative (2)
- Australian Government Department of Environment, Water, Heritage and the Arts (2)
- ACT Teacher Education Institutions (5)
- NSW Department of Education and Training (1)
- NSW Institute of Teachers (1)
- NSW Teacher Education Institutions (10)

The project also recruited a key informant, Professor Stuart Hill, who is a recognised leader in EFS research and practice. A leader of the Stage 2 project, Lisa Ryan, provided mentoring in methodology.

The recruitment process marked the beginning of the conceptualisation of this project as action research. A principal method of data gathering in action-oriented projects is the reflective journal. From this stage onwards a journal was kept, all actions were recorded and became the subject of reflection.

Development of sub-projects

Each team was sent a copy of a project outline, agreed with the funding body (DEWHA), that detailed the core aims of the project (Appendix 1). Using this framework each project was then negotiated with the team involved. Each team subsequently developed a sub-project outline. Project details were refined in negotiation with DEWHA. Sub-project outlines were also presented to, and discussed by, the whole project team at the initial forum held by ARIES. The methodology of each sub-project is described in Section 3.

Opening Communicative spaces

In order to create an opportunity for both group cohesion and interaction between all parts of the systems, ARIES conducted three fora. The first, held in Sydney, brought together the project teams (two representatives per project) with representatives of NSWDET and NSWIT. A mentor from the Stage 2 project, the key informant and interested teacher educators from the host university also attended. The aim was to introduce everyone to the project and to create an opportunity for conversation about what might be needed to embed EfS in teacher education. An envisioning exercise was conducted to establish views on what we expected to achieve for the teacher education system. The key informant and mentor from Stage 2 introduced participants to methods of bringing about change, based on their experiences.

A similar opportunity was then created within the ACT teacher education system. At this second meeting the outcomes of the first forum were presented by the project leader. The forum was attended by five teacher educators, representing the two teacher education institutions, and representatives of ACT AuSSI (2), DEWHA (2) and ACT DET (2). Following an envisioning activity an open discussion was held, addressing ways that change could be achieved within the ACT teacher education system.

A final forum was held to analyse the findings of the project. It was intended that this meeting would lead to further involvement of systems representatives to promote ongoing action. However, the constraint of time meant that only sub-project teams were present at this meeting. Further conversations have been held with systems representatives through phone, email and personal contact to progress the ideas developed in the early meetings. A summary of the fora actions and purposes is listed in Appendix 2.

All sessions at the first and second fora were transcribed and the transcripts were used as data. Permission was sought from all participants to use the information collected and all were fully informed of their right to withdraw any information. All were sent a copy of the transcripts and the draft report. All amendments are incorporated in the final report. This study was approved by the Ethics Review Committee of Macquarie University.

Data analysis

Each sub-project conducted an analysis of the data for that project. Each sub-project then wrote and presented a report at the final forum. As this was a complex project involving a number of groups conducting participatory action research, a similar methodology to that suggested by Westhues et al (2008) was applied. The team of project leaders (10) brought together at the forum engaged in a combined analysis and theory building process. Although projects used different methodology, each was focussed on identifying

enablers and constraints to embedding EfS into pre-service teacher education. The combined data analysis was focused on identifying, describing and theorising about the themes relating to these enablers and constraints. The theory building team developed a final framework that formed the basis of the report. This process is summarised in Appendix 3.

Validity

Westhues et al (2008) use three indicators of validity:

- communicative, analysing data collaboratively
- craftsmanship, which involves weaving together varied data sources, constant exploration of codes and categories and plurality of project membership
- pragmatic, the extent to which practitioners take up the model.

These three indicators form the basis of the validity claims of this project. We actively involved participants, outside experts (key informant, mentors) and systems representatives in sub-project design and data analysis. There was a high degree of overlap between the themes identified by each group regarding enablers and constraints. The model is now in the third round of development and has continued to motivate actions in the Queensland teacher education system.

Other actions

As well as facilitating the sub-projects and fora, the project leader also:

- analysed documents relating to policy in each university in the study
- attended the Australian Campuses Towards Sustainability Conference
- participated in activities organised by Macquarie University relating to sustainable campus or curriculum
- established a Basecamp website for exchange of documents, findings and literature.

Reflections on these events were recorded in the journal.

To support ongoing work in Queensland the five universities in the Stage 2 study were asked to write a short case study that could be placed on the ARIES website. The project leaders from each participating university conducted a workshop at each site to disseminate the findings of the Stage 2 project and to build capacity for change through conversations.

3 Overview of the sub-projects

One aim of this project was to open conversations with agents of change and, through them, with members of their organisations. The four sub-projects conducted in teacher education institutions were opportunities for ARIES to create dialogue with the teams and between the teams, and for them to talk with their colleagues.

In this co-participatory spirit the sub-project teams were asked to develop their own frameworks, methodologies and ways of reporting. Each study was negotiated to be appropriate to context, within the overarching guidelines provided by ARIES. These guidelines asked each project team to identify the enablers and constraints to mainstreaming EfS in their system, and contribute these to the ARIES study of systemic change. Findings relating to enablers and constraints are presented in Section 4. This section gives a brief review of the objectives and outcomes of each sub-project.

3.1 Charles Sturt University study

3.1.1 CONTEXT

Charles Sturt University (CSU) has embraced sustainability as a criterion for monitoring its operations and over the past few years the university has shown, through various operational and curriculum initiatives, that it values EfS. The CSU context is one in which the university and the faculty of education has made substantial commitment to activities towards sustainability. The most significant is the *Inland Living Experience*, conducted at the Thurgoona campus in Albury, that has involved networking with local sustainability groups and the local education community. The Faculty of Education is currently building stronger connections and collaborations within its cross-campus teacher education courses.

This time of transformation was seen as opportune for the development of the project to increase the implementation of EfS. The University has a number of committed champions of EfS who were willing to develop a project that would 'spread commitment to and practical implementation of EfS' in their teacher education curricula.

3.1.2 RESEARCH AIMS

The aims of the CSU project were outlined as:

- investigating possibilities and issues concerning the implementation of identified university *subjects in EfS* and *EfS modules*
- planning action to *implement* several such initiatives for teaching in 2010 and beyond
- establishing a research program of *self-reflective research* to sustain action and reflection on EfS in the teacher education curriculum.

3.1.3 METHOD OF THE STUDY

The CSU study took the approach of 'conversations about the practice of EfS (Kemmis & Mutton, 2009) and how this practice could be implemented in teacher education courses'. Initial interviews were held with those who had an interest in EfS across the faculty. These conversations then led to the development of a 'research group undertaking a kind of participatory action research exploring our own practices'.

Data was collected from conversations with:

- fourteen members of staff involved with 18 of the 38 teacher education courses
- representatives of staff at three campuses involved in teacher education
- five representatives of university and faculty groups involved with sustainability initiatives.

Transcripts of conversations were then examined by 'two members of the research team who made independent analyses of the transcripts to identify key themes (topics around which significant views, issues or concerns clustered)' (CSU project report). These analysts found good agreement on key themes. The analyses were then combined and integrated, and key quotes that illustrated the themes were collected together. Themes were discussed with other members of the sub-project team and agreement reached on the outcomes to be reported.

Another level of analysis linked the identified themes to the conceptual framework of ecologies of practice being developed by the wider research group (Kemmis and Mutton, 2009).

3.1.4 OUTCOMES

This study contributed to the ARIES project and identified a number of enablers and constraints to implementation of EFS at CSU. Other outcomes were:

- identification of a number of key agents of change within the Faculty of Education
- development of a self-reflective group to continue investigation of the possibilities for inclusion of EFS within the faculty
- contribution to raised awareness of EFS as an important issue within the faculty and university
- information amassed about what is currently being done and what needs to be done, which acts as a baseline for action to be taken in 2010
- increased networks with other universities and members of the education system concerned about sustainability.

3.2 University of New England study

3.2.1 CONTEXT

The University of New England (UNE) School of Education in Armidale provides teacher education to students located in rural and regional areas, many of whom are located off-campus. The university has recently revised its programs in response to teacher accreditation requirements of the NSW Institute of Teachers. The university had lately formed a *Talloires Declaration Committee*, and this group, which included participants in the sub-project, were in the processing of determining how much EFS was currently incorporated in units taught across the university.

The ARIES project became an extension of this university-wide study, focussing in the area of teacher education. Eight members of the School of Education collaborated to hold conversations with fellow staff about current EFS teaching and future plans for EFS in their school. A number of members of the school had previously collaborated on a book that showcased innovative ways to incorporate EFS in the primary curriculum (Littledyke, Taylor and Eames, 2009).

3.2.2 RESEARCH AIMS

The main research question was: 'How can EFS be promoted in teacher education courses at UNE?'

The project undertook to:

- map the current practice EFS across all pre-service teacher awards at UNE
- identify enablers and constraints to the embedding of EFS
- identify academics' aspirations in increasing EFS profile within teacher pre-service education
- identify points of change and instigate action plans for promotion of EFS.

3.2.3 METHOD OF THE STUDY

The research utilised a mixed methods approach. Two survey instruments were designed and applied (online) to determine the extent of EFS teaching in the pre-service teacher education program. A total of 83 units were audited. Fifteen semi-structured interviews were conducted with key staff from a range of curriculum areas. The first survey measured the current practice using indicators based in ecological, social, political and economic sustainability.

The second survey concentrated on unit coordinators' perceptions of sustainability. Respondents were asked to identify enablers and constraints to incorporating EFS in their units. Questions were also included that asked respondents to identify personal practices regarding sustainability, and some demographic data were obtained. The interviews probed more deeply into individual perceptions of EFS and followed on from the second survey.

Interview questions focussed on:

- understanding of sustainability
- views of the importance of EFS
- barriers and opportunities for EFS in teacher education
- personal actions for sustainability.

Interviews were transcribed and analysed by thematic coding; the survey data were provisionally analysed using the Analysis functions of Survey Monkey. Additional analysis is being undertaken subsequent to the project reporting.

3. Overview of the sub-projects

3.2.4 OUTCOMES

In undertaking an action research study, much of the learning derives from the reflections and learnings of project teams as they develop their findings. These are in addition to gains from the conversations held with other participants. Outcomes relating to enablers and constraints for inclusion of EfS are dealt with in depth in Section 4.

This sub-project reported a number of other outcomes of the research process and the data analysis:

- raised awareness within the school through the interview process
- raised awareness in interviewers of issues in implementing change
- assembly of baseline data to enable future action on EfS teaching
- development of possible strategies for facilitating EfS as part of university policy and within the education faculty.

3.3 University of Technology, Sydney study

3.3.1 CONTEXT

The University of Technology, Sydney (UTS) is a signatory to the *Talloires Declaration*, and has incorporated sustainable principles into its mission statement. The university is home to the Institute for Sustainable Futures, which conducts research in EfS. Teacher education is located at the university's Kuring-gai campus, a building surrounded by national park and immersed in natural bushland. This site, and its proposed sale, became a galvanising action for this study of EfS in pre-service teacher education.

The project focussed on the dissonance between pre-service teachers' views of EfS and the practice they encountered at university. Members of the teaching staff were interviewed about enablers and constraints to inclusion of EfS. Levels of current EfS practice were also estimated. The sub-project team consisted of two enthusiasts who endeavoured to interest their peers in joining a larger group, but with little success. This reluctance to participate was attributed to internal factors such as low morale, lack of resourcing and time pressures.

3.3.2 RESEARCH AIMS

The research question that was addressed by the UTS study was: 'What is the nature of any barriers to mainstreaming EfS in the BEd (primary) program at UTS?'

The study aimed to identify:

- understandings of EfS amongst participants
- the current state of EfS in teaching subjects
- opportunities that exist to raise the profile of EfS in the Bachelor of Education (BEd) subjects
- the nature and impact of University policies relating to EfS.

3.3.3 METHOD OF THE STUDY

This sub-project adopted Kemmis and Grootenboer's (2008) framework which relates the sayings and doings of participants and seeks to embed these within the broader social-political dimension. A series of three focus groups were conducted with the investigators, who were teachers of Science and Human Society and its Environment (HSIE), and lecturers in four other Key Learning Areas: Creative Arts; English; Personal Development, Health and Physical Education (PDHPE); and Mathematics).

Participants were encouraged to talk about their current teaching, and barriers and opportunities for including EfS in their programs. The discussion also covered the question: 'What do we understand by EfS?' A cohort of students (120) was invited to develop responses to a scenario presented in class and to discuss EfS projects that might be undertaken as part of their learning. Students were encouraged to critically reflect on the environment they encountered at university and in what ways this could be construed as sustainable. The implications for action were debated. Field notes of classroom debates were kept as sources of data.

3.3.4 OUTCOMES

This sub-project delivered a series of conversations with students and staff about EfS. Students stated their willingness to undertake projects relating to EfS within the university. The staff reported that some EfS is currently taught but time constraints prevent the prioritising of EfS at this stage. Other enablers and constraints are detailed in Section 4.

The project leaders reported that other outcomes were:

- willingness of some staff to increase their knowledge on Efs issues
- willingness of staff members to modify their lifestyle choices to reflect concern for sustainable living
- development of a list questions that now need to be addressed for more systemic change leading to Efs inclusion
- opportunity to present the project at a (subject area related) conference
- increased understanding of the project leaders about university policy and constraints to action.

3.4 Australian Capital Territory study

3.4.1 CONTEXT

This sub-project involved collaboration between the two major teacher education institutions in the ACT, the Australian Catholic University (ACU) and the University of Canberra (UC). The ACU Canberra campus is one of many linked institutions across Australia. Their mission statement reflects the concern of the Catholic Church for stewardship of the environment. University of Canberra is a signatory to the *Talloires Declaration* and is currently developing a new major and minor in sustainability, in recognition of its importance.

One teacher educator from each institution developed a unit of teaching for primary pre-service teachers within the Science and Technology subject area. Each unit was taught and then evaluated. These teacher educators have a long history of collaboration with each other. They also work closely with the AuSSI schools in their region, and the units were designed to maximise input from outside collaborators. Pre-service teachers were actively encouraged to learn about and participate in whole-school projects. The project team also initiated conversations with other members of the teaching staff about Efs, to identify enablers and constraints in their system.

The researchers commented that the project provided 'a valuable opportunity to exchange insights on what was happening in the two universities'. They reported that 'the timing was strategic and provided an opportunity to do valuable background research which would underpin bringing existing disparate and fragmented efforts into a coordinated course'.

3.4.2 RESEARCH AIMS

The aims of the study were:

- evaluation of the development of student understandings about sustainability in Science & Technology teacher education units at two universities
- mapping of factors which impact on the teaching of Efs in teacher education courses, in order to identify ways to enhance systems approaches to change in pre-service teacher education
- mapping of existing Efs links between Science & Technology and Studies of Society and Environment (SOSE) teacher education units at two universities
- development of an annotated bibliography of Efs resources.

3.4.3 METHOD OF THE STUDY

An audit of units across both campuses identified the presence of Efs principles. The extent of Efs teaching in five units: Science and Technology (UC and ACU); SOSE (UC and ACU) and Religious Education (ACU), was measured using a survey instrument. Categories of Efs content and skills measured were developed from the list of Efs principles provided by the Australian Government document *Living Sustainably* (Commonwealth of Australia, 2009, p. 9). Following discussion with the UNE team a lecturer survey, based on the same Efs principles, was used to determine pedagogical practices in the classroom. These Efs principles were also mapped against the graduate attributes of each university.

A survey of student attitudes was adapted from Hoy's Science Teacher Efficacy Belief Instrument. It was intended that pre- and post-testing would be carried out, but ethics approval was not obtained in time to measure student understanding at the beginning of the semester. A total of 37 students were surveyed. At UC students were in their 2nd year of study, at ACU in the final (4th) year. The survey measured the extent to which the unit enhanced the learning of students, affected student efficacy in teaching Efs, and increased student understanding of opportunities in schools.

Focus groups were conducted with students (three groups) and staff (one group). In these discussions students were encouraged to discuss how they saw their future role as teachers and their contribution to sustainability. The project had a commitment to listening to student views and expressing their concerns. Staff were invited to take part in discussions about enablers and constraints to implementing Efs in teacher education at the two institutions. Participants were also asked to reflect on their own aspirations and what would be needed for the incorporation of Efs into their teaching units.

3. Overview of the sub-projects

This project was conceptualised by the two project leaders as being action research. They were taking the action of teaching a unit, evaluating the effectiveness of the teaching in enhancing student learning, and then reflecting on that action (see Figure 2). Reflective journals were used to record the events and subsequent analysis.

Data from student surveys were recorded as percentages and graphed. Cumulative results of staff surveys were graphed to see which units addressed the principles and content. Data from focus groups were grouped into themes.

3.4.4 OUTCOMES

The action of engaging students and staff in conversation can stimulate change in wide ranging, although not always measurable, ways. The students in the unit at UC prepared posters for presentation to VIPs and parents. Many of the posters were on EFS related issues. These posters were presented to the ARIES project team and their quality was very impressive. Through this project the actions taken in the course could potentially increase the sphere of influence of the students, one of the objectives of both this sub-project and the overarching ARIES study. The ACT project directly engaged a high proportion of current pre-service teachers in that state, introducing them to whole-school projects.

The project also:

- developed baseline maps of what is currently being taught
- made overt links between university policies and teacher education
- identified enablers and constraints to implementation of EFS in the curriculum
- raised awareness amongst staff of what is being done and needs to be done
- increased connections between the two universities
- extended collaborations between the universities and other EFS providers such as AuSSI, the Commonwealth Scientific and Industrial Research Organisation (CSIRO), and Engineers without Borders
- increased professional communication at staff meetings.

3.5 Overview of sub-project outcomes

All of the sub-projects were able to increase awareness within their schools/universities about issues related to teaching EFS. Each sub-project reported that the opportunity to participate in the ARIES project came at a strategic time, when change was happening elsewhere, and the issue of EFS needed to be addressed. The outcomes have dovetailed with that change process. All teams were also able to extend or develop networks with their fellow teacher educators. Participation in the project also focussed attention on university policy that might support the EFS related initiatives.

Each team attended ARIES forums and participated in the mapping of the wider system. They contributed to the data gathering and analysis for the research on enablers and constraints that is discussed in Section 4. This research process was well regarded by the teams, as it increased both their professional networks and their knowledge of EFS. Relevant literature was shared and discussed, and there is evidence in the reports of its being incorporated into research design and analysis. The Basecamp site was intended to support this process and did offer an opportunity for some teams to consult documents. However, it was found that exchanges of emails were more effective than the centralised website. Overall, participation in the project developed skills and knowledge about EFS and about change processes.

The participating university departments now have available to them informed agents of change, who have mapped the baseline of what is being done and what needs now to be achieved if EFS is to be given a place in the university curriculum. This alone represents a considerable resource derived from a six-month project. Sub-project teams were enthusiastic to proceed with what they had begun. This study offered them the first step, and leverage for change. Two universities have increased the awareness of their students about whole-school approaches through teaching activities. The other teacher education faculties are looking at ways to increase student exposure to EFS in 2010. They now have plans, or at least further questions, that will enable this to happen.

Given the timeframe and funding constraints, parties felt that an amazing amount had been achieved. Team members considered that ongoing funding would enable them to harness the momentum and continue the work.

4 Enablers and constraints to mainstreaming Efs

The outcomes of each sub-project summarised in Section 3 were to some extent related to the individual designs negotiated with ARIES, and are pertinent to the context of each teacher education institution. The projects were designed to be the foundation for further action within those contexts. The common ground between each project was a focus on enablers and constraints to mainstreaming Efs within their context, in accord with the goals of the *National Action Plan*.

At a forum held at the completion of the project themes relating to enablers and constraints were presented, discussed and further combined into overarching themes. This section presents the synthesised findings of the ARIES project and the four sub-projects.

In developing this study of enablers and constraints it became clear that these largely represent a dichotomy. For every enabler that can be identified its lack, or opposite, can be construed as a constraint. In listing enablers we are delineating actions or processes that can be undertaken that will facilitate the embedding of Efs. This project developed quite an extensive list. However, it is also pertinent to ask to what extent the enablers are most evident – and to what extent the constraints are most applied – within the individual teacher education institutions and the education system. This section is organised according to five overarching actions we found to be enabling, and their associated constraints.

The five actions that were identified as enabling were:

- collaborating for curriculum change
- developing an ethos of sustainable practice
- connecting existing Efs content
- creating opportunities for integrated programs
- providing experiential learning.

Each sub-section discusses the degree to which the enablers or the constraints were emphasised within the wider teacher education system.

4.1 Collaborating for curriculum change

The teacher education system represented by Figure 1 encompasses a range of formal institutions that are interlinked yet often act separately. The findings of the study are that there are points of tension within this array of organisations, and goals may not always be compatible. The diversity of structures can lead to opportunity for greater variety and depth of knowledge development but it can also lead to fragmentation into ‘silos’ which compete and conflict. Therefore within this complex system collaboration was found to be an enabler, and lack of collaboration a constraint. The points at which tension was observed, and the associated instances of collaboration/lack of collaboration are summarised in Table 1, then discussed in depth below.

Table 1 Opportunities for collaboration

Tension point	Enabler	Constraint
National curriculum	National and state educational jurisdictions collaborate to combine whole-school approaches with curriculum initiatives	Efs falls between cracks
National teacher accreditation standards	States collaborate to develop new standards to promote Efs in teacher education	National standards reflect current lack of Efs in each set of state accreditation criteria
State curriculum	National and state bodies collaborate to define the best way to complement AuSSI and existing curriculum initiatives	Divisions exist in how Efs is taught in schools, leading to lack of support for whole-school projects
University curriculum	Collaboration and networking between teacher educators leads to integrated units, increased skill growth	Silo organisation of subjects, lack of conversation leads to poor awareness of whole-school opportunities

4. Enablers and constraints to mainstreaming EfS

4.1.1 NATIONAL CURRICULUM

ARIES project participants agreed that we have an opportunity with the national curriculum to facilitate teaching of EfS in schools and this in turn will make the need to teach EfS much more visible to those who teach teachers. This visibility will occur as the national syllabus influences the re-development of state curricula and through increased observation of whole-school EfS practice as sessional staff enter teacher education institutions, pre-service teachers undergo practicum experiences and academic staff work with schools.

In the longer term a national curriculum could become an enabler of EfS teaching. A strong representation was made by one participant from a state education department that we should avoid the marginalisation of EfS as we enter into a future dominated by issues such as global warming.

A number of participants in NSW and ACT were concerned about the dividing up of the national curriculum development process, and the reproduction of traditional subject disciplines. The division of EfS into subject areas was considered to be antithetical to EfS core attributes such as systems thinking and participatory action. Feedback through the project network was that the Australian Government Department of Education, Employment and Workplace Relations had been consulted about this and were ensuring that curriculum writers had access to expertise in EfS.

It was reported that discussions were taking place between the body developing curriculum, Australian Curriculum, Assessment and Reporting Authority (ACARA), and those concerned with curriculum development, such as the Australian Association for Environmental Education (AAEE), state departments of education and also a youth group concerned with sustainability issues. Collaboration between such bodies and ACARA is regarded as essential to the development of a supportive national curriculum, which many strongly felt should have EfS as a core principle that guides other curriculum outcomes.

Some university-based participants placed less emphasis on the national curriculum as an enabler. Although they supported the development of a strong EfS component, there was some cynicism about the ability of such a process to deliver such an outcome. One experienced EfS researcher advocated just working within the mandated content. Others observed that many were 'just doing it', and a number of the participants in the project were themselves involved in innovative school and/or university programs that were not mandated, or even supported, by their subject curriculum. Overall, the feeling was that a supportive national curriculum is an opportunity, but other ways of teaching EfS can and will be found.

Although the interesting thing, when you look at practice is that people are just doing it. So the schools I am involved with in the biodiversity monitoring, people are just biting the bullet and going ahead. 'Don't wait for policy, don't wait for things to be mandatory, just know intuitively how you want to go about this, just go ahead'. I feel the area would benefit from being made explicit. Being able to see where environmental education or EfS appears in a teacher education program, or in school curriculum documents so that it is apparent and it is expressed.

(Participant, Forum 1)

Studies have shown that failure to incorporate EfS holistically into the national curriculum has been a barrier to effective change in the UK (Littledyke, 2007; Ofsted, 2008). In the Stage 2 study the importance of engaging with the national curriculum process was highlighted, and the recommendation was that the national system should be mapped and key agents of change identified. The findings of the NSW/ACT report would support that recommendation.

Unless there are advances made to the Institute of Teachers ... to say that sustainability should be something that is considered at a government level, as something that's useful for teachers to have...

(Participant, CSU)

4.1.2 NATIONAL TEACHER ACCREDITATION STANDARDS

The finding of this study is that there has been little negotiation with the NSW Institute of Teachers (which impacts also on accreditation of ACT graduates) regarding EfS. The ARIES project communicated with this organisation and a representative attended the first forum. A formal briefing document presented to the meeting stated that 'we will support and encourage teachers through professional development and initial teacher education in areas of sustainability and environmental education'. The need to mandate change was discussed, but the position taken was that NSWIT were unable to alter current accreditation criteria while national standards were being developed.

The suggestion made was that the project team might engage with this process. As with the national curriculum, national teacher accreditation standards may offer an opportunity to help incorporate EfS into teacher education. Collaboration with teacher educators and other organisations such as AuSSI and Sustainable Schools NSW (SSNSW) may enable the development of appropriate national teacher accreditation standards.

The participants in fora and in sub-projects were adamant that in its current form the NSWIT teacher accreditation process was a constraint to embedding EfS. Each of the NSW universities contacted regarding participation in this project (six) were undergoing major revision of unit structures. This time burden prevented them from engaging with a revision of units to embed EfS. The application of the existing standards had also meant that a number of participants, who themselves were passionate advocates of sustainability, had been obliged to remove EfS to make space for other NSWIT mandated teaching and learning. Given that national standards are being developed, and possibly with existing state criteria forming the basis, it will be important to ensure that lack of dialogue and negotiation around this process doesn't become a constraint.

I am in the science stream and I have to teach a number of units. I am in the process of having to go through and take out EfS to satisfy curriculum and NSWIT accreditation requirements.

(Participant, Forum 1)

4.1.3 STATE CURRICULA

[Canberra context]

Easier to collaborate with people with similar interest in close proximity.

Knowledge within the community is very important.

(Notes made from forum presentation by ACT educators)

In the forum involving representatives of the ACT education system it was apparent that there was extensive collaboration between the teacher educators teaching EfS within a science unit, the coordinators of the AuSSI program in that state and those in the region who work with schools active in the AuSSI program.

This level of collaboration was an enabler of embedding EfS within these systems. The AuSSI team reported that they were able to support the *Every Chance to Learn* framework in the ACT curriculum that states 'the student acts for an environmentally sustainable future' (ACT Government, p. 13).

By contrast the participants from NSW teacher education institutions were not as involved with the Sustainable Schools NSW initiatives. One reason for this difference was the high number of schools in NSW relative to the number of coordinators for sustainable schools programs. Proximity is also a factor, as the distances that would need to be travelled in NSW to support this level of collaboration would be prohibitive.

The suggestion made here is that collaboration between curriculum making bodies, departments of education and sustainable schools initiatives supports an integrated curriculum. Direct collaboration between sustainable schools coordinators and university teacher educators may facilitate the delivery of EfS to pre-service teachers. Once a critical mass of schools has developed a collaboration with a program such as AuSSI (83% in the ACT), the pre-service teachers encounter whole-school approaches on their practicum. This drives the incorporation of EfS within the teacher education institution. The ARIES project observed this feedback cycle in operation in the ACT.

I found this really useful, AuSSI works. I have seen it in many schools, this has helped my own understanding.

(UC student, regarding unit of teaching with AuSSI collaborators)

4.1.4 UNIVERSITY CURRICULA

The structures don't allow connections between science educators or the scientists and education people across campuses in the sort of networking that could support something here.

(TE CSU)

There was widespread agreement amongst participants that EfS should be located within the curriculum as a cross-disciplinary perspective. This is in line with the objective of the ARIES project, which is to embed the whole-school approach to EfS. The silo nature of university subjects, and consequent lack of collaboration, was found to inhibit EfS teaching.

4. Enablers and constraints to mainstreaming EfS

One sub-project report wrote about a 'habitat' for EfS in university programs, questioning whether it might belong in Science or Geography. This team noted that Geography, which is currently part of HSIE in NSW, may again be separated from History and Social Science in a national curriculum. Several sub-project teams observed that if EfS is perceived to belong to one subject area, those in other KLAs will not become aware of the need for whole-school approaches or develop the necessary skills.

The lecturers involved expressed their appreciation of the opportunity for a professional conversation about their understanding and a desire for more. They demonstrated appreciation of the points of view of others and a holistic way of viewing EfS.

(ACT focus group)

Transdisciplinary units have been suggested by others (Paige et al 2008) as being a more appropriate means of teaching EfS. To develop such units would require extensive networking, often across campuses. Therefore we suggest that collaboration between subject groups is a significant enabler of effective EfS delivery, and lack of collaboration is a constraint. At the present time, in both NSW and the ACT, and at both school and university level, subject divisions are more prevalent than cross- or transdisciplinary programs.

One aim of the ARIES project and the sub-projects was to open communicative spaces. The view of participants was that this had been a valuable exercise. One report noted as an outcome the 'growing network of teacher educators within the Faculty of Education and university'. Participants in another sub-project proposed as an action 'conversations with colleagues about EfS in each area', although they noted that this might be difficult due to the unit focus of the school culture.

Precisely because of the discipline structure and unit focus, conversations are a primary enabler of EfS inclusion. Lack of such conversation is one of the most significant constraints to embedding EfS.

A barrier to networking and conversation that might lead to change is the increasing casualisation of the university workforce.

Staffing arrangements – sessionalisation there is no professional discussion such as we are having now. People have a wealth of knowledge, but no regular structure set up to discuss – almost need it to be mandatory to come to this meeting. Sessionals have less voice. Sessionals don't generally come to discussion – should be mandatory and paid to come. Would like to know if being permanent, or only on contract, makes it harder to plan for the future, and get involved in projects.

(Notes from ACU focus group)

If staff are not given funding or encouragement to remain on campus they will not be able to participate in cross-curriculum incentives. This is exacerbated if these staff come from schools where EfS is not taught in a holistic way. One vision that participants held for a desirable future was to reduce the influx of casual staff who could not participate in long-term planning.

Ford et al (2008) suggest that conversation is central to change, and the nature of conversation can be important. Conversations for understanding may need to be followed by conversations for performance. To maintain momentum for change conversation may need to be ongoing. If the early conversations fail to be convincing then the intended recipients may cease to listen to the message.

Unit coordinators embed key concepts within units that are applicable to that unit, conversations about what we do and how we can improve it.

(UNE report)

The question could be asked: do we need to hold conversations for awareness, or performance? The finding of the study is that the majority of teacher educators interviewed were aware of the need for EfS. Most reported that they had the capacity to teach the associated skills, although a significant number of participants felt that they could productively increase their expertise. The primary role of ongoing conversation would be to create practical opportunities for integration. This means conversation with colleagues and those who can reduce the structural barriers, such as policy makers and university hierarchy.

4.2 Connecting existing EfS content

In developing the foundations for future projects relating to embedding EfS, three of the sub-projects undertook audits of what was happening in their department. The most comprehensive audit was undertaken by the UNE team, who surveyed their faculty and gathered data on 83 units. The extent of economic, political, social and ecological sustainability was estimated. Ecological sustainability was found to be taught mostly in Science. Political and social sustainability were more widely covered, and some teaching of EfS skills was evident.

Similar findings were reported for UTS and the ACU/UC projects, although a smaller number of units were audited. Within the sub-project teams there were some who taught a unit into which they had injected a substantial amount of EfS content, including deliberate collaboration for whole-school approaches. However, these were the exceptions.

In one course, the B. Ed (Primary), for example, one subject is largely devoted to EfS, but it has only been realised in practice at one campus (Wagga Wagga) in 2009. EfS also had to struggle hard to be found a place in the new post-2007 curriculum for the course, given the extreme strictures placed on teacher education courses if they are to be accredited by the NSW Institute of Teachers.

(CSU report)

There were also reports of adventitious EfS learning brought about by students choosing to do projects and assignments on EfS related topics. For example, one student at UTS had completed an artwork related to the longevity of the campus site, an issue much in evidence amongst staff and students participating in the UTS study. Student projects around sustainability were also prominent in the ACU/UC Science and Technology unit evaluated in that study. In his reflections on a unit taught, one participant noted that '20% of students in my unit perform their research project around sustainability, much more than in the past'. Examples of the students' work were brought to the ARIES forum, and exhibited a high level of awareness of EfS issues.

In my opinion it fits wherever it can be naturally linked to other content areas – however it cannot be effectively taught through only one KLA. E.g. you may need SoSE outcomes to teach values, Literacy outcomes to enact social (political) change, Science & Mathematics outcomes to investigate/solve EfS issues.

(UC student focus group)

There was evidence of EfS skills and content being experienced by students at each of the participating teacher education institutions. However, this did not amount to a comprehensive learning about how to become a sustainable citizen, or how to teach EfS in an integrated way. The consensus of the project team was that 'connecting the dots' would be an enabling action for embedding EfS. This interlinking was important for both school education and university level education.

Within schools in the ACT there was a mandate to cover the essential learning to teach students to act sustainably, but the AuSSI program was needed to enable this to happen within the constraints of the existing timetable and structure. In NSW, where the curriculum is crowded and does not explicitly promote EfS, even greater effort is required to link the whole-school EfS project to existing KLA syllabus outcomes. Within the NSWDET/SSNSW alliance there have been some attempts to make this linking systematic and to present a guideline for teachers (see www.sustainableschools.nsw.edu.au).

- *Sustainability is already being taught, it is about linking it all together.*
- *Mapping process is very important.*
- *Look at commonalities that are occurring.*
- *It's not saying this is all new, rather it is about pulling it all together.*

(ACT AuSSI coordinator)

However, these resources are accessed by teachers after they connect with the sustainable schools initiative, which occurs less often in NSW than the ACT. The implementation of a Year of Learning for Sustainability by NSW DET in 2010 may help to make these links more explicit. As stated in Section 1.2 there is a connection between what happens in schools and what then becomes accepted practice in teacher education. Enabling the expansion of whole-school programs by connecting fragmented EfS will have a positive effect on embedding EfS in pre-service teacher education.

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If we are going to deal with this we need to immerse kids. It requires a different way of thinking about values, not about knowing things. The problem is we are not making the links. What we are doing at the higher levels is great but the students do not get it, need to get outside the box of the curriculum, it is too crowded. It is a question of immersion.

(Comment at final forum)

At university level, the pockets of teaching identified in the audits need to be linked so that the experience of the pre-service teacher is one of holistic understanding. This involves the process of collaboration between staff and university hierarchy, as discussed above. This enabling action was begun by the sub-projects in this study, and will continue in 2010 at participating universities.

One suggestion for connecting fragmented content was to develop a 'capstone unit' that would be offered at the end of a teacher education course. This unit would consciously bring together the strands taught throughout the entire course. There was concern that if Efs was embedded without integration, either through combined assessments or transdisciplinary units, it would effectively be lost and not translate into Efs teaching in schools.

I think educational sustainability would have to have that sort of embedment in subjects that it's more than just a week here or a workshop there. It's actually integrated into the assessment practices and schedules of the curricular method subjects as well.

(Participant, CSU study)

Teacher educators themselves rarely experience Efs learning in a holistic manner. McMillin & Dyabll (2009) describe a program at ANU that involved academic staff in whole-of-university projects that would mimic the kind of whole-school projects advocated by AuSSI. There was little evidence that this level of participatory experience was part of the existing learning within the universities in this study. Pre-service teachers were in some cases encouraged to participate in community projects, for example, through the CSU Inland Living Experience project, but their university teachers did not report similar pressures on their professional development. Many sub-project participants commented that they were stimulated to change their lifestyles, and become better recyclers or energy savers as a result of this project. More may need to be 'immersed' in sustainability learning before they translate this to their pedagogy.

Active linking of campus 'green' initiatives with teaching in course units may be another way of productively linking Efs learning that is currently fragmented. Most campuses in this study had facilities or programs offering opportunities for students to increase their awareness of Efs. The finding was that these opportunities are under-utilised. Potential connections between campus initiatives and what students might do, and also teach about in schools, were often not made explicit. This was an opportunity lost.

CSU Green know a lot about that, being involved in the process of setting it up. We are very good at doing buildings, changing them around, putting in things so we can assess how we're going but they're not talking to our students about it. Not setting up practices with our students that are useful ... We're thinking about meeting targets here, but not taking our population with us ... It's making that accessible and visible to students.

(Participant, CSU study)

Overall, the finding of the project is that connecting fragmented Efs content within the school curriculum, within university curriculum and between university curriculum and campus initiatives would be enabling actions to embed Efs. The existing fragmentation of Efs content and skills within these teaching arenas is a constraint to the mainstreaming of Efs within the wider teacher education system. Encouraging conversations between staff in different KLAs is a first step.

Developing a capstone unit, or transdisciplinary modes of assessment and delivery, may be ways of reducing fragmentation within teacher education courses. Students might be immersed in Efs learning throughout their degree programs and this might be made most effective by linking to campus initiatives. This learning could then be drawn together in the teacher education units, and explicitly related to whole-school approaches.

4.3 Developing an ethos of sustainable practice

Inhabiting an environment in which sustainable practice is evident and supported was found to be conducive to Efs inclusion in university teaching. The absence of modelling of sustainable practice, or conspicuously unsustainable practice, which could lead to a sense of hypocrisy, were significant constraints to Efs inclusion.

There was evidence that university policy, growing awareness within the wider community, and 'green' campus programs were facilitating this ethos on the home campuses of most of the teams

participating in this report. Where this was happening, these actions were regarded as creating opportunities and incentives for EfS teaching. If they were seen to be absent, this acted as a disincentive for action within the teaching program.

4.3.1 UNIVERSITY POLICY

Becoming a signatory to the *Talloires Declaration* was found to be a significant driver of university-level policy that could generate sustainable campus initiatives. For example, the UNE Talloires Committee had been established to identify what EfS was being done on that campus and what needed to happen. Macquarie University has a sustainability strategy, developed partly in response to the *Talloires* principles. Participants at UC and CSU also reported an awareness of the effects of the *Talloires Declaration* on their own campus activities.

We are a signatory to the Talloires Declaration and part of that is that we have the Vice Chancellor's advisory group forming a working party on greening the curriculum. So now it's coming from that level.

(UC participant)

The team at ACU also felt that university policy was supportive of a fundamental ethos for sustainable practice and teaching EfS, noting a movement within the church toward stewardship for the environment and the development of resources such as *On Holy Ground* (2009).

The Talloires Declaration, it talks about engaging with your whole community from within as in students, staff but also public schools in your area, government, industry and it's something I'm conscious of is that we've got to be good corporate citizens because, with our neighbours, and I guess it gets back to the practice what you preach, and you know if we're going to be teaching sustainability then we've got to improve our practices.

(CSU participant)

The main concern regarding the increase in policy incentives for sustainable campuses and curricula was that the pressure and paperwork for staff would increase without adequate support for change being provided. The argument made by the provider of a workshop (an outside consultancy) in which the project leader participated was that inclusion of EfS was not adding on, it just required identifying what was already there. This argument has been refuted as inadequate by the participants of this study.

Identifying what is there is a useful step, but more effort has to be put into reducing fragmentation. This will mean greater expenditure on staff release time and resource provision than is currently the case. In Section 4.4 the constraining pressures on university staff time are detailed. University policy is a driver of change but it needs to be accompanied by real support to reduce workload.

The Stage 2 report stated that university policy has not 'filtered through to faculty level' (Ferreira et al, 2009, p. 29). University policy is changing rapidly, and although the finding of the NSW/ACT study is that it may not have had sufficient impact, most participants were influenced by policy such as the *Talloires Declaration*. The issue in all three education systems may be that policy is not enacted because of lack of support.

4.3.2 GREEN CAMPUS PROGRAMS

Partly in response to policy incentives like the *Talloires Declaration* several universities had set up green campus programs. A powerful example of the positive effect of green campus initiatives was provided by CSU. This university is home to the Thurgoona campus, which has passive student housing and managed wetlands. It is effectively a showpiece for sustainable campus practice. This university ran the CSU Green Initiative, which was concerned with managing the environmental policy adopted by the university. At Macquarie the sustainability strategy was enacted through a Sustainability Office which, amongst many activities, held workshops in Teaching and Learning Week to encourage a green curriculum and hosted a Sustainability Expo. The campus was also host to the Australian Campuses Towards Sustainability Conference, attended as part of the ARIES project. This conference provided evidence of the extent to which campus buildings and facilities are now being examined and altered for sustainable practice.

A concern expressed by participants was that the university and its staff be seen to 'walk the talk'. That is, that there should not be a visible gap between policy and practice.

They'd say, well hang on, when I go around the University I see lights on in buildings late at night and so they've basically sort of pointed the finger back at management or the operations and are saying 'Okay, well maybe you guys should lift your game as well'.

(CSU participant)

This potential disjunction was also noted for schools. Environmental anomalies that were pointed out by participants included wastage of water through taken-for-granted ways of working and the use of 'scab duty' by teachers leading to recycling becoming associated with punishment.

4. Enablers and constraints to mainstreaming EfS

I had the AuSSi person in to talk to my students this week and that is what she was saying, that school toilets flush before the boys are peeing. So they are looking for other ways. I think it is extraordinary that we flush toilets with drinking water.

(Participant, Forum 1)

To enable change though creating an ethos of EfS the number of instances of visible disconnection between rhetoric and practice need to be reduced. The suggestion was also made by some that positive compliance or activism by students and staff should be rewarded.

Teacher educators could also act proactively within an informal curriculum through modelling good practice, for example by turning off lights or purchasing sustainable products for experiments. Students could be encouraged to pool cars to attend practicum and university teachers could be seen to use public transport.

Very important, need to be modelling behaviour. Day to day practices, we reuse and recycle materials.

(UNE participant)

Need to make sure that our students consider their own actions, local level things – is their classroom management sustainable in the long term?

(UNE participant)

Each of these individual activities might be small but they added together to create an all important ethos of sustainable practice.

As discussed above, there was also a belief that the sustainable campus ethos should be actively linked to teaching strategies as part of an effort to reduce fragmentation in EfS delivery.

4.3.3 COMMUNITY AWARENESS

The universities that are the sites of teacher education were found to be influenced by the wider social movement toward sustainable practice that was evident in their communities. Through exposure to media and other informal education processes, participating teacher educators were aware of the need to incorporate more EfS into their teaching and lifestyles. Pre-service teachers were often involved in community activities that influenced their willingness to participate in learning about EfS. The campus ethos was slowly being penetrated by a community ethos. Particularly in the Riverina and Armidale, the project teams found that the local controversies related to sustainable agriculture permeated the EfS debate.

Our work with community people and agencies involved in EfS near the Wagga Wagga campus, for example, involves people from around the community – like people from Erin Earth [a site modelling sustainable urban living] and people from the Riverina Environmental Education Centre and so on. We're thinking we'd like to hold a sustainability kind of festival on the university campus here to show the kinds of things the university's doing that people locally could do, but also to give other people the opportunity to sort of shop front there, the things that they're doing, but [so far] we haven't been able to organise it.

(CSU teacher educator)

Local issues and debates could be used for effective discussion and teaching. Participants in sub-projects were aware of the need to link EfS to these local activities.

For example a mob of kangaroos are coming through the area. Beyond us is the Department of Defence's land where they are doing this cull on the kangaroos as there is not enough food and they are breeding. I had a number of students go down to protest with placards and we had this conversation ... if there is no food and they are starving what is the alternative? It became a learning opportunity. Some students were not sure, 'we wouldn't do it at all, it's cruel to animals, not a humane way', but it became something quite current in the community.

(UC teacher educator)

Programs that linked the university teaching to community actions through partnerships were suggested as a way to increase the inclusion of EFS.

The argument made in the CSU sub-project report is that while a social movement exists it can still be characterised as weak in comparison to a strong counter force that drives the community toward consumerism. Overall, the 'dominant discourse' is not yet one of sustainability but one of competitive standards and economic survival. Unsustainable practice demanded through the implementation of policy that runs counter to *Talloires* principles still drives student teaching and assessment. Therefore, while some university policy currently enables green initiatives, and this supports staff and student awareness, the totality of university policy leads to a lack of resourcing for EFS programs and professional development. This could arguably be said to be a constraint to EFS inclusion.

In summary, university policy is increasingly promoting actions on campuses that are encouraging an ethos of EFS. The wider social movement towards sustainable practice supports development of this ethos. Interactions that link campus, community and teacher education programs should be encouraged. However, a more comprehensive review of the place of EFS within the totality of university objectives and practices may be needed before we can say that the students are immersed in an ethos that will encourage them to implement sustainable practice and EFS teaching in schools.

4.4 Creating opportunities for integrated programs

Many of the participants in this study reported that they were aware of the need to teach EFS, they had skills to teach EFS, but the constraint was, in the words of one interviewee, 'time, time, time'. There were a number of reasons why time became a problem, namely:

- NSW Institute of Teachers' specifications of university teaching
- the crowded school curriculum
- competing responsibilities.

Each of these time related barriers is discussed in turn. If finding time to teach about whole-school approaches in schools, and to teach in integrated ways, is the barrier, then the associated enabler will be to create opportunities that will increase the time available to teacher educators.

4.4.1 NSW INSTITUTE OF TEACHERS

In Section 4.1.2 the need for collaboration regarding teacher accreditation standards was noted. The point was also made that current writing of programs was time consuming and resulted in the loss of EFS even from existing curriculum as NSWIT standards began to dominate teaching time. The feeling amongst many participants was that over-specification of the teacher education curriculum, coupled with an absence of EFS as one of the criteria, was a significant constraint to EFS teaching.

Space is very important, over-specification is the problem. If we could get rid of this there will be more capacity to use local skills, resources. Less specification, and recognition that this (EFS) is something important for our teachers to do.

(Final Forum discussion notes)

It is important to state that this study does not advocate the addition of an EFS 'dot point' to the existing array. We consider that an overall reduction of specification and the opening up of space for whole-school and experiential modes of delivery will be what facilitates EFS uptake by teacher education institutions.

The most effective way to achieve change, with regard to teacher education may be to alter teacher accreditation nationally. New standards would need to both mandate less content and include an EFS component. This change may also be facilitated by a concurrent move to reduce the crowding of the school curriculum and to more effectively incorporate a holistic approach to EFS.

One criticism of such an approach would be its top-down nature. Supportive policy for EFS was certainly considered desirable by all the project teams. However, there was also concern that when the system is complex, policy change is not synonymous with authentic action. Teacher and teacher educators will need to be willing to comply with such mandated changes. They also need to be given time and support to respond, which means funding for staffing as well as changes to university policy. The mandated changes cannot happen effectively until community acceptance is sufficiently well advanced to make the change acceptable. The finding of this study is that good things are happening in schools and universities. Students, staff and school systems representatives involved in the project appear to be willing to accept the need for EFS teaching and learning. They now need to be provided with supportive structures for carrying out this out.

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My lie is we absolutely achieved the enabling through experiential, relational transformative education so that every single student would feel completely alive in the present and able to exhibit spontaneous behaviour and that sustainability is just an expression of that. And that is supported by all of our institutions, educational institutions, universities and government, business, families and communities through collaboratively owned partnerships and projects.

(Comment made at first forum, where envisioning involved telling your biggest lie about what is happening in teacher education regarding EfS)

In NSW/ACT the teacher accreditation body was supportive of EfS in principle but unwilling to mandate change at this time. Similarly, in Queensland EfS is not an explicit criterion but the Queensland College of Teachers was aware of its relevance (Ferreira et al, 2009). At the time of publication of the Stage 2 report that body had not taken action on EfS, possibly for similar reasons to those given by NSWIT.

4.4.2 NSW SCHOOL CURRICULUM

The busy nature of university curriculum is also related to the crowded nature of the NSW school curriculum. Within the NSWIT framework teacher educators have to provide their students with the content of senior and junior syllabuses. Given the high student-to-staff ratios in many teacher education institutions, teaching this content can take up much of the allocated hours. However, it should be noted that in the ACT the school curriculum was less demanding but the university curriculum remained crowded. This suggests that accreditation standards, possibly combined with inadequate staff and resourcing levels, may have more impact on EfS inclusion than the school curriculum. It is possible that NSW participants placed emphasis on school curriculum as a barrier because the need to teach content figured prominently in their day-to-day allocation of time.

The crowded nature of the school curriculum adds to the time burden for teacher educators already aware of the need to teach EfS. The relative absence of EfS in the curriculum may also lead to a lack of awareness of a need to teach it amongst other teacher educators. Science, Geography and HSIE subjects were credited with offering opportunities for some EfS teaching. For other KLAs, EfS might only be mentioned in a syllabus preamble, and no emphasis is placed on the need to develop whole-school programs. Within the state and Catholic school systems policies

have been developed to fill the gap, and promote sustainable citizenship. It is not clear that these policies are consulted by teacher educators working within their discipline areas. The representative of NSW DET who attended the forum spoke about the need to increase the profile of EfS so that teachers and the community would be more aware.

NSW DET was in the process of creating this articulated vision for EfS and it was presented to the team. This increased the awareness of our group about what might be possible in the future. The department is also offering some collaborative projects with universities regarding EfS in the coming year. Increased awareness of these initiatives may increase the profile of EfS in teacher education, but the impact of these policy changes is less likely to filter through to pre-service teachers than would a direct change to the syllabus documents that they confront each day in their coursework.

Our own challenge is one of getting a greater implementation in the environmental policy in schools in NSW. It seems that two major things are lacking as part of a vision for and commitment to sustainability amongst most people, and that obviously includes us teachers and curriculum writers. We had an articulated vision and following that up we have an articulated vision for sustainability education ...

(NSW DET representative)

When on practicum pre-service teachers have to struggle to manage classroom behaviour and master pedagogical content knowledge. There was a feeling amongst both teacher educators and the students themselves that the pre-service teachers were not able, within the relatively short duration of university courses, to acquire enough practical skills to go into schools and run an AuSSI type activity. This kind of whole-school program is difficult for experienced teachers. The need for these specialised skills is partly related to the current need to link disparate content, and to pull together a fragmented curriculum.

If EfS was mainstreamed within the curriculum and within teacher education then pre-service teachers would be 'slotted in' to existing programs and learn the associated skills gradually, as they do with more recognised content and pedagogy. Ideally pre-service teachers need more time within schools, and within the education course to master the basics. They also need these experiences to seamlessly incorporate a pedagogy that facilitates whole-school approaches to EfS.

4.4.3 COMPETING RESPONSIBILITIES

In the effort to recruit participants for this study, lack of time was often given as the reason for not being able to join the project. Members of departments were contacted and found to have commitments to other research projects or heavy teaching loads. As one participant noted, they get career rewards for research, not teaching. EFS is not regarded as a criterion of excellence in teaching. Some participants argued that developing rewards for participating in EFS, either as teaching or research, might increase its profile within teacher education institutions.

Competing responsibilities have been identified as a major barrier to EFS inclusion by a number of studies including the Stage 2 report (Ferreira, et al, 2009; Moore, 2005; Scott & Gough, 2007). In describing efforts to engage teacher educators in Queensland, the Stage 2 report listed as a minus 'difficulty incorporating sustainability into teacher education curriculum as there is a lack of time and a lack of space' (p. 38). The report also stated that EFS is not seen as core business, and some teacher educators are protective of their subject area.

Supportive leadership was regarded as an enabler of integration of EFS. In the ACU/UC study the deans and heads of schools were enthusiastic about further embedding of EFS. However, the experience obtained through the ACT forum was that these people were as busy as their staff, and not able to give substantial time and effort to processing something as complex as unit accreditation or unit development. Until workloads are reduced, the lack of such support acts as a constraint.

Students, as well as staff, have competing demands on their time. This makes it difficult to involve them in experiential projects and/or build connections with schools.

[Regarding extracurricular student activities for EFS]

I don't know what sort of take-up you'd have because I think our students are time poor and already juggling too much in terms of their commitments between their studies and their work life and their home life. So your take-up – I foresee that your take-up will be poor but I – but you know I think there's a place for it, yes.

(CSU participant)

In the UTS study students were asked about their willingness to undertake EFS related projects. They were generally in agreement about the importance of taking responsibility for their environment. However, 14 out of 20 students listed time as an obstacle to such experiential projects. Travel time to the campus or project site was one issue raised. Students also felt they 'have a lot on their plate'. If such a project was to be implemented it would need to be assessable before students would be willing to participate.

The unit taught as part of the ACT sub-project developed connections by bringing the partners to the university classroom, and by making the topic links to AuSSI schools explicit. This minimised the 'voluntary' student component and made the subject assessable. Student evaluations of this unit indicated they felt that it had influenced their ability and willingness to teach EFS as a whole-school program.

Across universities there is competition after the Bradley review. This competition won't allow innovative thinking to emerge. We are driven by the need to survive as a university.

(ACT forum notes)

A word sometimes mentioned in discussions about time was 'survival'. The need to keep doing the mandated tasks took precedence over inclusion of EFS, which is currently an add-on.

There is a certain irony in the emphasis on *not* teaching EFS being about survival. Current reports on climate change suggest that survival is definitely at stake and that an awareness of sustainable living skills is of paramount importance. Participants in the fora were aware of a sense of urgency in relation to this project and of a need to change their lives in a deep way. They were very committed, and acted as passionate agents of change because there was a real feeling that survival of all humanity is the issue. One recommendation of the team was that this emphasis not be lost.

4.5 Providing experiential learning

The *Living Sustainably: The Australian Government's National Action Plan for Education for Sustainability* (Commonwealth of Australia, 2009) endorses a model of EFS delivery which involves critical thinking, systems thinking and participatory action as part of whole-school programs. Extrapolating this model to the university teaching context, it is argued in this report that pre-service teachers need to be both aware of this style of pedagogy and able to initiate and carry out such programs in schools. This may mean that pre-service teachers need to become involved in whole-school activities, in the school or in the university, or both. This section discusses some of the issues associated with achieving this objective.

The participants in the ARIES project were aware from the outset that teaching EFS as a whole-of-school approach was the outcome to be desired. As a group it was decided that in approaching peers it was necessary to work from where they were at, and reinforce to them that they had the capability and power to teach EFS. This was because a perceived, and later confirmed, constraint to embedding EFS was the way it was viewed by many teacher educators.

4. Enablers and constraints to mainstreaming EfS

When presented with a specific set of indicators, such as those developed by the UNE survey, the participants in sub-projects could identify actions they already undertake. This recognition was seen as empowering. However, a problem with conversations about EfS is that the term now covers such a complex and broad array of content that it can be intimidating. This complexity then makes those outside of the field believe this is an area for experts.

Although some teacher educators recognise that they are ultimately empowered to teach EfS within the curriculum (Section 4.1), others do not feel empowered to deal with the enormity of the subject.

- *Thinking you are a little tiny speck – won't have an impact.*
- *Barriers are caused by conservative thinking of what is possible within a curriculum.*

(UNE report)

The sub-project teams all recognised a need to convey that EfS can be regarded as a lens through which other content is viewed. There was need to go beyond 'you are teaching these skills and can teach this content' to an awareness that 'you can initiate and facilitate project-based learning'. Within the timeframe of the study it was possible to hold conversations for empowerment at the content level, but more difficult to convey empowerment for connecting fragmented content or changing the system so that innovative forms of teaching could be implemented. There continues to be a need to engage teacher educators in dialogue about how EfS can best be taught.

I am looking at the subjects we do have and getting experiences in there for the students in some sort of ecological awakening type of thing.

(Comment made at first forum)

The current situation in teacher education is that existing policy, limited resourcing, and habitual ways of teaching do not make experiential learning the norm. This applies to both professional development opportunities offered to staff, which still tend to follow a conventional workshop format, and to pre-service teacher learning in the classroom. A lack of exposure to experiential learning amongst teacher educators and their students potentially reduces the probability that graduates will develop whole-school projects. The sections above have detailed some of the institutional constraints to this form of teaching. These include the already crowded curriculum and competing responsibilities.

However, it could also be the case that lack of familiarity and awareness of the possibilities limits the imagination of some teacher educators. An enabling action may be to develop experiences that will excite and empower teacher educators by giving them direct experiences in the environment and learning about how to adapt such experiences to their teaching.

The ARIES project developed a workshop that was designed to be fun, intriguing, located in the environment, and linked to conversations about change techniques and whole-of-school approaches. The workshop itself was intended to model what teacher educators might take into their classroom. The event was planned in conjunction with Manly Environment Centre, which has many years of experience in involving schools in local projects. It was facilitated by a Geography teacher who had worked on previous ARIES projects and was familiar with the ARIES model of systems/action research for change. The aim was to place a group of teacher educators in a place that would stimulate thought, and free exchange, about the holistic nature of EfS. The workshop was offered to all Sydney teacher education institutions. There was some interest but once again time (competing commitments) was given as the reason why few could attend.

In Section 4.3 the suggestion was made that a capstone unit may help to draw together pre-service teacher learning about EfS. The further suggestion made here is that this unit should either have an experiential component, or draw together other experiences of pre-service teachers rather than just linking a series of knowledges. These experiences might be gained in university campus projects, on practicum in sustainable schools or as part of units of study in their undergraduate degree. Providing an opportunity for experience-based learning for those who teach teachers may also help to support the development of whole-school approaches. However, if this is to occur it appears that other types of incentives will need to be created to encourage busy university academics to attend.

5 ARIES project outcomes

The ARIES project contributed to, and synthesised the findings on, enablers and constraints to mainstreaming EFS reported in Section 4. The other aims of the project were to map the systems of teacher education in NSW and the ACT and to enable actions that would facilitate mainstreaming of EFS. This section reports the outcomes relating to these aims.

5.1 Mapping the teacher education system

The diagram of the teacher education system shown in Figure 1 provided the basis for recruitment and analysis of data gathered in this study. Throughout the project understanding has developed about the interrelationships between components and how they impact on the mainstreaming of EFS. Figure 3 illustrates these systems relationships for NSW.

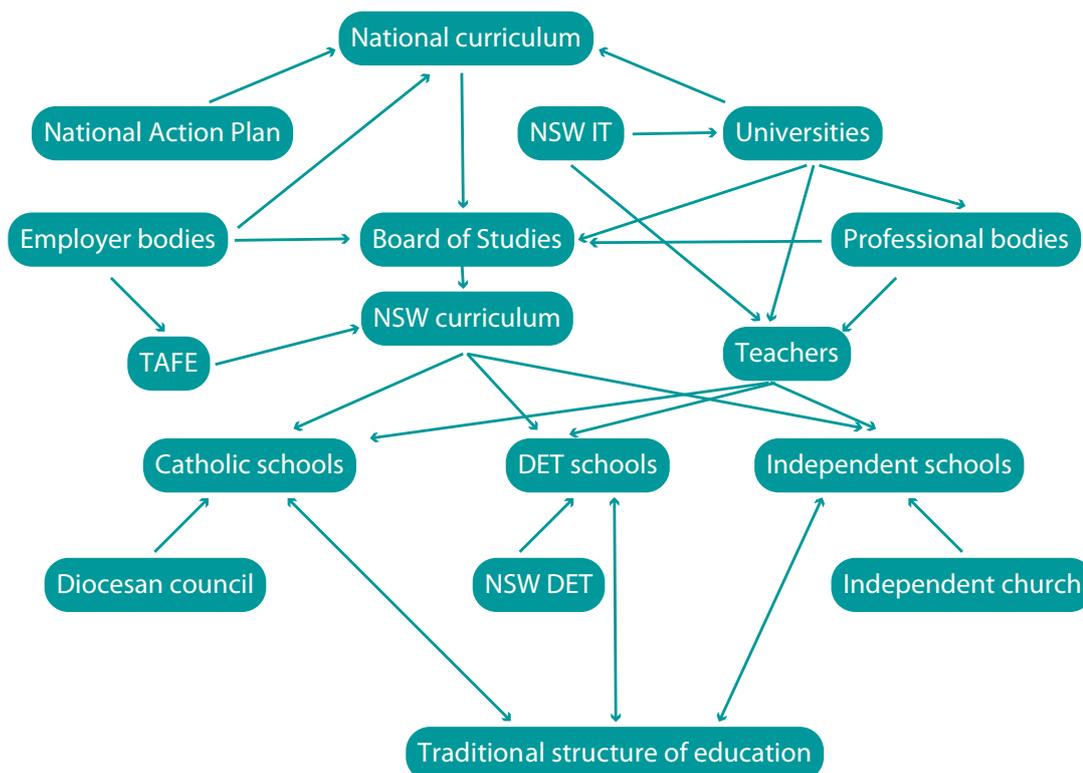
The NSW system encompasses three school types. Catholic schools are governed by Diocesan Councils and work with the *On Holy Ground EFS* policy. Public schools are governed by NSW Department of Education and Training and work with that organisation's Environmental Education Policy. Independent schools may be church-based or fully autonomous. There is no single EFS policy guiding these organisations.

Three features of the system stand out as being significant for all school types. Firstly, all schools groups (with the possible exception of some alternative independent schools) keep to the traditional timetabling and daily routine familiar from the English public school model. Students are arranged by age, their day is divided into periods, classrooms are separated and the time is divided by subject. This means that in nearly all schools whole-school projects involving outside collaborations can be difficult to organise.

Secondly, all schools draw from a pool of teachers that are educated in teacher education institutions similar in nature to those in this study. These teacher education institutions have to comply with standards set by NSWIT if their graduates are to be accredited to teach in NSW schools. In the future teacher accreditation may be influenced by a set of national teacher accreditation standards. One effect of implementation of NSWIT standards is greater similarity in course design and outcomes.

Thirdly, all schools work with the same curriculum, developed by the NSW Board of Studies. Employer bodies, universities and professional associations may all influence the content of the mandated curriculum. The existing NSW curriculum is crowded with content. Some EFS content and skills are included, but this is fragmented. There is a possibility that a national curriculum might directly influence the NSW curriculum to create coherence in EFS delivery.

Figure 3. NSW teacher education system



5. ARIES project outcomes

This system is quite centrally coordinated. Although it can be conceptualised as a complex system, such that what happens in one school might effect the whole system, pragmatically a change to one of these central features has greater probability of impact. Currently, the combination of curriculum, school structure and teacher accreditation acts as a constraint to mainstreaming EfS. However, the whole system is potentially able to respond to changes at these three points, leading to widespread adoption of EfS. A comparison might be made with a school system where schools have high degree of autonomy with regard to structure, curriculum and teacher accreditation, as is often found in the United States. The factors enabling mainstreaming in such a system may be more dependent on individual and community awareness of the need for EfS.

It should be emphasised that the centrality of NSWIT and curriculum processes within the NSW system mean that power is concentrated at these points. If they are used as axes of change then the change mandated needs to be carefully considered and executed. This report would caution that EfS not be included as an addition to the current content load. It should be incorporated according to the principles set out in the *National Action Plan*, and be experiential in nature and support a whole-school approach.

A systems diagram was also created for the ACT. There are many similarities with the NSW system. The same range of school types and organisation of schooling are found. One significant difference is the separation into senior colleges and 7–10 high schools, each

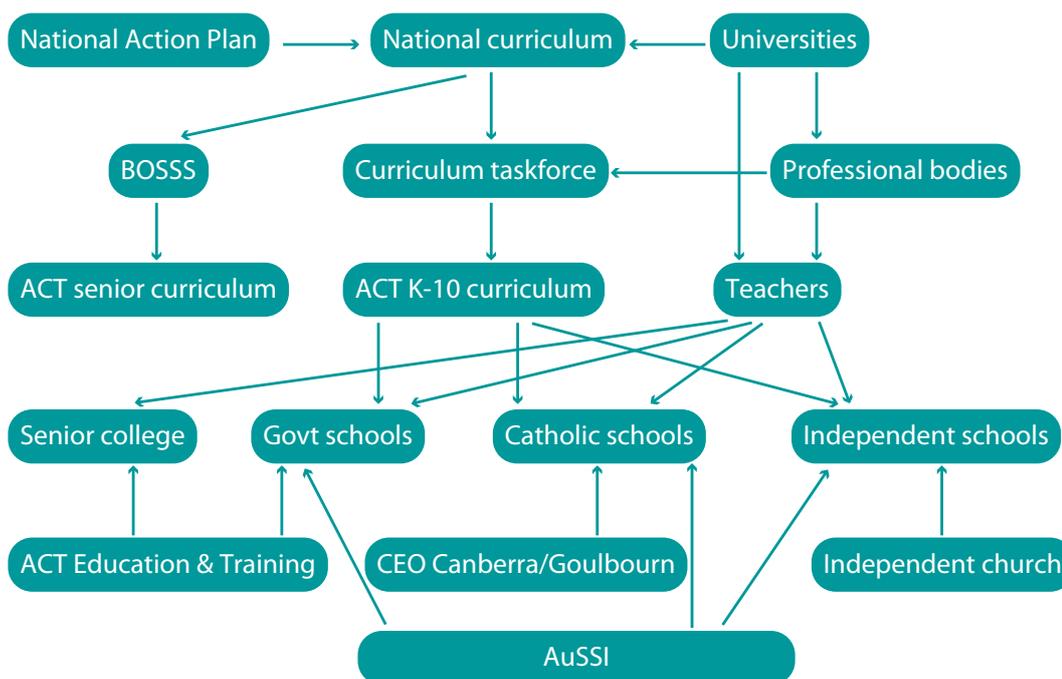
with a different curriculum-making body. Schools have more autonomy in curriculum design. Senior colleges develop their own units which are accredited by the Board of Senior Secondary Studies (BOSSS). The K–10 curriculum consists of 10 Curriculum Principles that guide 25 Essential Learning Achievements. This curriculum structure may be significantly affected by a national curriculum. At this time the ACT curriculum acts as an enabler of whole-school approaches to EfS.

The teacher accreditation system is less defined than that of NSW, and the ACT has no Institute of Teachers at this stage. Students may seek accreditation with NSWIT, the Catholic Education Office or ACT Education and Training. As with NSW the introduction of national teacher accreditation standards may impact on course design for pre-service teacher education.

By comparison with NSW, the sustainable schools intervention has reached a higher proportion of ACT schools (83%). The other major difference, not easily discerned from the diagram, is one of scale. The ACT Education and Training department directory lists 61 public primary and 16 high schools. This is on a par with the number of schools in one NSW DET region, yet these schools have dedicated policy, curriculum and sustainable schools resourcing. This difference of scale impacts on the ability to coordinate policy, curriculum and support, leading to mainstreaming of EfS.

Overall, the ACT system, because of its size, network interconnectedness and flexible structures would appear to be more amenable to mainstreaming EfS at this point in time.

Figure 4 ACT teacher education system



5.2 Ongoing conversations: QLD project

As part of the ongoing effort by ARIES to mainstream EFS the Stage 3 project managed further work in Queensland begun during the Stage 2 project. Funds were allocated to development of five case studies by each of the participating universities for display on the ARIES website. The project leaders of the Stage 2 project also developed a series of workshops, to be conducted at each participating university, for dissemination of the learning from the study. Ongoing work in Stage 2 was led by Dr Jo-Anne Ferreira and Dr Julie Davis, co-authors of the Stage 2 report.

This project included three activities:

- **Activity 1:** Broadening and deepening activities within participating universities.
- **Activity 2:** Contribution of information for the ARIES website to support EFS in pre-service teacher education.
- **Activity 3:** Development of five case studies summarising the intentions and outcomes of work at each university.

At the conclusion of this phase of the work a report was provided to ARIES, and information from this document forms the substance of this section. A brief summary of each of the activities is provided below.

Activity 1: Broadening and deepening activities within participating universities

The ongoing project sought to engage new hubs for change within the universities that had participated in the Stage 2 project. Both executive-level and individual teacher-educator-level hubs were targeted. A range of meetings and workshops were held, each negotiated with sub-project leaders and designed to be appropriate to the context of that department/university.

Each group reported a number of new outcomes in the intervening time since the reporting of Stage 2. Participating teams were able to use the opportunity for dialogue created by the meetings to disseminate the learning from the Stage 2 project and to open up new opportunities. Specific outcomes that were reported are:

- launch of a website for a local wetland that reports outcomes of the Stage 2 project. This website is the culmination of a collaboration between the university and local community groups. Both teacher education students and staff were involved in the site development
- holding of a planning day involving non-education staff to present Stage 2 findings, determine their awareness of EFS and develop new projects

- meetings with individual staff who were showing renewed or first-time interest in EFS
- purchase of resources for primary teacher education staff beginning the embedding of EFS into their subject outlines for 2010
- meeting with the education faculty at one university to determine which units currently incorporate EFS and which core units might be targeted for inclusion of EFS
- plan for a series of interviews with Stage 2 participants to be videoed and then shared with staff who are situated across widely separated campuses.

Through this ongoing work the team from the Stage 2 project were able to plan applications for funding to support further research in 2010.

Activity 2. Contribution to the ARIES website

The project supported the efforts of ARIES to maintain its website which informs others about EFS by providing examples of key journals, international links, reports, research literature, policy and significant websites.

Activity 3. Development of case studies

Case studies of the five sub-projects conducted as part of the Stage 2 project were provided for display on the ARIES website. These sub-projects have already been analysed in detail in the report of that project and will not be revisited here. The impressions of the authors, in looking back over their efforts for change were that significant gains have been made in the embedding of EFS at the university level. Evidence is presented that the education faculties will be teaching programs with increased EFS content within units from 2010.

As a result of their efforts EFS has become a key theme for unit development and assessment. EFS is increasingly central to thinking and practice within the education faculties. There is also evidence that each team leader continues to work toward greater mainstreaming of EFS within their faculties and the education system as a whole. Team leaders have been active in publishing the findings of their sub-projects and in using the Stage 2 project as the foundation for further research.

The period since the Stage 2 report has been one of consolidation of gains made and development of new ideas that has led to real change within teacher education in Queensland. It is hoped that these case studies will provide guidelines and inspiration for others who seek to act as agents of change under what can be challenging circumstances. They provide further support for the value of a systems/action research approach to implementing change.

5. ARIES project outcomes

5.3 Outcomes for mainstreaming EfS

In an action research process it is the changes in perspectives leading to action that have most impact. The sub-project teams in each of the states/territory (NSW/ACT/Queensland) reported changes in the perspectives of some of their peers, and great learning for themselves in conducting the conversations. The ARIES project participants reported that they had also learned from sharing knowledge with each other.

ARIES was able to facilitate this learning by:

- establishing a context for exchange through the project itself
- providing a hub for exchange of literature and ideas
- conducting the three fora in NSW/ACT
- Supporting further dialogues in universities involved in the Stage 2 project.

The process itself is part of EfS. Collaborative discussions have been really productive in sharing ideas, drawing people in across the schools. People who have not thought of these things. The process as being important to collective understanding and agreement. Given the nature of the area – it is unpredictable. It's not waving flags it's trying to empower people to live in a way to help us improve our lives.

(Notes taken at final meeting)

However, the greatest learning may be to ARIES, through association with this network of agents of change for EfS. The ARIES Stage 3 project facilitated collaboration amongst education-related institutions. Three of the sub-project groups were collaborative, two forming strong project teams, and one fostering links between the two universities. The belief amongst participants was that the most significant contribution of the project was to fund, and give purpose to, these opportunities to bring together interested people in the same room. The creation of networks was also both a goal and an outcome of the Stage 2 project. The report listed as one of its main outcomes 'facilitating cohesive communication corridors' between components of the education system (Ferreira et al, 2009, p. 51).

We have liberated consciousness-raising discussions, so we have a sense of our own agency and constraint, and coming together here we become aware that this struggle is important, there is a huge hunger for this in the teaching profession.

(Final meeting comment)

The establishing of networks has opened up possibilities of collaborations for the future. Some that are being considered are:

- Australian Learning and Teaching Council project with a Victorian group of universities regarding EfS in pre-service teacher education
- Australian Research Council project to further understand systemic change in EfS
- collaborations with councils and school educators to develop workshops.

There are also encouraging signs that the ARIES project will lead to ongoing collaborations amongst the sub-project teams. Several groups have exchanged visits and discussed working together in the future. In response to the suggestion of one team member the four sub-project groups have begun to collaborate on a presentation at the Australian Teacher Education Association conference in 2010.

On another matter, I caught up with [name] and [name] during the week, and all three of us really see some benefit in carrying the project forward in some way, and using the momentum and networks generated by what we've done. I'm really hoping this can happen in some way. I guess if any of us see opportunities for applying for funds, we can keep the other teams in mind and send us all an email.

(Comment sent in an email after the project)

Overall, the ARIES project has:

- mapped the teacher education system in NSW/ACT
- initiated and supported research to implement change toward EFS inclusion in five teacher education institutions
- identified enablers and constraints to teaching EFS in the education systems of NSW and the ACT
- extended the networks of those in the teacher education system in NSW and the ACT
- conducted conversations with representatives of education bodies
- fostered collaborations across teacher education institutions
- developed a workshop on change for whole-school approaches to teaching EFS
- supported ongoing work to mainstream EFS in the Queensland teacher education system
- increased our understanding of systems approaches through interaction with theorists and practitioners.

5.4 Reflections on enablers and constraints

The aim of this study was to identify enablers and constraints to mainstreaming EFS in pre-service teacher education in NSW and the ACT. The finding is that there remains work to be done and there are significant constraints to mainstreaming in the current climate.

Teacher education for sustainability in Queensland was described as 'fragmented and disjointed' in the Stage 2 study (Ferreira et al, p. 29). The five universities in that study identified isolated 'patches of green' but no teaching of whole-school approaches. Similar findings were made by sub-project teams that mapped EFS in their universities in NSW/ACT. In all states/territories organisation of curriculum into silos exacerbates this fragmentation and constrains the development of holistic approaches that prepare teachers for implementation of participatory, systems thinking approaches in schools. In all of the states and territories examined, mainstreaming of EFS at university level has been absent.

The ACT school education system appears to offer a model for mainstreaming EFS. In this system, the majority of schools have developed relationships with the AuSSI program. Resourcing of the AuSSI program relative to the size of the school system means that support can be given to teachers who wish to develop whole-school programs. The AuSSI team also initiated interest in schools where staff were originally reluctant. The curriculum offers both less crowding and an essential learning that makes it necessary for teachers to address EFS. In the ACT systemic structures, resourcing and policy appear to work together.

It is likely that proximity is also a factor. Personal and professional networks amongst educators and AuSSI were observed to be strong. Conversations about changes to policy and actions that would increase the synergy between what happens in curriculum, AuSSI and departmental policies were observed at the ACT forum. It is speculated here that this network embeddedness and proximity has a very significant effect on mainstreaming. Systems-wide mainstreaming may be much harder to achieve in a school education system where networks are more sparse and resourcing and curriculum are not supportive of EFS.

What is interesting is that the situation regarding mainstreaming of EFS in universities in the ACT was more similar to the situation in other universities than it was to the ACT school education system. Although the ACT teacher educators worked with the school curriculum, collaborated with AuSSI and participated in the same personal and professional networks, teaching of whole-school approaches was limited to one unit. Involving other teacher educators remained difficult. The constraints, therefore, appear to be intrinsic to the university system. The impression, from both Stage 2 and 3 project findings, is that the constraints to mainstreaming EFS in teacher education departments are much greater than those in schools.

One can only speculate on why. The most notable differences from the conditions pertaining in ACT schools are a lack of resourcing for policy change of this sort, leading to a lack of time to implement such change, and persistently crowded curricula. To mimic the systemic conditions that support school change in the ACT, teacher accreditation bodies would need to reduce the crowding of the curriculum and include an explicit 'essential learning' relating to the kind of pedagogy consistent with EFS. University teacher education departments would then need to embrace change in the way schools have done, possibly with the support of a funding and resourcing body equivalent to AuSSI.

Such a plan may sound hopeful, but should be viewed with caution. Efforts within the ARIES project to provide funds and resources, such as the workshop on whole-school approaches, met with a lack of enthusiasm. This may have been because other curriculum structures were not in place, and there was no time to attend these events. However, other explanations can be offered. Even with suitable structural change to curriculum drivers, university departmental organisation may prove less amenable to systemic change than is school organisation.

In a study of barriers to change in UK universities, Scott and Gough (2007) suggest that university staff protect their independence and place high value on autonomy. They suggest that barriers to change become necessary means to protect the position of universities as leaders of thought that challenge social policy. Barriers to change are likened to flood barriers. If accurate, this view would suggest that universities (seen as a combination of those whose job is to 'profess' evidence-based opinions) will always resist attempts to mainstream change.

5. ARIES project outcomes

The implication is that individuals within universities have to be willing to personally embrace, or even lead, any change toward EfS. Conversations for empowerment become critically important and change is necessarily slow within these organisations. Yet, if the guiding principle is one of evidence-based action, one could ask why we, who profess EfS, have not been convincing with what seems like overwhelming evidence. There remains a question at the heart of this conundrum of academic motivation for EfS that needs to be further investigated.

Scott and Gough (2007, p. 113) also state that 'in none of the university responses would there seem to be any *internally erected barriers* to the freedom that academics have to research and teach about sustainable development issues as they see fit'. The Stage 3 finding is that teacher educators were increasingly finding a need to change their own lifestyles to address issues like energy conservation, paper wastage and recycling and water management. University policy is increasingly making them aware of these issues, and changes to campus facilities support such thinking. More may need to be done, but change is observable.

This study would concur with the view that there were no internally erected barriers to increasing the teaching of EfS. The study of Paige et al (2008), describes some of the barriers to academics working together but developing the transdisciplinary unit was possible. Teaching whole-school approaches within universities would appear to be possible, although not yet fully supported. The greatest enabler to change continues to be communication amongst those in the education system. If teacher educators are made aware of the real evidence for a need for change, individual motivation can overcome the real but not insurmountable barrier of lack of time. This was the case for those busy teacher educators who acted as agents of change in this project.

5.5 Reflections on the ARIES model of systems change

Throughout this research there were ongoing discussions about the validity and usefulness of the ARIES model of change. Our key informant argued that the motivation of individuals to teach or learn sustainable practice is materially affected by their emotional maturity, and these factors need to be taken into account (Sattmann-Frese & Hill, 2008). For example, Macy (1995) and Gillespie (2009) have examined individual reactions to sustainability issues and find that personal guilt and trauma affect responses. In a study such as this, these factors may increase resistance to change but remain unspoken.

The team from CSU are developing an alternative framework in which teaching EfS is conceptualised as a practice, and is enacted through an ecology of practice, defined as:

Distinctive interconnected webs of human social activities (characteristic arrangements of sayings, doings and relatings) that are mutually necessary to order and sustain a practice.

(CSU report, p. 3)

Ecologies of practice seek to reintegrate systems (defined as institutions that operate in a social-political dimension), with the lifeworld of individuals (defined as the way people meet, socialise and interact within the socio-political structure). The argument advanced was that studies such as the ARIES project tend to focus on systems and people's roles within those systems, at the expense of engagement with lifeworlds.

Combined, the critical reflection within the team of the ARIES model of change, is that it fails to sufficiently acknowledge the history, thought processes, and attitudes of individuals who actually operate as the agents of change, while acting in various institutional roles.

The assumption of the ARIES model is that coordinated impact at all points in a complex system will lead to mainstreaming of EfS rather than isolated pockets of action. The complex system model adopted is not incompatible with individuals having a large effect in enabling and constraining the process (see, for example, Plowman et al, 2009). Social and individual psychological processes can be incorporated within the model. Similarly, an emphasis on lifeworld rather than institutional roles and structures is not incompatible with the overall model. Although operationally agents of change have been selected for their strategic institutional roles and the system is represented by interrelated institutions, there have been opportunities for the involvement of the personal. As an overarching framework the model is flexible and adaptable.

The overall reflection on the systems/action research process is that it is an effective way to engage a large number of stakeholders across all components of a system. The ARIES model has established its usefulness in the design and analysis of a number of studies (see, for example, Ferreira et al, 2009; Thomas & Benn, 2009). Engaging stakeholders in this way takes time and requires resources to buy time, but once achieved the change is deep and lasting. Informed change agents can potentially impact on ever-widening networks, as illustrated by the ongoing project in Queensland. The result is reduction in systemic constraints to, and possibly an increase in systemic support for, EfS.

However, the systemic model may be usefully complemented by greater concentration on individual motivational factors. There were a number of points in the analysis of the Stage 3 project where it was reasonable to question whether the systemic constraints listed by stakeholders represented the full story of their reluctance to embrace EfS. A greater understanding of stakeholder motivation might assist with the development of strategies that would support key agents of change in their efforts to increase the capacity of teacher educators to embed EfS.

6 Recommendations

This project recommends four courses of action for future change:

1. Support school curriculum change so that the syllabus reinforces the possibility of whole-school EfS, with participatory and systemic and critical thinking skills at the forefront of pedagogy.
2. Support the development of teacher accreditation standards that both reduce the crowding of university curricula and make the need to teach pedagogies consistent with EfS explicit. This would mean actively supporting pre-service teacher learning about whole-school approaches to sustainability.
3. Continue conversations with individual teacher educators to empower them to make change and overcome remaining constraints to EfS being taught in a holistic manner within the various Key Learning Areas.
4. Encourage the trend toward sustainable campuses and university policy in support of EfS teaching and raising the profile of sustainability policies amongst the plethora of policies that impact on teaching within the university.

Based on the readings, conversations and data analysis carried out for this study, the following suggestions are offered as to how to facilitate the recommended courses of action.

6.1 At national level

To increase visibility of the need for EfS in teacher education through acting on the school syllabus it is important to ensure that now, while it is still being formed, the national curriculum provides effective support for whole-school approaches to EfS. A number of national bodies have expertise in EfS, including The National Education for Sustainability Network, the Australian Association of Environmental Educators, AuSSI and ARIES.

These groups might:

- liaise with ACARA and those developing subject-area curricula to ensure that what is taught enables each student to acquire the means to develop as an aware citizen of a sustainable world
- participate in ongoing dialogue to ensure that we have a clear vision of what is needed to develop such a citizen.

To facilitate mainstreaming of EfS in pre-service teacher education more directly, national bodies – for example, DEWHA, the Australian Government Department of Education, Employment and Workplace Relations (DEEWR), and the Australian Council of Deans – might:

- engage with the development of national teacher accreditation standards to ensure they reflect Recommendation 2 above
- coordinate a national seminar on mainstreaming EfS in teacher education
- support teacher education institutions to initiate or continue efforts to mainstream EfS
- enable a network of mentors that would support change efforts by individual organisations.

6.2 At state/territory level

To increase visibility of the need for EfS in teacher education through acting on the school syllabus members of state/territory education systems – for example, departments of education and curriculum developers – might:

- participate in discussions with those working at the national level to progress combined agreement on a national curriculum
- converse with each other to negotiate agreement on a clear vision for EfS in future school education.
- adopt any national curriculum processes that enhance whole-school approaches to EfS.

To increase visibility of the need for EfS in teacher education by acting on the school environment, so that pre-service teachers and their educators encounter whole-school approaches, the state/territory bodies might:

- support the implementation of existing policy that supports whole-school approaches
- support greater professional development for current teachers.

This may involve increasing resources to sustainable schools initiatives in larger states, and/or locating them in districts, as the success of AuSSI in the ACT may be related to proximity between schools and sources of expertise in EfS.

6.3 At university level

To increase the visibility of the need to increase EfS in teacher education university policy makers might:

- continue to support sustainable campus facilities
- signpost campus developments
- support international policy initiatives such as the *Talloires Declaration*
- incorporate EfS skills in graduate attributes
- develop university sustainability policy

6. Recommendations

- review the entirety of university policy to establish the priority of EFS
- engage with bodies mentioned above as having expertise at the national and state level.

It is important that university policy be consistent with the desired whole-school approaches.

To enable the implementation of EFS policy those involved in funding and supporting teacher education departments might:

- discover which rewards and incentives would result in attitude change; for example, can EFS be related to excellence in teaching
- create whole-of-university projects in which pre-service teachers and teacher educators could participate
- support staff learning about EFS; for example, through workshops offering experiential approaches to teaching and learning
- increase resources to teacher educators, to reduce the time burden.

6.4 At education faculty level

The following activities undertaken by teams in ARIES projects have been found to support EFS teaching:

- Collate findings on what is being done within existing teacher education units and courses.
- Develop a plan (or a policy, provided that it does not become a top-down initiative) for what might be done over time.
- Develop competency; for example, through coordination of workshops to increase systems thinking, organisational change strategies or EFS teaching skills.
- Host student fora to increase active involvement and empower new teachers.
- Teach of a unit involving collaboration with AuSSI coordinators, community groups and sustainable schools.

Other suggested actions:

- Develop a capstone unit that draws together the fragmented EFS learning acquired during degree programs.
- Convene sustainability committees or networks.
- Align teaching units with graduate attributes consistent with sustainability principles.
- Develop a graduate professional development program in EFS.

6.5 At individual teacher-educator level

The finding of this study is that individual teacher educators can make significant changes to mainstreaming EFS in their system. Some suggested actions that might be undertaken are:

- Become an agent of change and increase capacity for system level change.
- Initiate conversations with peers about EFS.
- Role-model the practical, such as car pooling to outings or practicum visits, and turning off lights.
- Take responsibility for one's individual role as a social unit in the whole collective responsible for climate change, etc.
- Find out about school systems policy relating to EFS teaching and AuSSI.
- Incorporate EFS content and skills into current units, including assessment tasks.
- Consider ways to collaborate with peers to develop cross-disciplinary units or whole-department projects.
- Publish or disseminate research relating to EFS in pre-service teacher education.
- Use the environment and visits to parks, schools and local sites.

In pursuance of Recommendations 3 and 4 above, the participating teams strongly advised that the work begun with this project be continued. This would require support for ongoing conversations to build collaborations within teacher education institutions. It would also require support for teaching initiatives that enhance knowledge about whole-school approaches to EFS.

When implementing any of the above suggestions the emphasis has to be on how organisations and individuals can be supported to become more sustainable and to foster the idea of a sustainable world. Key values for change implementation are negotiation, respect, listening, empowerment, creating space, and reasonable workloads. Reflection on actions is encouraged. Formative evaluation and feedback may be more effective than critical review in achieving (voluntary) change. The key is to minimise resistance, frustration, anger and resentment. Once resistance mounts then we need to ask why, because at that point we must have gone from presenting a set of experiences that make an outcome rational and desirable, to a coercive mode. Once a core value of kindness departs from the change process our intervention will fail. In the long term the teachers we graduate will reflect the sustainable processes that created them.

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Appendix 1. Project outline

Mainstreaming Education for Sustainability in Pre-service Teacher Education Project outline

ARIES, with the support of DEWHA, is conducting a project to embed education for sustainability (EFS) into pre-service teacher education. This project builds on previous research that developed a systems model of change incorporating action research (Ferreira, Ryan & Tilbury, 2006). The systems/action research model has been trialled in Queensland teacher education institutions.

Outcomes that were reported by the participating organisations included:

- development of skills in EFS amongst colleagues working in teacher education:
 - development of institutional policies to facilitate inclusion of EFS into the teacher education curriculum
 - formation of networks between stakeholders
 - involvement of students in EFS forums at university and internationally.

The current project seeks to extend this model to NSW and ACT teacher education systems. Within each system, a number of project teams within key organisations will be funded by ARIES to conduct action research in their own organisations. Project teams will acknowledge a systems approach, which includes:

- envisioning the goals for EFS in pre-service teacher education
- undertaking a mapping of the system (which, for example, might include university departments, university policy makers, individual teacher educators, state/territory education departments, accreditation boards and/or EFS providers in the wider community)
- identifying barriers and facilitators to the inclusion of EFS in teacher education.

It is expected that this process will identify 'agents of change', or points of change that will be the focus of ongoing work toward inclusion of EFS.

The ultimate aim of the project is to further the policy of the Australian Government set out in the *National Action Plan on Education for Sustainability*, namely:

Consistent with the systemic approach to sustainability in schools adopted by AuSSI, the Australian Government will work with state and territory governments to ensure sustainability is appropriately embedded in policies, programs procedures and systems.

The project will also contribute to the implementation of *Educating for a Sustainable Future: A National Environmental Education Statement for Australian Schools*, which has been endorsed by Australian Government and state/territory education ministers through the Ministerial Council on Education, Employment, Training and Youth Affairs.

In practical terms, individual project teams may implement curriculum change, professional development for teacher educators, extend the resources for teaching EFS, or develop a program for implementation of policy change in their organisation. It is expected that projects will promote collaboration within and between participating institutions and organisations, including education and environment agencies implementing the Australian Sustainable Schools Initiative (AuSSI). ARIES aims to develop a partnership mode of working with stakeholders and with this in mind seeks to negotiate projects that will most support the goal of change within particular contexts.

Project teams are asked to participate, with ARIES, in a second level of systems mapping. Two forums will be held, one early and one late in the project. At the first meeting project leaders will be invited to discuss their views on EFS and their proposals for change. The second gathering will compare changes in perspectives and plans for implementation of change. Findings and reports from individual projects will be used to generate a larger report due in December 2009. The focus of the report will be identification of agents of change, barriers to change and recommendations for action. ARIES expects that organisations will make an in-kind contribution to the project. This may include an undertaking for continued integration of EFS into pre-service teacher education during 2010.

The timeline for the project is:

June/July

Development of projects in collaboration with teams.
First round of funding.

August

Project teams begin research. First forum held.

September

Interim reports detailing actions undertaken.
Second round of funds allocated.

November

Second forum. Project leaders to report on actions to be implemented, understandings achieved.

December

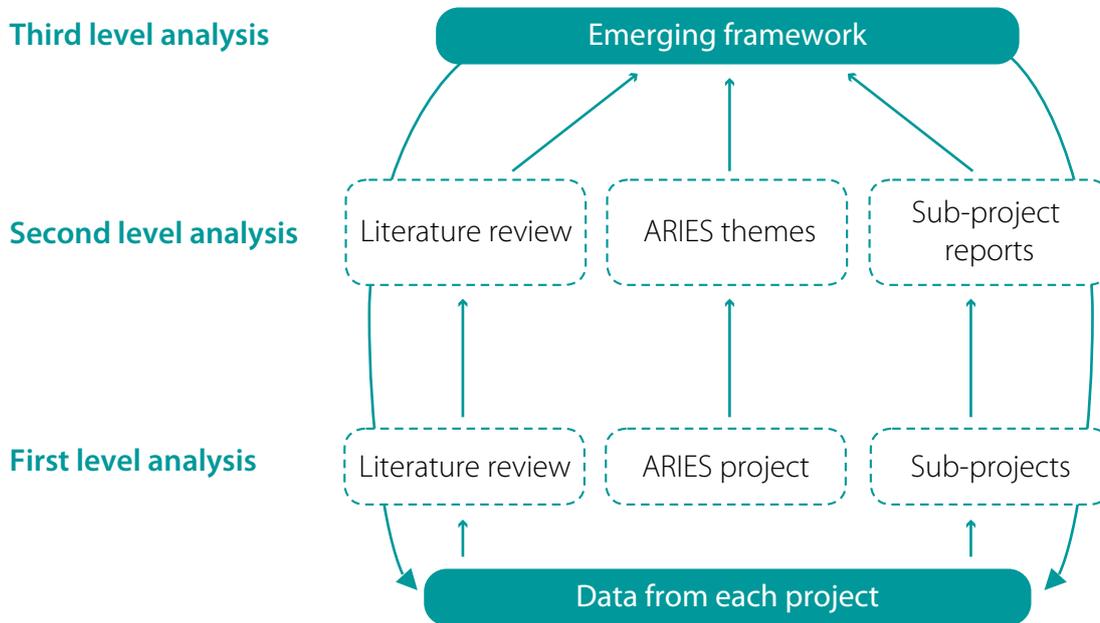
Final report to DEWHA.

Appendix 2. Summary of fora

Forum	Sydney	Canberra	Sydney
Purpose	Creating opportunities for dialogue	Creating dialogue	Data analysis
Activities	<p>Envisioning of the goals of EfS in teacher education.</p> <p>Introduction of projects to other teams.</p> <p>Conversations about potential enablers and constraints, and actions to be taken</p>	<p>Envisioning of the goals of EfS in teacher education</p> <p>Presentation of outcomes of first forum</p> <p>Discussion of enabler/constraints</p>	<p>Presentation of sub-project</p> <p>Discussion of findings</p> <p>Theory building</p>
Attendees	<p>NSW DET (1)</p> <p>NSWIT (1)</p> <p>Teacher Educators (10)</p> <p>Key informant</p> <p>Mentor from Stage 2 project</p>	<p>ACT DET (2)</p> <p>ACT AuSSI (2)</p> <p>DEWHA (2)</p> <p>Teacher educators (5)</p>	<p>Sub-project team representatives (9)</p>

Appendix 3. Data analysis

SUMMARY OF DATA ANALYSIS (AFTER WESTHUES ET AL, 2008)



Round 1, sub-projects

In the first round of data analysis each sub-project conducted its own coding of themes relating to enablers and constraints. The shared literature was used as a 'comparative template, something to test emerging data and categories' (Meadows & Morse, 2001). Brief descriptions of sub-project analysis are given in Section 3.

ARIES project analysis

Data sources for this project included the reflective journal on actions undertaken, transcripts of forum discussions, and documents relating to curriculum, university policy and educational policy in NSW/ACT. Transcripts and a summary of the journal were imported into the QSR NVivo 8 program. Data were then subjected to three rounds of coding and interpretation as recommended by (Miles and Huberman, 1994). In a first round of coding the data was divided into broad categories of enablers and constraints according to the initial question that framed the data collection.

These categories were then sub-coded into themes. For example, one initial code was 'campus facilities' and this was then sub-coded into 'project support', 'environment for teaching' and 'informal curriculum'. Data were also coded 'in-vivo' for other themes that emerged during the analysis. For example, one theme emerging was the questioning of the role of institutions within the complex system.

Relationships between the sub-categories were then identified, developed and presented to the theory building forum as tables and diagrams.

2nd round

In the second round of data analysis the ARIES project leader and representatives of sub-project teams (two to three per project) allocated one day to presentation of findings followed by discussion of shared themes. There was a high degree of overlap between the themes relating to enablers and constraints. This theory-building group decided on a framework for reporting and recommendations for action. The members of sub-project teams were sent a draft of the final report for comment.

