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Learning to Embed Sustainability in Teacher Education

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Preface

Education systems have a key role to play in preparing future citizens to engage in sustainable living practices and help create a more sustainable world. Many schools around the world have begun to develop whole-school approaches to education for sustainability (EfS) that are supported by national and state policies and curriculum frameworks. In addition, the United Nations Educational, Scientific and Cultural Organization's (UNESCO) guidelines for teacher education (2005) and the United Nations (UN) Sustainable Development Goals (2015) are setting an agenda and direction that builds on the activity and focus generated by the UN Decade of Education for Sustainable Development (2005–2014). Initial teacher education, however, lags behind in the effort to build the capacity of new teachers to initiate and implement such approaches (Evans, Stevenson, Lasen, Ferreira & Davis, 2017; Steele, 2010). Evidence suggests this is because there is limited or no core environmental or sustainability knowledge or pedagogy being provided in a thorough and systematic fashion through initial teacher education and in-service courses and programs (Bjöïneloo & Nyberg, 2007; Evans, et al., 2017; Ferreira, Ryan & Tilbury, 2007).

A major reason for this state of affairs is that teacher education is a complex process and sustainability is a complex concept. Teacher education systems have multiple interconnected, hierarchical levels; institutionalized subsystems; complex rules; and numerous stakeholders and interest groups with competing agendas (Ferreira & Ryan, 2012). Sustainability is also a complex, context-dependent concept with multiple variations and interpretations ranging from 'weak' to 'strong' (Neumayer, 2013). While teacher educators have a well-developed understanding of education systems, few have the knowledge, skills, and dispositions to incorporate a sustainability orientation into their teaching of teacher education students (UNESCO, 2005). The challenge for teacher education, therefore, is to develop teachers who understand and can employ an EfS framework to inform their future teaching and learning practices (UNESCO, 2005). The initiative discussed in this book sought, over a decade, to address this challenge through implementing a systems approach to embedding sustainability in teacher education institutions in Australia. We provide an overview of the key stages of this initiative, discuss our

rationale, and explain the model used to facilitate change. Additionally, we offer descriptive exemplars illustrating changes in teacher education facilitated through the initiative and provide a 'how to' guide and key lessons learnt. These are resources to be employed by those seeking to facilitate a system-wide change initiative in their organizations.

Bilinga, Australia — Jo-Anne Ferreira
Cairns, Australia — Neus (Snowy) Evans
Brisbane, Australia — Julie M. Davis
Cairns, Australia — Robert (Bob) Stevenson

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Dr. Neus (Snowy) Evans is a Senior Lecturer in Education at James Cook University (JCU) in Cairns, Australia, with a strong commitment to sustainability education and research. Snowy is the coordinator of the JCU Master of Teaching and Learning (Primary) program, and coordinates and teaches undergraduate and postgraduate subjects in the professional stream of a number of teacher education programs. Snowy's research background is in socio-ecological resilience and sustainability education in schools and initial teacher education. Her current research interests extend to teacher professional practice, pedagogy and place. She's particularly interested in exploring the intersection between teacher professional practice and sustainability theory, policy and practice. Other research interests include teacher and pre-service teacher thinking and wellbeing. Snowy's methodological expertise is in qualitative and case study research and systematic literature review approaches. Outside of work, Snowy is an avid cyclist.

Prof. Julie M. Davis is an Adjunct Professor at the Queensland University of Technology, Brisbane, Australia. She officially retired at the end 2016, though continues to write and research as a retirement 'hobby'. She is recognized as a

world leader in early childhood education for sustainability (ECEfS) with around 100 publications. She sole-edited the first textbook related to young children's learning and EfS aimed at early childhood initial teacher education with translations in Korean (1st edition) and Chinese (2nd edition). Julie was nominated for an Australian Teaching Award in 2017 for her career work in bringing EfS into early childhood teacher education programs. As a researcher, Julie co-edited the first research text on ECEfS, published in 2014, that brought together 20 authors from around the world to problematize ECEfS theory and practice, also translated into Korean. As this SpringerBrief publication illustrates, Julie has a long-standing interest in embedding EfS into teacher education, and has been involved with her co-authors for more than a decade in this field of interest.

Prof. Robert (Bob) Stevenson is an Adjunct Professor who officially retired at the end of 2016 as Professor and Tropical Research Leader (Education for Sustainability) in The Cairns Institute, and as Director of the former Centre for Sustainability Education (that he founded) at James Cook University in Australia. He was lead editor of the *International Handbook of Research in Environmental Education* (AERA/Routledge, 2013), which featured 51 research chapters from authors in 19 countries. He has most recently acted as Editor-in-Chief of the international *Journal of Environmental Education* (the oldest academic journal in the field). He remains on the editorial board of *Environmental Education Research* (EER) and the *Canadian Journal of Environmental Education* (CJEE) and also continues to write and research in his 'semi-retirement.' His scholarly interests focus on theory-policy-practice relationships in environmental and sustainability education, of which his 1987 paper, "Schooling and environmental education: Contradictions in purpose and practice" (reprinted in EER in 2007) has been widely cited in the field. Other areas of research interest are leadership and teacher professional development for whole school approaches to sustainability, and potential spaces and approaches to engaging youth in deep thinking about and acting on socio-ecological issues. In 2010 he received the North American Association for Environmental Education award for Outstanding Contributions to Research in Environmental Education and in 2018 was delighted to be made a Fellow of the Australian Association of Environmental Education for "elevating environmental education in Australia."

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Introducing Our Systems Change Initiative

Jo-Anne Ferreira and Julie M. Davis

Abstract In this first chapter, we provide an overview of the systems change in teacher education initiative we detail in this book. This initiative occurred over a 10+ year period, a time of rapid change in teacher education with an increased focus on the environment and sustainability, in Australia and internationally. We discuss the six stages of the project, outlining the unique focus of each stage and how these contributed to the development and refinement of our Embedding Change Model.

Introduction

The teacher education systems change initiative detailed in this book spanned more than ten years. The initiative occurred during a time of great focus on education, on the environment, and on sustainability within Australia and internationally. Chief amongst these was the United Nations (UN) Decade of Education for Sustainable Development (DESD)—2005–2014 (UNESCO, 2005). The DESD provided an impetus for a focus on education and sustainability in all UN member nations.

In Australia this led to new Federal Government policies, such as *Living sustainably: the Australian Government's National Action Plan for Education for Sustainability* (2009), and initiatives such as the Australian Sustainable Schools Initiative (AUSSI). In each of the Australian States and Territories, there was also an upsurge of new policies and on-the-ground initiatives. For example, in the State of Queensland, the Queensland Sustainable Schools Initiative (QESSI) was established to support schools, early childhood centers, technical, and higher education institutions in their education for sustainability (EfS) efforts. In Queensland, a reference group consisting of school, early childhood, non-government organizations, teacher educators and professional teacher and educational associations was formed to provide advice to the State Government on EfS. Non-government organizations and professional associations were also actively engaged in EfS efforts. Among these were the 'Education for Sustainability and the Australian Curriculum Project' (ESACP) undertaken by

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the Australian Education for Sustainability Alliance. This Alliance consisted of educators from all educational sectors, including those in environmental and educational organizations. The ESACP developed a number of initiatives, all aimed at ensuring that Australians had opportunities to experience and implement sustainability practices in their daily lives. These initiatives are discussed in more detail in Chapter "Teacher Education and Education for Sustainability".

While occurring concurrently, our initiative, as presented in this book, was different in that it had a clear focus on change across whole systems, rather than individual initiatives focused on parts of systems, or on individual behaviors. Our initiative began in 2005, the same year the DESD began, and continues to this day. The first stage of our initiative commenced two years before the launch of the iPhone, and while the rate of change in teacher education cannot be compared to technological innovations that have occurred since the launch of the iPhone, there has been significant innovation in the field of teacher education for sustainability as a result of our initiative.

Stage 1 (2005–06)

The first stage of our initiative involved an extensive review of international initiatives being undertaken to bring about sustainability-oriented change in initial teacher education. A systematic literature and website search, using a variety of databases, was conducted to identify relevant initiatives. Requests for initiative recommendations were also sent to our environmental and sustainability education community via e-lists. Documentation about specific initiatives, including program structures, supporting materials, resources and evaluation reports, were obtained from initiative websites where possible. Correspondence also took place with initiative leaders and related stakeholders to seek clarification or obtain additional information. This process resulted in the identification of 25 different initiatives.

Our review of these 25 initiatives indicated that there were three main approaches being used by teacher educators to facilitate change: resource development (such as the production and distribution of 'resource kits'); action research projects (where participants were both developing and driving the process of change); and contextual change initiatives (seeking whole of system change). Through our review of these approaches, we developed a new model, the Mainstreaming Sustainability Model. This model incorporated key features of action research and whole of system approaches to change, as action research invited the development of deep and meaningful engagements, while a whole of system approach allowed for engagement with a number of stakeholder organizations and key agents of change within a system (Ferreira, Ryan, & Tilbury, 2006). The model proposed a strategy for initiating change simultaneously across and within initial teacher education institutions and related organizations.

Stage 2 (2007–09)

The second and third stages of our initiative examined whether the Mainstreaming Sustainability model was an effective means for mainstreaming sustainability in initial teacher education (Ferreira, Ryan, Davis, Cavanagh, & Thomas, 2009). The model was initially piloted in seven teacher education institutions in two Australian States/Territories. Using action research as its methodology, the pilot built on and supported existing informal teacher education networks of academics and professionals with an interest in EfS. The pilot worked to strengthen communication across teacher education faculties and departments, while at the same time expanding and deepening engagement with a range of individuals and organizations whose work directly or indirectly impacted on the work of teacher educators, such as government education departments, curriculum authorities, teacher registration bodies, professional associations, teacher unions and teacher education students.

Stage 3 (2009–10)

In Stage 3, the pilot was replicated in two further Australian States/Territories across 3 additional universities (Steele, 2010). There was a strong focus in this stage on curriculum development and change in teacher education programs. Five key factors that facilitated change were identified:

1. collaboration;
2. developing a shared vision/ethos of sustainability and sustainable practice;
3. connecting existing EfS content and practices;
4. using experiential and active learning processes; and
5. creating opportunities for integrated programs within teacher education.

Stages 2 and 3 also allowed us to trial the model in a diverse range of contexts in Australia: different State governance systems; different State curricula; and both metropolitan and regional universities.

Stage 4 (2012–13)

This stage of our initiative sought to extend and deepen the findings of the earlier stages by further trialing, refining and extending the model (Stevenson, Ferreira, Davis, & Evans, 2014). In this stage, all universities with initial teacher education faculties or departments (including several with early childhood teacher education programs), along with allied government, non-government and professional associations, across one Australian State (Queensland), sought to bring about institutional change that would facilitate the embedding of sustainability in the programs, courses,

practices and initiatives of their institutions. The main outcome of the initiative was a revised model for system-wide change, based on and supported by multi-site case studies. In addition, our initiative further enhanced capacity for change within and across teacher education systems in Queensland.

As our focus on the systems change process gathered momentum, we also established a national network of teacher educators interested in education for sustainability (EfS). We invited representatives from each of the other Australian States to the final meeting of Stage 4 participants in Queensland, to introduce them to our model, formalize the national network, and to provide support for them to initiate a similar project for change in their own States/Territories. These State/Territory representatives provided an analysis of similarities and differences between the Federal and their State systems at our final meeting. They then disseminated the process of change, including successful project strategies and outcomes, across teacher education institutions and other key change agents within their respective States. They also acted as facilitators for the creation of a State network and for stimulating their State's participation in the national network.

The initiation of a national network for supporting the embedding of EfS in teacher education enabled Stage 4 participants to share the knowledge, understandings and experiences they had gained over the life of this stage of our project. It also allowed national representatives to draw from more experienced change agents, share and compare stories of EfS from very different contexts, and to clarify their understanding of EfS, change processes, and leadership for change, in a supportive environment.

Stage 5 (2014–15)

Drawing on the emerging network, a series of State-based workshops with teacher educators for sustainability were held across Australia. At these meetings, the systems change research project and the re-named systems change model—the Embedding Change Model (Evans, Ferreira, Stevenson, & Davis, 2017)—were presented and discussed. These meetings served to further consolidate and strengthen the national network.

Stage 6 (2016–Ongoing)

Since the completion of Stage 5, our activities have focused on dissemination, with a range of papers, chapters and conference presentations, and ongoing relationship development and collegial support through the national network. While our initiative has focused solely on change efforts within Australia, there is now growing international interest, and our Model is being used outside of Australia to facilitate change within initial teacher education institutions.

Our initiative continues but with a different focus. The key focus now is not about working directly with particular teacher education institutions or systems but is instead focused on providing mentoring and support for ongoing efforts to embed sustainability in teacher education in Australia. Participants remain involved in the initiative through a number of loosely coupled networks that continue to promote, support and facilitate change for sustainability in teacher education. Participants engage with one another on an as-needs basis, through direct communications; opportunities provided by local, national and international meetings, seminars and conferences; and through blogs, newsletters and academic publications.

Chapter Summary

In this chapter we have discussed the varied foci of each of the stages of our initiative, showing the shifts that have all contributed to the development and refinement of our Embedding Change Model. In the following chapters, we outline the rationale for undertaking this initiative (Chapter "Teacher Education and Education for Sustainability"), provide an overview of the model for change we have used (Chapter "The Embedding Change Model"), share descriptive examples of projects undertaken by those who participated in the various stages of our initiative (Chapter "Exemplars of the Embedding Change Model in Practice"), and discuss the process we followed when using the Model (Chapter "Using the Embedding Change Model"). We conclude (Chapter "What We Have Achieved and Learnt") by reflecting on lessons learnt and possible ways forward in our joint efforts to embed sustainability in teacher education programs.

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Teacher Education and Education for Sustainability

Neus (Snowy) Evans

Abstract Teacher education, for at least the last 50 years, has been challenged to engage with a range of social and environmental concerns. We outline here the ways in which teacher education has been repeatedly seen as a key context for facilitating change and reflect on its failure to adequately do so. An overview of the fields of environmental and sustainability education, along with an outline of key policies and strategies, is provided. We also explore what constitutes quality education in the 21st century, and the role that education for sustainability can play in achieving this. We conclude by arguing that, while there have been many efforts and many pockets of good practice, these remain disconnected from one another and have, therefore, not led to broad-scale embedding of education for sustainability in teacher education.

Introduction

The world as we know it is facing unprecedented challenges brought about by disruptions to social, economic and ecological systems. Climate change, biodiversity loss, political turmoil and war, growing social inequality between the poor and the rich, and increasing desertification and dryland salinity pose extremely serious threats to the health and wellbeing of human and other than human systems. The latest reports from the World Wildlife Fund (Grooten & Almond, 2018) and Intergovernmental Panel on Climate Change (IPCC, 2018) confirm that "unsustainable human activity is pushing the planet's natural systems that support life on Earth to the edge" (WWF, 2018, para 1). Overexploitation of species, agriculture and land conversion between 1970 and 2014 has caused an average 60% decline in global mammal, amphibian, reptile, bird and fish populations (Grooten & Almond, 2018). Added to this are an increasing number of emergency situations arising from climate change.

We are currently witnessing the effects of 1 °C rise in global temperatures (above pre-industrial levels) through more extreme weather, rising sea levels and diminishing Arctic sea ice (IPCC, 2018). It is expected that by 2052 global temperatures will rise

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by a further 0.5 °C to a total warming of 1.5 °C above pre-industrial levels. The effects of this further rise in global temperature is predicted to manifest in more extreme heatwaves, storms and droughts, mass species extinctions, and further sea level rises (IPCC, 2018). This prediction is already real, with Australia having in January 2019 the hottest month since records began in 1910 (Cox, 2019).

The consequences of such global warming are serious. A 1.5 °C rise in temperature will decimate ecosystems and impact the habitability of places, leading to social and economic disruptions and forced migration (IPCC, 2018; McLeman, 2018). We are already witnessing forced migration resulting from sea level rise in low-lying communities such as Shishmaref in Alaska and island states such as Kiribati in the South Pacific. A further 0.5 °C rise in temperature will exacerbate the occurrence of environmental disasters, while also disrupting human health and wellbeing. The most recent *Lancet Countdown on health and climate change: From 25 years of inaction to a global transformation for public health* report (Watts et al., 2018), for example, predicts a complex array of health impacts from climate change. These include under-nutrition and bacterial diarrhea resulting from reduced fishery, aquacultural and agricultural productivity and floods; and cardiovascular, respiratory and vector-borne diseases encouraged by ozone increase, particulate pollution, and pollen allergenicity that results from heatwaves, drought and fire. In short, the impacts of climate change alongside other sustainability concerns are serious for the health and wellbeing of all Earth systems and organisms. As concerned educators faced with a void in policy and/or leadership to drive change for sustainability, we naturally turn to education.

Education, Sustainability and a 21st Century Education

The idea that education pay attention to sustainability is not new. Calls by the United Nations for the inclusion of sustainability education into all areas of teaching and learning dates back to *Agenda 21* (UN, 1992). Since the mid-1970s, the UN has been calling for environmental education to be a key component of teacher education programs (UNESCO-UNEP, 1977). Education has been called on because of its capacity to ensure current and future generations develop the knowledge, understanding, values, skills and dispositions necessary to overcome environmental challenges and threats and to ensure a sustainable environment for both current and future generations.

Education with such a focus is borne out of a number of different educational concerns, often referred to as "adjectival educations". These include, for example, Development Education, Global Citizenship Education, Peace Education, Environmental Education and, more recently, Climate Change Education. Key concerns of each of these educations have together formed the basis for Education for Sustainability (EfS). EfS itself has a range of names, each demonstrating a different area of emphasis for educators. For example, EfS is also referred to as Sustainability Education (SE), Education for Sustainable Development (ESD), Learning for Sustainability

(LfS), Climate Change Education, and Environmental Education for Sustainability (EEfS). EEfS was used for many years by the Australian Government as it best reflected their conceptualisation of sustainable development as *ecologically* sustainable development, and their focus on protecting the environment. More recently, the term Education for Sustainability (EfS), has come to be commonly used in Australia, reflecting the importance of education in achieving environmental, social, political and economic change. We do not use the term Education for Sustainable Development (ESD), as the UN does, as we argue that this problematically places the focus on continuous development and economic growth. While a focus on humans and the economy is important, this should not over-ride the focus on the natural environment (Jickling & Wals, 2012).

The underpinnings of EfS, for the authors, is education *for* the environment (Fien, 1993, 2000), which clearly locates our concerns in the realm of individual and community actions for economic, political, social and environmental improvements. Whatever the name used, the goal is firmly focused on developing citizens capable of responding to complex 21st century challenges (Australian Research Institute in Education for Sustainability [ARIES], 2009). In this book, we use the term commonly employed in Australia, that is, Education for Sustainability (EfS). More important than the term, however, is ensuring that education in the 21st century responds to the challenges of the times and contributes to quality educational outcomes for learners, and political, social and economic practices that do not harm the environment.

What is meant by quality 21st century education? The answer is not straight forward because the concept of quality is a shifting one (Laurie, Nonoyama-Tarumi, McKeown, & Hopkins, 2016; UNESCO, 2005a). While there is general agreement on the benefits of a quality education (see, for example, UNESCO, 2004, 2005a), there is a lack of clarity on what it is or what it looks like. Some, such as UNESCO (2004, 2005a) and Laurie et al. (2016), see quality education as education that develops the sorts of knowledge, skills, understandings, values and dispositions to enable all to become global citizens, working to address social justice and sustainability concerns. Delegates at the 2015 World Education Forum agreed that quality education encompasses the acquisition of a broad set of knowledge, skills and values capable of fostering critical thinking, creativity, solidarity, dialogue and problem solving (UNESCO, 2015a). The Incheon Declaration (UNESCO, 2015b), resulting from the 2015 World Education Forum, states that quality education is that which:

> fosters creativity and knowledge, and ensures the acquisition of the foundational skills of literacy and numeracy as well as analytical, problem-solving and other high-level cognitive, interpersonal and social skills. It also develops the skills, values and attitudes that enable citizens to lead healthy and fulfilled lives, make informed decisions, and respond to local and global challenges through education for sustainable development (ESD) and global citizenship education. (p. 2)

Others (e.g., Hattie, 2003; Killen, 2016; Rowe, 2003) align quality in education with teacher attributes and the extent to which the teacher is able to exercise those attributes. Whatever the case, at the heart of the problem is that education itself is highly complex and context dependent; therefore, it is impossible to develop a

universal definition, curriculum, list of criteria or topics capable of capturing quality in education (UNESCO, 2005a).

There is some agreement, however, on the concept of a 21st century education. For the Australian Institute for Teaching and School Leadership [AITSL] (2017a), 21st century education is about teaching 21st century skills (whatever these are), employing enabling technologies, and using personalized and flexible learning approaches. Domenech, Sherman, and Brown (2016) argue that 21st century education involves creating literate, participating, productive citizens through connected, but personalized learning. For Watson (2017), it includes equipping students with the necessary resources to compete in a global economy; to create a fair, just and flexible society; and to teach students to think well. UNESCO's (2015c) vision for 21st century education similarly includes an economic imperative within a humanistic approach where education and knowledge are seen as a common good, particularly within UNESCO's broader sustainable development aspirations. In summary, common themes amongst this sample of 21st century education thinkers include connectivity, criticality, flexibility and a call for educational change.

How to approach the teaching and learning of 21st century imperatives is, however, more controversial. Conservative educators advocate for classroom work that focuses on the three Rs—reading, writing and arithmetic—arguing that such key knowledge and skills are vital for full participation in 21st century societies (Watson, 2017). Progressive educators acknowledge that the three Rs are critical but argue that by themselves they are insufficient to develop student capacity to tackle complex 21st century problems. Here EfS has a role to play in working towards the development of competencies, skills, concepts and tools that can be used to reduce or halt unsustainable practices and enhance resilience in the face of imminent change (Wals & Benavot, 2017).

We contend that it is possible to attend to the teaching and learning of traditional academic skills, like reading and writing, alongside competencies and general capabilities, like critical thinking and creativity, within the context of a local sustainability problem. Such an approach not only results in an increased relevance of the content learnt, it can also lead to the achievement of a range of ancillary outcomes such as improved student attendance, and the development of problem-solving, critical and systems thinking skills and capacities (Swedish International Centre of Education for Sustainable Development [SWEDESD], 2016).

To provide some background, EfS is an educational approach with roots in Chap. 36 of *Agenda 21* (UN, 1992) and is referred to in these documents as Education for Sustainable Development (ESD). In *Agenda 21*, ESD was underpinned by four imperatives:

(1) improve basic education;
(2) re-orient existing education towards sustainable development;
(3) increase public awareness and understanding of sustainability issues; and
(4) promote training for workers and community members (McKeown, 2006; UN, 1992).

The imperatives for ESD, over the 25 plus years since publication of *Agenda 21*, have changed only marginally. The most recent UNESCO initiative to support ESD—*The Global Action Programme on Education for Sustainable Development (GAP)*—calls on ESD practitioners to:

(1) reorient education and learning to enable development of skills, values and attitudes necessary for contributing to sustainable development; and
(2) strengthen education and learning in all agendas, programs and activities that promote sustainable development (UNESCO, 2018a).

Whatever the specific aims, EfS/ESD is consistently promoted as education that encourages development of knowledge, skills, values and attitudes necessary for transitioning to a more sustainable and just society for all (Leicht, Heiss, & Byun, 2018). Addressing EfS/ESD, then, means including key sustainability issues into teaching with the intent of shifting thinking to the point that it provokes and enables people to make decisions and take actions towards a safer, healthier and more prosperous world (United Nations Economic Commission for Europe [UNECE], 2012).

How 21st century education systems undertake this work varies. In Australia, for example, there is no direct imperative to address EfS. The Australian Curriculum includes sustainability as a cross-curriculum priority from Foundation Year to Year 10 and includes climate change and biodiversity in the senior Geography curriculum. However, it is perfectly possible to successfully complete 12 years of schooling without gaining any EfS knowledge, understanding, skills, values or dispositions because Geography is an elective in the senior years of schooling and the sustainability cross-curriculum priority is an optional rather than a compulsory requirement from Foundation Year to Year 10.

Further complicating matters are State-based interpretations of the Australian Curriculum (as Education in Australia is a State Government rather than Federal Government responsibility). These variations end up either prioritising, minimising, or completely ignoring EfS. EfS is also disregarded within the Australian Teacher Professional Standards with no reference made to competencies for teaching EfS. This is somewhat ironic, given that the Australian Institute for Teaching and School Leadership (AITSL, 2017b) Standards (AITSL is the national body responsible for providing leadership for Australian States and Territories in promoting excellence in the teaching profession) are presented as "a public statement of what constitutes teacher quality. They define the work of teachers and make explicit elements of high-quality, effective teaching in 21st century schools that will improve educational outcomes for students" (AITSL, 2017b, para 1). Given the lack of any real requirement to address EfS content or employ EfS pedagogies, it should come as no surprise that EfS in Australian teacher education is seen as optional and marginal to the main purpose of initial teacher preparation. The state of EfS in teacher education is expanded upon further below. First, we provide a brief history of environmental and sustainability education.

History of Environmental Education and Education for Sustainability

The call for the environment to be included in education agendas can be traced back to the 1972 United Nations Conference on the Human Environment (IUCN, 1972) and the resulting *Belgrade Charter: A framework for environmental education* (UNESCO, 1975), which outlined the goal for environmental education as:

> [Developing] a world population that is aware of, and concerned about the environment and its associated problems, and which has the knowledge, skills, attitudes, motivations and commitment to work individually and collectively toward solutions to current problems, and the prevention of new ones. (p. 3)

Two years later, the United Nations Educational, Scientific and Cultural Organization (UNESCO) together with the United Nations Environment Programme (UNESCO-UNEP, 1977) expanded the definition (in the Tbilisi Declaration) to recognize the importance of systems, holism, and attention to context. In the Tbilisi Declaration, there was emphasis on environmental education being embedded across the whole system of education, and on adopting a holistic approach to examining social and economic issues through an environmental lens. Despite this focus being adopted in 1977, we can see it remains the same over 40 years later, for example, in the UNESCO document *Textbooks for Sustainable Development: A Guide to Embedding* (UNESCO, 2017a).

Ten years after the Tbilisi meeting, in 1987, the World Commission on Environment and Development proposed the concept of sustainable development in *Our Common Future*, commonly known as 'The Brundtland Report' (UN, 1987). Environmental educators, like others, began to explore the implications of this concept for their work, and thus began the shift in environmental education from a focus on the environment, to a focus on sustainable development. In Europe this is called education for sustainable development (ESD), while in Australia, this is referred to as education for sustainability (EfS). In 1992, the United Nations produced an action plan for sustainable development entitled *Agenda 21*, that emphasized the role of education, public awareness and training in sustainable development. In Chap. 36 of *Agenda 21*, there was a call for educators to reorient education towards sustainable development. Here too the significant role of teachers was recognized, with recommendations for initial and in-service teacher education to incorporate ESD.

The next significant initiative in the development of the field of EE/ESD/EfS was the declaration by the United Nations of the Decade of Education for Sustainable Development (DESD), which ran from 2005 to 2014. The DESD was a further attempt by UNESCO to encourage education towards sustainability in the face of a worsening global crisis due to overuse of natural resources, poverty, violence and inequity (UNESCO, 2017b). The objective of the Decade was to integrate the principles, values, and practices of sustainability into all aspects of education, with the goal of promoting changes to ensure environmental integrity, economic viability and social justice for present and future generations.

The Global Action Programme (GAP) on Education for Sustainable Development (ESD) followed on from the DESD and now forms part of a broader UNESCO education agenda to 2030. The broad aim of the GAP is to generate attention and action in relation to ESD across all levels and areas of education (UNESCO, 2018a), including early childhood, primary, secondary, vocational and higher education. The GAP has two objectives and five priority action areas (see UNESCO, 2018a). Of particular importance to educators is the objective to reorient education and learning to enable everyone to acquire the knowledge, skills, values and attitudes to contribute to sustainable development. Action areas in support of this include the integration of sustainability into education and training environments (whole-institution approaches) and increasing the capacity of educators and trainers (UNESCO, 2015c).

UNESCO's 2030 agenda also includes 17 interconnected sustainable development goals (SDGs). The aim of the SDGs is to "secure a sustainable, peaceful, prosperous and equitable life on Earth for everyone now and into the future" (UNESCO, 2017c, p. 6). Of particular importance to educators is goal 4: Ensure inclusive and equitable education and promote lifelong learning opportunities for all. The goal is bolstered by seven global targets designed to promote access, retention or reorientation of education and training by advocating that all young people complete primary and secondary schooling, have equal access to affordable vocational training, are free from educational, gender and wealth disparities, and achieve universal access to quality higher education. Underpinning goal 4 is a belief that education, at all levels, is a powerful driver for sustainable development (United Nations Development Programme, 2018). Of particular interest here, within the context of teacher education, is target 7 calling for EfS to be integrated into teaching and learning practices:

> By 2030, ensure that all learners acquire the knowledge and skills needed to promote sustainable development, including, among others, through education for sustainable development and sustainable lifestyles, human rights, gender equality, promotion of a culture of peace and non-violence, global citizenship and appreciation of cultural diversity and of culture's contribution to sustainable development. (UNESCO, 2017d; Goal 4.7)

The extent of progress towards Goal 4 is unknown at the time of writing this book as it is set for review in 2019. However, it is clear that the scene for the fifteen years between 2015 and 2030 is set, the characters fixed, and education, specifically teachers, are (re)confirmed as having a key role in the achievement of sustainability. The repeated inclusion of education in sustainable development policy firmly places the problem of sustainability as a problem for education to address and resolve. Education is seen as a catalyst for change towards sustainability and the 17 sustainable development goals. This is because education, particularly when taking an EfS approach, can enable development of the type of knowledge and competencies required for overcoming challenges associated with achieving each SDG (UNESCO, 2018a). In the words of Irina Bokova, Director-General of UNESCO, "Education is key to the global integrated framework of sustainable development goals. Education is at the heart of our efforts both to adapt to change and to transform the world within which we live" (UNESCO, 2015b, p. 3).

Sustainability Education and Initial Teacher Education

First identified as a need at the 1971 IUCN Conference on Environmental Conservation Education, the importance of embedding environmental education into the education of teachers has been reinforced ever since (e.g., UNESCO, 1978; UNESCO-UNEP, 1977, 1988); in international directives (e.g., UNECE, 2005, 2012, 2016); initiatives such as the UNESCO Chair on Reorienting Teacher Education for Sustainable Development; the Education for Sustainable Development Toolkit (McKeown, 2006); the DESD and GAP; and scholarly work (e.g., Evans, Ferreira, Stevenson, & Davis, 2017a; Evans, Stevenson, Lasen, Ferreira, & Davis, 2017b; Ferreira & Ryan, 2012; Ferreira et al., 2009; Kennelly & Taylor, 2007; Nolet, 2009; Steele, 2010; Summers, Childs, & Corney, 2005). Most recently, UNESCO has supported the integration of sustainability education in initial teacher education through Priority Action Area 3: Building capacities of educators and trainers (UNESCO, 2017e).

UNESCO formalised the need for teacher education in sustainability at the first intergovernmental conference on environmental education in Tbilisi in 1977, where ministers from around the world identified initial and in-service teacher education in environmental education as a 'priority activity' (UNESCO-UNEP, 1977, p. 20). UNESCO-UNEP went further in 1990, declaring the preparation of teachers to teach environmental and sustainability education as the 'the priority of priorities' (UNESCO-UNEP, 1990, p. 1). Since then, UNESCO has reinforced and promoted the important role of teacher education in working towards sustainability (Buckler & Creech, 2014) by, for instance, releasing guidelines and recommendations to reorient teacher education to address sustainability (UNESCO, 2005b). Teacher education in and for sustainability is seen as critical to ensuring teachers develop the necessary knowledge, understanding, skills, values and dispositions to enable the inclusion of sustainability education in teaching and learning practices. Sustainability is now recognized in many school curricula and university policies around the world (Buckler & Creech, 2014). For example, in Scotland, learning for sustainability is an entitlement for all learners. Correspondingly, every practitioner, school and education leader needs to demonstrate learning for sustainability in their practice (Education Scotland, n.d.). Similarly, in Sweden, it is a requirement that sustainable development is incorporated into education curricula at all levels as well as in teacher education (The Swedish Ministry of the Environment, 2004).

Ministers of education around the world have supported UNESCO's leadership on the incorporation of ESD into teacher education through various declarations. These include the *Bonn Declaration on Learning for Work, Citizenship and Sustainability*, resulting from the UNESCO World Conference on Education for Sustainable Development in 2009 and attended by some 50 Ministers and Deputy Ministers of Education. The *Bonn Declaration* called for the reorientation of curriculum and teacher education programs to integrate ESD into pre- and in-service programs of teacher education (UNESCO, 2009a). The ministerial call was repeated in 2014 at the Aichi-Nagoya UNESCO conference on Education for Sustainable Development.

This time, over 70 Ministers and Deputy Ministers of Education agreed to the further expansion of ESD into all levels of pre-service and in-service teacher education (Lotz-Sisitka, 2014). Most recently, 120 Ministers of Education from 160 countries adopted the *Incheon Declaration: Education 2030: Towards inclusive and equitable quality education and lifelong learning for all* (UNESCO, 2015b). The *Incheon Declaration* forms part of The Global Education 2030 Agenda for sustainable development (UNESCO, 2015b, 2017f) which is underpinned by 17 goals (see UNESCO, 2018b) explained above. The continued support by Ministers of Education for the inclusion of ESD/EfS into teacher education highlights the important role teacher educators have as powerful agents of change, capable of delivering the educational response needed to reorient education to achieve the SDGs (UNESCO, 2018a). The extent to which this work has progressed to date is uncertain. Currently, UNESCO's (2018a) reporting and our own review of work around the world highlights that while there are many examples of embedding ESD/EfS in teacher education, these tend to be isolated efforts rather than wide-scale, systematic approaches (Evans et al., 2017b; UNESCO, 2018a). Hopefully by 2020, when all nations are required to report to UNESCO's Global Education Monitoring Report on the extent to which ESD is mainstreamed into teacher education (UNESCO, 2016, p. 287), we will have a more positive picture to report.

That policy does not always lead to action or effective practice is well known. Although "pockets of innovation" (Nolet, 2013, p. 54) are reported from around the world, the extent to which new teachers have the capacity to embed EfS into teaching and learning practices once in schools is not clear. We know from research that enhanced knowledge positively impacts teacher education students' capacity and willingness to teach EfS. For instance, Evans, Tomas, and Woods (2016) found that increased knowledge and understanding of sustainability concepts strongly influences teacher education students' self-efficacy to teach EfS once they become teachers in schools. Kennelly (2012) and Andersson's (2017) studies, in the Australian and Swedish contexts, found clear links between initial teacher participation in a dedicated EfS subject and pro-sustainability beliefs, norms, preparedness, and motivation to teach sustainability education once in schools. However, researchers consistently reported beginning teachers felt unprepared to teach EfS and this negatively impacted the inclusion of sustainability in school education. Miles, Harrison, and Cutter-Mackenzie (2006) maintain that although novice teachers report wanting to include EfS into teaching and learning, insufficient knowledge prevents them from doing so. This finding is echoed across other research. This is not a new problem, with Fien and Tilbury (1996) reporting over two decades ago that low levels of preparedness were all too common and that the importance of paying specific attention to training in EfS was under estimated.

The extent to which EfS is embedded into initial teacher education also varies, partly in response to patchy developments in school education policy. For instance, EfS is a requirement in Danish and Swedish teacher education and forms part of the Professional Standards for Teachers in Scotland, Georgia and Sweden. The province of Ontario, Canada, has developed a set of core sustainability competencies for all pre-service teachers alongside a range of strategies and resources for integrating EfS

into teaching and local communities. In other countries, EfS is either an optional extra (UNESCO, 2017b), non-existent or has been demoted over time. This is the case in Australia, where strong leadership in EfS was once prioritised through a range of policies, curriculum frameworks and other initiatives like *Caring for Our Future: The Australian Government Strategy for the United Nations Decade of Education for Sustainable Development, 2005–2014* (Department of the Environment and Heritage, 2007); *Educating for a Sustainable Future: A National Environmental Education Statement for Australian Schools* (Department of the Environment and Heritage, 2005); and whole school approaches such as AuSSI (Australian Sustainable Schools Initiative) and QESSI (Queensland Environmental Sustainable Schools Initiative). However, these have been cancelled or downgraded over time, as governments and political priorities change. A smaller number of initiatives such as the sustainability cross-curriculum priority in the Australian Curriculum (Australian Curriculum, Assessment and Reporting Authority [ACARA], n.d.); AuSSI in the State of South Australia; and ResourceSmart Schools in Victoria, still exist. Sadly, the lack of material support such as funding and professional development also greatly affects the extent to which such initiatives can have meaningful impact or gain prominence. As a result, it is quite easy to teach and successfully meet Australian Curriculum outcomes in areas of learning without addressing any aspect of the Sustainability cross-curriculum priority.

Considering the historically inconsistent levels of support for, and priority given to, sustainability in Australian education, it stands to reason that the inclusion of sustainability in teacher education is a patchy or neglected area of practice (Ferreira, Ryan, & Tilbury, 2014a, 2014b). This same narrative is reflected in other countries (Ferreira et al., 2014a, 2014b; Hopkins, 2012; McKeown-Ice, 2000; UNESCO, 2009b, 2017g). UNESCO's assessment of the UN DESD found the range of countries embedding EfS/ESD in teacher education rose from two per cent in 2005 to eight per cent in 2013 (UNESCO, 2016). While this is a positive step forward, it is important to recognise that where EfS is addressed, it often takes a haphazard approach that is dominated by patches of isolated activity such as one-off curriculum development projects (Summers, Childs, & Corney, 2005), stand-alone EfS modules (UNESCO, 2017a), or is integrated, for the most part, into Science and Geography subjects (Van Petegem, Blieck, Imbrecht, & Van Hout, 2005) rather than through a consistent or systemic approach (Ferreira, Ryan, & Tilbury, 2006; Steele, 2010; Tilbury, Coleman, & Garlick, 2005). Our most recent review of the field (Evans et al., 2016) confirms this. We found that the field is characterized by 'patches of green' (NSW Environment Protection Agency, 2003), driven mostly by the passions and concerns of individual teacher educators who experiment with embedding EfS within their own spheres of influence. While these efforts are commendable, our body of work spanning over 12 years tells us this is not enough. Instead, we advocate for a systemic approach to embedding sustainability in initial teacher education.

A systemic approach is much more effective because it goes beyond including sustainability into the curriculum or pedagogies of particular subjects. In initial teacher education, this means EfS is part of its core focus and activities. It becomes an integral part of the faculty/school/departmental policies, core curriculum foci and

values, and is obvious in everyday pedagogies, practices and activities. Importantly, a systemic approach works within the teacher education system to seek change at all levels by including all stakeholders such as teacher education students, teacher educators, teacher education administrators and policy developers, allied professional associations, as well as the wider school community (Ferreira et al., 2006).

Chapter Summary

What this chapter illustrates is the many efforts that have taken place in the last 50 or so years to embed initially environmental education, and lately EfS, into teacher education. These efforts have resulted in pockets of good practice but have not led to a broad-scale embedding of EfS in teacher education. In the following chapter, we propose that this may in part be because the change efforts are too disconnected. We, therefore, propose a systems change model that we argue may be more successful in facilitating both deep and wide change that results in EfS becoming embedded in teacher education.

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The Embedding Change Model

Jo-Anne Ferreira

Abstract In this chapter, we discuss the ways our Embedding Change Model works to connect disparate components of a system so that we can achieve the outcome of embedding sustainability in teacher education. We provide a brief overview of contemporary change models, and of the theories and concepts underpinning our Embedding Change Model. We articulate how the Model enables change to occur simultaneously within and across an education system, and how it can work to join up and build capacity for all the people and organisations seeking to facilitate embedding of sustainability within a teacher education system.

Introduction

The question driving our work has always been how we can ensure that education for sustainability (EfS) is embedded into teacher education programs, and what the best model might be to help to facilitate this change. In the first stage of this project, we undertook an extensive literature review, and from this developed our own model for change, underpinned by systems and organizational change theories. In this chapter, we examine the fundamentals of systems theory and explain the processes involved in creating system wide change. We present the Embedding Change model as a framework that enables change to occur simultaneously within and across an education system. As systems theory underpins the Embedding Change Model, our first task in this chapter is to examine insights from systems theory we used in our efforts to ensure that EfS is integrated into initial teacher education systems in Australia.

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Models of Educational Change

Educational systems tend to be characterised by resistance to change (Cuban, 2013; DuFour & Fullan, 2013; Fullan, 2013; Hargreaves & Shirley, 2012; Tyack & Cuban, 1995), and many teachers are hesitant to explore issues outside of their familiar knowledge areas (de la Harpe & Thomas, 2009). Many teachers regard EfS as a novel concept, with few exposed to the content and pedagogical processes of EfS in their initial teacher education or through in-service professional learning in the field (Ferreira, Ryan, & Tilbury, 2007). In addition, educational systems seem resistant to change, which Fullan (2013) argues is due to the use of traditional rationalist models of change.

While the notion that change is achieved through linear processes is common, such an orthodox perspective has been challenged both by generalist educators (Cuban, 2013; DuFour & Fullan, 2013; Fullan, 2013; Hargreaves & Shirley, 2012), as well as within EfS (Elliott, 1991; Johnson & Mappin, 2005; Sterling, 2006, 2008). For example, Elliott (1991) argues that such rationalist, linear models of change demonstrate an 'engineering model' because, just like engineers, such models attempt to control the change process by communicating their requirements to those who will implement the change and develop a set criteria for monitoring and supervising progress. The assumption is that such a process is 'rational' and will, therefore, ensure orderly planning and implementation. However, Elliott argues that such a view of change ignores context, with all its complexities. Also ignored are the social realities of human interactions and activities, which also impact on how change occurs.

In traditional change models and approaches, change is not only seen as orderly and rational, but also contained within a single organizational structure. For example, an educational setting is here understood as a unique organization—more or less an island—with only loose connections between similar organizations. However, we know that 'no man (sic) is an island'. What such approaches fail to recognize, therefore, is that individual organizations are part of larger, more complex systems. In order to embed EfS in teacher education, we argue that the whole teacher education system, as well as individual teacher education sites, must change. While small-scale changes in individual schools, or brought about by individual teachers, are positive, they must be connected into large-scale organizational change if an innovation is to take hold.

It is clear that system-wide transformation requires a 'letting go' of notions of large-scale mandated reforms. Such monolithic social restructuring we know will not alter patterns that have historically constituted what we understand the nature and purpose of education to be (Farrell, 2000; Fullan, 2013; Fullan & Scott, 2009; Tyack & Cuban, 1995). What we see happening, therefore, is that reforms tend to become assimilated into previous patterns, which then become even harder to change. What is required instead is for complexity and diversity within contexts to be identified, understood and taken into account. This means that the large-scale implications of small-scale change must be investigated and understood. The newer wave of organizational change specialists (Dawson & Andriopoulos, 2014; Kotter,

2012) argue that it is the local, small-scale, bottom-up, emergent changes that cannot be readily anticipated that should be where we look to see change. Efforts therefore need to be made to 'join up' these small-scale localized changes. In so doing, they will work together to drive an overall change across a broad educational system. As Farrell (2000) notes, "the task of the planner is not to invent and/or implement the innovation or reform across the whole … but, rather, to develop and unleash a capacity to innovate throughout the system" (p. 95). Thus, achieving change is not about simply adopting another program or policy into your own setting. Rather, as Fullan (2011) suggests, it is about developing capacity for change with a focus on the transferability of capabilities. This is more important than the implementation of new products. In our initiative, therefore, building and enhancing capacity for change has been our focus rather than seeking to unilaterally drive a particular way of understanding, implementing or embedding EfS into initial teacher education.

Cultural Change Through Systems-Based Approaches

Systems-based approaches provide sophisticated ways of understanding and addressing the realities and complexities of contemporary organizations. In contrast to traditional reductionist approaches, thinking systemically provides a framework for understanding the world as an interconnected set of factors situated within a context.

What Is a System?

A system, here, is a human constructed entity made up of discrete, yet interrelated, elements. Systems are also bounded, that is, they have limits. There are features that are within a system and those that are outside. Systems can also be hierarchical, that is, containing sub-systems. In systems thinking, it is important to recognize boundaries in systems as they set the types of exchanges that may occur between a system and its sub-systems and the broader contextual environment surrounding the system. A permeable boundary encircles each system. It is through this boundary that information and resources are able to pass (Ferreira, Ryan, Davis, Cavanagh, & Thomas, 2009).

Changemakers within systems and sub-systems are able to define what constitutes a system for them (given that these are human constructs). Identifying a system boundary helps to clarify opportunities and the right people for enacting the desired organizational changes. This group of people can then work together to explore how the parts of a system are interdependent, and to understand the nature of their system's connections, external influences, their own roles and the roles of others in the system they have identified. Through such a process, members work together to develop and deepen their understandings of the larger system of which they are a part (Gharajedaghi, 2011). Such a process provides a holistic understanding of a system

that clarifies the ways in which the whole system emerges from the interactions between its parts and within its contextual environment. Therefore, if we attempt to 'solve' problems without understanding their connection into a broader system, we may unintentionally make a situation worse and produce undesirable outcomes.

In order to think and work systemically one needs, therefore, to identify the particular system of interest and its sub-systems. As these are human systems, thinking systemically also focuses attention on relationships and roles (Meadows, 2009) at each level of the system. It is these relationships and roles that affect how the system is able to function. From systems theory we also know that interactions are subject to 'hierarchical levels', 'hubs' and 'feedback loops'.

Hierarchical Levels

Systems have inter-relationships that are both hierarchical and subsidiary. There are three general hierarchical levels: the environment in which the system is located, the system itself, and sub-systems within the systems. A system of interest, containing sub-systems, is located within its contextual environment. What constitutes a 'system' and 'sub-system' can change based on the level of the system being considered at any particular point. For example, the sub-systems of a teacher education system may include teacher education institutions, schools, professional associations, government agencies, curriculum and policy bodies, and teacher accreditation and registration bodies. Each of these forms a sub-system within the broader system and may themselves contain additional sub-systems (Ferreira et al., 2009).

While a sub-system cannot directly 'control' a system of which it is a constituent part, the broader system also has constraints, and is only able to exercise partial influence over a sub-system. For example, if a single teacher education institution is seen as a sub-system, then it is influenced by, but has no direct influence over, government departments or individual schools. However, while a sub-system has no direct influence, changes can none-the-less be effected within the larger system through the activities and directions taken by the sub-systems. Together, these sub-system changes are able to impact on the broader system, causing it to change. This exemplifies the 'butterfly effect' (Hilborn, 2004) and illustrates how large-scale systemic change can be achieved from small-scale contextually specific changes.

Hubs

The notion of 'hubs' (Meadows, 2008, 2009) is another important concept within systems thinking. Hubs may be areas of activity or particular individuals. These individuals may not be in positions of power within an organization and are often identified only during a system mapping exercise exploring roles, requirements and interactions within a system of interest. Systems mapping (described in a later chapter)

helps to identify hubs of activity and those individuals who act as hubs within their sub-system.

Hubs are 'things' that connect with a disproportionate number of nodes within a system and thus play a key role in networks within systems. Identifying the hubs within a system is vital for leveraging influence. The notion of a hub is aligned with the concept of a leverage point in systems dynamics, that is, a place within a complex system where a minor change within one sub-system can result in a disproportionate change within a whole system (Hjorth & Bagheri, 2006; Meadows, 2009). Change across a system, such as the teacher education system, can thus be achieved by working with those individuals who are identified as crucial leverage points.

A key function of hubs is to build capacity and momentum for change through incorporating additional parts and players in a sub-system into the change process. They are crucial for scaling up and embedding change.

Feedback Loops

Interactions within systems occur through feedback loops, both negative and positive. Positive feedback enhances the degree of agitation within a system, while negative feedback allows systems to regulate or stabilize themselves. Feedback loops also help a system to maintain equilibrium through the making of continuous adjustments. This type of behaviour in a system is considered a balancing loop (Hjorth & Bagheri, 2006; Senge, 2006). In a teacher education system, for example, a positive feedback loop could be the ways in which hubs encourage others to change, who then encourage others to change, thus amplifying the original effect within the system or sub-system. A negative feedback loop could any processes and procedures that may frustrate the efforts of people attempting to effect change.

Systemic thinking also highlights that there are lags within systems. This means that the outcome of a change may not be apparent for some time (Senge, 2006). For example, student teachers may take up to four years before they begin teaching in schools, so there may be a delay before their knowledge about sustainability can be put into practice in schools.

Embedding Change Model

These key concepts from systems thinking have provided the theoretical framework for the Embedding Change Model (Fig. 1). This model demonstrates how systemic change can be achieved and illustrates the complexity of a systems-based approach to change.

The Model offers guidance on strategies for achieving systems change. These include:

- Identifying the system and its sub-systems;
- Identifying the system's boundaries to understand elements that can be influenced and changed;
- Mapping and understanding the relationships between system parts;
- Identifying and engaging hubs within and across the system who provide points of leverage;
- Developing a common vision for change;
- Developing participants' capacity for change;
- Developing coordinated and strategic communication strategies across the whole system; and,
- Continuously monitoring, evaluating and adapting the processes of change at the sub-system and system levels.

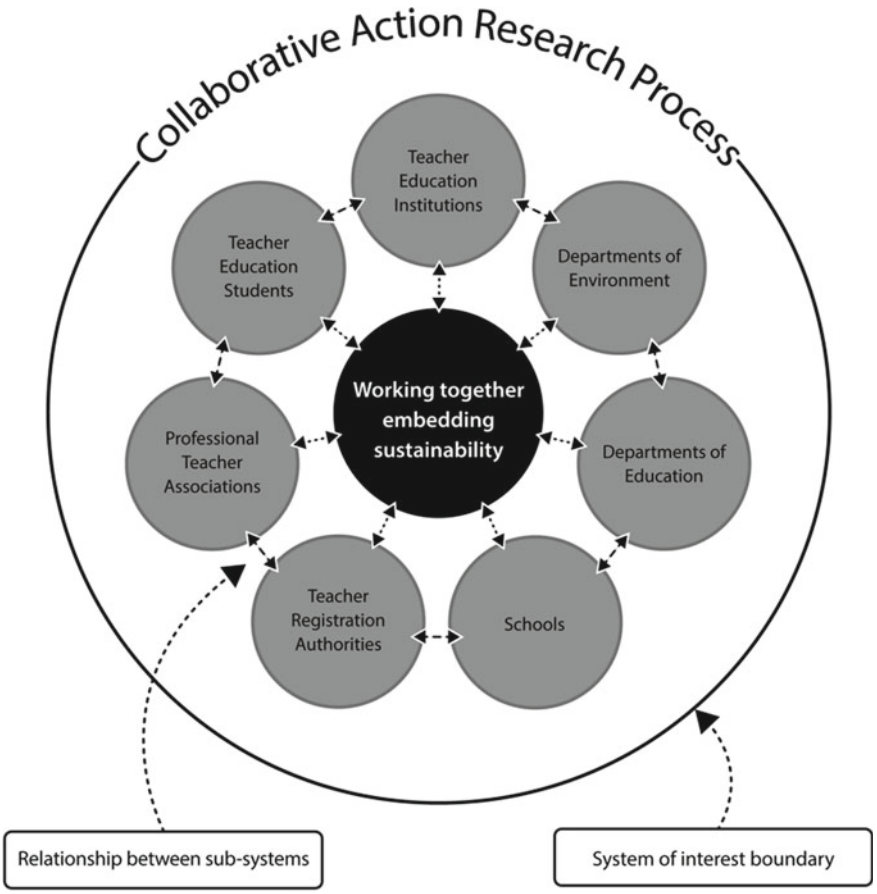

Fig. 1 Embedding Change Model

The Embedding Change Model provides a framework for effecting change at a number of levels within a system. In a teacher education system, for example, we might see change occurring at the accreditation, policy, planning and/or practice levels. The model assumes that sustained change occurs when there is a common vision for change and when all members of that system are working in ways that are consistent with the common vision. If this occurs, then we will begin to see a change being embedded across multiple levels of a system.

Chapter Summary

As environmental and sustainability problems increase and become more complex, the need for teacher education to engage with EfS and systems change approaches is also becoming more urgent. What is required is capacity building for change across all levels of the teacher education system to facilitate widespread and rapid change. Educators need to be reformers within their educational institutions as well as activists in their broader educational systems (Fullan, 2011, 2013). This is required if the small-scale changes individuals achieve are to lead to broader changes within teacher education systems. In this chapter we have outlined the theory behind our Embedding Change Model. In the next chapter, we show how our model has been used by a range of practitioners.

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Exemplars of the Embedding Change Model in Practice

Julie M. Davis and Juliet Davis

Abstract This chapter presents an overview of some of the change initiatives we undertook using our Embedding Change Model. Through five examplars, we illustrate how each of the organisations involved embedded change through connecting up with multiple partners. The exemplars illustrate how each university has taken account of their unique contexts, previous history of education for sustainability in the School/Faculty/University, any top-level policy support, and the experience of the teacher educators involved in leading change within their institutions. These examples illustrate that using the Model led to a flourishing of strategies and outcomes that have resulted in each teacher education institution uniquely embedding education for sustainability in their organisations and programs.

Introduction

As the introductory chapters in this book outline, there is limited knowledge about, or pedagogical possibilities, in relation to education for sustainability (EfS) within initial teacher education courses and programs, in Australia and internationally. Despite ongoing calls over many years for EfS to be provided in a thorough and systemic fashion within teacher education programs, the evidence—both anecdotal and from reviewing published research—indicates that what is available remains small-scale, ad hoc and of limited impact. To change this unsatisfactory pattern, the initiative outlined in this book sought to address this situation. It is important to note that a key feature of our systems work with multiple partners across varied university contexts is not standardization, but a rich flourishing of strategies and outcomes that have resulted from each university developing its own way of embedding EfS into their teacher education programs. The five exemplars profiled in this chapter illustrate how each university has taken account of their unique contexts, previous history of EE/EfS in the School/Faculty/University, any top-level policy support, and the experience of the teacher educators involved in leading change within their institutions.

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As noted, this system change project has taken place for well over a decade and has involved a significant number of universities across Australia. Over the life of the project, 18 universities offered detailed case studies written by teacher educators outlining what they did—driven by use of the Embedding Change Model—to include EfS content and pedagogies within their initial teacher education programs. We invite you to explore these accounts through the following reports generated over the life of the project:

The Australian Research Institute for Environmental Education (ARIES)/Australian Federal Government-funded:

Mainstreaming Sustainability into Pre-service Teacher Education in Australia (Ferreira, Ryan, Davis, Cavanagh, & Thomas, 2009) http://aries.mq.edu.au/projects/preservice2/files/Pre-Service_Teacher_Ed2.pdf

Mainstreaming Education for Sustainability in Pre-service Teacher Education in Australia: Enablers and Constraints (Steele, 2010) http://aries.mq.edu.au/projects/preservice3/Pre-Service_Teacher_Ed3.pdf

The Australian Office for Learning and Teaching (OLT)-funded:

A State-wide Systems Approach to Embedding the Learning and Teaching of Sustainability in Teacher Education (Stevenson, Ferreira, Davis, & Evans, 2014a) https://researchonline.jcu.edu.au/37349/1/A_state-wide_systems_approach.pdf

Case Studies: Embedding Sustainability into Teacher Education (Stevenson, Ferreira, & Davis, 2014b) https://researchonline.jcu.edu.au/31491/1/31491%20Stevenson%20et%20al%202014.pdf

Embedding Sustainability in Teacher Education: An Introductory Guide (Stevenson, Davis, Ferreira, & Evans, 2014c) https://eprints.qut.edu.au/67598/1/ID111900_Embedding_EfS_Guide_2014.pdf

For this book, a small number of descriptive exemplars (5) have been amended and updated to incorporate more recent efforts, new outcomes, and new goals for embedding sustainability change initiatives within the participating universities. As these updates have been undertaken by original authors there is some variety in how they are presented, reflecting the diversity of initiatives, people and contexts. These exemplars make up the substantive part of this chapter and describe the context for change in the individual universities as well as the aims, outcomes, and future directions for these universities in terms of embedding EfS into their initial teacher education programs.

Illustrated throughout these exemplars is the diversity of efforts undertaken by individuals and teams in the participating universities as they explored their institution-specific supports and barriers to building awareness and capacity for embedding EfS into their teacher education courses and programs. It is important to note that not only were the university contexts different, but there was also great variety amongst the participants leading the changes. Participants ranged from beginning lecturers just starting off their careers as teacher educators, to those with significant, decades-long experience in both teacher education and EfS. Some participants had

little or no knowledge of EfS while others had extensive local, national and international reputations in EfS. This variety meant that participating institutions had different levels of systemic engagement with EfS - from individually-initiated activities and actions that were about 'getting started' with embedding EfS, through to those working through well-established networks and systems having wider impact within their School/Faculties and, in some cases, into other parts of the university system and the broader teacher education system. It must be pointed out, however, that 'novices' in EfS and/or teacher education were not necessarily limited to a narrow range of changes. In some cases, these novices were able to use their participation in the project to execute wide and deep changes within their Schools/Faculties.

In summary, these exemplars provide a snapshot of the diversity of approaches, experiences and achievements of participants as change leaders. We have provided this selection as we believe they will help readers to obtain a sense of the rich possibilities that can be generated through utilizing the Embedding Change Model. Please note that Exemplar E offers a longer, more detailed account than the other cases provided in this chapter due to the deep and continuing efforts of the teacher education academics at this university to implement EfS initiatives. They outline in some detail their opportunities and achievements in systemically embedding sustainability/EfS into their teacher education programs.

Exemplar A

Institutional Context

University A has three regional campuses and has provided online and distance education programs for many years. The University is one of a small number of Queensland universities that enables rural and remote learning through the online environment. The University prides itself on its adaptability in meeting the needs of all its students and has forged a reputation as one of Australia's leading providers of both on-campus and online education programs in Australia, with more than 75% of its students studying in distance or online mode.

University A has made a number of commitments to ensure it is environmentally sustainable. These include membership of the national *Australasian Campuses Towards Sustainability (ACTS)* and the *Association for the Advancement of Sustainability in Higher Education*. It has also set up a University Sustainability Office, with facilities to promote Sustainable Transport Solutions, as well as an AUS $6 million Sustainable Energy Solution project.

The Education for Sustainability (EfS) project at University A was conducted within a context of significant institutional change, with external government reaccreditation of the Bachelor of Education occurring at the same time as the Faculty was responding to a range of internal and external factors and changes.

Project Aims

University A focused on embedding sustainability into their Bachelor of Education (Primary) program.

Project Description

Once the system mapping activity was undertaken by the project lead, a focus group of teacher educators was formed to discuss ways in which sustainability could be embedded across the whole of the Bachelor of Education program. The focus group initially assumed that the Science discipline would be the most appropriate subject area to embed sustainability concepts and approaches. It was soon realized, however, that an authentic embedded approach to EfS required its inclusion across the entire program, in all courses and in all discipline areas.

Consequently, a program audit was undertaken to determine how sustainability was currently engaged with in the Bachelor of Education program. Through a survey of 83 courses, it was discovered that sustainability was embedded within at least eight courses. These occurred in all program levels (Primary Education, Secondary Education) as well as a number of disciplines, including the Sport, Health, and Physical Education specializations. Sustainability also featured in three shared courses and one core course taken by all students enrolled in teacher education. It is likely that other touch points for sustainability also occurred within other specialist education programs such as Early Childhood, Special Education, Business, Environmental Science, and Vocational Education, however these were not surveyed. On the basis of this survey, the focus group then worked collaboratively with other teacher educators to identify additional areas where sustainability could be embedded, particularly through a focus on local environmental issues and concerns.

Project Outcomes and Current Directions

Activities undertaken as part of this project led to:

- Increased awareness about sustainability/EfS at University A;
- Capacity building across a number of course areas in the Bachelor of Education;
- Understanding that EfS is not solely the domain of Science and that there is potential to integrate/embed sustainability across a number of courses and disciplines; and
- The emergence of the idea of employing local environmental issues (for example flood mitigation, transportation, energy resources and mining) as content 'vehicles' for EfS across a range of discipline areas.

Exemplar B

Institutional Context

University B is a large urban university in Queensland with two city-based campuses. The current project is situated in the Faculty of Education, which has over 5000 students and 200 staff, making it one of Australia's largest providers of undergraduate and postgraduate education for teachers. University B's Faculty of Education is recognized as one of the top three Australian Faculties of Education in research and has a number of staff engaged in research in the EfS field.

Project Aims

This project sought to:

- Embed EfS more widely into its initial teacher education offerings; and,
- Enhance efforts to build capacity and awareness for EfS within University B.

Project Description

In the early stages of the project, the implementation of EfS was conducted primarily within the then School of Early Childhood within the Faculty of Education. One of the early initiatives undertaken was working with teacher education students to identify what they believed they should be learning about the environment through their teacher education program. Students worked collectively, using Facebook to communicate with one another, and also drew in students from all the other universities participating in this phase of the project in Queensland. The students decided that EfS should be a mandated component of their studies and developed a *Student Teacher Charter for Education for Sustainability* (2009). They then presented their Charter to the State Minister of Education at a forum in State parliament. This helped to highlight to the government of the day students' aspirations for EfS to be an embedded part of their teacher education programs.

At the Faculty level, EfS was embedded initially into the Graduate Diploma in Education (Early Years)—a program for students who held a degree other than Education—through bringing together Sustainability, EfS and the Arts in a unique subject connecting these three content areas. At this time there was also a wider 'curriculum refresh' process occurring in the Faculty, providing new leverage opportunities to extend the embedding of EfS. Teams were established to inform the Refresh process (for example, a leadership team, Think Tank, course structure teams, Key Learning Area and discipline studies advisory teams, special interest groups (SIGs) and exter-

nal reference groups), and these teams (or sub-systems) provided an opportunity to review the place of sustainability and EfS in all teacher education programs in the Faculty.

As a result of this activity, a Sustainability Special Interest Group (SIG) was established with the goal of ensuring sustainability became a key component and thread in the university's initial teacher education programs. The Sustainability SIG met in the first half of 2012 to advise the program restructuring teams on key design considerations relating to the allocation of courses and potential linkages across courses and programs, with the aim of ensuring that Sustainability was embedded consistently and meaningfully in and across all teacher education programs. Members of the SIG had a broad view of EfS as a concept that included environmental, social and economic sustainability—and hence was everybody's business—and strongly expressed the view that Education (and teacher education, in particular) had a key role to play in achieving sustainability objectives.

As a result of this groundwork, and leveraging off the requirement of Australia's national curricula and early years learning framework to include Sustainability, EfS is now an embedded part of curriculum in the Education Faculty. That said, it is true to say that activities relating to embedding of sustainability continue to be rather ad hoc within the Faculty. Multiple staff changes and restructures across all levels of the Faculty have impacted adversely on robust embedding. Nevertheless, there are multiple ways in which EfS is embedded in teacher education courses and programs at this time.

Project Outcomes and Current Directions

Initially, an integrated Arts and Sustainability course was included in the Early Years and Primary graduate entry programs. When these programs were replaced with a Master of Teaching (Early Childhood and Primary) they each included a standalone Humanities course with a focus on Sustainability. Similar standalone courses are now included in the most recent iterations of the undergraduate early childhood and primary courses. This allows for expanded opportunities to focus on sustainability and EfS. For example, a new elective course was taught for the first time in 2016, part of a suite of STEM (Science, Technology, Engineering and Mathematics) offerings that link EfS and health promotion. This attracted students from across the Faculty—early childhood, primary and secondary. Other examples of Sustainability being embedded into courses include a first-year early childhood core course on health and health promotion, a first-year core Arts course for early childhood and primary students, and in a final year core course on leadership in early childhood services. Another outcome of the ongoing project to embed sustainability into programs at University B has been the robust conversations between colleagues about matters such as the meaning and significance of EfS, especially as curriculum specialists jockey for space within ever changing initial teacher education programs and ever-changing policy imperatives.

Other opportunities for embedding EfS into teaching programs have also occurred in off-shore programs in Papua New Guinea and China, as well as in a range of short professional development courses and other ad hoc professional learning events for in-service teachers.

Within early childhood programs in the Faculty of Education, a hub of innovation in Early Childhood EfS research has also developed over the last decade or so. This includes the establishment and management of the *Transnational Dialogues in Early Childhood Education for Sustainability Research* network, which has an extensive range of international partners, and aims to build capacity in ECEfS research. Such capacity is seen as essential to embedding EfS into teacher education programs. There is also a well-established niche in higher degree research in EfS in the Masters, Education Doctorate and Ph.D. programs in the Faculty. In 2017–18, several teacher educators from University's B Education Faculty collaborated with colleagues from the University of Stavanger, Norway, in the development and delivery of a Ph.D. course focused on sustainability, democracy, social justice and active citizenship in early childhood for European early childhood doctoral candidates, thus continuing the momentum for embedding EfS into teacher education programs.

Exemplar C

Institutional Context

Situated in Queensland, University C has demonstrated commitment to sustainability in curricula by implementing the *Universitas 21 Statement* on sustainability and by becoming a signatory to the *Talloires Declaration* in 2009. University C's School of Education has been a provider of teacher education since 1945 and, at the time of involvement in the Embedding Sustainability in Teacher Education project, had 1218 students enrolled in a suite of undergraduate teacher education programs.

Project Aims

The aims of the project were to:

- Explore how the University C School of Education might embed EfS in their initial teacher education programs; and,
- Identify strengths and gaps of the current provision of the Bachelor of Education (Primary) program with regard to embedding sustainability and EfS.

Project Description

To achieve these aims, the following activities were undertaken:

- Convening a focus group discussion for teacher education staff;
- Auditing course profiles of the Bachelor of Education (Primary) program in relation to sustainability and EfS principles;
- Identifying how teacher educators embed EfS into course content and assessment via an online survey; and
- Interviewing two coordinators of courses that explicitly embed education for sustainability principles in order to identify their rationale and strategies.

Project Outcomes and Current Directions

As a result of these activities, EfS now has a presence in the School of Education at University C. There have been discussions, surveys, interviews and inclusion of EfS resources in the School's weekly updates, and sustainability-focused morning tea gatherings (twice a year, in June and October). These activities have brought sustainability issues to the forefront of the School of Education's consciousness. From this new, more visible position, greater scope for real action to embed EfS has become possible.

Since the original project, the following initiatives have been instigated in the ongoing efforts to embed EfS:

- *University C Sustainability Week*—a team of academics from the School of Education led an EfS workshop for the wider university community.
- Collaboration with the University's *Community Garden Association* for students enrolled in an Education and Creativity course. Through this collaboration, students developed place-based arts projects for children at the community garden site. Projects were shared at a lunchtime lecture in University C's Sustainability Week (2014) and were featured in University C's Sustainability newsletter (Issue 14—Winter 2014). Students have fond and lasting memories of their involvement and came to understand how place-based arts projects focussed on sustainability can be facilitated in schools, once they become teachers.
- The School of Education currently partners with an Environmental Education Centre (EEC) where third year primary education students experience a guest lecture from the Principal and have the opportunity to partake in a whole-day workshop, and another whole-day observation visit, to learn about the innovative, performative, place-based pedagogical practices employed at the EEC. To date, this experience has motivated two students to complete Honours studies on EfS with additional students indicating they also plan to implement some of these strategies when they are teachers in schools.

Exemplar D

Institutional Context

University D, in New South Wales, is a signatory to the *Talloires Declaration*, and has incorporated sustainability principles into its Mission Statement. The University is home to an Institute for Sustainable Futures, which conducts research in EfS. University D's project examining the embedding of EfS in initial teacher education was galvanized by the proposed sale of the University's bushland campus, where teacher education programs were delivered in a building surrounded by national park. Regrettably from an EfS perspective, the bushland campus has now closed, and all Education activities are now delivered at University D's city campus. The city campus and its surrounds still provide some good opportunities for EfS, and the city location now permits easier access to EfS resources and networks, along with an opportunity to explore urban environmental education. In addition, the new buildings were designed with a strong sense of sustainability in mind.

University D has also recently established a Climate Justice Research Centre, indicating the centrality of social impact considerations for University D. Therefore, there are opportunities to leverage off these commitments to social justice and sustainable futures within the university system when seeking to address sustainability-related issues. This extends from the exploration of ways to include sustainability projects, such as citizen science projects in curriculum, to having a larger portion of catering at University events being plant-based.

Research Aims

The research question explored through University D's project in the embedding sustainability in teacher education initiative was: *What is the nature of barriers to embedding EfS in the BEd (primary) program at University D?* The project focused on the dissonance between teacher education students' views of EfS and the practices they encountered at university.

Thus, the project and its associated research, aimed to identify:

- Understandings of EfS amongst student teacher participants;
- The current state of EfS in individual teaching courses;
- Opportunities that exist to raise the profile of EfS in Bachelor of Education (B.Ed.) courses and the program overall; and
- The nature and impact of University policies relating to EfS on the School and its programs.

Project Description

Participants engaged in three facilitated focus group discussions about their current teaching, and barriers and opportunities for including EfS in their programs and courses. The discussion also addressed the question: *What do we understand by EfS?*

Additionally, a cohort of teacher education students (120) was invited to develop responses to a sustainability scenario presented in class and to discuss EfS projects that might be undertaken as part of their learning. Students were also encouraged to critically reflect on the broader environment they encountered at University D, and opportunities for more sustainability actions were also discussed.

Project Outcomes and Current Directions

This project delivered a series of conversations with both students and academics in teacher education about EfS. Students stated their willingness to undertake projects relating to EfS within the University. Academics reported that while some EfS was taught, time constraints prevented the prioritising of EfS.

The project leaders reported that other outcomes were:

- Willingness of academics to increase their knowledge on sustainability and EfS issues;
- Willingness of academics to modify their lifestyle choices to facilitate sustainable living;
- Development of a list of areas that now need to be addressed in order to ensure system-wide change leading to EfS inclusion within teacher education programs;
- Opportunity to present the embedding project at a (course related) conference; and
- Increased understanding by the project leaders about university policy and opportunities for action.

Perhaps the most significant change to emerge from the project was the establishment of an elective course, 'Environmental Sustainability Education', in the Bachelor of Arts/Bachelor of Education (Primary) and Master of Teaching (Secondary) Education programs. The elective is offered on an annual basis, and routinely attracts a full cohort of 30 students. While this is a positive, it is limited. Not all students undertake the elective, and the establishment of an elective course does not guarantee teaching of sustainability across the curriculum. Indeed, it may even jeopardize this. Nevertheless, the establishment and delivery of the elective course makes a significant contribution to EfS in the School of Education. Future plans include an audit of sustainability education within all programs, courses and projects within the School, expanding out from our focus in this project on only one program.

Exemplar E

Introduction to the Institutional Context

Education for Sustainability (EfS) has been a part of teacher education at Queensland's University E for 17 years, while an embedding approach has been in place for nearly 10 years. A sustainability course, *Environmental Education for the Tropics,* was first introduced into teacher education as a final-year elective back in 2001. In introducing this course as one of the first to be offered online at University E, Whitehouse (2008) was initially concerned with "how to engage students meaningfully with place-based learning through the no-place of cyberspace" (p. 11). She concluded after six years that "well-conceived, web-based delivery is certainly no barrier to teaching and learning environmental education in the tertiary sector" (p. 11). This online elective, now titled *Environmental and Climate Change Education for the Tropics*, has sustained high levels of student enrolments and satisfaction over nearly 20 years.

A transition to an expanded embedding of sustainability approach in teacher education began when University E underwent a university-wide 'Curriculum Refresh' initiative from 2009 to 2011 to re-position itself as a 'University of the Tropics' with an explicit interest in sustainability and climate change issues. A central aim of Curriculum Refresh was for University E to become a national and international leader in addressing the critical challenges confronting the tropics. The University employed an integrated approach to improving environmental, cultural, economic and social sustainability throughout the university via teaching, research, operations and campus management, and community partnerships (Lasen et al., 2015).

As part of the Curriculum Refresh project, the School of Education adopted a whole-of-school approach to embedding Education for Sustainability (EfS) in its Bachelor of Education (B.Ed.). The recognition of sustainability as a cross-curriculum priority in the then newly-developed Australian national school curriculum, *Foundation to Year 10*, helped to support this whole-of-school approach. In addition to revising a longstanding elective, the Curriculum Refresh project saw the development of two new core sustainability courses. Academic staff also collaborated to embed sustainability concepts, principles, and issues, across courses in both the early childhood and primary majors. In 2011, at the completion of Curriculum Refresh, there were a total of 1255 students enrolled in the B. Ed. program across two campuses, and various modes and majors (internally in Early Childhood Education, Primary, Middle School, and Secondary majors; and externally in an ECE major and the Remote Area Teacher Education Program' [Primary]).

An *Embedding Sustainability in Teacher Education Project* was established in 2009, initially as part of Curriculum Refresh, when School of Education staff identified EfS as a core theme for the School and its teacher education programs. This project expanded beyond a curriculum development initiative to also be a research project using action research methodology to document, monitor and study individual and collective efforts in embedding sustainability concepts and values across,

initially, Bachelor of Education classes. The intent of this research was to identify the outcomes, emerging issues and enabling and constraining factors in this process.

Project Aims

This case study focuses on the embedding of EfS into the B.Ed. program through three core courses and one elective course, as well as the process of supporting staff to embed sustainability concepts, principles, and issues across other courses in the B.Ed. curriculum. The four EfS courses comprised:

1. The first-year core sustainability and science education course, *Foundations of Sustainability in Education*;
2. An embedded component in a third-year core professional studies course, *Early Childhood Education and Care*;
3. A final-year elective course, *Environmental and Climate Change Education for the Tropics*; and
4. A final-year core course, *Service Learning for Sustainable Futures*.

The core sustainability and science education course, *Foundations of Sustainability in Education*, was designed to ensure that teacher education students in the first-year of their program developed an understanding of the science and complex global challenges underlying sustainability. In later courses, namely *Early Childhood Education and Care*, *Environmental and Climate Change Education for the Tropics* and *Service Learning for Sustainable Futures*, teacher education students built capacity in developing climate change and sustainability learning actions across diverse schools and communities. This EfS-embedded program was intended to provide graduates with the requisite understandings of sustainability principles and issues to meet one or more of the six overarching learning outcomes in the B.Ed.

Project Description

Academic staff in teacher education worked collaboratively to design dedicated sustainability courses, revise a longstanding sustainability elective in order to enhance attention to climate change education, and embed sustainability principles, concepts, and issues across the early childhood (birth to 8 years of age) and primary (Preparatory to Year 6) majors, including science curriculum studies. The following courses were the result of this process.

Foundations of Sustainability in Education "draws upon the natural and social sciences and geographic and temporal scales to engage students in exploring a number of local and global sustainability issues, such as climate change, renewable and non-renewable energy, water availability and quality, biodiversity conservation and resource management, sustainable food production, and human population growth

and wellbeing" (Lasen et al. 2015, p. 329). This course offered both content and assessment to promote the centrality of the environment to sustainability while developing students' foundational knowledge in physics, biology, chemistry, geography, demography, and earth and environmental sciences. *Foundations of Sustainability in Education* also helps teacher education students to draw connections between science, sustainability education, and early childhood education, which are developed further in later EfS-embedded courses.

In *Early Childhood Education and Care,* students were asked to develop classroom activities and stimuli to address a number of policy guidelines. In particular, early childhood curriculum frameworks, the Australian National Curriculum emphasis on embedding sustainability as a cross-curriculum priority in learning areas such as science, and the Australian Education for Sustainability policies which emphasize the need for whole-of-school engagement and student participation in sustainability action processes. For example, one of the assessment tasks in *Early Childhood Education and Care* required students to develop a stimulus teaching resource to promote the EfS learning experience of children under five years of age. They were also required to write an accompanying rationale outlining how the resource aligned with the outcomes and themes from the contemporary curriculum documents, as well as strategies for using the resource to support children's understandings of sustainability.

Given that some of the original curriculum of the *Environmental Education for the Tropics* online course was now enacted in non-elective parts of the refreshed B.Ed., this elective was re-designed as part of the Curriculum Refresh to incorporate the developing field of climate change education. Teacher education students undertaking this course were now exposed to the complexities of climate change education and provided with strategies for effective environmental education practice across various professional and community settings. As well as encouraging analytical and reflective thinking, *Environmental and Climate Change Education for the Tropics* also aimed to assist students to develop an understanding of systems thinking by relating global sustainability and climate change issues at the global level to the local scale, and providing opportunities to explore interrelationships in local place-based contexts within which teacher education students are closely connected. The main assessment task in *Environmental and Climate Change Education for the Tropics* asked students to integrate climate change and sustainability knowledge into daily education practice by developing a curriculum research project of choice.

Service Learning for Sustainable Futures was a compulsory final-year course that served as the program capstone for both early childhood and primary education majors, in which teacher education students were required to partner with community organizations to plan, implement, and reflect on local, national and/or international service learning projects promoting social and environmental responsibility. The intended learning outcomes were critical reflection on professional learning, active citizenship and contribution to community, and demonstrating professional engagement with colleagues and the wider community to foster sustainable communities.

Subsequently, teacher education researchers comprehensively mapped the curricula and assessment methods across the individual courses and worked to ensure that

EfS was a central component of each of the above courses. As well as developing the four courses listed above, University E academics have worked to substantially embed sustainability concepts across a suite of other courses (see, for instance, Simoncini, Lasen, & Rocco, 2014), including social science and science curriculum studies. A four-stage iterative process was introduced in which teacher education academics at University E:

1. Identified the central characteristics (content and processes) of their particular class as a way to explicate their vision of and orientation to contributing to teacher education, by addressing the questions of: What are the core ideas or values that are central to the B.Ed. course you teach? What do we share and what might we share in our program orientation?
2. Identified what sustainability and EfS mean and might mean to them by addressing individually and collectively the question: How do the core ideas and values and the content and processes of my teaching relate to EfS?
3. Examined a number of EfS frameworks (e.g., UNESCO-UNEP/IUCN/WWF Caring for the Earth) and discussed: To what extent and in what ways do these frameworks help us connect our teaching orientation and our ideas about EfS? What framework(s) might we adopt/adapt/construct for our program?
4. Began to identify the implications for researching and evaluating teaching and learning practices: How might we engage in on-going systematic inquiry (i.e., research and evaluation) so that we are monitoring and improving our efforts?

Project Outcomes and Current Directions

Student evaluations have suggested that first-year teacher education students were engaged in learning the underlying science, socio-political contexts, and potential courses of action relating to local and global socio-ecological challenges, as part of a *big picture* perspective, in *Foundations of Sustainability in Education.* Third-year teacher education students were opened up to a range of possibilities to embed *sustainability opportunities* in young children's daily activities in *Early Childhood Education and Care.* Final-year teacher education students developed capacity to implement and reflect upon sustainability and climate change learning experiences, involving authentic actions, across diverse school and community contexts in *Environmental and Climate Change Education for the Tropics.*

In addition, facilitating sustainability education across multiple modes and for diverse cohorts has substantially enhanced our teacher educators' own pedagogical and technological knowledge and skills. With a view to preparing diverse cohorts of early childhood and primary educators to confidently and competently engage their future students in science and sustainability education across a range of school contexts, the focus in these courses was on active and collaborative inquiry-based, technology-enabled, and praxis-oriented learning and assessment experiences.

There is an urgent need for innovative teacher education approaches and strategies that assist future teachers to engage meaningfully with an interdisciplinary body of new knowledge and to become well-prepared to teach in ways that enable them to cope effectively with the new and emerging challenges they face (GMV, 2009). Effective sustainability education requires a re-imagination of current practices, involving a shift from add-on to systematic approaches that embed sustainability within a school or department's policies, practices, and teaching and learning activities (Ferreira, Ryan, & Tilbury, 2007a, 2007b; Greenwood, 2010; Sterling, 2004).

Chapter Summary

Embedding practices undertaken by participants who were engaged in profiling their particular cases for this book included:

- Building an understanding of sustainability and EfS within their faculty so that more academics are 'on the same page' about key ideas and purposes of the project;
- Ensuring that sustainability is seen as 'everyone's business'. This widens the focus from the more traditional Science and Geography foci, allowing discipline experts in, for example, the Arts, Humanities and Health, to understand the relevance of sustainability to their disciplines.
- Surveying academics and students about their knowledge of sustainability and EfS, and mapping EfS practices currently in place (or not) in their particular context, and using this information to inform future actions;
- Enlisting student teachers as key supporters for embedding sustainability into courses and programs. Student interest should be a key motivator for developing teacher education programs that are relevant to current and future generations of learners;
- Liaising with Heads of School/Faculty and/or with Teaching and Learning Deans in order to enlist their support for sustainability/EfS initiatives;
- Engaging with key University/Faculty documents and policies to leverage change for sustainability and EfS within their Faculties/Schools; and
- Capitalizing on university and Education faculty restructuring or curriculum refresh opportunities as opportunities to 'think outside the box' and create or strengthen new alliances and possibilities for embedding sustainability and EfS in teacher education programs.

In summary, there have been a wide range of strategies developed across these case study sites with many more outlined in the full cases profiled in our earlier detailed reports on this long-term project. This diversity results from adopting an approach that is not 'one-size-fits-all' but, rather, is a *process* that grows from applying the Embedding Change Model to the specific context of each university and Faculty of Education.

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Using the Embedding Change Model

Jo-Anne Ferreira

Abstract In this chapter, we outline the process and tools that we found best facilitated the use of the Model. We present these here for you to adapt for use in your own contexts. We share the 6 steps we followed: (1) Scoping and structuring the process; (2) Considering project participants, their roles and their leadership capacities; (3) System mapping; (4) Engaging and developing the network; (5) Providing, sharing and developing new knowledge and information; and (6) Action research/reflection in/on action. As mapping the system of concern is a key process, we also share the questions we used to help participants identify their system of interest, determine its purpose, decide on the transformations being sought, and develop their own model of the component parts and boundaries of their system. We conclude the chapter by discussing a range of barriers, and our strategies for overcoming these.

Introduction

Through the many stages of our project, we have identified a number of processes that facilitated the use of our model. These have helped us to successfully enact change within our teacher education systems. This chapter provides strategies for using the Embedding Change Model to create pathways for change, and in particular highlights tools that we found useful during the project. The material presented in this chapter is designed to be flexible and adaptive. While you will choose to use the suggestions in this chapter in ways that match your particular context, our aim is ultimately to assist you to help your students develop new perspectives on EfS, and to develop skills to enable them to become effective EfS teachers in early childhood services and schools. This chapter also identifies barriers to the change process and explains some strategies that were successful in our projects for overcoming these. This chapter is largely based on the following report: Stevenson, Davis, Ferreira, and Evans (2014).

J.-A. Ferreira et al., *Learning to Embed Sustainability in Teacher Education*,
SpringerBriefs in Education, https://doi.org/10.1007/978-981-13-9536-9_5

Strategies

This section provides advice on how to use the Embedding Change Model to create pathways for embedding EfS in teacher education. Some of these steps, especially Step 5: Providing, Sharing and Developing New Knowledge and Information, should be done concurrently with other actions throughout the life of the project (see Fig. 1). At the end of this section, we share examples of the processes we employed which were all framed in relation to the Embedding Change Model.

When selecting tools to further your project, keep in mind the principles of EfS to ensure that the tools you are using are well aligned with these principles. These tools might include, for example, systems thinking, collaboration, participation, critical reflection, action, contextually relevant approaches, and so on (Tilbury, 1995).

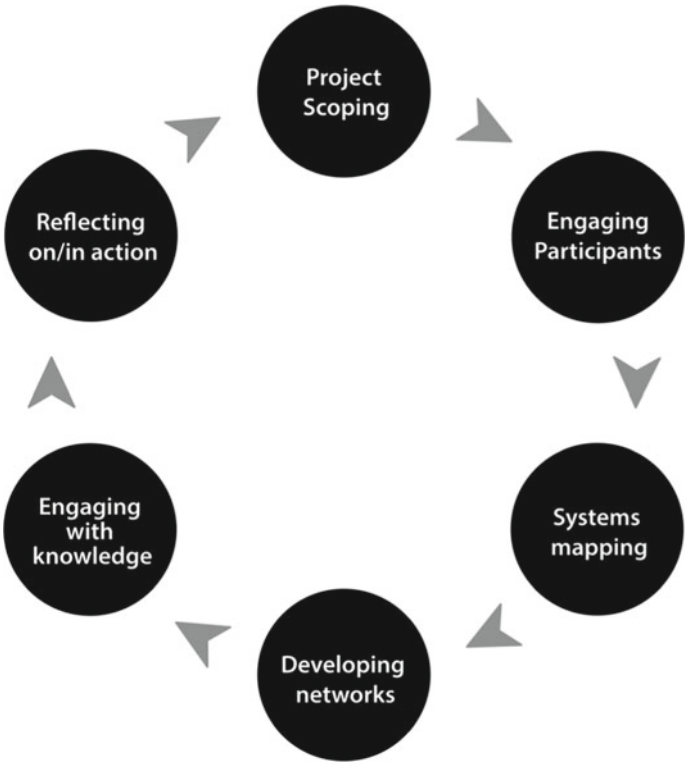

Fig. 1 Steps to change

Step 1: Scoping and Structuring the Process

Scoping your project will help you to consider and manage your timeframe, budget and resources. We suggest you begin by assembling a project team from the various sub-systems you initially identify in your teacher education system. This will allow you to move beyond individual, siloed attempts at embedding EfS and begin to establish the systems-based networks through which system-wide change will occur.

Step 2: Considering Project Participants, Their Roles, and Leadership Capacities

Leadership is an important consideration when seeking to effect system wide change. At the start, the roles and expectations of the project team and the project participants need to be clarified. We suggest you consider the kind of leadership you want for the projects, so that you are able to build both horizontal and vertical leadership into the project from the start. In thinking about leadership approaches, it is also important to ensure that these are philosophically consistent with EfS.

Step 3: System Mapping

Given the systems focus of the Embedding Change Model, it is important to explore and identify the elements of the system within which the change you wish to achieve is to occur. Systems mapping is a strategy that will help you to identify the components of a system (the sub-systems) and the relationships and interactions between them.

Systems mapping supports strategic action by helping to map out spheres of influence. For each component in a system, try to identify the individuals who are your hubs or key agents of change. Also think about how the components interact with one another and how the system interacts with its environment. In initial teacher education, for example, key agents of change could include teacher education institutions (administrative and academic staff, students), Departments of Education and the Environment, teacher registration authorities, national or State curriculum authorities, professional teacher associations, education unions, and schools.

Through the development of a systems map, you are able to explore the breadth of the teacher education system within which you are working, as well as the relationships between the system components. Understanding this allows you to see the various avenues for leveraging and facilitating change. The map can then be used as an initial discussion point with others you are seeking to engage in the change, so they can see their influence on and in the system, and expand on the roles, responsi-

bilities and relationships of their sub-systems as well. A systems map also allows all participants to see a visual representation of their place and role within the system as a whole.

Step 4: Engaging and Developing the Network

Networks are a strategy to embed and scale-up change within and across systems. They offer ways of building capacity, and creating cultural change, within large-scale organizations and systems such as teacher education institutions and schools (Ferreira & Davis, 2012). Put another way, collaboratively developing a systems map provides the structure for change, and the networks provide the relationships for change.

In implementing the systems change model, you will be creating a network that engages at multiple levels of a teacher education system. This is necessary to form the sorts of relationships that will allow for collaboration on key issues and embed change throughout a system. Networks also provide commitment and support for systems change initiatives.

These networks and relationships can be created and nurtured through one-on-one meetings, workshops and frequent online engagements (emails, Zoom/Skype, etc.).

Workshops

Workshops provide a safe, face-to-face space within which to:

- Create new relationships and networks
- Collaborate, participate and support
- Develop knowledge and understanding
- Think critically
- Reflect on processes of change.

Our projects held three workshops, of two days each, around 3 months apart. Participants gained important benefits from the workshops including building support through being part of a broader network; creating new relationships within the teacher education system; clarification of purpose and process; exposure to new knowledge and perspectives; and understanding that people are at different stages and were doing different things in their EfS journey.

Tip: Workshop minutes are valuable research data. Make sure you have ethics approval to use this data.

Online engagement

This strategy provides opportunities to:

- Use technology to overcome location and cost barriers
- Maintain contact within a network over time
- Achieve similar outcomes from workshops in a more efficient way, e.g. group discussion, develop networks.

Our projects used monthly tele-conferences to encourage participants to discuss emerging issues, understandings of EfS, constraining factors, and to reflect-on-action and systemic change processes. Participants liked the sharing nature of these meetings as they helped them to stay focused on the project, and to discuss and clarify issues as they emerged.

Tip: There are now a number of alternatives such as Zoom, Skype and UStream which will give you visual connection as well and can be audio recorded as data.

Step 5: Providing, Sharing and Developing New Knowledge and Information

As with any new project, process or model, there may be varying levels of understanding amongst participants around key concepts such as EfS, systems change and systems thinking. It is important to develop shared understandings of these concepts so that participants are able to communicate effectively on these issues and decide on appropriate actions to enable change. Sharing and developing knowledge within the network allows for the development of a system wide vision and approach to change.

We explored the various conceptions of EfS among project participants by holding small group discussions about sustainability and what it means for educators, identifying characteristics of EfS and its implications for teacher education curriculum and pedagogy, and sharing current status and approaches to EfS in teacher education institutions.

These discussions allowed group members to develop a vision of EfS that was appropriate to their institutional situation and an understanding of the implications for teacher education, and how embedding EfS into teacher education may best be achieved within their own institutions and in the system as a whole.

Under the guidance of the project team, participants were then able to start to work with their teacher education colleagues to identify and map approaches to embedding EfS in their teacher education curriculum that were consistent with the project's shared vision of EfS.

Such discussions can be facilitated by tools such as *Pecha Kucha presentations*, which invite participants to share the current status of and experiences with embedding EfS in their teacher education institutions and illustrate changes they achieve over the life of the project, in a short and focused way.

Pecha Kucha

This is a presentation format that allows for short, sharp presentations.

- 20 slides × 20 s each, automatically timed = 6 min 40 s.
- The format keeps presentations concise, and keeps things moving at a rapid pace.

We used this strategy for participants to showcase EfS in teacher education at their institutions, and to highlight the progress that had been made as a result of their systems change projects. Participants enjoyed this style of presentation and were glad to have the opportunity to share and discuss progress on their initiatives.

Tip: Varied interpretations of the concept of Pecha Kucha can result in interesting presentations. There are many websites with information and advice on Pecha Kucha.

Step 6: Action Research/Reflection-in/on-Action

When working to effect change within a complex system—such as the teacher education system—cause and effect can be hard to recognise and measure. Influences and actions may have unexpected results, and these often manifest in non-linear ways. Action research, with its strong reliance on reflection, provides an approach to understanding the impact of actions and interventions within a system (Kemmis & McTaggart, 2005). Critical versions of action research are conceptually consistent with EfS (Stevenson & Robottom, 2012).

Action research involves a systematic process of cycles of planning and action followed by observation and reflection. Reflection-in/on-action is a less formal and systematic process than action research. Under both approaches, participants define a problem, such as embedding EfS in teacher education, plan and undertake actions, then monitor/evaluate and reflect on observations of these actions. These opportunities for reflection allow actions to be revised—to incorporate new learning—as the project progresses. Action research or reflection-in/on-action are useful approaches when undertaking a systems-based approach to change as they provide opportunities for deep engagement, reflection and change. We used case studies to help document the action research process.

Case studies
This tool is used to report, investigate, analyse and reflect on an individual project. They can be presented in many formats. Participants were asked to prepare a case study as part of the project. Preparing a case study helped participants to capture and evaluate their initiatives for embedding EfS in teacher education. Participants reported that they found the case studies enjoyable to write, as they provided them with an opportunity for reflection, and to identify next steps and potential areas of research.

Tip: Although we referred to these documents as case studies, they were in effect a personal narrative of participants' lived experiences. They can be supplemented by workshops and online discussions about how the project is progressing, what initiatives are taking place in other institutions, and the challenges being faced along the way.

Snapshots From Our Project

Scoping the Process and the System

To initiate implementation of the systems model for embedding EfS in teacher education we assembled our project team—this consisted of teacher educators at the tertiary level from a number of institutions. We then engaged stakeholders from academic, government and professional organizations.

Workshop 1: Introduction of EfS concepts, systems mapping and status of EfS in teacher education, developing networks. The systems mapping exercise was carried out using a template which provided trigger questions to engage participants to consider key elements within the system. These system maps took shape in the form of drawings, mind maps and PowerPoint slides.

Questions for systems mapping exercise	
Identity • What is the identity of your teacher education system (the inner circle)? • What distinguishes it? • How would you recognize it? • If you were to name it, what would you call it? • What is the identity of the wider system (the environment) in which your system is located?	**Purpose** • What is the purpose of your system? • What is the purpose of the wider system/environment in which your system is located?
Transformation • What do you want to change? Work from the present to the desired situation. Why is this issue/change important? What is your interest in the issue? • Who has the power and/or influence to allow/enable this change? • Who are the people involved in the change? Consider those who will benefit and those who will not • Who is going to do the work to make the transformation happen? • Who will be the guardian or custodian of the transformation process? This is someone who is independent/has no power but who can give voice to the consequences of your actions that you may not see • What are the environmental factors that affect the system? That is, what will expand or restrict the process of transformation—think about resources, social norms, institutions, policies, regulations and legislation, technology, communications, research, individuals, etc. • What are the sub-systems? Describe the purpose and function of each sub-system: what does it do, how does it make an important contribution to the larger system? Next think about the all-important relationships between the sub-systems, as these are more important than the sub-systems themselves when seeking to transform a system	**Modelling** • Develop a model of your system • Think deeply about the relationships and interactions between the sub-systems. Develop a 'demand' model by asking what each sub-system needs of every other sub-system. Think also about resources, information, products, power, influence, and communications within and between your sub-systems. Do this for each of the relationships between each of the sub-systems

Participant Roles and Leadership

We explored the theories of leadership with participants and examined how they aligned with principles of EfS. Participants found these discussions helped to clarify their roles in the project and their roles within their own teacher education institutions. Most importantly, it helped participants to see themselves as leaders of change in their institutions.

Workshop 2: Focus on leadership, processes for enabling change, Pecha Kucha presentations from participants about current status of EfS in their teacher education institution, opportunities for research from the project.

Engaging and Developing the Network

The project team engaged representatives from teacher education institutions, Faculties/Schools of Education and relevant professional bodies across Australia in a multi-level systems-based approach, involving collaboration at the State, institutional and program levels, to develop curriculum practices that reflected a shared vision of EfS.

The project commenced in Queensland and first identified and engaged key participants at the Faculty level. Together these participants developed of a vision of EfS in teacher education for the project as a whole and worked to identify what was meant by the Queensland teacher education system, including its sub-systems and the relationships between all parts of the system. The network was then expanded to include all other sub-systems, including teacher registration authorities, government agencies and professional associations. Near the conclusion of the project, a national network that included representatives from a teacher education institution in every other State and Territory in Australia was established to ensure strong state-based teacher education networks, all working to embed education for sustainability.

Workshop 3: Pecha Kucha presentations were delivered by participants about the new status and progress of EfS in their teacher education institution as a result of project initiatives. Participants also reflected on the ways in which the model for change and involvement in the project had facilitated this change and discussed next steps.

Barriers and Opportunities

The Embedding Change Model is not designed to uphold the status quo, but to create change within a system. Consequently, there are likely to be barriers to implementing change using the Model. Listed below are some of the common hurdles to embedding EfS in teacher education that emerged in our projects. While these barriers to change may at times seem overwhelming, we list below a number of strategies for overcoming them.

Barrier 1: Engaging the System

Barrier: Research indicates individual teacher educators are motivated to change and have the ability to incorporate EfS (Steele, 2010). The greatest constraint is providing overall systemic support for such changes to happen.

Pathway to change: A systems approach to change provides opportunity to ensure systemic support for embedding EfS. Individual educators can employ systems thinking and tools to engage the system.

Example: Involvement in a state-wide system has given the activities of individuals involved in the project status, legitimacy and a high profile within their institutions. It has also allowed them to connect with staff in, for example, schools or government agencies in ways they were not able to before. We also found that when there is support from other areas of the teacher education system, such as State or Federal Government agencies, other parts of the system feel supported and there is less resistance to change.

Barrier 2: Crowded Curriculum

Barrier: Teacher educators often feel that there is no space for more material within their curriculum.

Pathway to change: Embedding EfS in teacher education does not necessarily mean adding significant new content; often it is a matter of modifying existing content. Start with an audit to see what is already relevant, and what can be built upon.

Example: At one of the participating institutions a curriculum refresh was underway at the time stakeholders were investigating embedding EfS into the teacher education programs. What was intended to be a minor revision to programs became an unforeseen opportunity to make links between Faculties, leading to a major restructuring of courses.

Barrier 3: Systemic Structures

Barrier: The siloed nature of organisations responsible for policy and curriculum direction provides a challenge to integrated, interdisciplinary change.

Pathway to change: Shifting the view from 'silo' to 'system' allows for links to be made between disciplines, faculties and institutions. Use these links to create support and increase the spread and efficiency of EfS initiatives.

Example: Involvement in the EfS project has enabled the sustainability voice to be heard within partner institutions. The project has provided participants with the confidence and support to offer suggestions to program developers about where sustainability can be included.

Barrier 4: Economics/Financial Support for Change

Barrier: Lack of resources or additional funds.

Pathway to change: See what existing resources can be reoriented; seek opportunities to apply for grants internally and externally.

Example: For some institutions the project was able to be piggybacked to a curriculum refresh initiative, hence the project was supported and given prominence through the refresh process. In this way, more people were engaged in talking about EfS than might otherwise have been.

Barrier 5: Volatility of Higher Education Sector

Barrier: The higher education sector is undergoing significant change, including restructuring in many institutions. There is uncertainty around the outcomes of such restructures.

Pathway to change: The higher education sector is changing all the time. However, this dynamic atmosphere presents opportunities for deeper and wider change as existing systems, structures and processes are dismantled.

Example: While we couldn't see changes at the start of the project, they ended up coming about very quickly—hard and fast—given the multiple disruptions being experienced in the higher education sector, including the need to be more responsive to contemporary educational issues and needs, and for education to be relevant to learners in the 21st century.

Barrier 6: Limited Awareness or Expertise in Staff and/or Institution

Barrier: Individuals' understandings of EfS are often limited if they are viewed solely through the lens of individual disciplines. For example, a science educator may not see the relevance of discussing the social justice or economic dimensions of EfS, making it difficult for those seeking to enact change to convince others of their role in that change.

Pathway to change: It is not necessary to be an expert to begin to explore possibilities for EfS in teacher education. Professional development, connecting with EfS networks and with experienced colleagues can help establish new knowledge and understanding of EfS.

Example: Through knowledge gained and connections made in this project, links have been made between professional experience and EE centres. For example, as a result of our initiative, more students in Queensland were able to undertake their professional experience placement in EE centres, extending the teacher education experience of EfS beyond the tertiary setting and out into the system.

Barrier 7: Limited Institutional Commitment

Barrier: Disconnect between different levels. For example, there may be Vice-Chancellors who endorse sustainability at an institutional level, which may not align with the priorities of those who are concerned with managing budgets.

Pathway to change: While there may not be explicit mandates for EfS in your institution, there are often EfS dimensions that can be explored within existing teacher education agendas. Find these openings to build alliances, interest and commitment. Develop a business case for EfS in your faculty.

Example: This project and process has provided a voice for EfS at universities involved in our initiative. It has created awareness and as a result, opportunities have arisen at different levels, including new accountability in work units around sustainability measures and new opportunities for research on sustainability in universities.

Ideas for the Future

Below are some initiatives implemented by our project participants. We hope these provide some ideas for you to use in your efforts to embed EfS in teacher education at your institution.

Map current EfS practices and needs within at least one teacher education course/program at your university	Extend the repertoire of curriculum and resources for embedding sustainability in teacher education and major disciplinary areas
Improve pedagogy through creating communities of EfS practice across Schools of Education and select disciplinary areas	Develop and implement activities to enhance participation and engagement of academic staff across Schools of Education and disciplinary specializations
Use tools such as case studies to gather data for research on embedding EfS in teacher education.	Apply action research principles to your network communications and initiatives to create opportunities for learning, reflecting, and revising
Use your approaches to and projects for embedding EfS in teacher education as opportunities for your own research	Capitalize on the networks that have been created within the system to generate future projects and additional changes
Contribute to the development of a vision of EfS in teacher education for your university	Create a local sustainability network at your education faculty level. Use this as a platform to map the teacher education system and expand your network

Chapter Summary

In this chapter we have presented a 'how to' guide for utilizing our model in system-wide change. Key to implementation are the mapping of one's system, the identification of key agents of change who act as hubs within the system, and the development of a shared vision and networks. With these in place, change is more readily facilitated within sub-systems and across a whole system.

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What We Have Achieved and Learnt

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Abstract This chapter provides a brief overview of the key achievements and lessons from this initiative. In addition to a range of short and longer-term outcomes, we reflect on the value of the Model in framing and guiding efforts to embed change within organisations. We argue that the Model is greater than shifts and changes in curriculum, priorities and focus, be these governmental or institutional, because of its focus on fundamentally rethinking how organisations and systems work. Thus, the Model has built-in 'future-proofing'. At the same time, we recognize that not only do different organizations have different cultures that may shape the interpretation and deployment of the Model, but that we live in uncertain times and a largely unpredictable future that may, over time, require adjustments to the Model.

Introduction

We have been on a long and winding journey over the past twelve years with this teacher education change project. We have learnt much about practical and theoretical approaches to embedding systems change in teacher education for sustainability. The primary lesson for us has been that creating change is complex, needs to be contextualized, and is not easily mapped in a linear fashion as it occurs in multiple places, through multiple actors, and across multiple sectors. Often it occurred in interesting and exciting ways that we had not initially anticipated when we started the process. The value of the Embedding Change Model presented in this book is that it can be used as a framework and guide for efforts to embed any type of change in any organization. This is because all human endeavors and institutions form 'soft' systems. In essence, because the Model is greater than any shifts and changes in curriculum, priorities and focus, be these governmental or institutional, the Model has built-in 'future-proofing'. At the same time, we recognize that not only do different organizations have different cultures that may shape the interpretation

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and deployment of the Model, but also that we live in uncertain times and a largely unpredictable future that may over time demand adjustments to the Model.

Nevertheless, having investigated and reflected on the process, we know that the project has had a wide range of outcomes, both short-term and longer term, that include the following:

Short-Term Outcomes

Using the systems change model, EfS was introduced into teacher education contexts that previously had not engaged with the EfS body of knowledge and/or EfS pedagogies. Further, the project contributed to the strengthening of existing initiatives in universities that were already engaging with EfS. The diverse histories, specific contexts, and individual experiences of engaging with EfS across these institutions resulted in different approaches and processes used to embed EfS (Evans, Ferreira, Davis, & Stevenson, 2017).

A range of theoretical and practical strategies for participants were developed that focused on systems theory and systems change, key sustainability concepts, EfS perspectives and pedagogies, and leadership theories and approaches. These were important because, for some participants, this project was the first time that they had an opportunity to engage with sustainability and EfS. Ways these ideas can be embedded into (and perhaps even disrupt) existing practices in teacher education also emerged. These included working in interdisciplinary ways (science and art education); working across sectors (teacher educators working with government policy makers); and engaging teacher education students in advocating for change.

Case studies were developed with excerpts from five briefly outlined in this book. These identified a range of ways of implementing EfS in teacher education, were reflective of the various institutional and geographic contexts and starting points for change, and provided insights and guidance for others seeking to facilitate such change.

Specific strategies ranged from individually initiated activities and actions to working through existing university committees, networks and systems. The contextual diversity suggests there are distinctive ways that teacher educators experience efforts to embed EfS within their respective institutions, including opportunities and barriers that shape the ways in which sustainability is understood, taught and learnt.

A ‘how to’ toolkit was developed to share the process we followed in mapping and identifying systems, sub-systems, and the actors within them; engaging with others to develop networks; sharing information; taking actions; and, reflecting on actions.

We created a strong network of teacher education academics in our home State that includes all teacher education providers and relevant stakeholders in our State. In conjunction with this core group, an informal National Teacher Education for Sustainability network of individuals and groups continues to connect, liaise and work together to advance the task of embedding EfS into their current institutions.

Our processes and lessons were shared through local, national and international conferences and seminar presentations. This book is one such output that we envisage will be an accessible book for other teacher educators looking for a blend of theoretical insights and practical strategies that use systems change to embed EfS into teacher education.

Anticipated Longer Term Outcomes

- There is evidence of enhanced teacher educator capacity to embed EfS into initial teacher education with positive impacts of EfS on more general teaching and learning pedagogies and practices in teacher education.
- The multi-site case study in the final project stage revealed processes and strategies that enabled change agents to engage productively in building capacity for embedding EfS in preservice teacher education.
- A cross-site analysis of the institutional case studies suggests that the following key strategies should be employed by teacher educators as agents of change for embedding EfS:

    1. Mapping the key agents of change—within both the external policy and/or governance system and the institutional teacher education and sustainability subsystems;
    2. Establishing and strengthening networks of engaged colleagues—within their School/Faculty and across the university;
    3. Building ever more complex understandings of sustainability and EfS through robust dialogues that may result in multiple conceptualizations of EfS; and
    4. Mapping the EfS policies and practices currently in place (or not)—in teacher education and the whole institution (Evans et al., 2017, p. 73).

- Our overall goal was to create widespread change in teacher education towards sustainability, in contrast to previous small-scale, piecemeal changes. The networking, case studies and focus on dissemination leads us to believe that our work is contributing to this goal becoming at least partly achievable in the near future.
- Our project feeds into the current interest in universities for interdisciplinary/transdisciplinary partnership capacities especially in terms of research, and for engagement with a wide range of stakeholders. This project offers a model for such long-term initiatives.
- In the longer term, the work of teacher educators in embedding EfS enhances teacher workforce capacity to embed sustainability into teaching and learning practices for all stages of education, from early childhood to secondary and vocational education.

Key Lessons

- Embedding EfS in teacher education is an evolving change process influenced by the prior institutional history and current state of cultural and structural engagement with sustainability at both the teacher education and whole university levels (Evans et al., 2017).
- Leadership for change can come from anywhere within a system, but people need to learn how to be leaders for change. Hence, we included 'learning to lead' as one of the integral components of our approach (Ferreira, Ryan, & Davis, 2015).
- Identifying the hubs in a system (often key individual change agents and/or key organizational groups) is pivotal to successful change. It is worth taking the time and effort to find the 'right' hubs by mapping the key agents of change at all levels of the teacher education system and creating or expanding networks to engage these key agents of change.
- Change occurs and can be embedded through leveraging off other current structures, policies and initiatives within your university that may not appear to be directly related to EfS, but are capable of supporting it, such as greening campus initiatives, student engagement initiatives, staff professional learning initiatives, and so on. The change process can also be assisted by being opportunistic and taking advantage of changing circumstances in the form of curriculum, or organisational reviews, or restructuring (Evans et al., 2017). By working with such processes, you bolster both their and your efforts, and begin to overcome existing fragmentation.
- Individuals are motivated by many and varied reasons to become engaged in facilitating and leading change for sustainability such as learning how to build and lead/implement strategic frameworks; learning new tools and methods; refreshing their teaching; or adding to their prospects for job promotion. Taking such personal aspects into account, and giving value to these, keeps people engaged with the process.
- Change can be facilitated with relatively small amounts of funding and support. If people see that this work connects to their own personal and institutional goals, then they will work to facilitate change without the need for large amounts of funding.
- Networking with other like-minded colleagues both within and outside one's institution helps to overcome isolation and build knowledge and change capacity. Hence, our processes continuously sought to connect people, both during planned face-to-face events and through other means such as video conferencing, emails and websites.
- Understanding the importance of context in change initiatives is vital. We never thought to create a 'one size fits all' strategy for engendering change; rather, we have developed a change process and accompanying theoretical and practical tools that may prove useful for application to many more situations and contexts.
- Understanding context includes identifying the structural and cultural characteristics of the higher education institution, including those of the School/Faculty in

which teacher education is situated, and the external policies that shape teacher education practice in EfS. These characteristics and policies may be enabling or constraining new and/or desired practices and should form part of one's thinking about context.

- The curriculum and pedagogical processes of embedding EfS in teacher education are both structural and organic. The importance cannot be overemphasized of ongoing collaborative inquiry and critical reflection as teacher educators develop knowledge of and practices in EfS along with their understandings of the impact of these practices on pre-service teachers (Summers & Turner, 2011).

Chapter Summary

What we hope occurs as a result of this book, is that our outline of the rationale, processes, exemplars, outcomes and key lessons from our project will inspire others to 'have a go'. We encourage you to implement your own tailored approaches to using the Embedding Change Model. We hope this is just a beginning: interest in embedding EfS in teacher education in Australia continues to expand, and we are heartened that there is growing international interest in this work, particularly in European countries such as Austria, Germany, and the UK, as well as in China, Korea, Japan and the United States. We welcome you to be part of this journey and look forward to hearing about your successes in the future.

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Glossary of Key Terms

Cross-curriculum priority Sustainability is one of three cross-curriculum priorities in the national Australian Curriculum. There are also cross-curriculum priorities of Aboriginal and Torres Strait Islander Histories and Cultures; and Asia and Australia's Engagement with Asia. These priorities are intended to enrich the curriculum through the development of content and learning that addresses the issue of sustainability within key learning areas.

Environmental education (EE) Environmental Education is a holistic, lifelong learning process directed at creating responsible citizens who explore and identify environmental issues, engage in problem solving, and take action to improve the environment. Originally, its focus was on learning and teaching *about*, *in* and *for* the natural environment but it is now similar to Education for Sustainability and Education for Sustainable Development (see below).

Education for sustainability (EfS) Education for sustainability develops the knowledge, skills, values and worldviews necessary for people to act in ways that contribute to more sustainable patterns of living. It seeks to empower individuals and communities to reflect and act on ways of interpreting and engaging with the world such that social, economic and environmental systems are not diminished for both current and future generations. This is the term currently used in Australia.

Education for sustainable development (ESD) See Education for sustainability above. ESD is more commonly used in Europe, and in United Nations (UN) and United Nations Educational, Scientific and Cultural Organization (UNESCO) policies and documents. This term is not widely used in Australia and has been critiqued in the fields of EE and EfS for its focus on economic development.

Embedding change/sustainability In contrast to ad hoc, short-term change that does not last, embedding refers to human, social and educational processes that seek to achieve broad and deep cultural change for sustainability, within and across institutions and organizations.

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Initial teacher education This is the contemporary term for what has in the past been called pre-service teacher education and/or teacher training. It usually refers to a university degree that prepares students for a career as a school teacher. In some universities, early childhood teachers (who may work in early childhood centers or in the early years of schooling) are also prepared for teaching through initial teacher education programs.

Organizational change Allied with 'embedding change', organizational change is about the ways in which an organization's strategies, processes, procedures, technologies and cultures come to be changed, as well as the effect of such changes on an organization.

Sustainable development (SD) Sustainable development commonly refers to human development processes that simultaneously meet human needs while also sustaining the ability of natural systems to provide the natural resources and ecosystem services upon which society and the economy depend. The most common definition comes from the 1987 Brundtland Report, *Our Common Future*.

Sustainable development goals (SDGs) There are 17 Sustainable Development Goals (SDGs) identified by the United Nations (UN). The SDGs provide an action plan to address key global challenges including poverty, inequality, climate change and environmental degradation, with the goal of achieving prosperity, peace and justice. They build on the UN's Millennium Development Goals.

Sustainability (see Sustainable Development). This is the commonly used term for SD in Australia. There are multiple interpretations of sustainability and varied foci, usually either on economic sustainability or environmental sustainability. There are also 'weak' and 'strong' forms of sustainability. Weak forms tend to focus on economic development, while strong forms tend to focus on the environment and on human development and well-being.

Sustainability education (SE) See education for sustainability above. This is an alternative term used instead of education for sustainable development and education for sustainability.

Systems thinking/systems change Systems thinking/systems change has emerged because reductionist problem-solving approaches have failed to adequately cope with the realities of complexity and uncertainty that cause systems to behave sub-optimally. In contrast, systems thinking/ systems change identifies links and synergies to find new ways of framing and overcoming problems. It is multidisciplinary and calls on multiple agents, relationships and power structures to facilitate a change. As a way of guiding systems change, systems thinking helps to identify root causes of problems and issues and enables the development of innovative solutions with the capacity to break through barriers and resistance.