

INTEGRATING EDUCATION FOR SUSTAINABILITY IN PRE-SERVICE TEACHER EDUCATION

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Abstract

Education for Sustainability (EfS) has been prioritised in the School of Education at James Cook University (JCU). This paper presents a case study that explores the ways in which teacher educators integrate EfS in their teaching in the Bachelor of Education (B.Ed.) (Primary) at JCU, and their perceptions of enablers and constraints. Two key findings arose from the analysis of semi-structured interviews conducted with four subject coordinators, and their subject outlines: (1) teacher educators at JCU integrate EfS in different ways through their choice of assessment, content and/or pedagogy; and (2) constraints operating at the School level, namely teacher educators' perceptions and understanding of EfS, were perceived to be salient challenges to the integration of EfS in the program. Vision, leadership and funding at the University level were also identified as enabling factors that warrant further investigation. Findings contribute to existing literature regarding the integration of EfS in pre-service teacher education, and serve to inform practice at JCU and universities more broadly.

Key words: Education for Sustainability; pre-service teacher education; higher education; case study; Australia.

EfS in Pre-service Teacher Education

While the role of pre-service teacher education in developing teachers who are “ready, willing and able to teach for sustainability when they begin their teaching careers” is recognised as being fundamental to sustainable development, it is also acknowledged that, in an effort to achieve this, “initial teacher education has not been used to its full potential” (Ferreira, Ryan, & Tilbury, 2006, p. 226). Multiple studies, for example, have reported both teachers' and pre-service teachers' poor knowledge and understanding of sustainability issues and concepts (Boon, 2010; Summers, Corney, & Childs, 2004; Taylor, Nathan, & Coll, 2003). For pre-service teachers in particular, these findings suggest a “widespread confusion” about sustainability (Dove, 1996, p. 97) that may be attributed to a lack of complete and/or first-hand knowledge of sustainability concepts (Tuncer et al., 2009). Pre-service teacher education programs, therefore, play a critical role in beginning teachers' preparedness to educate for sustainability.

For the purposes of this study, EfS is viewed as teaching and learning that seeks to develop the knowledge, skills and understanding necessary to make decisions and implement actions informed by “a consideration of their full environmental, social and economic implications” (Australian Government Department of the Environment, Water, Heritage and the Arts [AGDEWHA], 2009, p. 4). In this way, EfS aims to develop students' “capacity to contribute to a more sustainable future in terms of environmental integrity, economic viability, and a just society for present and future generations” (UNESCO Education Sector, 2005, p. 5).

Currently, stand-alone subjects represent the most commonly reported method by which to include EfS in pre-service teacher education programs (e.g., Hegarty, Thomas, Kriewaldt, Holdsworth, & Bekessy 2011; Kennelly & Taylor, 2007), which is largely incongruent with emerging research that calls for more systemic and transdisciplinary approaches (Ferreira, Ryan, Davis, Cavanagh, & Thomas, 2009; Hopkins & McKeown, 2005). Studies have also found that teacher educators integrate EfS in their teaching practice in a number of ways, through curriculum activities and/or assessment (Karpudewan, Ismail & Mohamed, 2009); workshops (Jenkins 1999/2000; Paige, Lloyd, & Chartres, 2008); and partnerships or networks between groups, agencies and stakeholders (Ferreira et al., 2009; Varga, Koszo, Mayer, & Sleurs, 2007).

These approaches to the integration of EfS in pre-service teacher education may be enabled or constrained by a number of factors, as identified by researchers across a variety of contexts in higher education (Down, 2006; Ferreira, Ryan, & Tilbury, 2007; Harpe & Thomas, 2009; Hopkins & McKeown, 2005; Moore, 2005; Scott & Gough, 2007; Steele, 2010; Thomas, 2004). Table 1 presents a summary of these factors and the level at which they operate within the institution (i.e., at the School or Discipline level, and the wider University level). Other factors are dependent on external stakeholders and collaborators in teacher education. While some factors clearly work to either support or challenge the inclusion of EfS, some can do both, depending on the way in which they play out in particular contexts (e.g., leadership at the University level can work to either enable or constrain EfS policies and practices at the School level, according to the institution’s strategic priorities).

Table 1
A summary of enablers and constraints to the integration of EfS in higher and pre-service teacher education, as identified in the literature

Contextual Level	Factor	Enabler	Constraint
Factors that operate at the School or Discipline level	Perceived relevance and priority of EfS	✓	✓
	Educators’ awareness, knowledge and expertise in EfS	✓	✓
	Professional conversations	✓	
	Connecting new and existing curricula	✓	
	Incentives to engage with EfS	✓	
Factors that operate at the wider University level	Presence of an institutional ethos of sustainable practice	✓	✓
	University’s disciplinary boundaries		✓
	Availability of funding	✓	✓
	Leadership	✓	✓
	Academic staff evaluation		✓
Factors dependent on external stakeholders and collaborators	Collaboration between stakeholders in teacher education	✓	✓

Sustainability at James Cook University

JCU is a multi-campus institution with a strong focus on embedding sustainability in teaching and learning. The University’s Strategic Intent describes its commitment to producing graduates with the expertise required for the sustainable development of tropical communities (JCU, 2011a), and research within the University is focused on meeting the challenges facing the tropical region (JCU, 2011b). In 2008, the University’s faculties participated in a Curriculum Refresh Project funded by the Department of Education, Employment and Workplace Relations through its Diversity and Structural Adjustment Fund (JCU, 2011c). A critical aim of the project was to systemically incorporate a distinctive focus on sustainability

in the University's programs (JCU, 2011c). As part of the project, the School of Education undertook a number of initiatives to address three key themes: an embedded awareness of sustainability issues; curriculum that integrates Aboriginal and Torres Strait Islander knowledge and perspectives; and internationalisation of the curriculum (JCU, 2011b). In relation to the first of these themes, the School implemented a range of strategies to support its focus on sustainability in both research and teaching, including the introduction of undergraduate and postgraduate study options in EfS in 2010, and a commitment to embed EfS across its programs.

Research Problem

Given the School of Education's focus on EfS, this study explored teacher educators' practices and perceptions regarding its integration in their teaching and in the B.Ed. (Primary) program more broadly. In doing so, the following research questions were investigated:

1. In what ways do teacher educators at JCU integrate EfS in their teaching?
2. What do teacher educators at JCU perceive to be factors that enable or constrain the integration of EfS in the B.Ed. (Primary)?

In response to the call for researchers "to contribute their ideas to the discussion over how to best incorporate EfS in pre-service teacher education in Australia" (Kennelly & Taylor, 2007, p. 3), this study illuminates the ways in which teacher educators at JCU embed EfS in their teaching practice. Likewise, the investigation of factors that are perceived to enable or constrain the inclusion of EfS in pre-service teacher education responds to Hopkins and McKeown's (2005) urge for new knowledge in this field to be "developed and widely shared" (p. 9).

Research Methodology and Procedures

To gain an insight into the integration of EfS in the B.Ed. (Primary) at JCU, four subject coordinators from the University's School of Education participated in semi-structured interviews. Heidi, John, Sue and Alison (pseudonyms) were invited to participate as an outcome of critical sampling methods (Patton, 2002). Collectively, they coordinated and lectured five subjects in the B.Ed. (Primary) at the time this study was conducted (Heidi coordinated two subjects). These subjects were selected for their: (a) representativeness of the four year program, and (b) likelihood to contain EfS. An overview of these subjects is provided in Table 2. A summary of Heidi, John, Sue and Alison's teaching experience at JCU and experiences with EfS in their teaching and/or research is provided in Table 3.

Table 2

A description of the subjects in the B.Ed. (Primary) at JCU coordinated by the study participants

Subject	Description
Introductory EfS Subject	This subject provides an introduction to principles and practices of science and sustainability education. The subject explores sustainability issues by investigating the interrelationships between ecological, economic, social and political systems; the mechanisms that lead to the degradation of these systems; and, resultant risks to human well-being.
Professional Development Subject 1	This professional development subject uses an experiential learning framework to introduce students to key concepts of effective learning and teaching; specifically regarding planning, pedagogy, and classroom management. Professional experience is embedded in this subject.
Professional Development Subject 2	The focus of this subject is the development of effective pedagogies, as informed by critically reflective practice. Pre-service teachers engage with an inquiry-learning framework to investigate and reflect upon a range of professional practices. Professional experience is a co-requisite of this subject.

Professional Development Subject 3	This subject builds on Professional Development Subject 1 and 2. The subject draws extensively upon school-based activities to explore the relationship between theory, policy and practice. Professional experience is a co-requisite of this subject.
Service Learning Subject	This subject introduces pre-service teachers to the pedagogy and practice of service learning. Pre-service teachers undertake a service learning project in partnership with community agencies, industry or business (on a local, national or international scale) that promotes social and/or environmental sustainability.

In this study, semi-structured interviews conducted with Heidi, John, Sue and Alison represent the primary source of qualitative data. Subject outlines were also analysed to triangulate the interview data and to provide further insight into the intended curriculum of each subject (Creswell, 2007). At interview, participants were asked about their understanding of EfS, its relevance to the teaching of their subject/s, whether they incorporated EfS in their teaching practice, and, if so, in what ways; the successes or challenges they experienced embedding EfS in their teaching; the factors that may have contributed to these experiences; and any other insights they may have had into embedding EfS in their teaching practice. Transcription and coding of the interview data was performed manually in a process consistent with that described by Creswell (2007). The researchers solicited participants' views on data interpretation via member checking to enhance the validity of findings.

Table 3
Participants' teaching experience at JCU and their experience with EfS in teaching and/or research

Participant	Subject	Length of time teaching this subject (years)	Experience with EfS in teaching and/or research*
John	Introductory EfS Subject	<5	2
Alison	Professional Development Subject 1	<5	2/3
Sue	Professional Development Subject 2	>10	1
Heidi	Professional Development Subject 3	5-10	2
	Service Learning Subject	<5	

**Note.* To ensure participants' confidentiality, their experience with EfS in teaching and/or research was rated on a scale of 1-3, whereby 1 represents no or little experience, 2 represents some experience and 3 represents extensive experience. Participants self-nominated a category.

Findings and Discussion

In order to investigate the ways in which teacher educators at JCU integrate EfS in their teaching, and identify the enabling and constraining factors perceived to support or challenge this integration, semi-structured interview data were qualitatively analysed to provide a fine-grained perspective into the experiences and perceptions of four subject coordinators' teaching in the B.Ed. (Primary). In this section, evidence is provided to support the following key findings:

1. Teacher educators at JCU integrate EfS in different ways through the curriculum (specifically, through assessment, content and/or pedagogy); and
2. Constraints operating at the School level, namely teacher educators' perceptions and understanding of EfS, were perceived as salient challenges to the integration of EfS in the B.Ed. (Primary) at JCU.

Evidence pertaining to each of these findings is presented and discussed below.

How do teacher educators integrate EfS in their teaching practice at JCU?

At interview, Heidi, John, Alison and Sue were asked whether they integrated EfS in their subjects, and if so, how. An analysis of their comments at interview found that Heidi, John and Sue did so in multiple ways through the curriculum, assessment, subject content and pedagogies they employed (Table 4). Although Alison identified that “there might be space in the near future to consider sustainability issues in a substantive way”, she explained that EfS was not included in Professional Development Subject 1, as she did not perceive it as a priority in the context of the subject’s intended outcomes. Accordingly, this was reflected in her subject outline, where no references to sustainability were found.

Table 4
A summary of subject coordinators’ responses at interview regarding their approaches to integrating EfS in their teaching

Assessment

Unit plan (1)
Lesson plan (1)
Eco-science investigation and report (1)
Digital webstory (1)
Curriculum resource evaluation (1)
Examination (1)

Subject content

Teaching sustainability content (2)

Pedagogy

Guest lecturers (3)
Subject’s pedagogical framework (2)
Examples provided to pre-service teachers (1)
Subject readings (1)

Note. Numbers in parentheses indicate the number of times a particular approach was claimed to be employed.

Integrating EfS through Assessment

Heidi, John and Sue all integrated EfS in their teaching through their assessment regime. While Heidi and Sue both integrated EfS into a broader assessment task (i.e., a unit plan and a sequence of lessons in Professional Development Subjects 2 and 3, respectively), John’s assessment regime had an explicit focus on EfS, which reflected the purpose of the Introductory EfS Subject he taught. The latter was also true of Heidi’s assessment in the Service Learning Subject, as it, too, dealt explicitly with EfS content.

Heidi, in Professional Development Subject 3, required pre-service teachers to create a unit plan that demonstrated their engagement with EfS principles. They were expected to utilise an action-oriented framework (e.g., project-based or problem-based learning) that integrated key learning areas and demonstrated a commitment to educational partnerships beyond school boundaries. In this way, Heidi’s approach to implementing EfS through assessment was transdisciplinary and holistic (Australian Government Department of Environment and Heritage [AGDEH], 2005; AGDEWHA, 2009). In contrast, Sue, in Professional Development Subject 2, required pre-service teachers to plan a sequence of lessons that focused on a sustainability concept, an approach that appeared to be opportunistic. This, perhaps, was a reflection of her personal interest in and commitment to EfS; it aligned with her personal “philosophy”. It has been suggested that this approach can be problematic, as

integrating EfS in such a way that does not require pre-service teachers to engage deeply with underlying principles can lead to them becoming fatigued with sustainability (Hegarty et al., 2008).

In the Service Learning Subject, pre-service teachers undertook service learning projects that focused on social and/or ecological sustainability, and completed pre- and post-placement assessment tasks. The service learning project was designed to “broaden pre-service teachers’ world view” and provide an experience that illustrates “their local actions impact on global perspectives”, a concept that Heidi identified at interview as fundamental to her understanding of sustainability. According to the subject outline, the pre-placement task required pre-service teachers to explore notions of service learning and sustainability, and provide a rationale that justified how their project contributed to the development of a sustainable community. The post-placement task called for a critical reflection on how this played out, in practice.

In the Introductory EfS Subject, the assessment tasks comprised of an eco-science investigation and report, a digital webstory and curriculum resource evaluation, and an end-of-semester examination. The eco-science investigation called for pre-service teachers to design, conduct and report on an investigation into a sustainable method used to purify water. The second assessment task required them to create a webstory about a local sustainability issue and evaluate a relevant supporting curriculum resource in accordance with the “*Principles of good practice for education resources*”, as outlined in *Educating for a Sustainable Future: A National Environmental Education Statement for Australian Schools* (AGDEH, 2005, p. 22). Finally, the examination combined short- and extended-answer questions to assess pre-service teachers’ knowledge and understanding of sustainability concepts, their ability to apply their understandings in given contexts, and their critical evaluation skills.

Integrating EfS through Subject Content

As evident in their subject outlines, John and Heidi are the only subject coordinators who explicitly taught EfS content. While Heidi included subject readings with an explicit focus on social and environmental sustainability in the Service Learning Subject, John organised the Introductory EfS Subject’s content in discrete modules. Collectively, these modules introduced pre-service teachers to key sustainability and EfS concepts and principles; the implementation of EfS in schools; key policy and curriculum documents; and critical sustainability issues (e.g., human population and urbanisation, water resource management, and climate change). As John explained, each module had a “deliberate science focus” to help pre-service teachers engage with the issues. He explained that this was derived from the Queensland College of Teachers’ (QCT) proposed pre-registration testing of primary teachers in Queensland, in the areas of literacy, numeracy and science (QCT, 2012).

Integrating EfS through Pedagogy

Heidi, John and Sue each revealed that they integrated EfS in their pedagogy. Heidi identified that in Professional Development Subject 3, she explicitly incorporated EfS in examples provided to pre-service teachers. Heidi explained that she provided them with sample unit plans centred on issues relevant to social or environmental sustainability (e.g., refugees).

Sue and John both identified that they invite guest lecturers (such as classroom teachers, principals and scientists) in Professional Development Subject 2 and the Introductory EfS Subject to speak to pre-service teachers about EfS initiatives occurring in schools, and to

provide applied examples of sustainability principles (both social and ecological) examined in class.

Heidi and John both indicated at interview that they explicitly modelled pedagogical frameworks congruent with EfS, service learning and inquiry, with a view that pre-service teachers could employ them in their own classroom practice. These frameworks were also explicated in their subject outlines. John utilised an inquiry framework in the delivery of the Introductory EfS Subject, whereby pre-service teachers engaged with the weekly topic, acquired and processed new information, and reflected on the implications of what they have learnt for their personal and professional practice. Heidi utilised a service learning framework, in which pre-service teachers undertook a service learning project in partnership with community agencies, industries or businesses that promoted social and/or environmental sustainability. Engaging pre-service teachers in service learning projects also supports the call for integrating EfS by way of experiential learning (Steele, 2010). At interview, Heidi described the conceptual congruence between service learning and EfS, and noted that the aim of the subject was to enrich pre-service teachers' understanding of their own teaching role through their service learning placement: "In order for them to contribute to more sustainable futures they must have broader ranges of experiences and they must engage with a broader range of groups [and] environments. And they must bring these experiences into the classroom ... to enrich their own students' learning".

What do teacher educators at JCU perceive to be factors that enable or constrain the integration of EfS in the B.Ed. (Primary)?

As well as examining the integration of EfS in their teaching practice, this study also invited teacher educators to articulate their perceptions of factors that enable or constrain the integration of EfS in the B.Ed. (Primary). Three themes arose from the analysis of these data: enablers and constraints cited by subject coordinators related to factors that operate at the School level (namely, teacher educators' perceptions of EfS, and their understanding of how to best integrate EfS in their teaching practices); factors that operate at the wider University level (the University's vision for graduates, leadership and resources); and factors dependent on external stakeholders and collaborators (partnerships with external agencies and other members of the community) (Table 5).

Table 5

A summary of subject coordinators' responses at interview regarding their perceptions of enablers and constraints to the inclusion of EfS in the Bachelor of Education (Primary) at JCU

	Enabler	Constraint
Factors that operate the School level		
Perceptions of EfS as irrelevant or not a priority		✓✓
Knowledge of EfS content		✓
Knowledge of how to integrate EfS	✓	✓✓✓
Factors that operate at the wider University level		
Leadership	✓	
Vision	✓	
Funding	✓	
Factors dependent on external stakeholders and collaborators		
Collaboration with external agencies	✓✓	✓
QCT's proposed pre-registration testing of Primary teachers	✓	

Note: The number of ticks indicates the number of times each factor was cited as either an enabler or constraint.

Factors that Operate at the School Level

Heidi and Alison both identified staff perceptions of EfS as a constraint to its integration in the B.Ed. (Primary) at JCU. In particular, Heidi described how some staff did not perceive EfS as being relevant, preferring instead to teach “content and pedagogies for their curriculum area”.

As noted earlier, Alison did not integrate EfS in Professional Development Subject 1, as she did not perceive it to be a priority in the subject. She explained that she was committed to exiting a cohort of pre-service teachers who had fundamental knowledge and skills in planning and behaviour management, were establishing a repertoire of teaching strategies, and had sound “academic literacies”. She also noted that in Professional Development Subject 2, she taught second year pre-service teachers who were “still trying to find their feet in a professional program”. These factors lead Alison to question whether EfS was a priority in her subject. Notably, Alison emphasised that her decision not to integrate EfS was not because she “can’t think of clever ways of building sustainability themes into Professional Development Subject 1”. These findings support existing research that reports academic staff perceptions as a constraint to the integration of EfS in both pre-service teacher education programs (Down, 2006; Scott & Gough, 2007), and other undergraduate programs (Cotton, Warren, & Maiboroda, 2007; Reid & Petocz, 2006; Thomas, 2004).

Sue cited staff knowledge of EfS content as both an enabler and constraint, as evidenced in the following excerpt:

I probably think that is an enabling factor, although I can see how it could be potentially inhibitive for somebody who didn’t have any kind of commitment or interest in EfS. I think, for me, it works as an enabling factor because I can see how it related to the philosophy of what I do. Whereas if you had a different philosophical approach or different priorities, it could be quite challenging; you might need things to be spelled out more clearly to understand how it relates. We’re doing teamwork [in Professional Development Subject 2]. Teamwork is an element of social sustainability. Because I can see that connection I can make [it] explicit. If someone was struggling to understand the content of EfS, then that might be more difficult.

Another constraint, arising from three teacher educators’ comments, was a lack of knowledge of *how* to best integrate EfS both in academic staff’s teaching practices and across the program. Alison, for example, commented on the difficulty of integrating EfS without it seeming “artificial”.

Factors that Operate at the Wider University Level

Only Heidi reported on factors unique to the University context. She cited leadership, resources and the University’s vision as enablers. Heidi commented that the most significant enabler was that the Faculty’s Pro-Vice Chancellor provided a directive and rationale for the integration of EfS in the program, providing the School of Education with a vision of graduating teachers who were committed to sustainable futures and improving educational outcomes for the region’s communities. Heidi also described that the funding provided by the Federal Government to support the University’s Curriculum Refresh Project acted as an enabling factor.

At the time this study was conducted, Heidi held a leadership position within the School of Education. It is likely that this position gave her a broader insight into factors that operated beyond the School. As Heidi was the only teacher educator to identify factors operating at the wider University level, further research is required to establish the implications of these factors on teaching practices within the School of Education.

Given JCU's systemic approach to integrating EfS in curriculum through its Curriculum Refresh Project, it is not surprising that supporting factors operating at the University level were identified by Heidi, as they provided a "directive" for the School of Education staff to integrate EfS in their teaching. For Sue, who had endeavoured to incorporate EfS in her teaching for a number of years, the project served as a "validation" and "encouragement" to continue to do so. Moreover, the systemic nature of the Project aligns with the emerging research that suggests such an approach is the most effective way to integrate EfS in pre-service teacher education (Ferreira et al., 2006). Furthermore, these preliminary findings support existing research that suggests an ethos of sustainability and sustainable practice is conducive to the integration of EfS in pre-service teacher education (Harpe & Thomas, 2009; Steele, 2010). Likewise, these findings align with existing literature that reports leadership and funding as enablers in both pre-service teacher education and other undergraduate programs (Harpe & Thomas, 2009).

Factors Dependent on External Stakeholders and Collaborators

Collaboration with external agencies was cited as both an enabler and a constraint to the integration of EfS in the B.Ed. (Primary) at JCU. John explained that collaborating with external agencies such as the Commonwealth Scientific and Industrial Research Organisation (CSIRO) and members of the Indigenous community enabled him to provide pre-service teachers with applied examples of the social and environmental sustainability principles examined in his subject. He also commented that the proposed introduction of pre-registration testing for Primary teachers in Queensland was a driver for the introduction of the Introductory EfS Subject into the B.Ed. (Primary) (QCT, 2012). Heidi identified that establishing partnerships with volunteer travel programs strengthened the Service Learning Subject and allowed for pre-service teachers to undertake international placements. In stark contrast, however, Heidi also described that she had to liaise with the QCT in order to include the Service Learning Subject in the B.Ed., as part of the program's accreditation process. As sustainability is not explicit in the current standards forwarded by the teacher registration authority, Heidi noted that this process was challenging.

Conclusion

The current study investigated the integration of EfS in a primary pre-service teacher education program at JCU; specifically, the ways in which teacher educators integrate EfS in their teaching, and their perceptions of factors that enable or constrain its integration in the B.Ed. (Primary). Qualitative analysis of interviews conducted with four teacher educators who teach in the program found that EfS is integrated in different ways through the curriculum. While factors that operate at the School level, namely teacher educators' perceptions and understanding of EfS, were identified as salient challenges to the integration of EfS in the program by all four participants, enabling factors operating at the University level were identified by only one teacher educator.

These findings present a number of implications for EfS policy and practice in pre-service teacher education, at JCU, and universities, more broadly. In light of the finding that teacher educators may not perceive EfS to be relevant to their particular subjects or curriculum areas,

or know how to best integrate EfS in their teaching, it appears that there is a need for professional development at the School level to develop teacher educators' understandings of EfS and build their capacity to incorporate EfS concepts, principles and practices in their teaching. The continued development of resources for teacher educators that support the integration of EfS across the curriculum would also help to alleviate these constraints. Given that teacher educators are "perfectly poised" to promote EfS (Hopkins & McKeown, 2005, p. ii) the provision of professional development and resources are important enablers to its integration in pre-service teacher education (Steele, 2010).

Factors operating at the wider University level (specifically, vision, leadership and funding) were cited by one teacher educator as being important enabling factors that supported the integration of EfS in the B.Ed. (Primary) at JCU. Although this preliminary finding warrants further research, it supports existing literature that suggests that a systemic approach at a wider University level is required to effect change at the School level (Ferreira et al., 2006).

While this study is limited by its small sample size, it has begun to illuminate the ways in which teacher educators at one Australian university embed EfS in their teaching practice, and the factors perceived to enable or constrain this integration. Further research is necessary to identify potentially useful practices more broadly, so as to further the discussion around how to effectively incorporate EfS in Australian pre-service teacher education.

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