Linda Hobbs · Coral Campbell
Mellita Jones *Editors*

School-based Partnerships in Teacher Education

A Research Informed Model for Universities, Schools and Beyond

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This book is dedicated to Dr. Jeff King who started the journey with us in person, and finished the journey in our hearts. His spirit we take with us, and to him we dedicate everything that emerges.

Foreword

Becoming 'Classroom Ready' Through Partnerships

Recent developments in Australian teacher education have focused on making teachers 'classroom ready' (TEMAG 2014), but although such a notion is problematic (Mills and Goos 2017), the TEMAG implementation strategy has mandated that teacher education programme have school–university partnerships in order to be accredited (White et al. 2018). This book predates the mandate and provides sound evidence for the benefits for all in having such partnerships, as well as adding some much-needed theorising about partnerships through the STEPS Interpretive Framework. In this, I commend the contributors for recognising that a model is not one true story and that a model only comes alive and is relevant when seen through the lens of the context in which it is being applied.

School–community partnerships in education have been around for some time now, but until fairly recently these partnerships have tended to be more community-based rather than with business or educational institutions (ACER 2010). In the ACER study, schools gave a number of reasons for forming partnerships, some of which overlap, but including: improving student engagement, improving academic outcomes for students, enhancing the social well-being of students and broadening students' vocational options and skills. Initiatives such as Sustainable Schools encouraged schools to look to their local community for learning partnerships that would enable the development of whole school approaches to students learning about and becoming immersed in sustainability (see Smith et al. 2012) including: improving students' understanding of the environment, improving student engagement and providing opportunities for students to learn about future 'green career' options. But partnerships between universities and schools beyond practicum experiences for pre-service teachers were rarely mentioned.

When I was teaching science to pre-service primary teachers, my goal was to provide them with experiences that would make them confident and competent to teach science. This was never an easy task as so many of them had not studied

science beyond Year 10, some had no interest in science, and almost all wanted to avoid teaching it—as the Goodrum et al. (2001) study found. At that time, I saw popular culture as a strategy for engaging the pre-service teachers as well as modelling strategies that could be used with students in primary classrooms, so in my teaching I tried to make science as familiar as possible by showing how it could be taught using children's books such as Allen's (1980) *Mr Archimedes' Bath*. At that time, I did not think of school-based teaching for my students, but not long after Russell Tytler, a then-colleague at Deakin University, started such an approach that I was glad to emulate in the teacher education programme at RMIT University when I was Head of the School of Education (see case study in Chap. 3). Of course, school-based primary science teacher education at RMIT took on its own identity at RMIT under the watchful eyes of Jane Edwards, the late Jeff King, Linda Hobbs and then Andrew Gilbert. This book documents the experiences of an expanded version of these Deakin and RMIT initiatives and appropriately argues that model could be applied across all curriculum areas.

The Science Teacher Education Partnerships with Schools (STEPS) Project also models the benefits of partnerships across universities, as it involved academics from five universities, all passionate about providing opportunities for engaging pre-service primary teachers in classroom teaching and learning that effectively connects theory with practice. Through these multiple partnerships, the participants are endeavouring to prepare classroom-ready teachers, while working, in their own theorising and practices, with Mills' and Goos' (2017) assertion that teaching is an intellectual exercise requiring constant informed and complex decision-making, including knowing about curriculum, pedagogy and assessment and having knowledge and understanding of students and their backgrounds. The multiple strategies discussed in the various case studies of the contributors' practices encapsulate teaching as an intellectual exercise and exemplify how we are always becoming classroom ready.

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This project emerges out of years of working with schools and appreciating the roles that schools play in pre-service teacher education. Thanks to the principals, teachers, students and wider school communities with whom we are honoured to work; ultimately, it is for the growth and enhancement of these places of learning that we undertake the important work of building partnerships. To the pre-service teachers, past, current and future, this work is a testament to the pedagogical contract within which we collaborate with you on your (and our) learning journey. To the participants of the study at the schools and universities, thanks for your insights, honesty and forward thinking in helping us create new ways of thinking about what we do. To those who acted as a 'reference' to clear thinking (reference group: Professor Russell Tytler [Deakin University], Professor David Clarke [The University of Melbourne] and Professor Annette Gough [RMIT University]), or kept our eyes on the outcomes (evaluator: Paul Chesterton), thanks for your mentoring and participation in the generation of some amazing ideas! To those who gave feedback, either as active participants or interested bystanders at conferences or workshops, reviewers of papers, colleagues, friends and family, it is through sharing our thoughts that we become aware the gaps and inconsistencies, but also what is cogent and fundamental.

And we give the final acknowledgement to the Office for Learning and Teaching (OLT) who enabled us to come together as an amazing group of people, a partnership that has been transformative, built on trust, reciprocity, respect, recognition of our diverse and respective talents, adaptability and responsiveness, and a shared commitment to science education and our students. Its been a great journey!

Contents

Introduction to the Book

This book, *School-based Partnerships in Teacher Education*, emerges from research conducted as a part of the Australian Government Office for Learning and Teaching (OLT) funded Science Teacher Education Partnerships with Schools (STEPS) Project (2012–2013). The book is a culmination of the research and collaboration between researchers from five Australian universities (Deakin University, University of Melbourne, Australian Catholic University, RMIT University and University of Tasmania), all of whom used school-based approaches to primary science teacher education. The models involve partnerships between universities and primary schools to engage pre-service primary teachers in classroom teaching and learning that effectively connects theory with practice.

There is an increasing emphasis on the place of school–university partnerships in teacher education internationally. Many of these partnerships are based around the traditional practicum that is a core part of all teacher education programmes in Australia and abroad. However, with the strong emphasis on literacy and numeracy in primary schools, the practicum does not always provide the desired level of modelling or opportunity for pre-service teachers (PSTs) to engage in teaching across all areas of the curriculum. This is especially the case for science as its prevalence and quality are often restricted by a lack of teachers' knowledge and confidence. As such, embedding a school-based component into coursework offers a different sort of partnership to be established where opportunities for observations and teaching that is dedicated to certain areas of the curriculum are possible. Five case studies of this type of partnership are explored in this volume. In this exploration, the roles of all partner members are considered, demonstrating the importance and value of each member of the triad: the PST; the classroom teacher; and the teacher educator. Cogent features of success and the challenges and threats to implementing and maintaining these partnerships are revealed, providing a research and theory-informed practical guide for initiating, implementing and sustaining school-based teacher education programmes. In addition, the book provides mini-case studies of how the partnerships are being applied to other contexts. This guide is presented in summary tables with illustrative vignettes and an interpretive

tool that teacher educators and/or schools leaders could use to grow a school–university partnership that is applicable across disciplines.

This book intends to:

- Provide in-depth, practical examples of partnership theory in practice with evidence-based principles and a model to guide the establishment, implementation and evaluation of school–university partnerships.
- Explore the value of different types of partnerships for differing needs and purposes through useful tables and illustrations.
- Provide descriptive interpretations of different stages and types of partnership to guide practice.
- Illustrate how a partnership model can be modified and applied to multiple contexts.
- Through analysis of practice, and a review of the extant literature related to partnerships, the research resulted in a multifaceted partnership model, the Interpretive Framework, which is designed to be inclusive of a range of partnership types, purposes and processes, paying specific attention to new practices; the growth that can emerge through partnerships; and the critical success factors that determine their sustainability. While the STEPS Project focused on partnerships in primary science teacher education, a key strength of the partnership model developed and explored in this book is its basis in cross-case, national, international and inter-state analyses of practices. These broad-ranging analyses give the model relevance to a range of settings, both within and potentially outside of education. This relevance is shown in the book through the application of the partnership model to case studies of other partnership arrangements within and external to teacher education. These case studies illustrate how the language of the model can be applied and used as an Interpretive Framework for describing and evaluating a range of partnership practices.

Part I of the book frames the research undertaken in three contributing chapters. In Chap. 1, we begin with a review of the rising tensions and contradictions inherent in the discourse surrounding the 'theory–practice nexus', which appears to be pervading much of the critique, and is informing current directions in teacher education in Australia. Partnerships between universities and schools provide rich opportunities for PSTs, academics, teachers, principals and school students to work together in preparing the next generation of teachers. While the literature is broad, there remains a need to develop a language for initiating, maintaining and evaluating partnerships. Partnerships are largely under-theorised and few multi-case analyses are represented in the literature. We draw on the partnership literature to construct a vision of rich learning opportunities and meaningful interactions that can be created through universities and schools working together.

Arising out of this context, the research and subsequent partnership model presented in the book provides exemplars of, and a language for describing, different models of school-based practice. All researchers in the STEPS team use a school-based approach to teaching their primary science education units as part

of their undergraduate (or postgraduate in the case of University of Melbourne) primary teacher education programmes. Their individual efforts provided an impetus for a cross-case analysis of partnerships and formed the stimulus for the ongoing research. Chapter 2 outlines the conception of this research, its objectives and intended outcomes, and the longitudinal and iterative methodology utilised to develop the cross-case analysis of these five distinct practices. The process of collaboration was key to the success of the research and has been instrumental in developing well-informed, rich and useful outputs, including the Interpretive Framework featured in this book.

Chapter 3 provides a detailed account of the structures, approaches and arrangements of each of the five models examined in the research. Case studies of each approach are used in a cross-case analysis to identify key themes that are discussed further in Part II.

Part II describes the STEPS Interpretive Framework, presented here as a partnership model. In examining the variety of factors inherent in each of the five independent science education programmes as case studies, the research team identified key pedagogical principles for and factors that affected the formation and effectiveness of the partnerships. Ultimately this led to the development of a four-part Interpretive Framework for describing: (1) the processes of growing partnerships from initiating, maintaining and evaluating a partnership; (2) a typology of partnerships that recognises value in all; (3) pedagogies or practices that can emerge because of partnerships in primary science education; and (4) how a partnership can lead to growth and change. These components inform a set of action planning tools that can be used to support partnership negotiation, maintenance and evaluation.

The first two parts of the framework—represented as the Growing University–School Partnerships (GUSP) and Representing Partnership Practices (RPP)—are the organising elements of the Interpretive Framework. They underwent extensive discussion within the project team and trialling and dissemination to wider audiences of educators through conference presentations, a pre-conference workshop and journal articles, as well as application to other projects focusing on partnerships. This process led to iterative improvements and the development of the other parts of the Interpretive Framework, all of which are described in this section of the book.

Chapter 4 describes the ways in which the partnership arrangements examined in the research lead to strong educational and attitudinal growth in terms of PST confidence, professional identity and self-efficacy and capacity to learn and teach science. Linking theory and practice is central to this approach, especially given the limited opportunities that PSTs often have to teach science or observe it being taught due to a traditionally low priority given to science in many primary schools in Australia. A partnership model involves key stakeholders who stand to benefit from quality science education.

The degree of embeddedness of the partnership within the partner organisations is captured in the RPP, the element of the Interpretive Framework discussed in Chap. 5. While classifying a partnership is not necessarily an end in itself,

appreciating that there are a variety of purposes, intended outcomes and commitments afforded by partnerships is important. The RPP presents a typology of partnerships as Connective, Generative and Transformative, each of which is described and exemplified in Chap. 5. Examples of practice to illustrate the opportunities, benefits and possible limitations of each in affecting quality learning outcomes for the different partner stakeholders are also considered.

Arising from the initial case studies developed by the research team was an appreciation for what was common across our practice, as well as the unique characteristics essential to each approach. The processes of developing partnerships, how to maintain them, and the opportunities, challenges and pitfalls are all endemic to partnership work. Chapter 6 outlines these processes through the GUSP element of the Interpretive Framework and associated examples of practice.

Chapter 7 provides a narrative describing the decision-making processes that are required to make these partnerships work, showing how a partnership may be built from the ground up. Using the avatar of a teacher educator called 'Damtru', the chapter draws on the data generated by the STEPS Project to show some of the options available for how to arrange the students, work with the school teachers involved, use the school and university locations to provide different learning experiences for the PSTs and develop assessment that gives adequate representation of the learning of PSTs. Using the voices of the different stakeholders captured through the analysis conducted by the STEPS Project, this narrative provides a cohesive representation of the partnership processes involved in a school-based approach to teaching primary science education.

The outcomes of the partnerships studied are represented further in Chap. 8 as a series of vignettes and data snapshots documenting how these types of learning experiences can lead to PST growth. When undertaking a meta-analysis of themes emerging from the data, it became clear that there were common elements that seemed to mark the professional growth of the PSTs in terms of shaping their identity and confidence, praxis and relationships with each their peers, the students and the schools. This chapter proposes a growth model that signifies the loci of growth for the PSTs (identity, confidence, praxis and relationships), how this growth was manifested as personal and professional growth, and what was needed to create the conditions for growth through some enablers of growth (collaboration, coordination and communication). A framework for interpreting these gains is also provided.

Chapter 9 acknowledges the difficulties and challenges associated with sustaining university–school partnerships. A set of critical success factors are presented, including a set of partnership principles arising from the data and grounded in the partnership literature. This chapter draws on the experiences of other teacher educators who use or do not use partnerships for a range of reasons. In order to support the uptake of such school-based approaches within the science education sector, it is important to acknowledge the range of challenges and threats that other teacher educators experience, either from reluctant university managers to acknowledge or support such practices with necessary time and resources, or interference with other processes such as formal professional placement. The

researchers in the STEPS team have been able to alleviate or mitigate against such challenges and threats within their contexts.

The STEPS Interpretive Framework as a partnership model was initially based on the science education context. In Part III of the book, however, ways in which the partnership model is relevant to other educative-based partnerships are exemplified. The chapters in this section provide mini-case studies of how the model is being applied to other partnership arrangements both internal and external to education and teacher education. Included are the chapters detailing other examples of university–school partnerships from within teacher education in other countries and subject areas (Chaps. 10–12) and other partnerships involving schools (Chaps. 13 and 14). Chapter 15 has been included to show how the STEPS Interpretive Framework might be applied to educational contexts and disciplinary contexts not involving schools, showing here partnerships related to nursing Work Integrated Learning (WIL) and medical–legal partnerships. Application of the partnership model outside of educational contexts requires a re-assessment of the language, intention and relative usefulness of the different parts of the model.

The book concludes with Chap. 16, by raising questions of the applicability of partnerships in other education partnerships and presenting two visions for the future use of partnerships and the applicability of a partnerships model. This final chapter draws together these re-conceptualisations of the model to identify what is quintessential to education-based partnerships. While this is a valuable act of reduction, one thing we have learned is that any attempt to distil practice to a model loses context. Context is of fundamental importance, and a model only comes alive and is relevant when seen through the lens of the context in which it is being applied.

Part I
Framing the STEPS Project: Partnership Theory and Practice

Chapter 1
Theory and Practice: The Context of Partnerships in Teacher Education

John Kenny, Mellita Jones and Christopher Speldewinde

Abstract Due to more accountability for funding and demands of employers for more "work-ready" graduates, the provision of more authentic learning experiences is gaining attention in a range of professions other than teaching and raising questions about the effectiveness of university learning. The literature on Work Integrated Learning (WIL) indicates many of the issues and proposed solutions are common across disciplines and are related to funding and policy changes in the higher education sector. There are common calls for university programmes to be better integrated with authentic work-based experiences and the establishment of learning partnerships with employers to facilitate improved learning outcomes. These criticisms are evident in initial teacher education, through demands for universities to produce more "classroom ready" beginning teachers. The problem stems from the separation of the theory of teaching, as covered at university, and the practice of teaching in real classroom settings. Much of the research has suggested more effective learning for pre-service teachers can best achieved by integrating university studies with the authentic learning in schools through the practicum experience. Partnerships between university and schools have been recommended as an essential element to ensure this nexus between the theory and practice of teaching. Effective partnerships would aide in establishing and maintaining the relationships necessary to improve the quality of initial teacher education. The STEPS Project is a response of a group of science teacher educators operating in this reality who have embedded school-based learning into their primary science education units to provide their pre-service teachers with authentic science teaching experiences. WIL literature suggests the issues of authentic learning and the partnerships necessary to support it are common across many

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disciplines, which implies that the lessons from STEPS Project may be applicable to other curriculum areas within teacher education and to a range of other professions.

Keywords Partnerships · School-based · Teacher education · Theory–practice nexus

1.1 Introduction

This book argues that strong university–school partnerships are an effective way to bridge the theory–practice divide which is often a criticism of university learning. Along with nursing, medicine, engineering and a range of other professions, teacher education incorporates opportunities for students to engage with their profession through Work Integrated Learning (WIL), which has emerged in recent times as a priority for university courses. The notion of "work-readiness" of university graduates is widely promoted by employer groups across many domains. Using teaching as an example, many reports have called for more practical-based training for teachers to address a perceived lack of "classroom readiness" in graduates.

At the heart of this debate are two very distinct views about the nature of learning to be a teacher. On the one hand, teaching is viewed as a profession where expertise requires ongoing learning through reflection on practice "praxis" Schön (1983) and, on the other hand, it is viewed as craft, where teacher preparation is concerned with a range of skills and techniques that can be demonstrated and practiced in real teaching situations (Dalmau and Guõjónsdóttir 2002; Grushka et al. 2005). For those with the former view, the danger of the craft view is that university learning is devalued; it is labelled as "theoretical" or "academic".

The authors of this book see teaching as a professional activity involving contested theories that have to be applied in an increasingly complex and changing society. In this book, we set out to explore and articulate more clearly what value the university adds to the education and preparation of teachers. The underlying argument is that the problems with initial teacher education do not arise from the theoretical nature of university learning, but the disconnection of university learning from practice and therefore its inability to directly inform practice as the beginning teacher learns.

A shift to this form of learning involves a recognition of the importance of university learning and developing closer relationships between universities and schools (and other industry partners) to promote more integration of the learning through authentic teaching experiences in which the theory becomes apparent.

In this chapter, these issues are explored, firstly in the context of teacher education, where the STEPS project began, to identify the unique characteristics of partnerships that enabled pre-service teachers (PSTs) to gain an authentic experience of teaching science; experiences that aimed to overcome the disconnect and build their confidence and competence to teach science.

The remaining chapters explore more deeply learning partnerships within the context of science education, and the ancillary benefits of partnerships for teachers

and teacher educators. The fact that the work in the STEPS Project was based on applying notions of learning, partnership and communication, and that these same notions arise in learning contexts other than teaching, suggested that the outcomes of the STEPS project may have applications in areas other than teacher education, so this is also explored in several case studies in Part C of this book.

1.2 Broader Policy Context

The debate around teacher education has persisted against a backdrop of neoliberal economic policies in higher education for over twenty years. While the Australian university sector has been subjected to increased external accountability, there have been significant cuts to government funding and increased student numbers (ACDE 2002; AVCC 2004; Bradley Review 2008). Marginson and Considine (2000, pp. 56–59) reported that between 1987 and 1997, the proportion of funding of higher education by government fell from 85 to 54%. More recently, the Bradley Report Discussion Paper (2008, p. 10) into higher education reported that "public universities receive less than half of their revenue from the Commonwealth" than they used to receive. Further, demand driven enrolment policies and increased managerialism in universities, focused on efficiency gains, have resulted in the massification and commodification of higher education and increased student-staff ratios (Kenny 2009).

In their report on the state of science education to the Department of Education, Training and Youth Affairs, Goodrum et al. (2001, pp. 60–61) noted how reductions in funding to universities have affected faculties of education in Australia. Despite student numbers remaining the same, there was a 21% reduction in full-time-tenured staff and an increase in casual staff. They also reported a drop-off in contact hours for first-year primary teacher students "from 21 to 24 contact hours of instruction to 12 h between 1990 and 1999". This clearly has implications for the quality of teacher education in general and science education in particular.

More recently, the report by the Teacher Education Ministerial Advisory Group (TEMAG) in 2014, called for changes to teacher education to produce more "classroom ready" teachers. It also called for more selective entry into teacher education programmes but did not consider the contradiction this would present to Faculties of Education in a demand-driven higher education system.

Furthermore, the uncapping of student places entering teacher education degrees has led to "strong recent growth in undergraduate enrolments in initial teacher education" (Weldon 2015, p. 11). Anecdotally, as a consequence of this growth, science education academics reported difficulties in placing students in schools for practicum (Kenny et al. 2015).

1.3 Teacher Education Under the Spotlight

Many inquiries, both nationally and internationally, have addressed the question of the quality and effectiveness of initial teacher education programmes: in Australia (Louden 2008; Ure et al. 2009; Ingvarson et al. 2014), in the USA (Darling-Hammond and Lieberman 2012), and in England (MacBeath 2012). TEMAG (2014) echoed a number of earlier reports (House of Representatives 2007; Parliament of Victoria 2005) in calling for stronger partnerships to be established between university teacher education programmes and schools. The focus of these reports has usually been the practical teaching components of teacher education because of the belief that working in schools helps PSTs to link educational theory with practice, by providing authentic professional learning opportunities that cannot be replicated or easily simulated at university (Ingvarson et al. 2014; McCaleb et al. 1992; Ure et al. 2009). McIntyre et al. (1996, p. 174) noted that during typical school-based practicum, the supervising colleague teacher can have a significant effect on the nature of the experience for the PST. They argued that the practicum experience should therefore also include a reflective mentoring approach and staff development for the colleague teachers. However, they also noted that despite the practicum experience being a "crucial stage in teacher preparation" the choice of placement was often based on administrative convenience rather than "what would provide as quality experience" (p. 173). They also pointed out that the choice of colleagues to work with the PSTs is also usually outside of the control of the university and questioned the underlying assumption that any teacher competent teacher will make an effective practicum supervisor. Ducharme and Ducharme (1996, p. 1035) noted that PSTs are often more focused on learning the "tricks of the trade", which may lead them to question the relevance of their pre-service university education. This view of teaching as a "craft" to be mastered has led to consistent calls for a shift of teacher education from universities to school settings. It suggests the adoption of an apprenticeship model for teacher training and highlights the key problem for PST education programmes: the apparent separation of theory and practice, a point noted more recently by Ingvarson et al. (2014).

By contrast, others have argued for a more "professional" model of teacher education to address the reality of the theory–practice gap. This approach suggests closer cooperation between schools and universities to improve the quality of teacher education (Darling-Hammond 2006; Ingvarson et al. 2014; Korthagen 2001; SCEVT 2007; Ure et al. 2009) with an emphasis on mentoring and reflection. The practical teaching experience (or practicum), as a key component teacher education, is proposed as the means of achieving this integration. A high-quality practicum experience for PSTs is described as one that integrates "theoretical knowledge and professional practice and communication between universities and schools" (House of representatives 2007, pp. 71–73). Thus, how the practical experience integrates with the university courses is critical for improving the quality of the PST experience and building their job readiness.

Darling-Hammond (2000) claimed that more effective teachers emerge from teacher education when extended practicum experiences and university course work are tightly integrated. Noting the importance of high-quality teacher education for the economy, Ingvarson et al. (2004) considered teacher education approaches from around the world and Australia in terms process for recruitment through to early career teaching as well as the design, delivery and assessment of teacher education programmes (including practical teaching experiences). They called for more emphasis on experiences embedded in school communities to enhance the quality of graduating teachers' "extended time in schools" provided there are "strong connections between theory and practical experiences, and where schools and universities share an understanding of the purpose of professional experience for students" (p. 20). They expressed surprise that "so little research funding has been devoted to identifying best practice and the distinguishing features of effective Australian teacher education programs" (p. 45):

> Recognition is growing that future teachers need to be placed in situations where they are active learners in the process of learning how to teach – that they should be placed in situations where they have to learn how to think like a teacher. (Ingvarson et al. 2014, p. 41)

Ingvarson et al. (2004, p. 12) proposed a series of "best practice" principles for teacher education (see below) based on those put forward by Darling-Hammond (2006, pp. 316–317):

- *Coherence*, based on a common, clear vision of good teaching grounded in an understanding of learning, permeates all course work and clinical experiences.
- A *strong core curriculum*, taught in the context of practice, grounded in knowledge of child and adolescent development, learning in social and cultural contexts, curriculum, assessment and subject matter pedagogy.
- *Extensive, connected clinical experiences* that are carefully developed to support the ideas and practices presented in simultaneous, closely interwoven course work.
- *Well-defined standards of practice* and performance that are used to guide and evaluate course work and clinical work.
- *Explicit strategies* that help students to (1) confront their own deep-seated beliefs and assumptions about learning and students, and (2) learn about the experiences of people different from themselves.
- *An inquiry approach that connects theory and practice*, including regular use of case methods, analyses of teaching and learning, and teacher research applying learning to real problems of practice and developing teachers as reflective practitioners.
- *Strong school–university partnerships* that develop common knowledge and share beliefs among school- and university-based faculty and allow candidates to learn to teach in professional communities modelling state-of-the-art practice for diverse learners and collegial learning for adults.
- *Assessment based on professional standards* that evaluates teaching through demonstration of critical skills and abilities using performance assessments and portfolios that support the development of "adaptive expertise".

In practice, these principles suggest that authentic and extensive teaching experiences which connect to university course work, and are supervised by experienced teachers, are a necessary part of quality teacher education. Such experiences may be gained through the formal practicum, but also through other opportunities embedded into a teacher education programme where PSTs are required to engage with the teaching profession.

1.4 Policy Meets Practice

Research suggests improving the quality of initial teacher education involves more integration between university learning and school experiences; however, professional experience programmes of this nature are expensive to run, due to the organisational and administration costs, payment of teachers, and the provision of suitable supervision and mentoring (Ingvarson et al. 2014). If the level of integration is expected to increase, it is reasonable to assume the associated costs will also.

Further, Weldon (2015) predicted an imminent growth in demand for teachers, driven by a population bubble arising since 2008. The impacts of these policy changes to teacher education are likely to be complex and need careful consideration. With an estimated 18,000 students graduating as teachers each year in Australia (Ingvarson et al. 2014, p. 44), places for practical experience are in very high demand, to a point where it becomes difficult to find schools and classes "willing to host students" (Ingvarson et al. 2014, p. 41). This finding is supported by research within the STEPS project which noted that in many cases funding constraints have also worked against the provision of such programmes within universities (Kenny et al. 2015).

Clearly systemic tensions exist in a high growth environment with reduced funding, and it will be difficult to establish and maintain the required level of integration between schools and universities. Without a clear and coherent re-think of the most effective way to structure teacher education, the literature shows that student teaching practice will probably continue to be ineffective and, as McIntyre et al. (1996) described, prepare "teacher candidates for the loneliness of the classroom, not for reflection and collegiality" (p. 173), where they "often observe practices in the classroom … (that) contradict what college instructors consider appropriate practice", leading PSTs to doubt the "worthiness" (p. 175) of what they are learning on campus.

The practicum requires clear educational focus and cooperation between schools and universities to provide suitable mentoring and guidance for the PSTs, with opportunities for them to reflect on their learning and make connections between the theory and practice of teaching (Loughran 2002).

1.5 The Emergence of Partnerships in Science Teacher Education

The above literature considers the broad issues of quality teacher education, but is largely silent on the issues related to preparing teachers to teach effectively within specific curriculum areas and how this integrates with the practicum. For example, when considered in the context of a generalist primary PST who needs to gain quality teaching experiences in classrooms for each learning area in the curriculum, it adds a further dimension to the need for suitable mentoring.

In addition to closer partnerships with schools, the TEMAG report also recommended that all primary pre-service teachers should acquire "at least one subject specialisation, prioritising science, mathematics or a language" (2014, p. 22), as a requirement of accreditation of all initial primary teacher education (ITE) programmes in Australia. In 2017, the Australian Institute for Teaching and School Leadership (AITSL) published further guidance on what this means in practice. In contrast to secondary teachers, "the aim is not to produce primary teaching graduates who teach in only one curriculum area, but are generalist primary teachers, with a deep focus in a particular learning area" (AITSL 2017, p. 1).

This has clear implications for primary teacher education programmes. As science teacher educators, the academics who came together to form the STEPS Project had each independently responded to an identified need to ensure primary PSTs had opportunities to gain authentic science teaching experiences in classrooms, which largely did not occur during their normal practicum. With our focus on science education, we were aware that science education has been an area of significant concern nationally and internationally with long-term evidence of falling enrolments in science courses and predictions of negative implications for Australia's long-term economic prosperity (Goodrum et al. 2001; Lyons 2006; Marginson et al. 2013; Tytler 2007). A report, by the Office of the Chief Scientist (2014, p. 11) in Australia confirmed this:

> Australian schools also show a decline in the rates of participation in 'science' subjects to the lowest level in 20 years. This has consequences for the general level of science literacy in the community and the future workforce. Australian schools also show a decline in the rates of participation in 'science' subjects to the lowest level in 20 years. This has consequences for the general level of science literacy in the community and the future workforce.

The Chief Scientist's Report went on to call for an emphasis on science, technology, engineering and mathematics (STEM) teaching at all levels and a core STEM education for all students, supported by high-quality and relevant teacher training and subject-specific professional development to ensure a sufficient supply of subject-qualified STEM teachers in Australian schools. Clearly there are implications here for preparation of future teachers that cannot be ignored if student interest and retention in STEM subjects is to improve.

Mulholland and Wallace (2003) argued that there are particular difficulties associated with preparing inexperienced teachers to become effective teachers of science, not only from the specific science pedagogical content knowledge (PCK) demands

of science (Shulman 1987), but also from the high levels of classroom organisation and management required to teach science, which many experienced teachers also find difficult. This highlights the need for authentic experiences and specific support for both pre-service and beginning teachers of science.

For primary teachers, there is an additional barrier identified due to their lack of confidence with teaching science, as most have little formal science in their background at the tertiary level and even at the senior school level (Goodrum et al. 2001; Tytler 2007). Thus, in reality, many practising primary teachers avoid teaching science, which, in turn, limits the opportunities for PSTs to gain an authentic experience of teaching science during their normal practicum and perpetuates the problem of an under teaching of science in primary school (Kenny 2010).

For primary science teaching, therefore, the formal practicum does not necessarily ensure that pre-service primary teachers have the sort of authentic teaching experience. There was a need to consider more specifically how to integrate authentic science teaching experiences in schools with the university science education course. Independently, a number of science educators have explored how this might be done. Howitt (2007) argued that the university teacher educator is crucial for supporting the PST with specialist pedagogical expertise in science. Kenny (2010, 2012) described a triadic model of support for integrating the university science education course work, with authentic practical experiences for PSTs who worked in the classroom of a practising teacher and who provided support on general pedagogical matters, while the university teacher educator provided specific pedagogical support in science. These authentic learning opportunities were shown to build the confidence and competence of the PSTs. Other reports exist of programmes designed to integrate university-based courses and school-based experiences in teacher education, to provide PSTs with authentic teaching, learning and assessment experiences outside of the formal practicum (Jones 2008; Patrick et al. 2009). These studies reported enhanced learning by the PSTs, but also underlined the importance of establishing strong partnerships with the school and highlighted the need for shared understanding of expectations between partners.

There seems to be a general acceptance that partnerships between universities and schools offer opportunities to improve teacher education by integrating university course work with authentic classroom experiences supported by suitable mentoring. Given the funding constraints discussed earlier, the question for education systems and faculties is "How can this be done in a cost-effective manner?"

1.6 Ongoing Challenges for Teacher Education

Across the world, evidence is emerging of shortages of qualified teachers in certain curriculum areas, leading to a growing phenomenon of teachers teaching "out-of-field" (Hobbs 2013; Kenny and Hobbs 2016; Weldon 2016). Attempts to address these shortages have given rise to professional learning initiatives which aim to

overcome the shortages by retraining practicing teachers with qualifications in other fields to teach out-of-field (Crisan and Rodd 2011; Kenny and Hobbs 2016).

In the secondary teaching space, *Teach for Australia* (TFA) was set up to emulate similar initiatives overseas to address teacher supply problems in certain disciplines (Weldon et al. 2013). TFA candidates tend to be high-performing graduates with qualifications in specified fields who are employed as *Associates* and complete an initial intensive education induction before taking up a placement in a school the following year. As associates, they undertake a two-year programme involving university study and an 80% teaching role to complete their teaching qualification with the support of an in-school teacher mentor and an Educational Adviser.

Louden (2014) claimed that, while effective as a form of teacher education, TFA is an expensive and a "small-scale solution". By contrast, Weldon et al. (2013) reported that the cost-effectiveness of the TFA programme could not be determined due to lack of evidence of its effectiveness or retention of the participants and the high levels of support required. They also noted the small numbers of graduates in the programme, the high costs of recruitment, high start-up costs, high levels of support required through the provision of mentoring and the small number of graduates which resulted. Scaling up the programme would clearly present problems.

In Australia, with the growth in demand for teachers predicted to increase (Weldon 2015), issues of the supply of suitably qualified teachers and their ongoing professional education will continue to impact on teacher education programmes. Ensuring quality and effectiveness of teacher education, in whatever form, seems to rest with greater cooperation between universities and schools. The challenge is to identify the value added to teacher education by the university and the school and to build partnership arrangements based on this mutual understanding.

The House of Representatives (2007) "Top of the Class" report also strongly advocated for partnerships to improve teacher education, but noted that "partnerships are often the result of determined efforts by inspired individuals in universities, schools and systems" (p. 79). This is consistent with more recent reports by academics engaged in school-based arrangements (Kenny et al. 2015). The "Top of the Class" report further noted that the practicum was inadequately funded and that universities were not held sufficiently accountable for how these funds were spent. Clearly, if effective partnerships between universities and schools are to be established to develop "classroom ready teachers", as called for by TEMAG (2014), adequate funding is a necessary pre-requisite to ensure greater integration between the university learning and school-based experiences, as compared to the current mass ad hoc approach to the practicum, but does this necessarily imply greater cost?

All Australian universities have to enter into a funding agreement with the Commonwealth. The University of Tasmania Funding Agreement for 2014–2016, for example, clearly indicates that the current Commonwealth allocation per full-time education student to support their practicum is $840 per annum, and that the university must "use these amounts only for those purposes" (p. 11). However, as the Top of the Class report (2007) indicated often these funds are absorbed into general revenue and not used for their intended purpose. Thus, the first step to improve the

quality of initial teacher education should be to ensure these funds are spent for their intended purpose of resourcing the practicum.

Another consideration is to design focused units of work at university, such as the school-based approaches used by teacher educators involved in the STEPS project, that integrate authentic classroom experiences in selected areas of the curriculum with university learning, thus linking theory to practice. There is scope to consider how to formally link the assessment to complement the practicum so that PSTs can gain recognition of this additional work in schools, such as credits towards their practicum. The AITSL graduate teacher standards would provide a mechanism to achieve this outcome.

The school-based approach has potential as a way to implement the "specialisations" as called for in TEMAG (2014) which recommended that all primary pre-service teachers should acquire "at least one subject specialisation, prioritising science, mathematics or a language" (p. 22). AITSL (2017) has defined specialisations as "clearly defined pathways into and/or within a programme … that are in demand, with a focus on subject/curriculum areas" including "assessment within the program requiring graduates to demonstrate expert content knowledge, pedagogical content knowledge and highly effective classroom teaching in their area of specialisation" (p.1). AITSL (p. 3) also noted that "Primary specialisation represents a significant reform to the way that primary teachers are prepared. If the reform is to be fully realised, change to the structure and/or content of many initial teacher education programmes may be required".

In a partnership, each partner contributes something unique to the situation. When shifting the learning from university to schools through teacher educator guided experiences, universities can add value to teacher development by providing the theoretical framework to both inform and interpret teaching practice. In simple terms, a successful partnership occurs when two or more entities work towards a shared vision in a relationship that is characterised by mutuality and trust (Argyris and Schon 1996; Kruger et al. 2009; Rossner and Commins 2012). The nature of partnerships, as they pertain to the STEPS Project, is explored in more detail in Chap. 2. The school–university partnerships were negotiated as a means to provide access to classrooms for pre-service teachers to gain authentic science teaching experiences as part of the science education programme and occurred outside of the normal practicum.

In forthcoming chapters, the learning from the STEPS Project is presented to show the processes involved and characteristics of partnerships that can be lead to PST learning and growth. The school-based approaches described, while focused on science, may be applicable to a range of subject areas in which PSTs are required to demonstrate the application of specialist knowledge in authentic situations. Indeed, the resources developed through the STEPS Project have the potential to support similar integrated approaches in other professions and this is explored in the next section.

1.7 Work-Readiness and Work Integrated Learning

The notion of "work-readiness" of university graduates has come to the fore in recent years in a range of professions, including teacher education. Australian universities have come under increasing pressure to be accountable for the effectiveness of their teaching programmes. Employer bodies have demanded more "work-ready" graduates (ACEN 2015). As a result, Work Integrated Learning (also referred to as cooperative learning) is gaining more attention in universities.

WIL, however, has long been an accepted part of education and training in a range of university professional programmes such as social work, nursing, teaching, engineering and medicine. Patrick et al. (2009, p. v) define WIL as "a range of approaches and strategies that integrate theory with the practice of work within a purposefully designed curriculum". It as an "umbrella" term that includes activities such as practicum, internships, project-based learning, experiential learning and clinical practice (p. 9). The Tertiary Education Quality and Standards Agency (TEQSA) (2016), defined WIL as "any arrangement where students undertake learning in a workplace outside of their higher education provider as a part of their course of study" (p. 1).

The appeal of WIL is that it is seen by all stakeholders, governments, students, academics and employers and as "a powerful vehicle for developing generic or professional skills" and an "opportunity to improve their employability and work readiness" (Patrick et al. 2009, p. 13). For students, it provides an authentic "opportunity to apply theory to practice" and gain "cultural awareness of their discipline" (Patrick et al. 2009, p.13). However, TEQSA (2016) also makes it clear that there are risks associated with WIL and insists that universities will be required to "demonstrate a well-founded approach to the use of WIL and the type of WIL involved in a course. This will need to be evident in the design and rationale of the course as well as in the specification and methods for assessment of learning outcomes that link to WIL and employment" (p. 4).

The WIL literature reveals many parallels with the problematic situation described earlier in the case of teacher education. Oliver (2015) warns that "simply being in a workplace where one observes or does menial tasks, is unlikely to make a significant difference to employability" (p. 61). Further, echoing the observations of Ingvarson et al. (2004) on teacher education, Bell et al. (2015) noted there has been little research in Nursing on how "academic partnerships" can be established so that universities work in collaboration with external bodies, to improve nursing student learning experiences.

The value of WIL is its ability to provide learning experiences that enable students to relate their university learning to a real professional work environment. Oliver (2015) argues that WIL programmes should be considered on the basis of the two concepts "Authenticity" and "Proximity". Where *Authenticity* means "how closely a task resembles professional level challenges" and *Proximity* means "how closely the context resembles a professional environment" (pp. 61–62). This implies more integration of university learning programmes with what happens in the workplace.

Learning of this nature highlights a range of issues and challenges that can impact the WIL experience including differences in culture, understandings about what constitutes good learning, who controls the learning, institutional constraints, and government policies (Patrick et al. 2009). Unless these issues are explicitly addressed, it can lead to a perceived disconnect between the university and work places and criticisms of the work-readiness of students, which suggests that the implementation and sustainability of a successful WIL programme requires cooperation by both the relevant industries and higher education organisations. It necessitates communication and negotiation across institutional boundaries.

Peach et al. (2011) reported on a study very similar to the STEPS project, where academics from five universities across the globe came together to investigate commonalities and differences across WIL programmes. They recognised that, because each of the organisations involved were autonomous, there was a need to consider what happens at the interface between the organisations in order to create mutually beneficial relationships (p. 3). They adopted the notion of "Boundary Spanners" to recognise people who operate at the periphery and who "facilitate information exchange" between the organisations in work-related programmes (p. 2):

> A major challenge faced in work related programs is developing structures and processes across boundaries that assist stakeholders to cross social and cultural borders between education and work (p. 6).

While they were concerned with how well programmes "support learners to mediate between theoretical and everyday knowledge in order to create new knowledge and new practices" (p. 3), Peach et al. (2011) also suggested that students are not simply ambassadors for the university, but are also boundary spanners and act as "stakeholders" (p. 6) in the programme and should therefore be expected to contribute to the development of each organisation. These requirements need an "innovative, connective model of pedagogy and learning in work-based contexts" (p. 3), so they concluded that "successful work-related programs need systems, structures, policies, and practices that enable stakeholders to share and assess knowledge across organisational boundaries" (p. 11).

Peach et al. (2011) also recognise "the conflicts and costs associated with efforts to creating an environment of joint enterprise and expectation (sic)" (p. 11). In programmes of this sort, tensions may arise due to stakeholders having different motivations, objectives and understanding. For example, university academic staff may focus on the unique learning opportunities for students; university managers might emphasise community engagement aspects, or an opportunity to address generic capabilities; students may see it as a chance to become more employable; and employers might focus on covering skills shortages or longer-term recruitment (Patrick et al. 2009, p. 17): "If mutually beneficial sustainable programs are to be achieved, mature and sophisticated relationships must be fostered and supported by all parties concerned so that the university learning environment and workplace are successfully merged" (p. 17).

University programmes face some specific practical challenges that can seriously affect the quality and effectiveness of WIL programmes. The increased emphasis

on WIL in universities and its impact on staff and funding resources needs to be carefully evaluated and documented.

TEQSA also points out that WIL is more than simply placing students into a workplace. There is a clear need for an "integrated approach to the planning and implementation of WIL that is based on formalised relationships and a common understanding of the associated responsibilities and level of commitment required" (Patrick et al. 2009, p. 38). This points to "new models of engagement that are purposefully designed and constructively aligned both to mainstream university curricula and employer needs (p. 39)." "WIL academics are involved in a wide range of activities and are required to initiate and sustain WIL as well as manage the learning outcomes of the experience" (Patrick et al. 2009, p. 35).

WIL programmes have to be carefully designed and managed, so organisations need to acknowledge the workload demands on the staff managing and teaching into WIL and provide administrative systems to assist staff who act as boundary spanners (Oliver 2015). This area also provides an opportunity for the University sector to really engage students and explore new learning opportunities. As TEQSA (2016, p. 2) points out, "good practice in WIL is also a dynamic field of educational research and practice".

The WIL literature highlights the commonalities of the issues in teacher education with those in other professions. What is needed are analysis and frameworks that can assist in the establishment of integrated university and work-based learning programmes. There is a need to describe the stages necessary to develop successful partnerships and understand the values underpinning successful partnership practices and pedagogical approaches. Values such as mutual respect, trust, open communication and adequate resourcing have for example been described in relation to health-based WIL partnerships (Bell et al. 2015; Miller et al. 2015). The outcomes of the STEPS project detailed in the following chapters make an important contribution to understanding how the requirements of WIL might be meaningfully incorporated into teacher education and other university learning programmes.

1.8 Conclusion

The partnerships examined through the STEPS Project were established to ensure PSTs had an opportunity to build their confidence to teach science and to address the fact that the practicum experience could not be relied upon to provide the authentic science teaching experiences needed to do so. However, the way these school-based approaches are supported with funding and how they interact with the practicum needs some further consideration. We see such programmes as a means to complement the practicum experience, not to replace it, by targeting specialist curriculum areas which may not be readily accessible in a normal practicum. If this level of integration of university learning, with authentic school-based experiences, was to become a more mainstream part of teacher education, there is potential to address many of the concerns associated with the quality of teacher education.

Reforming and scaling-up university teacher education programmes to be more integrated with school-based practice is likely to require a review of the current funding arrangements for teacher education. The establishment and maintenance of these partnerships, in conjunction with normal practicum arrangements, and the associated communication, staffing and administrative issues, are likely to be more expensive to operate than the indiscriminate approaches reported in the literature. However, the pay-off will be more effective and "work-ready" graduate teachers and more opportunities for teacher professional learning based around practice and a reduction in mentoring cost to schools. These programmes must be sustainable, they cannot rely on dedicated individuals heroically going above and beyond the norm.

Among the other questions that will need to be addressed are those concerned with accreditation, and how these school-based experiences will interact with the practicum in terms of the assessment of students, particularly in the light of the current teaching standards for teachers (AITSL Standards), and how the roles of the teachers and academics involved will be supported.

The commonalities of the issues within teacher education and other professions offering authentic experiences for students as part of the university learning programme is evident in the WIL literature. There is a need to envisage and implement partnerships that support universities and other groups to develop more integrated learning programmes. The outcomes of the STEPS project have the potential to assist stakeholders to clearly define the nature of the desired learning outcomes, the benefits for all stakeholders, and a way to establish, maintain and evaluate partnerships in a range of education work-related learning situations and professions.

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Chapter 2
Science Teacher Education Partnerships with Schools (STEPS)

Andrew Gilbert and Sandra Herbert

Abstract This chapter describes the background and context surrounding the STEPS project and articulates both the process and goals established at the outset of the research endeavour. The STEPS research responded to a continuing concern regarding primary teachers' acquisition of scientific understanding, confidence to teach science and persistent questions concerning the effectiveness of traditional approaches to teacher education. STEPS brought together academics from five Australian universities with established, innovative and successful primary science practices involving partnerships between universities and primary schools that engaged pre-service primary teachers in classroom teaching and learning that effectively connected theory with practice. This chapter presents the multiple case-study methodology (Yin in Case-study research: Design and methods, Sage Publications, Thousand Oaks, CA, 2009) utilised to examine the experiences of establishing, maintaining and growing these partnerships with each university campus acting as a "site". Key features and critical success factors required to establish and maintain strong working relationships with schools leading to the development of the interpretive framework are presented.

Keywords Partnerships · Science teacher education · School-based Interpretive framework · Primary science · Pre-service teachers

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2.1 Introduction

Chapter 1 reviewed the rising tensions and contradictions inherent in the discourse surrounding the "theory–practice nexus", which appears to be pervading much of the critique of pre-service teacher (PST) education, and is informing current directions in teacher education in Australia. It drew on partnership and Work Integrated Learning (WIL) literature to construct a vision of rich learning opportunities and meaningful interactions that can be created through universities and schools working together.

This chapter describes the background and context surrounding the STEPS project and articulates both the processes and goals established at the outset of the research endeavour. All researchers in the STEPS project came together through a common interest in existing school-based approaches to their primary science education units at five different universities. These units were part of their undergraduate primary teacher education programmes. The individual efforts of the STEPS project provided an impetus for a cross-case analysis of partnerships and formed the stimulus for the ongoing research. This chapter outlines the conception of the research project, its theoretical and practical objectives, intended outcomes, as well as the longitudinal and iterative methodology utilised to develop the cross-case analysis of these five distinct practices. The process of collaboration was a key to the success of the research and has been instrumental in developing well-informed, rich and useful outputs, including the Interpretive Framework featured in this book. In later chapters, we endeavour to explore the influence of these practices on school-based partners.

The STEPS Project responded to a continuing concern regarding primary teachers' acquisition of scientific understanding, confidence to teach science and persistent questions concerning the effectiveness of traditional approaches to teacher education. The STEPS Project involved describing, comparing and reflecting on the work carried out by science partnership programmes at five universities from Victoria and Tasmania. It capitalised on the successful experience of these universities, each pursuing a model of science teacher education that accords with acknowledged features of good practice, including:

- a close relationship between educational theory and classroom practice;
- productive partnerships between universities and schools, involving academics, school teachers and leaders, PSTs and school students; and
- the centrality of reflective practice focusing on the development and implementation of curriculum; the relational and instructional elements of the pedagogical contract; and the development of PST's professional identity.

The STEPS Project represents a significant curriculum renewal in science education, pointing the way forward for theory–practice coordination into teacher education.

The programmes and processes, described in this chapter, involved examination of each individual university's practice to discern critical elements for developing and sustaining partnerships. To this end, the STEPS Project brought together academics from five Australian universities with established, innovative and successful

primary science education practices involving partnerships between universities and primary schools that engaged PSTs in classroom teaching and learning that effectively connected theory with practice.

2.2 The Context of Primary Science Teacher Education

Concern about the preparation of teachers is not limited to science. In the past decade, there have been a number of inquiries into the quality of Australian teacher education that persistently challenge the manner and effectiveness of initial teacher education programmes, so many in fact that Louden (2008) wrote of the "101 damnations" of initial teacher education. Criticisms about initial teacher education claim that it is overly theoretical and does little to assist PSTs to make links between theoretical components learned at university and the "real world" of the classroom (House of Representatives 2007; Parliament of Victoria 2005). There is a widespread call for teacher education to address this theory–practice divide so stronger partnerships with schools seems to offers a way forward in achieving this (Australian Council of Deans of Education [ACDE] 2004). Further, there exists a need to investigate these innovations in primary science teacher education pedagogy where partnership arrangements work towards the professional standards set down by Australian Institute for Teaching and School Leadership (AITSL). In addition, Peterson and Treagust (2014) call for explorations surrounding how reciprocal relationships between schools and universities (developed during partnerships) may impact science teaching in terms of pedagogy, efficacy and willingness of both classroom teachers and PSTs to engage in meaningful science instruction.

In recent years, the use of school–university partnerships to address the theory–practice divide in teacher education has had an increasing focus in international teacher education studies (e.g. Darling-Hammond 2005; Patrick et al. 2008; Ryan et al. 2012). Darling-Hammond (2006) purports that the integration of course work and fieldwork help PSTs to better "understand theory, to apply concepts they are learning in their course work, and to better support student learning" (p. 307). This integration of theory and practice, through the key role of reflection, better prepares PSTs to "handle the problems of everyday teaching through theory-guided action" (Korthagen et al. 2006, p. 1021). Darling-Hammond (2006) asserts that teacher education programmes need to provide opportunities for PSTs to analyse and apply theory, reflect on their subsequent practice, and have further opportunities to retry and improve.

The project outlined in this chapter collates and analyses the deliberations of teacher educators who have successfully established partnerships with schools for the purpose of school-based delivery of pre-service science teacher education. Furthermore, the chapter outlines how the approach to these deliberations led to the development of an Interpretive Framework that identifies the distinctive nature of this school-based practice and thus presents the general principles that others may attend to in order to commence, refine or grow their own school-based, partner-

ship approaches to teacher education. The establishment of this framework should also help to identify the general principles that foster successful partnership outcomes that address the concerns outlined above about science teacher education and teacher education generally.

2.3 Role of Partnerships in Pre-service Teacher Science Education

The existing school–university partnerships in the STEPS Project all stemmed from teacher educators' desires to answer problems that have continued to vex primary science teacher education in terms of reducing fear of science content and developing PSTs' professional confidence in order to teach science in their future practice. In the simplest terms, partnerships can be viewed as two or more entities working towards a shared vision. For the purposes of this study, we use the following construction of partnership: "the concept of a genuine university-school 'partnership' connotes a collaboration of professional conversations, collegial learning and aligned processes" (Rossner and Commins 2012, p. 2). This idea for partnerships rests on the essential work of Kruger et al. (2009) who argued that there are three key factors of successful partnerships: trust, mutuality and reciprocity. Trust requires all stakeholders to understand that there should be benefits to be gained for each stakeholder; mutuality depicts the degree to which each partner understands that working together does lead to gains for each; and reciprocity speaks to the value each partner holds for the other. Successful partnerships are ones that convey an affinity for an equal relationship demonstrated through a shared vision, equitable use of available resources, and a balance of power between stakeholders in decision-making processes (Argyris and Schon 1996).

Learning to teach is a difficult task in any context, but learning to teach science has additional challenges due to the content and pedagogical demands that science presents, particularly for primary-level PSTs who sometimes carry negative experiences and associations towards science (Mulholland and Wallace 2003). Studies regarding student interest in science consistently demonstrate that students in the middle grades are often "turned off" to science as a response to primary years science instruction that utilises traditional pedagogical approaches that rely heavily on memorisation that work solely to fill students with disconnected science facts (Keys 2005; Milne 2010; Tytler et al. 2008). These approaches to science often do not have direct relevance to young people's lives and the interrogation of these common primary science pedagogies is essential if we are to make progress towards interesting future children in the sciences. These approaches stem from primary teachers low levels of confidence and incomplete background knowledge in science, which impacts both their willingness and ability to teach science effectively (Gilbert 2009). These are critical areas of concern when considered in combination with other studies showing that the development of students' understanding is fundamentally tied to the quality

of teaching (Darling-Hammond 2000; DEST 2003; Hattie 2009). There is recent evidence which suggests that engaging PST's in science focused partnerships can positively impact both their confidence in science teaching and provide increased access to pedagogical content knowledge (Kenny 2010; Kenny 2012). While this research points to critical success factors leading to productive relationships in specific single programmes, the purpose of the STEPS Project was to establish critical success factors that are inclusive of a variety of partnership arrangements and pedagogies, and to situate these within a coherent Interpretive Framework.

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Partnership arrangements often offer challenges for both school and universities that can affect the development and sustainability of effective and reciprocally beneficial partnerships (Houseal et al. 2014). These challenges fall loosely into five categories: (a) content knowledge background needs of participants, (b) accuracy and relevance of student data, (c) securing and negotiating resources (materials, time and personnel), (d) communication needs and barriers and (e) outside factors affecting both the educational and research communities. In many cases, existing literature tells us that if the above challenges inherent in school–university partnerships are not addressed, they can seriously limit the effectiveness of a partnership (Evans et al. 2001; Houeseal et al. 2014; Ledley et al. 2003; Moreno 2005). These theoretical positions frame the positioning of this research within school contexts across the five participating universities and their partner schools.

2.4 Understanding the Terrain of the Project

It is important to note that these programmes arose organically at different university sites at differing points in time to ensure pre-service primary teachers had opportunities to build their confidence to teach science and to address the fact that the practicum experience could not be relied upon to provide the authentic science teaching experiences needed to do so. In order to make sense of these independently constructed and maintained programmes, the STEPS Project involved describing, comparing and reflecting on the work carried out by each individual science partnership programme. It was not a simple task to conceptualise the history, evolution, activities and spirit of these disparate programmes. In addition, this volume represents not only conceptualising the enactment and vision for partnership practices but also to investigate where these programmes overlapped. Therefore, multiple case studies (Yin 2009) emerged as an important tool to best understand the approaches across these multiple and dynamic programmes. Utilising these multiple case-study methodologies, the project examined the collective experiences of establishing, maintaining and growing these partnerships where each university campus acted as a "site". The processes, described in this chapter, involved examination of each individual uni-

versity's practice of school-based partnerships for PST science education to discern critical elements for developing and sustaining partnerships. Later chapters of this volume will endeavour to explore the influence of these practices on school-based partners.

At its core, the STEPS Project was a work of collaboration, which seemed to be a natural extension for the ways the partnership arrangements were approached in schools. In an effort to make sense of each university's approach to engaging with primary schools, the project team drew upon the same principles that were often utilised across school partner sites, namely listening, communicating; valuing ideas of colleagues; and other similar concepts that worked to build trust and respect for all participants involved. This was essential, particularly in the beginning, because one of the STEPS Project's immediate goals was to better understand each individual programme in terms of both connection to their university structure and the nature of collaboration with primary schools. It was important to note these frameworks of respect undergirded every step of the project including initial discussions, grant writing, data collection/analysis and developing the products from this work. The process began through informal discussions of science educators in the STEPS Project team concerning their programmatic approaches. From those often informal discussions, the group decided to pursue funding from the Australian Office of Learning and Teaching to better understand the dynamics of university–primary school partnerships and develop a frameworks for carrying out partnership work.

2.5 Context

Eight science teacher educators from the participating universities (Deakin University, Australian Catholic University, University of Tasmania, RMIT University, and University of Melbourne) successfully collaborated on the joint Office of Learning and Teaching (OLT) grant application that funded the STEPS Project. Each of the partner institutions contained a school-based component in their science teacher education programme. The grant proposal design contained a two-part approach representing (1) the development and (2) the implementation of the Interpretive Framework. The intention of the project was to develop a partnership model that encapsulated the process of developing, maintaining and evaluating university–school partnerships, as well as for differentiating between the varying purposes associated with such partnerships; this partnership model is called "The STEPS Interpretive Framework".

The academics on the project team began to examine and compare the underpinning theories informing their practice with a view to developing a common theoretical framework for partnership based approaches. Initially, we found that the operation of partnerships remains largely under-theorised, with few multi-case analyses represented in the literature. In order to articulate the variety of rich learning opportunities and meaningful interactions involved in each context, where productive working relationships had been established between the university and local schools, a cross-case

analysis of the various arrangements in place at each of the five universities enabled establishment of a platform and stimulus for ongoing research into school-university partnerships in teacher education.

Initially, the focus of the study was the sharing of the teacher educators' particular cases and underpinning theories, generation of data relating to teaching and learning at each site, and insights from relevant literature, to inform the development and refinement of the Interpretive Framework. This process is reflected in the intended outcomes of the STEPS Project, which are provided below:

- provide a synthesis of the variety of teaching and reflective practices and informing theories;
- document exemplars of innovative pedagogies emerging from the different cases;
- create an interpretive framework informed by contemporary practice that can guide improvement of science teacher education programmes;
- determine sustainable methods for establishing and maintaining effective school-university partnerships generalisable across a range of contexts;
- facilitate uptake of innovative school-based practices within the sector for the purpose of improving the educational outcomes of science teacher education programmes, and teacher education programmes generally.

This complete list is provided here to frame the overall goals and vision for the project; however, the focus of this chapter will concern the first three points and set the context for the construction of the case studies and the Interpretive Framework. Chapter 3 provides a detailed account of the five cases studies including structures, approaches and arrangements of each of the models examined in the research. The Interpretive Framework will be discussed in-depth within Part 2 of this volume.

2.6 Methods

2.6.1 Conceptualisation of the STEPS Project

This process of conceptualisation for the STEPS Project did not happen in a vacuum. These ideas grew and evolved over time through different avenues including: cross-pollination where faculty carried out partnership work and then moved to other universities where they continued those partnership efforts in new contexts; and sharing of programmes through professional conferences and formal research. This professional interaction helped to guide the literature search, construct the annotated bibliography, conceptualise the data collection associated with the evaluation of our individual partnerships and frame the goals of creating an interpretive framework regarding the construction and maintenance of partnership programmes.

In order to meet the multi-layered goals of the STEPS programme, the project team committed to maintaining an exceptional level of communication across all stages of the research process. This willingness to collaborate and share served as

the project's modus operandi, which laid the foundation for our collective approach to data collection, framing our goals, and evaluating the impacts of these partnerships. The credibility and reliability of the findings was strengthened by the longitudinal, purposive and collaborative approach adopted by the project team. The approach was longitudinal in that an extended timeline of meetings and events provided time for appropriate analysis and reflection on individual and collective data, and discussions about the analyses and implications of emerging findings. Meetings included face-to-face meetings as well as a series of teleconferences with the project team, project evaluator and the reference group at critical moments of the project, including: pre-funding when the project was conceptualised and roles were defined; commencement of the project through a two-day retreat to clarify tasks and roles; data collection and analysis where the parameters for the framework were established.

It is expected that the findings from these efforts will impact *teacher education* by providing practical and theoretical models of effective science practice through real science teaching experiences that PSTs often do not have during placement or as an in-service teacher. The project also has a potential impact on *school practice* through preparing willing and able teachers, but also modelling for the in-service teachers through involvement in contemporary and effective science teaching pedagogy. The following descriptions highlight the processes that led to the construction of key products associated with the STEPS Project, namely the annotated bibliography, case studies and Interpretive Framework.

2.6.2 Processes Regarding the Construction of the Project Annotated Bibliography

The collaborative nature of the project was exemplified in the process for the way the team constructed the annotated bibliography that was to inform the project. The approach utilised the collective knowledge of the team by compiling article citations and descriptions of the works previously utilised within each team member's own research and practice. In addition, each member sent entries and articles to be compiled and collated prior to the collective search for research pieces unknown to the research team. This utilisation for the collective knowledge of the team, led to a large working library of resources that were categorised into themes, which helped to quickly frame a body of literature related to multiple aspects of partnership research.

The ideas gleaned from this process constructed the theoretical elements and direct connection to current research that directly informed the study. For instance, the current state of *science teaching in primary schools*, as well as the tendency for PSTs to have limited positive experiences with science and opportunities to see science taught or teach science on placement. This element was related to the conceptualisation of a *theory–practice divide* between authentic classroom practice and educational theory. There appeared to be changes in the teacher education sector moving towards situated learning experiences that require *partnerships* with schools

as a way of linking theory with practice. Partnerships were often fundamentally important to the school-based practice. The research was conceptualising value for the schools, also the distinctiveness of the science context in terms of this approach. *Reflective practice* and *teacher efficacy and identity* were fundamental to the practices: teacher identity can be a mechanism for developing a teacher efficacy; and professional identity and teacher reflection was a mechanism through which identity development occurs. Reflective practice, identity and efficacy focus strongly on the experience of the PST. This focus on teachers thinking their way into a space is a move away from the previous model of primary science teacher education, which was principally focused on competence and confidence (a deficit model). Timing of the school-based practice is important so that PSTs are "ready" to begin to develop an identity in relation to science.

The project examined the specifics of the models used by each university involved. They were all different in terms of *site* and *context* that is the schools used; and the *nature of the school-based approach* and *specifics of each model* varied depending on the unit aims and goals of both the university's science education programme and nature of the partnerships involved. In addition, the variety of models included meant that the project was able to investigate and generate *critical success factors and barriers* that can exist across differing contexts.

2.6.3 Processes Regarding the Construction of the Case Studies

Yin (2009) explained that the multiple case-study approach, involves a number of single cases where each site "might be the subject of an individual case study, but the study as a whole covers several [sites] and in this way uses a multiple-case design" (p. 53). Each university campus is conceptualised as a *site* and presented individual case(s) of school-based science teacher education for which data collection occurred. There were a total of five universities and eight campuses involved in the study (three campuses from Deakin University, two campuses from RMIT and one campus from each of the remaining universities) providing an ideal number of cases for a multiple case-study design (Stake 2006).

Careful selection of the cases was also important to represent a diverse range of approaches and experiences informed the project outcomes; in this way, the study enacted a holistic case-study design (Yin 2009). This holistic case-study design allowed both the common and unique features of individual cases to be considered and thus enabled the incorporation of a range of contexts. Stake (2006) indicates the importance of the selection of cases in terms of diversity of context in order to demonstrate "how the program or phenomenon appears in different contexts" (Stake 2006, p. 27). The range of contexts represented in the STEPS Project also included programmes across a range of geographic locations including metropolitan, regional and rural university campus locations; small and large PST cohorts; school-

based approaches embedded in course work and practicum; and different partnership approaches ranging from cooperative to collaborative. Representing this diversity of contexts was essential in ensuring that the findings and products constructed from these efforts would provide transferability across a range of contexts and could enhance the potential for greater uptake within and beyond other teacher education programmes.

The project team was purposive in that the shared philosophy about science education, science teacher education, and the project goals and outcomes were established very early (pre-funding meeting) and provided a clear vision that was maintained throughout the project team's work. A retreat at the beginning of the first year enabled all project members to regroup, realign themselves with what had been promised and redefine the project direction, in order to turn the proposal into a plan of action before dispersing to respective sites. This shared philosophy enabled the team to establish a strong focus and clear and attainable outcomes for the project and its associated research opportunities. Working alongside the project evaluator from application development enhanced this purposive work because project outcomes were consistently placed at the centre of discussions around data collection and analysis.

Finally, the project team adopted a collaborative approach by working together and alongside one another. Working together involved team meetings between all team members or smaller working groups to interrogate ideas in light of the individual perspectives of cases, the literature and other research that each member brought to the project. The team also had individual roles and responsibilities within the project, which were completed by working alongside one another. These roles were defined at the pre-proposal phase and were designed to be substantive and tailored contributions. Role distribution provided opportunities for individual contributions to the team's output and enhanced the sense of ownership felt by individual team members. A sense of trust, responsibility and ethics was established through this focus on collaboration.

2.6.4 Role of Case Studies Within Larger Project Goals

The STEPS Project collated and analysed individual cases of teacher educators who have successfully established partnerships with schools for their science teacher education programmes. This led to the development of resources, principles and frameworks that can guide the establishment and maintenance of powerful learning experiences. The variety of teaching and reflective practices and informing theories used in school-based science teacher education programmes were synthesised and informed the development of the Interpretive Framework and sustainable methods.

The case studies were written following a framework structure across all universities that included a rationale for the creation of their partnership programme and the resulting evolution of those programmes over their history. In addition, each case study focused on the following key categories:

- *Context*—historical description of why and how the programme was started; changes over time; reasons for continuance; structure/description, grade level, how the school-based programme sits within science education learning sequence within course; a description of the way the context shaped the structure and processes involved.
- *Goals*—intended outcomes of the programme.
- *Commitments*—response to goals, relationships between teacher educators and PSTs.
- *Theories informing practice*—informing programme structure and informing pedagogy.
- *Partnership*—role clarity; nature of partnerships between schools and universities; relationships between teacher educators and PSTs, relationships between teacher educator and schools, PST/teacher/school.
- *Indicators of success*—local successes, e.g. pupils and schools; willingness of schools to remain or come on board; PSTs evaluations; publications/presentations; uptake within the course/programme and sector generally.
- *Impact of perceived constraints and affordances*—university rules; school rules; resources; timetabling.

Each university team was responsible for collecting data and writing up individual case studies. Each case description provided evidence for the complexity and diversity of each context since each partner in a university–school partnership depicted the overall approach. The variety in the case studies arose because of the differing needs of each of the university structures, for example the University of Melbourne model occurred during PSTs normal placement and had no teacher educator presence in the schools, which constrained teacher educator interactions with PSTs and the schools, unlike the other models where the experience was part of core or elective units. The University of Tasmania model was an elective unit and was discontinued after three years due to course restructuring, whereas the other models occurred within core units and are ongoing. RMIT was unique in running double lessons during the teaching weeks, while all others had single lessons of 50–60 min. Deakin was the only model that had no on-campus classes prior to moving the PSTs into schools. The teacher educators from Deakin and RMIT always accompanied students into schools and ran tutorials in schools, whereas ACU and University of Tasmania models ran tutorials on-campus with occasional teacher educator visits into schools. These design features had different implications on the nature of the experience. Common to all, however, was the move of the PSTs from an on-campus tutorial space into a primary school classroom, and the expectation that PSTs developed and taught a unit of science to students. This was one of the essential hallmarks of the efforts across all partnership sites. These arrangements were true for the 2013 programmes (2012 for University Tasmania). It is worth noting that some elements of the programmes have since changed due to unit renewal based on the outcomes of the research, or from course restructure.

2.6.5 *Processes Regarding the Construction of the Interpretive Framework*

The development of the Interpretive Framework was iterative in its approach in that data collection occurred in phases and each phase informed the aspects included in the framework and its refinement as time went on. The initial phase (Phase 1) involved the sharing and documentation of current practice and subsequent cross-case analysis to identify common and unique features of the various cases. The phase was tasked with identifying the fundamental elements underpinning our practice—who was involved, what was done and why it was done this way. The synthesis of the case studies was the first step in this process developing narratives and vignettes for sample practice. Then the project team considered existing frameworks from the literature and government and organisational documents and found that these frameworks were presented in different ways:

- Diagrams/figures with key elements that were discussed.
- Tables with relationships between various elements or components, what might be done, and possibilities or outcomes.
- Full documents that described the background theory, lists of the framework elements that are teased out, and case studies to contextualise and apply the framework.
- Descriptions of various elements.

The team identified parameters to be incorporated into the Interpretive Framework, which included identification of the key stakeholders, as well as the elements of our practice that were important to include in the Interpretive Framework. This set of parameters served as an identification of what was important:

- Be broad enough to allow for depth of theoretical exploration within the different dimensions
- Have practical application
- Have theoretical application
- Draw on current practice
- Draw on current literature
- Lead to new practice
- Support the development of new practice
- Encompass all elements of establishing and implementing practice.

This was followed by an analysis of literature (Phase 2) that situated the cross-case analysis within the learning of the broader sector, allowing for a deeper analysis of practice, and assisting the identification of key themes (Fig. 2.1) that would inform the Interpretive Framework.

The next phase moved on to fine-grained data collection at each school partnership site (Phase 3). Data informing the development of the Interpretive Framework included: 106 pre- and 105 post-questionnaires from PSTs; 10 PST interviews; 15 interviews with university staff; 80 interviews with teachers and principals; 20

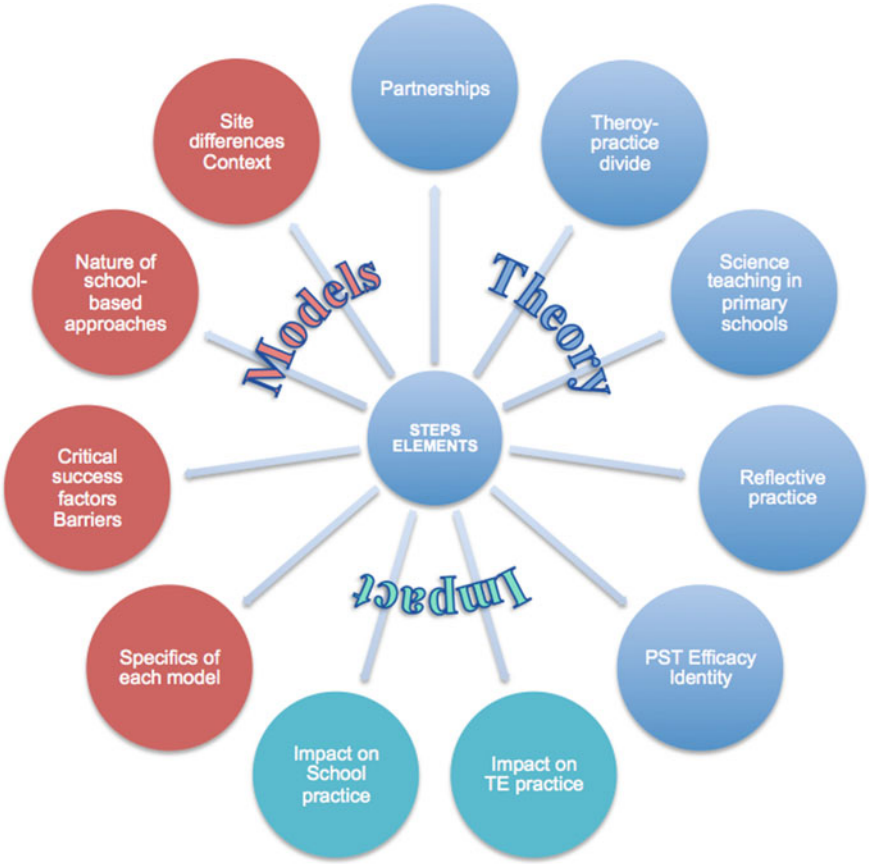

Fig. 2.1 Key themes informing the interpretive framework at Phase 2

interviews with teacher educators from other Australian universities. These multiple sources of data have assisted in confirming the key elements of the multiple cases, thereby ensuring the credibility and reliability of the framework. Stake (2006) claims that at least three sources of confirmation are needed for data to provide "assurances that key meanings are not overlooked" (p. 33). This involved STEPS project members collecting data representing viewpoints of key stakeholders within the individual case studies. Data included questionnaires and interviews with PSTs and interviews with university educators and in-service teachers and principals involved in the current year's programme. The goal was to elevate the voices of school-based personnel to drive the direction and development of the Interpretive Framework.

Analysis of this data involved a categorical analysis of the interview transcripts using NVIVO, then a closer thematic analysis where key themes emerged. These themes were related to four key areas: partnerships; impact on school sites; teacher educator goals; and PSTs. The partnership-related themes included trust and reci-

procity, risk-taking, communication and feedback. The impact on school site was related to the valuing of science content and strategic relationships. The sole theme regarding the goals of teacher educators was the integration of education research into classroom practice. Lastly, themes related to PSTs were encompassed by shifting identities, learning science PCK and valuing of science practice. The key themes captured in this analysis related directly to "the valuing of science" and "strategic relationships with schools".

The last stage (Phase 4) was designed to broaden the scope of our understanding for partnership work across Australia, including identification of existing partnership practices. This was done through a variety of efforts including: word of mouth through collegial interaction; active recruiting at Australian conferences; informal surveying via email; and any other means to learn of partnership work in science contexts. As these programmes were identified, they were offered the opportunity to be interviewed as part of the data collection sequence. The goal was to build a vision for partnership practices across differing levels of scale.

These phases led to the emergence of four key components that ultimately comprised the STEPS Project Interpretive Framework including: (1) Guiding Pedagogical Principles (GPP); (2) Representations of Partnership Practice (RPP); (3) Guide for Growing University–School Partnerships (GUSP); and (4) Growth Model. Each of these Interpretive Framework components recognises the ranging needs of different stakeholders, and elements of practice that have been found to be fundamental to the success of the partnerships. Each of these components will be introduced here, but these components will be the focus of later chapters.

1. **Guiding Pedagogical Principles (GPP)**: capture the educational practices afforded by a partnership which enable authentic interaction between a PST, the teacher and the students. Quality and effective science teacher education can be achieved when the guiding principles are exhibited. Further detail about these principles can be found in Chap. 4.
2. **Representations of Partnership Practice (RPP)**: There are a diversity of approaches and types of partnerships, some more cooperative, others more collaborative. Each serves a purpose, and may be short-term or long-term. Further detail about the RPP can be found in Chap. 5.
3. **Guide for Growing University–School Partnerships (GUSP)**: The practice of initiating, maintaining and evaluating any type of partnership can be underpinned by a set of principles to guide the partnership practice. Further detail about these practices can be found in Chap. 6.
4. **Growth Model**: The focus of growth is tied to the nature and quality of the learning experience that occurs within the specific partnership. For the university–school partnerships represented in the STEPS project, the overarching aim is growth in the quality and effectiveness of teaching and teacher education. A representation of how partnerships enable growth can been seen in Chap. 8.

These components grew from analysing data from key stakeholders and informed the development of illustrative narratives and vignettes describing key aspects of the experiences of each stakeholder group which are used to illustrate practice. The

narratives were written as a way of linking the data to the elements of the Interpretive Framework and justifying it according to practice. By constructing the narratives, the team was able to consider the intended nature of their current partnerships versus evidence of the reality of the relationship. For example, if the goal was to have a transformative partnership but the data suggested that the partnership was largely generative, then this prompted reflection and impetus to renegotiate the partnership.

The narratives were developed to demonstrate what the GUSP and RPP look like in practice. Each narrative aligns with one or more cells of the GUSP or RPP, and consists of a description of the cell being represented, along with excerpts from the case study and interview data as illustration. These narratives provide context for the cells of the GUSP and RPP. The vignettes were written around themes that relate to questions and issues that emerged during dissemination and evaluation of the project outcomes (workshops, presentations, as well as the teacher educator interviews). These themes are important in supporting uptake of school-based practices by other teacher educators.

Framing the Interpretive Framework was ultimately a representational issue: deciding which areas of our practice would be highlighted and afforded through further inquiry; and the form of representation that would act as productive constraints on our thinking. Also, there were pedagogical decisions made based on the desire to inform and instruct others of the partnerships and desired pedagogies. The framing and development of the Interpretive Framework followed the following lines of enquiries: *Initiating, Implementing & Evaluating*—Aims and Rationale; Institutional Requirements; Identity, Confidence, Praxis and Relationships; Nature and Quality of Learning; Commitment to Action. These evolved into *Principles of Partnership Practice*—Risk-taking and Trust; Reciprocity and Mutuality; Recognition of Respective Goals; Respect; Adaptable and Responsive; and Diverse Representations which are explained in more detail in Chap. 6. The final stage in the development of the Interpretative Framework was the *Growth Model* and the loci for growth, enablers of Growth and Personal and Professional Development.

2.7 Conclusions

The suite of STEPS outputs is described in detail in Chaps. 4, 5, 6, 7 and 8. They should prove useful for teacher educators and schools who wish to explore partnership arrangements further. These resources are accessible through the STEPS Project website: http://www.stepsproject.org.au. In addition to the GUSP and RPP, the various resources include: an annotated bibliography (Speldewinde 2014); narratives that illustrate the GUSP and RPP; partnership principles capturing the underpinning theories and ideologies that guide quality partnerships; vignettes to speak to particular stakeholders exploring partnerships; Guiding Pedagogical Principles (GPP) that capture pedagogical principles underpinning the practices that can be enabled by partnerships; a growth model outlining how partnerships foster change and growth;

action planning tools to negotiate, monitor and evaluate partnership arrangements; and a promotional video available to view on the project website.

The STEPS Project provided significant answers to issues currently occupying the minds of teacher educators and key policy makers, concerning the relationship between university teacher education, schools and PST practicum arrangements. In addition to traditional practicum arrangements, the outcomes of the STEPS Project call for discipline-based partnerships—for science but potentially for other curriculum areas—as an important adjunct to current practice that can open up models for more effective practicum organisation. The exploration of assessment of students in these programmes, centred in evidence-based reflective practice, will inform current concerns about defensible teaching standards and knowledge of pedagogies.

As the reader moves through the chapters within the following section, they will be taken on a journey that describes these components and provides important insights for how to carry out these approaches. The goal for this work is help others considering taking on starting, sustaining or reflecting on their own partnership work so that they will have a guide for those best practices in terms of understanding the myriad of issues involved in partnership work and how to meet those challenges and create meaningful opportunities for PSTs and students.

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Chapter 3
Models of School-Based Practice: Partnerships in Practice

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Abstract This chapter describes the five individual models of school-based practice involving university–school partnerships, each presented as a single case study. Each partnership was independently developed, and there are both common and unique characteristics of the partnership and the pedagogical practices that emerge when a cross-case analysis is conducted. This variety illustrates that there is not one way to work in partnerships in teacher education. Each case study is presented including a set of pedagogical principles that are common across the case studies, and set of themes are developed that are further explored in Part 2 of this book.

Keywords Partnerships · Science teacher education · Models of School-based Practice · Primary science · Pre-service teachers

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3.1 Introduction

Recent commentaries and policies on teacher education have highlighted the need for pre-service teachers (PSTs) to engage with the teaching profession in authentic ways, whereby professional experience is linked to theoretical insight. The relationship between theory and practice needs to be highlighted so that PSTs see how each can inform the other.

Teaching is a complex profession and a PST's practicum experience may in fact compound the notion of a theory-practice divide (Loughran et al. 2008). When PSTs undertake a standard practicum, they often observe teachers and make judgements of practice, without access to the teacher's thinking as they work with students. Teachers' understanding of how students learn and how they react to a learning situation is often contextually bound and tacit—that is, not expressed. PSTs may interpret the teaching experience differently to the teacher and miss the pedagogical understandings which underpin the choices teachers make.

Science learning in schools is considered particularly difficult as it is usually embedded in an inquiry approach with hands-on activities. Teachers state that it requires more time and more effort that other curricula areas to set up and to enact. They also state that less familiarity with key science ideas often means that they are not as comfortable making assessments of students' learning. The impact of this is that there is less science being undertaken in primary classes (Campbell and Chittleborough 2014) and fewer opportunities for PSTs to observe good science teaching practice.

When we contemplate models of teacher education, that is the education of PSTs, we consider a raft of possibilities which are enacted in most universities around the world: on-campus, face-to-face, off-campus, distance learning, cloud learning, blended learning, work-integrated learning (practicum), and micro-teaching. For science education, PSTs need to become proficient with subject matter (content), pedagogy (how to teach), and science pedagogy (how to teach science). Science education learning is promoted through experiential engagement and educators need to ensure that PSTs have the opportunity to be involved in this form of learning to enhance their own engagement and understandings. Teacher education faculties are expected to provide the best possible environment for PST learning and over years; this has led to more extensive school-based experiences. A school-based approach to PST science education provides the opportunity to employ intense, explicit work where PSTs engage authentically with school students through hands-on inquiry-based activities. In most instances, the PSTs are provided with support to develop their own understanding of science content, some teaching strategies to engage students in inquiry lessons and ways to assess students' learning. Teacher educators need to ensure science content knowledge is effectively delivered through a school-based, micro-teaching experience (Watson et al. 2013).

3.2 Rationale for Case Studies

This project (and subsequent case study development) responds to calls by the Teacher Education Ministerial Advisory Group (2015) to incorporate work-integrated learning into teacher education programs. The universities involved were already investing in current innovations in primary teacher education pedagogy, whereby science education units are delivered through a school-based approach. These innovations bridge theory and practice within partnerships between the academy and the profession.

The five universities involved in the STEPS project all developed partnerships with primary schools to engage primary teachers in classroom teaching and learning that effectively connects theory with practice. In these collaborative programs, PSTs design and implement science curriculum in primary schools, not as part of the normal practicum arrangements, but as part of their coursework. A central aspect of the school-based programs is the guiding of student reflection on their practice. Kenny (2010) notes that while such reflection on practice can be difficult to sustain and assess, it is critically important for PSTs' developing professional identity, their pedagogical content knowledge (PCK), and their teaching philosophy.

A case study approach was undertaken to understand and illuminate the complexities (Campbell 2000) of each university model of school-based practice. The purpose of studying each case was to gain a better understanding of the factors leading to the dynamism and operation of each school-based model, the characteristic of school-based PST science education, the participants (university educators, teachers, PSTs, students') involvement; and to determine the diversity of the school-based model of PST science education.

The 'case' is developed through a description of each school-based model, with 'thick description' enabling a detailed appreciation of the main factors inherent in the case and how these factors interact with each other. The development of a case study answers questions of how, or why, things happen or occur in a particular way. A situation with multiple cases, or a cross-case study, as in these circumstances, helps to clarify and explain the causal links which may be too complex or difficult to see in a single case (Yin 2009). A cross-case analysis can allow for explanations which can then be tested systematically across the cases (Miles et al. 2014). The descriptive framework was used for organizing the case study data from the school-based models, which Yin (2009) suggests is appropriate for analyzing causal links by enabling pattern matching, identifying non-equivalent-dependent variables as patterns, or through contrasting explanations as patterns or simpler patterns. Important similarities or differences which emerge allow for theorizing about possible explanations for the outcomes. Tactics such as identifying themes and patterns, counting and clustering (Miles et al. 2014) add theoretical coherence. Using a wide range of data and making multiple comparisons improves case study validity (Miles et al. 2014).

Through critical appraisal of the case studies, key features of each approach were identified and the success factors which were critical to establish and maintain strong working partnership with schools will be explicated. These factors are discussed in detail in later chapters.

This chapter describes five individual models of school-based practice involving university–school partnerships, each presented as a single case study. In each case, the school-based approach model was part of a course or unit not normally linked to the traditional 'placement'. While the school-based models were developed independently, the cross-case analysis revealed several common characteristics across all of the models in regards to the pedagogical practices, as well as aspects unique to the context. This suggests that there is no one single way to design these school-based approaches, but a set of themes emerged from the cross-case analysis, and these are explored in Part 2 of this book.

3.3 Development of Case Studies

To inform the analysis of the models existing in the five universities, an extensive review of the literature was undertaken to gather information about existing school-based practices and definitions of models. A comprehensive annotated bibliography was constructed around the following key terms (or derivatives of these terms): partnerships, efficacy, science teaching, reflection, pre-service teaching, education, collaboration, and Australia (as context).

3.4 Case Studies from Five Universities

Researchers at each of the institutions were required to write an individual case study of their site where the practices and context were identified. In an attempt to keep the case studies as objective as possible, each case study was written independently of the others so that there was no initial cross-contamination of key ideas. As indicated above, a common template for recording material was utilized to ensure each case study considered similar areas of data in terms of information and practice. These areas included:

- the rationale for, and goals of, the partnership approach;
- theories informing the teacher educator's practice;
- the structure of the school-based experience; and
- features and nature of the partnership:
  - including roles of various members;
  - ways in which the students were involved;
  - constraints and barriers encountered; and
  - and plans for future practice.

3.4.1 Model 1: Deakin University

School-based approaches have a long history at Deakin. The approach was initiated at Burwood Campus in 1990 within the Bachelor of Education course, Waurn Ponds Campus in 2000 and Warrnambool Campus in 2003. The approach was originally undertaken due to the realization that PSTs were rarely given the opportunity to teach science in schools, and even when they were, were not adequately supported to do so (Grindrod et al. 1991). The use of schools in the preparation of primary science teachers was instigated in order to give PSTs an authentic experience of teaching science concepts to students while being supported by teacher educators, and to develop their capabilities as teachers of science. In particular, this approach is based on the educators' constructivist theoretical perspective—enabling PSTs to construct their own understandings of science education through involvement with schools. The PSTs also engaged in constructivist teaching approaches: using probing of students' prior knowledge to inform subsequent teaching, and working at the level of conceptual change with students. Developing PSTs identity as a teacher of science also informs the way the program is developed and maintained.

The broad structure of the approach is that the normal three-hour workshop is held in a school local to the university, rather than in the university laboratories as would normally be the case. During the three hours, pairs of PSTs plan and teach small groups of students for one hour each week, building up skills in framing and implementing activity sequences according to the principles that are promoted in the workshop. The final phase of the workshop is a reflection session in which students recount their experiences in a pedagogical discussion.

The structure of the school-based experience has changed over the years. Initially, it was the only mode of delivery when there was one science unit in the Bachelor of Education course. The current school-based experience is used in the second of two science education units. In the first unit, students participate in on-campus classes except for a two-lesson sequence with students focusing on probing science understandings. The second unit is entirely undertaken in schools and focuses on building, planning for, and analyzing the growth of students' science knowledge and skills over a whole unit of work, drawing heavily on the 5E inquiry framework. This is part of the PSTs' assessment and is embedded in their planning and reflection documents. Until 2014, the unit was delivered in third year, after several years and 20–30 days of practicum placement, so the PSTs were well experienced in their understanding of students, classrooms, and schools.

The school-based science unit has the following features:

- Almost all workshops (3 h per week) are run in local schools;
- PSTs teach a whole unit (approximately 6–8 lessons) to small groups of students; and
- Workshops include, approximately, a 1 h tutorial focusing on pedagogical strategies and science concepts, 1 h of interaction with students, and 1 h of reflection on practice.

However, even within this one institution, variation exists between the three Deakin campuses in terms of the partnership arrangements, how the three hours are used, group size of students, the number of schools involved, and the age of students involved. These aspects of the partnership arrangements are directly negotiated with the schools involved.

This program has received high PST satisfaction ratings over the years. For example, 99% of students indicated that working with students in schools was a supportive aspect of the course (2000–2002).

> Initially I was frightened of taking this unit, but I feel much more confident now (Student, 2001).
>
> Firstly, I would like to say that the hands-on approach available out at a school for this unit is an exceptional idea, and that I have benefited from the availability of such a program. (Matt, Student, 2002)
>
> Most useful unit in teaching that was engaging, especially being in schools and in tutorials. (Anonymous, Student, 2003)

The quality and success of the program is also demonstrated by the increased number of schools requesting to be involved at all campuses, and the ongoing nature of partnerships with schools that have been involved over many years. In 2016, over 16 schools were involved in the school-based program. Also, schools are increasingly embedding the Deakin science experience in their school community activities, through things such as science fairs and science days. For example, one school has an annual science night that incorporates the Deakin science students. The Deakin science PSTs organize the event with help from teachers and Deakin teacher educators; train the students on how to run and explain the activities; and help with the coordinators of events.

From 2015, the third-year unit moved to fourth year and the focus shifted from providing a strong science teaching experience to developing teacher readiness. Partnerships with schools started to incorporate experiences where PSTs have a more authentic engagement with the profession by interacting with the school teachers in a more substantial way. Rather than the PSTs choosing the science program of study, it is aligned with the school's designated science program and is run by the PSTs in consultation with the teacher and the Deakin academic teacher educator. PSTs provide a written report on each child's learning to the teacher at the end of the unit which is then incorporated into the teachers' reports on a child's learning.

3.4.2 Model 2: Australian Catholic University, Ballarat

Using an approach based on similar foundations to the Deakin model, collaborative partnerships at ACU were established between PSTs from a core third-year science education unit and practising teachers in regional Victoria. A school-based approach to science teacher education has been a core component of the Bachelor of Education (Primary) and Bachelor of Early Childhood and Primary Education courses at ACU

Ballarat since 2008. The ACU case has been through several iterations and has proven to be an effective forum for professional mutual learning in primary science. Initially, the program involved groups of four to five PSTs planning, implementing, and reporting on a mini-unit of science for a whole grade. In response to feedback from the PST involved, the program was recently changed to involve PSTs working in a smaller group of two PSTs, but continuing to work with a whole class of students.

In developing the program, the educator was informed by several theoretical approaches:

- Social constructivism—PSTs working with students and teachers in schools to help develop student's science understandings. The way they approach their lessons, using probing for prior knowledge, Vygotsky zone of proximal development, scaffolding, formative assessment;
- Deep learning—based on a student-centered approach, connecting across contexts of relevance to learners. There is a constructive alignment when the curriculum, teaching methods, assessment processes, learning environment and the institutional climate mutually support one another;
- Inquiry—planning science in an inquiry way, linking with student's prior experiences and own questions;
- Reflective practice—PSTs must reflect on their teaching informally, as they teach the students, measuring the effectiveness of their teaching strategies and their unit of science. More formally, they reflect through participation in reflective sessions with the educator and through their lesson reports; and
- Self-efficacy theory—improving PSTs efficacy toward science through modeling successful practices, providing them with first-hand experience of success, constructive feedback and effective feedback through successful experiences.

Currently, the program involves a pair of PSTs working collaboratively to plan, co-teach, report, and reflect on a five-week mini-unit of science. PSTs work in Ballarat schools in blocks of 1.5–2 h per week across a five-week period. In this time, they explore science ideas and Öprocesses with their class of students. Their mini-units are planned around the 5Es inquiry framework, which helps to ensure that there are a lot of hands-on experiences supported by conceptual development and embedded assessment.

The benefit of having both the primary and the early childhood and primary courses in the program means that all primary school levels (Prep—Grade 6) have the opportunity to be involved. PSTs also write a report for each child in their class, which is returned to the school and often sent home to parents as a part of the school's formal reporting process.

The program forms a major learning and assessment task for PSTs. They are assessed on the quality of the inquiry plan and on the reports they write on students' learning. They are not assessed on their actual teaching; however, this does provide an essential basis for their reflective thinking and writing, which then forms part of their assessment. PSTs receive time in lieu of science tutorials, but still attend university for science lectures where they debrief and share ideas for improving their science teaching practice.

PSTs, classroom teachers and principals all value the experience because they see how engaged the students are. There are multiple benefits for everyone involved. Some of the comments attesting to this are included below.

> I'll be more willing to teach it [science] now I think, because I see that they do get enjoyment out of it, because before I was 'oh, I think they'd hate it.' (PST 2007)
>
> Being in a school and actually being able to apply my knowledge in a real world environment has helped my understanding of science teaching. (PST 2010)
>
> It was great the girls were questioning the whole time. They just didn't stand back and observe, they were right in amongst it. Yes we've just volunteered whenever you've sent out. We just all say yes because the kids have loved it and we've enjoyed having them. (Teacher 2013)
>
> The benefit for our teachers is that they can see if contemporary teaching of science is being instructed in the colleges and being brought to our schools. Our teachers can see in a sense, even though these are only beginning teachers, they can still be modelling best practice teaching in terms of small group work, questioning techniques, use of equipment, referring to resources and so on. So our teachers also get a bit of a wakeup call or a bit of a reminder of what they could be doing in science as well, so it's a win/win for both groups.
>
> [T]he kids were really excited to be part of it and there was particularly that hands on experiential aspect to it but naturally for a good number is going to be engaging. I think again the interaction with the ACU guys just in terms of who they were as younger people coming into the school helping us with our learning that in itself was engaging for them. (Principal 2013)

3.4.3 Model 3: RMIT University

The school-based course is offered in the Bachelor of Education third-year science course (unit of study). In 2007, the course was designed to build PSTs' practical knowledge of constructivist theories of teaching and learning through the 5E inquiry model, as advocated by the primary connections resources (Australian Academy of Science, 2015). The unit attempts to build PSTs' professional identity and uses reflective practice. In more recent times, multiple-representations in science and student learning stories are incorporated into PSTs' learning experiences. The unit of work PSTs produce is assessed through the quality of the science unit, the way it supports constructivist learning and inquiry teaching practices. The PSTs are assessed in regard to their reflective experiences, identity, and individual child's engagement.

In teaching teams of five students, the PSTs plan and implement a 5E sequence of lessons on a given science topic to a primary school class, with each PST teaching one lesson each within the sequence. The sequence is either five or six lessons long, involves one PST acting as the leading teacher while the other teachers lead group work or rove during whole class activity. In 2010, the assessment of the course has focused on: 'Development of the teacher'—through reflection on professional identity and teacher commitments and confidence with science and science teaching; 'Development of student learning'—through targeted, relationally based and storied

assessment, and 'Development of curriculum'—through planning, implementation and critique of curriculum.

The RMIT Science Program (school-based) was initially conceptualized to provide PSTs with authentic opportunities to engage primary students in science. The expectation was to develop PST confidence in order to tackle the challenges of science teaching when they began their future practice. After the 2007 pilot program, PSTs reported high levels of satisfaction with the initial pilot, and the program was expanded across the entire primary program at the Bundoora campus. In 2010, the program was expanded to include the new Bachelor of Education course at RMIT's Brunswick Campus.

Alongside the positive outcomes for the PSTs, it became increasingly clear that there were also significant outcomes for the primary students, classroom teachers, and the school community. The positive outcomes for all the stakeholders ensured that the unit continued and expanded. In 2016, the RMIT school-based science program involved seven primary partner schools in the greater Melbourne area.

This course/unit provides PSTs the opportunity to challenge their preconceived notions for science practice in a supportive, team atmosphere. Consequently, they are able to take on the challenge of teaching using inquiry-based practices. The RMIT science education program consists of a compulsory two-semester sequence. The first is university-based and is designed to prepare PSTs with theoretical and pedagogical knowledge to design effective 5E inquiry units. The following semester, PSTs design original units based on the content needs of the partner school. PSTs construct these units over a series of weeks with support from the university team and deliver them in primary classrooms at the close of the semester. During the second semester experience, the PSTs write and develop their unit in the first five weeks of the semester. They work in teams of five and are supported in three-hour tutorial/workshop sessions over that five-week period to write a seven lesson sequence that followed the 5Es format of primary connections.

There is much evidence that PSTs have positive experiences during the two-semester school-based sequence. Compared to the RMIT School of Education 'overall satisfaction rating' of 74%, the rating of the science program over the last four semesters been 100%. Student written comments also highlight their increased confidence when it comes to teaching science.

> Engaging, challenging, and rewarding course - the application of theory and the opportunity to practise it in a real classroom with our peers is an invaluable experience. (Student)

Teachers also articulated the seriousness with which students approached their work in schools, as evidenced by the words of one of the teachers.

> The RMIT student teachers thoroughly prepared and presented science concepts with a developmental hands-on approach…Activities were well organised and well prepared. They were highly engaging and really encouraged students to do the thinking for themselves. (Teacher)

3.4.4 Model 4: University of Melbourne

The Primary Science Education program was developed to respond to research (Harlen 1997) that indicates that primary teachers need extensive experience and confidence to teach primary science in classrooms. The Melbourne Graduate School of Education (MGSE) program seeks to provide knowledge, experience, and skills to PSTs to teach science through an in-class teaching requirement, workshops and lectures. Since the mid-1990s when the Bachelor of Education program ran school-based science programs, PSTs have taught science units in classrooms. The school-based experience now reflects the Masters of Teaching clinical model of teaching. (http://education.unimelb.edu.au/about_us/clinical_teaching).

The PSTs, called teacher candidates, teach a sequence of lessons and develop a unit of science teaching. Teacher candidates are expected to teach science education to a whole class. Their role enables them to develop skills as diagnostic, interventionist teachers responding to learner's identified learning needs. They use student work as evidence that informs the sequence of science teaching. In addition, they are expected to be reflective of their own learning and develop their own twenty-first century skills, including collaboration, communication, creativity, and inquiry. The inquiry approach used follows the 5Es model.

Science education is part of the core program for Master of Teaching primary teacher candidates in the first semester of their second year. The school-based component of the Primary Science Education program embeds into the Master of Teaching program, two days each week in a classroom setting.

They also participate in $2\times$ one-hour lectures and $1\times$ two-hour campus-based workshops per week. This occurs while they are teaching their science units in classrooms, supported by their classroom-based mentor teacher. In addition, they receive support from a school-based teaching fellow and a MGSE clinical specialist.

Teacher candidates stay in the same school for a year. The teaching fellow and clinical specialist meet with the science education academics leading the subject before each semester. The teaching fellow and clinical specialist source a mentor teacher who has planned to teach science to their class. The teacher candidates work with these class teachers to develop a unit, adapted to the science learning needs and interests of the students. The unit keeps the science focus uppermost, but blends technology, literacy and numeracy into the class-based experiences.

> The Science Education program immersed teacher candidates in real science education. The lessons and activities ranged from Harry Potter themed inquiry lessons to chocolate investigations. This course and the instructors created passion and joy in learning. I can honestly say it was the positive example upon which I base my current teaching. (M. Teach Graduate 2013).

3.4.5 Model 5: University of Tasmania

A partnership approach to science teacher education was developed for final year PSTs in the Bachelor of Education (Primary) at the University of Tasmania and conducted in 2007, 2008, and 2010. The aim of the unit was to develop PSTs' confidence and competence to teach science through an authentic teaching practice. The unit enabled PSTs to develop their self-efficacy and reflective practice supported by the partnership with the teacher and university academic. Constructivist teaching approaches applied to student-centred learning needs underpinned the PSTs' developing practices.

PSTs in their final year were offered a science elective in which they would work collaboratively with a local volunteer teacher. They were to plan and teach a unit of work in science in the classroom of the teacher.

During the first four weeks of the unit, teachers meet with the PSTs to establish the partnership and begin the planning process. PSTs were to teach at least a two-hour block of science over a six-week period. In this time, they would explore science ideas and processes with their class of students. The science education teacher educator supported the PSTs to develop an inquiry approach that incorporated hands-on experiences, focused on conceptual development, and embedded assessment. The role of the teacher and science educator was supportive rather than supervisory.

The PSTs prepared an assessment of several of the students in the class, completed weekly reflective exercises, and a science portfolio designed to be used when applying for teaching positions after graduation. The program formed a major learning and assessment task for the PSTs who participated who were assessed on the quality of the inquiry plan and on their portfolio. While they were not assessed on their actual teaching, their teaching experiences provide an essential basis for their reflections. PSTs did not attend tutorials on-campus during the teaching period but returned after the teaching to debrief, share experiences, and complete their portfolio.

The PSTs classroom teachers and principals all valued the experience because they saw how engaged the students were. There were multiple benefits for everyone involved. Some of the comments attesting to this are included below.

> "We went out into schools and taught. It was the biggest learning experience for me… It was hard to do with the workload, but we had release time from class. Actually had to get organized and put theory into practice. The thing was theory into practice. We were a bit sick of theory and wanted to bring it all back and relate it. Unit plans and designs – let's see it. It was really valuable to me." (Andrew, PST, 2010)

> It allowed me to reflect upon my own teaching by observing and assisting. It reinforced just how different children learn and how much they rely on their prior knowledge and experience when completing tasks – particularly when predicting and recording observations and results. (Teacher, 2008)

> Instead of trying to run the whole program myself it gives me a chance to watch and listen to the class and learn. (Teacher, 2010)

> Students exposed to new approaches to teaching science. Students developing and enhancing skills and knowledge. (Principal, 2007)

> The interest came from teachers. Teachers are aware of the importance and value of this curriculum area. They take advantage of local resources to assist in provision for students e.g. Science Talent Search. The new Tasmanian curriculum plus the knowledge that a national curriculum is around the corner has highlighted the need to look more closely at the teaching and learning of science in a cohesive way. (Principal, 2008)

3.5 Data Arising from the Models

The following data were generated from the case study descriptions, using the key template descriptors indicated earlier (pg XX): the rationale for, and goals of, the partnership approach; theories informing the teacher educator's practice; the structure of the school-based experience and the features and nature of the partnerships.

3.5.1 Rationale for, and Goals of, the Partnership Approach

Across the cases, the "*rationale for, and goals of, the partnership approach*" related strongly to the opportunity to provide links between the theory PSTs were gaining at their university and the actual practice of teaching science to primary-aged students in a classroom setting. This was variously described within the case studies as:

- Providing experience of teaching science concepts, develop PSTs' capabilities as teachers of science.
- Providing professional mutual learning in primary science and offering reflective thinking.
- Building PSTs' practical knowledge of constructivist theories of teaching and learning through the 5Es (Engage, Explore, Explain, Elaborate, and Evaluate) inquiry model.
- Providing opportunity and extensive experience to PSTs to raise confidence to teach primary science in classrooms.
- Seeking to provide knowledge, experience, and skills to PSTs to teach science.

3.5.2 Theories Informing the Teacher Educator's Practice

In considering the '*theories informing the teacher educator's practice*', the most-oft-mentioned theory was that of constructivism. This was particularly true of the models of school-based science education which had been in place for many years (e.g., from Deakin University and University of Melbourne) when 'constructivist theory' was the main informing theory for educational cognition. The constructivist theory was used to underpin the teaching approaches used in schools. Modeled by the

educators, PSTs adopt teaching approaches during the school-based teaching which were informed by constructivist theory:

- The teaching sequence (unit of work) was based on social constructivism where students' developing understanding and knowledge occur through hands-on pedagogy (interactive approach) in collaboration with others.
- Using a student-centered approach which recognizes that students construct their own understanding—also core to the constructivist theory of learning. Inquiry approaches also support this student-centred focus.
- Eliciting students' prior understanding of a topic was core to all units of teaching. This is a key aspect of constructivist teaching—to allow for building on students' knowledge.
- All units incorporate PST assessment tasks associated with the school-based teaching, linked with formative and summative assessment of students.
- Talking science—the processes of listening to others talking and explaining—and learning from others, and being challenged—all reflect a socio-cultural learning environment—that is necessary for meaning making and problem solving.
- The school context of working with students and teachers enabled PSTs' construction of their own knowledge as they were interacting with others.
- Cultural constructivism was involved as PSTs had to adjust to the unique culture of their host school.

Over time, other theories started to impact on how the program was developing and changing. The case studies also cited other theories, depending on the focus of the educator(s) involved. These included:

- Teacher identity, reflective practice (DU)
- Deep learning, reflective practice, self-efficacy (ACU)
- Identity, reflective practice, representational approaches (RMIT)
- Reflective practice, clinical model—diagnostic and interventionist, responding to identified concerns (UM)
- Self-efficacy, reflective practice (UTAS)

All models used inquiry approaches and reflective practice in different modes of operation. An inquiry approach is consistent with constructivist learning theories. Known frameworks used in the models to facilitate this learning include the 5Es; primary connections resource materials; and use of representations. reflective practice featured in every model of school-based science delivery, in one form or another. PSTs reflected on their teaching practice, individually or in teams, strategies used, the effectiveness of their developed curriculum, how the students responded to the science learning, and how they used the assessment to make judgements about students learning. Some PSTs were involved in reflecting on whole class learning in terms of broad curriculum delivery while catering for individual learning.

The clinical model, although building on a previous constructivist school-based model, was initiated more recently, and deviates from the format of the other models in several ways. In particular, it advances the idea of the model as informed by twenty-first century skills of collaboration, communication, creativity, and inquiry.

3.6 The Structure of the School-Based Experience

There is a similarity in the structure of the school-based experiences across the sites and models. Most programs require the PST to plan, teach, and assess a compete unit of science work of approximately six-nine lessons; however, there are variations in the structure resulting in a number of differences:

- PSTs teaching whole classes of students;
- PSTs team teaching small groups of students,
- PSTs are organized in teaching teams,
- PSTs teach individually,
- the school teacher involvement—little involvement to significant role.
- Support through on-campus classes.
- Support through site-based tutorial experiences.

A schematic was developed (see Fig. 3.1) which incorporates the key structural components of each case study. It provides a visual representation of the five models and illustrates that

- There is a mixture of undergraduate (U/G) and postgraduate (P/G) programs;
- there the Universities ran the school-based science programs on regional (Regional) and/or metropolitan (Metro) campuses;
- Four of the programs occurred in core (Core) and one in an elective (Elective) unit
- all models involve PSTs teaching students over a number of lessons (the number of weeks teaching the students represented, roughly, by the number of white rows);
- the cohorts of PSTs involved varied greatly across the programs (indicated as # PSTs);
- all models except for Deakin involve PSTs teaching whole classes of students (student group size represented as blue);
- PSTs are organized in teaching teams or teach individually (green), and the school teacher plays a significant part in two of the three models (+T); and
- there is a mixture of on-campus and site-based tutorial experiences (rows showing the number and placement of on-campus tutorials as light gray and off-campus tutorials as dark gray).

The variation across models arises due to the different needs of the university structures, and these different design features impact on the nature of the experience for all participants. For example, while all other models involve taking students to schools during normal tutorial times, the University of Melbourne model embeds the school-based science teaching experience into the normal placement. This places constraints on how the university teacher educator can interact with the PSTs. However, one common structural feature of all models is the physical movement of PSTs from the university campus to a primary school classroom.

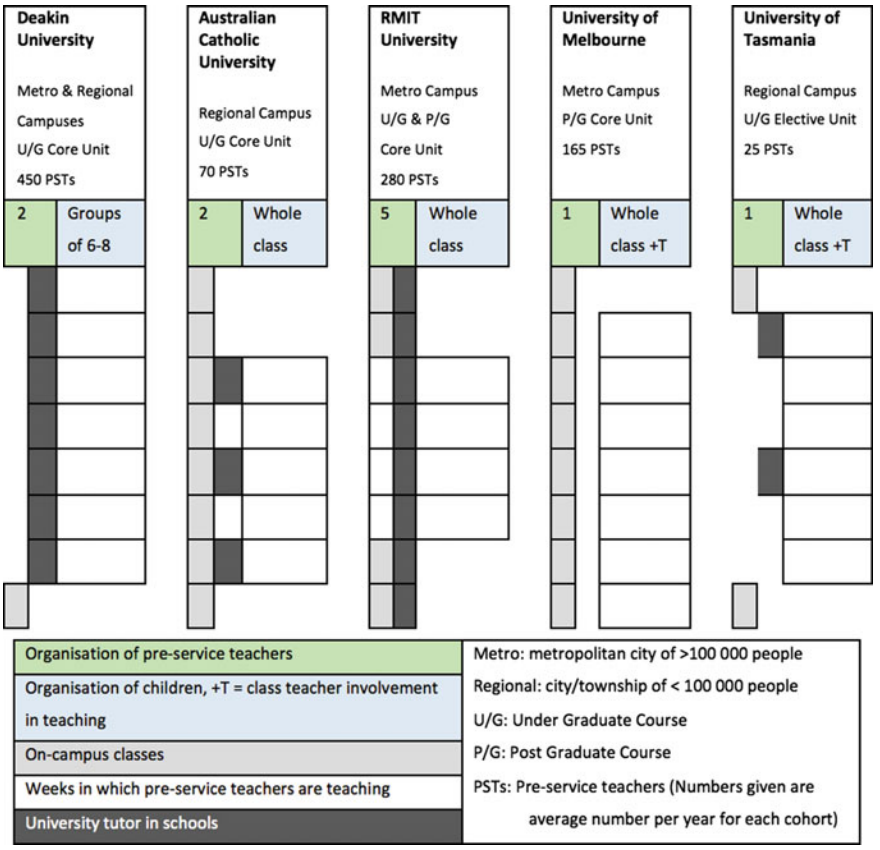

Fig. 3.1 Structure and format of individual cases

3.6.1 The Features and Nature of the Partnership

There are a number of different participant roles in the school-based science education partnership. For example, the educator establishes the initial contact with the school, providing information about the program and negotiating the possibilities of the program. The liaison continues as the program is developed around the school's needs (individual classrooms requirements) and the university requirements (grouping of students, teaching needs and time and space at the school). The educator contacts all PSTs prior to the commencement of the university teaching period to nominate the students to a school, grade level, and teacher. For one program (Deakin University), students are also set up in pairs to work together. Assisting PSTs in the planning of their unit occurs either at the university prior to commencement of the school-based experience or at the first session at the school.

The responsibility of the PST includes regular weekly attendance, working collaboratively with other students and supervising teachers, developing appropriate lessons geared to student needs, teaching effectively, assessing students' learning formatively and summatively and reflecting on teaching.

The role of the supervising teacher varies considerably from model to model and even within the model. Some teachers work with the university academic to establish the science needs of the class, while others work with the PSTs—co-planning. Some teachers use the time to undertake other work, while others stay in the class contributing to the teaching or providing feedback.

Students' involvement depends somewhat on the approach taken by the teacher and the PST. If an inquiry approach is taken, students have input into the learning outcomes. However, in many cases, student autonomy is established through the interactivity of the lessons.

In establishing the school-based practice, some constraints and barriers can be encountered. Material and resourcing can be difficult with much of this falling back to the universities or the PSTs themselves to supply. Time for negotiation with the teacher can be difficult for the PST given a teacher's face-to-face classroom commitment. Student behavior can be an issue but with appropriate teacher support, this usually does not affect the lessons or learning outcomes.

The practice around these school-based partnerships is being re-evaluated by the various partners at all times. The amount of buy-in from the schools has increased in recent years which has led to greater teacher professional development as teachers involve themselves more in what the students are learning. The theories informing school-based practice have gradually expanded, moving away from a conceptual change model (constructivism) to one of student inquiry where student autonomy is considered important. The development of PSTs PCK in science is now framed in an understanding of changing identity and greater reflective opportunities are provided (Fig. 3.2).

The nature of the school-based interactions differ across the models as the factors which are incorporated in the partnerships are affected by varying aspects of schools and universities as institutions, people within these institutions and the development of relationships. The partnerships include and are informed by:

- Theory and Practice—what happens and why;
- Professional learning, learning together, practicum;
- PST confidence, self-efficacy, and professional role;
- Science teaching/science education—inquiry, PCK; and
- Type of placement—practicum, micro-teaching.

3.7 Discussion

As indicated previously, cross-case analysis frequently looks at important similarities or differences in the patterns across cases. This was applied to the models to develop the richness of the understanding of them.

Similarities across the models included:

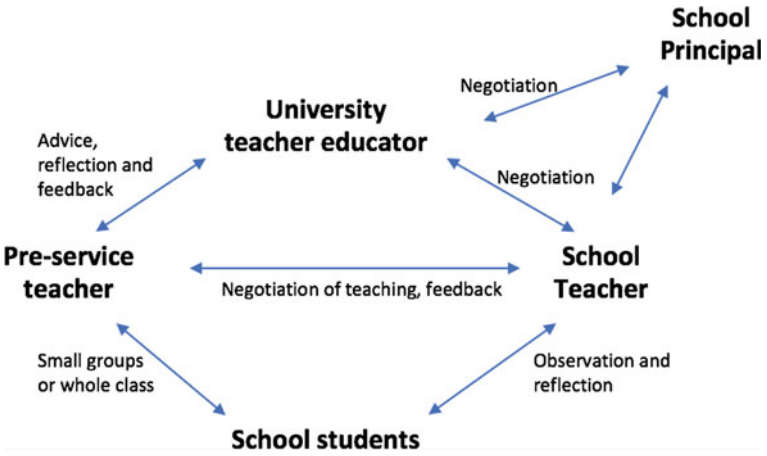

Fig. 3.2 School–based interactions

- Extended duration of model—most have been running for 8 years or longer (except the elective unit at UTAS)
- Usually, whole grade teaching by a group of PSTs (variation—Deakin working in pairs with smaller groups of students)
- Based on constructivist theory of learning, initially
- Core science education unit for most model.

Differences across the models included:

- Placed in a variety of university-level courses—undergraduate bachelors and masters—education
- Variations in the number of students involved—25–450
- Variations in the way PSTs work as individuals, pairs or larger groups
- Variation in the duration of teaching students, Sessions may be four to seven weeks
- Role of the teacher in support of the PST—teacher co-teaching for some models, not for others
- University educator/teacher educator—onsite for some models, not for others
- Additional university classes—for some models, not for others
- Preliminary meetings between students and teachers occurred in some models, not in others
- Reporting of students' learning to teacher occurred in some models, not in others
- Recognition of the days (as placement or additional field days) occurred in some models, not in others.

With the cross-case analysis, we were looking for elements, or themes which shed light on the school-based practices. Our macro-analysis looked at the broader elements of the university/school of education/unit operation and primary schools, whereas we also considered the micro-aspects relating to PSTs in schools, teachers, university staff in schools. We are aware that there are many other aspects which

could have been compared, but these will form part of the analysis and discussion of the fuller case studies of the schools which incorporate the data arising from interviews.

The analysis of the factors of the school-based models helps to understand what could be influencing the ongoing durability of these various programs and the commitment from all participants to ensuring that they are ongoing. There is no doubt that they are considered successful in developing PSTs' confidence and capabilities to teach science. However, the school-based science teaching practice, embedded in these models, pushes PSTs to think past the mindset of tips and tricks to considering how to teach effectively. Having PSTs teaching science as a specific unit/course within their teacher education course/program provides a school-based experience that cannot be gained in the university environment. The intense focus on a teaching domain, and groups of school students ensures relationships and rapport are built with school students. This is supported by teacher educators and teachers who observe and support the PST to deliver the unit of work. Obstacles can impede the success of the model relating to timetabling both in a school and in the university environment. The workload involved in organizing these programs is also an issue for consideration (Kenny et al. 2016). However, the effort seems worth it, as this time in schools, which is in most cases additional to the traditional 'placement', provides PSTs with excellent preparation to move into teaching.

3.8 Conclusion

In conclusion, we found that the comparison of the five university models provided insight into significant factors which could impact on the outcomes of school-based teacher education practice. These factors are discussed in future chapters as aspects of the partnership arrangements with schools are more closely defined and examined.

The next Chap. 4 discusses the partnership arrangements in terms of the educational and attitudinal growth of PSTs. PSTs' confidence to teach science, their self-efficacy, along with their growth in professional identity are aspects considered in the following chapter.

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Part II
STEPS Interpretive Framework as a Partnership Model

Chapter 4
Linking Theory and Practice Through Partnerships

Gail Chittleborough and Mellita Jones

Abstract This chapter reports on the important role of establishing partnerships between universities and primary schools to provide the opportunities for school-based teaching that engages pre-service primary teachers in an authentic experience of science classroom teaching and learning. It is argued that partnerships present a mechanism through which teacher educators can best enact praxis—the linking of theory and practice, in their science teacher education courses. Evidence from the STEPS project is drawn upon to demonstrate ways in which partnerships between universities and schools provide an authentic basis for pre-service teachers, teachers, and teacher educators to explore the application of theoretical ideas that underpin effective science teaching practice. Examples of partnership practice illustrate ways in which partnerships enable the successful application of pedagogical content knowledge through pre-service teachers' planning, implementing and assessment of a learning sequence in science, and reflecting on their teaching. The important role of establishing partnerships between universities and primary schools to provide this school-based teaching and learning opportunity is acknowledged. Moreover, the essential role of the science teacher educator is recognized, as it is the teacher educator who provides active leadership for the effective connection between theory and practice that ultimately builds pre-service teacher confidence and competency to teach science. These elements of linking theory and practice through partnerships culminate in the chapter's conclusion where the Interpretive Framework model is introduced, to aid thinking and planning around how universities and schools can work together in effective partnerships.

Keywords Partnerships · Theory–practice nexus · Interpretive Framework
School-based · Teacher educator · Pedagogical content knowledge
Communities of practice · Pre-service teachers

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4.1 Introduction

The STEPS project (2012–2013) brought together five universities that each used a school-based approach for their science education units. The project began with a strong focus on the discipline of science, because as science educators we were aware of the limited opportunities that pre-service teachers (PSTs) often have to teach science or observe it being taught due to a traditionally low priority given to science in many primary schools in Australia (see Goodrum et al. 2001). But the interrogation of our school-based practices revealed the school–university partnership as the primary factor in the success of school-based work. Without a strong partnership, the school-based experience fails.

PSTs' learning how to teach science in primary school is often surprised when some students respond to their questions revealing a sophisticated and high level of understanding of science ideas. PSTs are therefore challenged to ascertain the students' understandings and to identify the optimum pathways for their learning of science, thereby linking theory and practice.

Teaching science commonly challenges not only PSTs' expectations about students' understandings of science, but also their own background knowledge of science content and skills (Wilson et al. 2015). PSTs can find teaching science in primary or elementary schools confronting because they are commonly unsure of their own scientific knowledge and are unfamiliar with scientific thinking and processes. It is central that the PST is supported in learning the "science" as they learn how to teach the science in authentic school-based settings.

As we collected data in the STEPS research and subsequently examined the various aspects of our programs, the importance of the nature and role of the partnerships between the schools and the universities became a significant component of the project. While there were core philosophical groundings between our programs, we found that the nature of the university–school partnerships we established was not the same. This led the direction of the research to delve deeper into the impact of the type of partnership and the nature of the partnership on the PSTs' learning experience [see Chap. 5, Representing Partnership Practices (RPPs)]. Essentially, partnerships emerged as the primary factor in the success of school-based work and subsequently, theory–practice nexus in a way we could see was relevant not only for our science education units, but more broadly for school-based teacher education in general.

This chapter explores how the five school–university partnerships link theory and practice in their efforts to support PST in learning how to teach science. The analysis that characterizes the nature of partnerships results in generating the Interpretive Framework for school–university school-based partnerships.

4.2 Establishing Partnerships Between Schools and Universities

Each of the five partnerships and their associated practices are presented as five case studies in Chap. 3. In four of the five cases, science teacher educators personally sought out schools and organized the school-based visits for their PST themselves. This was a separate and additional school experience to the PST's normal practicum or fieldwork. Situating the experience outside the normal practicum period provided the PST with a school-based experience that was dedicated to science teaching. It also meant that PSTs were supported by a science teacher educator rather than a generalist teacher and that they had an assessment task related to the school-based science teaching. It is significant that the science teacher educator sought to embed the professional experience with opportunities for theoretical insights. The report produced by the Teacher Education Minister's Advisory Group (TEMAG) (2014) emphasizes the importance of planning, orchestrating, and designing opportunities "to connect theory and practice" (p. 15) and not relying on "an ad hoc approach" (p. 15). The case studies in the STEPS project demonstrate the ways in which this science-dedicated experience was a planned and intentional approach for connecting theory and practice that achieves this particular recommendation of the TEMAG report. As a result of the science teacher educator's direct involvement in liaising with school staff, they had knowledge of the school, the curriculum focus, and the priorities of the school, which they were then able to communicate to the PST, thus providing support to the overall experience. The science educator was able to model to the PST, the respect that needs to be shown to schools and their community, acknowledging the privilege of being given permission to work with the school staff and students, and respecting the school priorities and curriculum foci. In the STEPS program, most partnerships depended on the relationships developed by the individual science teacher educators working with local primary schools in various ways. This commitment was a key way in which successful partnerships came to fruition.

4.3 Themes for the STEPS Project

This section provides a brief overview of the themes that emerged from the data collected as a part of the STEPS project. More detailed information about the data and analysis conducted is available in Chap. 2. A summary of the extensive data set and the emergent themes they informed is provided below.

The data set for the STEPS project included:

- 106 pre- and 105 post-questionnaires from PSTs;
- 10 PST interviews;

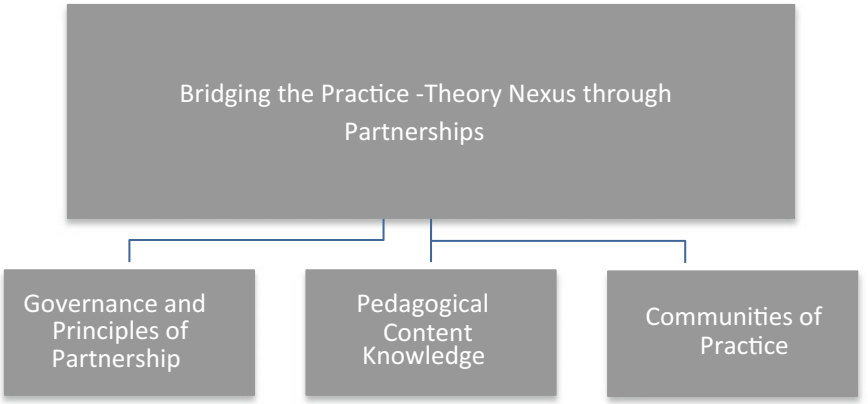

Fig. 4.1 Theory–practice nexus with respect to partnerships

- 15 interviews with university staff;
- 80 interviews with teachers and principals;
- 20 interviews with other teacher educators.

Coding of the interview data was initially based on themes from the research literature, and additional themes that emerged as data were analyzed. The themes were discussed and defined as they developed over time throughout the project. There are multiple themes which included:

- Theory and practice;
- Partnership;
- Reflection;
- Confidence and identity;
- Science teaching;
- Placement;
- Promoting or extending the model;
- Feedback about the model.

The first two of these themes, theory and practice and partnership, are reported in this chapter to show how the school-based programs linked theory and practice through partnerships, but there is also an overlap into other themes. The themes are the foundation of the Interpretive Framework that is described below and outlined in detail in Chaps. 5 and 6. The analysis of the STEPS data looks at the theory–practice nexus with respect to partnerships, in particular the governance and principles of the partnership, the development of pedagogical content knowledge (PCK) and communities of practice (see Fig. 4.1).

4.4 Partnerships

School-based learning opportunities that are necessary to provide PSTs with opportunities to make the connections between theories and practice depend on partnerships between the school and the universities. The PSTs, who are generally enthusiastic, commonly undertake interesting science activities that align with the school curriculum, provide more individual attention for the students, and provide feedback to teachers.

Schools and universities together negotiate the science teaching time and provide the organization required to situate PSTs in the school. Schools also often provided feedback and mentoring for the PSTs, which further supported the school-based experience. There was a commitment from both the university and the school personnel to ensure the school-based program, which benefits all participants.

It is argued that partnerships present a mechanism through which teacher educators can best enact praxis—the linking of theory and practice, particularly in science teacher education courses. The data analysis conducted throughout the STEPS project highlighted the importance of the nature and strength of the partnerships between universities and schools to provide opportunities for PSTs to enact pedagogies in their teaching practices that reflect educational theories.

The growing importance and strength of partnership is reflected in changing expectations and changing requirements of the teaching qualifications. The TEMAG report (2014) recommends immersion experiences in schools and stronger relationships between schools and universities, to support PST: "One aspect to achieving this is active and strong partnerships between teacher education providers, teacher employers, principals and teacher regulatory authorities" (TEMAG 2014, p. 4). The report highlights the inadequacy of some existing school–university partnerships lending weight to the value of the Interpretive Framework that includes descriptors and scope of school–university partnerships. It is a timely and useful tool to better understand how to grow school–university partnerships.

Despite the increasing call for more school–university partnerships, the record of successful partnerships is limited and even school-based sessions can be difficult to organize and maintain. Comments from participants reveal the challenges including organizational issues, lack of flexibility, lack of commitment from all staff, and reluctance to commit the additional time that the partnership requires. Teachers and school are busy learning environments, and committing to the partnerships requires time and effort that is not always directly related to their students' learning. Despite this, many teachers are very keen to foster professional growth of new teachers.

4.5 Principles of Partnership Practices

Six key Principles of Partnership Practices emerged from the analysis of the STEPS data are:

- Risk-taking and trust;
- Reciprocity and mutuality;
- Recognition of respective goals;
- Respect;
- Adaptable and responsive to changing needs;
- Diverse representation.

4.5.1 Partnerships: Risk-Taking and Trust

A determinant for the success of partnerships is the ongoing relationships and effective communication between the partners. Partners need a shared understanding and shared expectations when participating in the program. Joan, a classroom teacher, has been involved in the program for over a decade at her school:

> I guess it works well because we've had that partnership built up over a number of years so we've got the relationships, the rapport, the same lecturers tend to come out to our school so they arrive at the school and you already know them and they know you, they know how we work here, they're familiar with the spaces and the children so that continuity has been really good. (Joan, Teacher, Deakin)

Partnership requires sharing and negotiation among partners. Partnerships can be maintained or grown once that initial trust is established and consistency of success is experienced. However, in the beginnings of a partnership, there is an element of risk-taking that needs to occur. Classroom teachers may have had poor previous experiences working with PSTs and can be hesitant entering a new partnership; PST commonly lack confidence in teaching science, they are often nervous and inexperienced and yet they are responsible for the teaching of science as part of the partnership; and Science educators liaise with all partners to ensure the PSTs are well prepared for this task and that the teachers have confidence in their preparation, thereby reducing risk. These and other risk factors tend to influence the nature of most partnerships, particularly in the beginning of the partnership arrangement. With time, however, partnerships can evolve into more sophisticated and transformative types of arrangements as trust is built through experiences of success. Earning this trust is a key determinant for the success and longevity of the partnership arrangement.

> Trust definitely but more than that. It's the level of consistency. So if you say you're going to do something we trust that that will happen. (Leanne, Principal, RMIT)

These comments demonstrate the need for commitment; clear, consistent communication, and risk-taking and trust building by all partners. As school teachers work

more closely with PSTs, trust grows between them and typically teachers are more willing to share their resources and accept contributions from the PST; for example, PST collects video as examples of practice—providing evidence for portfolios, etc., write contributions for the student reports and teachers provide feedback to PST.

4.5.2 Partnerships: Reciprocity and Mutuality

While a school-based teaching experience is valuable—it is the partnership between school and university with the shared goal of supporting PST that provides the authentic school experience. By distinguishing school-based teaching from partnerships, it can be used to show the significant change in emphasis and the move to generative and transformative partnerships. In generative and transformative partnerships, the PST has more identity, has ownership, usually is working closely with particular school curriculum, gets feedback from classroom teacher, etc. The quote here from Robyn echoes two common subthemes, knowledge sharing and mutually beneficial model:

> I try to get activities which can be sort of hands on. The one area that I myself am not too keen on is Physics, so when it comes to Biology or Chemistry I'm fine. So the Physics aspect I really need to do a lot of work myself like Force and Energy and Levers and Pulleys, it's not my forte. This year your students did that with my lot and it was fantastic, I learnt as well, so that was really good as well. (Robyn, Teacher, RMIT)

These subthemes emerged in the analysis of interviews as key benefits of partnership work. Indeed, the mutual benefits enabled by the partnership experience are a key factor contributing to ongoing success. The governance of a partnership with agreements by leaders must be matched by commitments by all participants to a shared goal and shared understanding of commitment to ensure success. The partnership activities may take additional time and responsibilities that need to be acknowledged.

As these examples illustrate, some of the reciprocal benefits include the dedicated science learning experiences that PSTs bring to the classroom; the potential for classroom teacher learning to occur through these experiences; and naturally, the authentic teaching experiences that PSTs have, which help to build their teacher identity, self-efficacy, and knowledge to teach science. These learning experiences are seen as beneficial for students' learning as well as for teachers who value the gaining of new ideas for science teaching, thus recognizing the professional learning opportunity the partnership provides.

4.5.3 Partnerships: Recognition of Respective Goals

The relationship between the science teacher educator and the school staff forms the foundation of the partnership. The partnerships commonly saw science teacher

educators working extensively with PSTs in schools alongside teachers. Traversing the divide between institutions is a significant difference of the school-based science programs compared to ordinary practicums. The strong belief in the value of a school-based program inspired the science teacher educators to do the extra work required to make the partnership a success. This included recruiting schools; paying attention to logistics such as the period of time set for the teaching; the rooming; determining the needs, restrictions, and desires of each partner; working with school curriculum requirements; etc. Examples of teacher's feedback on their experiences in the program:

> I'm pretty satisfied with it I think that it was beneficial to me, it was beneficial to the children and I hope that it was beneficial to the Deakin students as well if they'd enjoyed the experience and learned something from it. I think it is a good program because they do get that it's the one program where they really get the idea of being able to teach a unit of work and even on teaching rounds sometimes that's difficult to achieve. (Natalie, Teacher, Deakin)

The analysis of the project data found that working with schools requires (Hobbs et al. 2015):

- Understanding the needs and rationale for the involvement of both partners;
- Recognizing the university and school demands in terms of constraining and enabling factors that govern what is and what is not possible;
- Careful consideration by both partners of the nature and type of partnership they are willing and able to commit to;
- Conceptualization of how PSTs interact with students (e.g., informing theories adopted in the teaching—inquiry, 5Es model, other; content areas taught; etc.); and
- Organization of specific details affecting the running of the program in the school (teaching spaces; length of time with students; use of resources; involvement of classroom teacher).

Many PSTs describe the school-based teaching experiences as significant in their learning of how to teach science.

4.5.4 Partnerships: Respect

Negotiation and collaboration are necessary because schools are very busy learning communities and the science programs must work around other commitments. A teacher educator from one of the science teacher education programs described frustration at the unexpected changes:

> I think sometimes the schools don't understand that the program needs to be delivered consecutively. Sometimes schools will agree to have University students come in but then Grade 5 will be out on camp and they'll have sports day and sometimes there can be quite large gaps. (Jenny, Teacher Educator, Deakin)

Respect for one another's needs to be considered and met is essential for the success of partnerships.

4.5.5 *Partnerships: Adaptable and Responsive to Changing Needs*

The data also reported issues and challenges with the model, e.g., funding and resources, continuity. This project collected data about recruiting new schools and the impact of changes on existing relationships such as the impact of PST cohort increasing, a new principal arriving at the school, or institutional structural changes. Ongoing commitment to continue to work with the universities demonstrates schools' belief in, and valuing of, these programs.

Data from PSTs revealed comments about challenges specific for the design of the particular school-based models. The valuable feedback challenged aspects of design. Some participants referred to the challenges of one particular model having weekly visits that were considered too disjointed, so the teaching lacked consistency for the students. Other feedback requested more opportunities to talk to teachers and to access more background information about the students. The data includes:

> perspective from the kids of what they were doing in class but from the teachers that would have been good as well. (Erin, PST, UTas)

The partnerships were dynamic and responsive to these comments—within the limitations. Over the period of the project, the designs of programs have changed in response to feedback and the analysis that has shed light on the importance of the partnership.

The discipline focus of science is a significant component of the partnership. One principal acknowledges the benefit of having science taught by PST:

> We were a small school when I first got here, still are but we were fifty-four kids, so for me there were a lot of upsides to the actual program. Number one is we had some expertise in the teaching of science, number two it covered our quota on our curriculum for science and it kind of up-skilled our staff on what to do and what to look for and how to run science lessons. (Aaron, Principal, Deakin)

This principal went on to describe the enthusiasm:

> So I think it's created an excitement and an 'I can do' type attitude that it's not only for adults, or science is for nerds or science is not me … and when they do food tech or when they do arts and cooking they realise 'this is about chemical change, we've talked about this in science' and I know you're going to think that I'm making this up but we were on camp and I think we were doing cooking and a child said 'I think this is in the science … it is about chemical change' it was something along those lines. (Aaron, Principal, Deakin)

The engagement and the holistic learning that occurred for students, teachers, and PSTs is typical of the valued outcomes of the programs.

4.5.6 Partnerships: Diverse Representation

The participants highlighted the potential use of the model in other disciplines. Examples of comments by teachers, from two cases, reflect the positive feedback, for example,

> Very positive, 'buddy teaching', she teaches the scientific principles while I am attending to some aspects of student management. (Joan, Teacher, Deakin)
>
> Well, I've had groups of the (pre-service) students in my classroom over the years and they would come in third term for six weeks and I loved them coming because they knew what they were teaching, they had been taught, they had learnt, they knew their subject matter. (Jane, Teacher, RMIT)

The six Principles of Partnership Practices describe a school–university partnership that is significantly more than a school-based school setting for teacher's education that has been used for decades. Growing teachers with an understanding of the knowledge and skills necessary for teaching science is a product of the strong school–university partnerships that have a shared ownership and responsibility of supporting the profession.

4.6 Developing Pedagogical Content Knowledge

The connection between the subject knowledge—for example of a particular science concept—and the pedagogical knowledge of how best to teach this conceptual idea to the students in your class is defined as PCK (Shulman 1986). Having PCK is what makes a great teacher and epitomizes the links to educational theory. In the context of learning how to teach science, the development of PCK, confidence to teach science, and the central role of university–school partnerships in enabling these outcomes are illustrated in this chapter through case studies taken from the recent STEPS project (Hobbs et al. 2015).

PCK represents specialist subject matter knowledge applied to teaching for particular students' needs (Berry et al. 2017). First described by Shulman in 1986, PCK has been used successfully to characterize the expertise that a teacher exhibits in the knowledge of content and pedagogy. Shulman (2015) described how PCK focuses on the teachers thinking, planning, decision making, and subject matter knowledge and how these are fused into their teaching. Teachers have to cater for individual students' learning needs, and this may mean changing a teaching plan, asking different questions, or modifying a lesson or an activity to explore a scientific concept. To accomplish this, teachers draw on their scientific content knowledge and knowledge of teaching strategies that are most likely to be successful in shifting common alternative or misconceptions (Shulman 1986). By drawing on content and content pedagogical knowledge simultaneously, teachers bridge the nexus between theory and practice.

PCK is a valuable element of teacher preparation programs. Van Driel (2015) reminds us of the complexity of PCK and explains how a teacher's PCK is dynamic and develops with teaching experience. Professional collaboration and reflection have been shown to aid in the development of a teacher's PCK (Van Driel and Berry 2012). Gess-Newsome (2015) highlighted the importance of the teacher's classroom practice and particularly the teaching skills that develop. More recently, Gess-Newsome et al. have shown the importance of a teacher "using student learning as the metric of success" (2017, p. 17) in developing PCK. This highlights how the authenticity of the classroom setting and reality of students' outcomes provide feedback and help a teacher to reflect on their own PCK, thereby bridging the theory–practice divide. The model of Teacher Professional Knowledge and Skill, proposed by Gess-Newsome et al. (2017), shows how the topic-specific professional knowledge is a product of multiple inputs including teacher professional knowledge bases, classroom practices, and student outcomes. Distinguishing the teacher professional knowledge bases and skills deepens the understanding of the complex PCK construct.

4.7 Developing Communities of Practice

The partnership crosses the boundary between the school and university, and new communities of practices are possible. For example, teachers adopt a role as mentor and coach to PSTs, and PSTs become school teachers—teaching science to students and simultaneously demonstrating science pedagogies to the classroom teachers. While these new roles can present significant challenges to the participants, there is an increasing expectation of schools and teachers to be involved in teacher education as recommended in the TEMAG report: "Effective partnerships between teacher education providers and schools are important in managing the complexities of professional experience and the integration of theory and practice" (p. 10).

Wenger (1998) describes communities of practice in which participants undertake shared activities, mutually engaged with re-negotiation of its joint enterprise. The community of practice infers involvement and ownership by the participants (Lynch and Smith 2012). Figure 4.2 shows the interconnectedness of possible communities of practice in the partnership. Reflection and collaboration, essential attributes for teaching, are clearly fostered through a successful community of practice embedded in a strong partnership. The emphasis on evaluating the effectiveness of pedagogical approaches based on the students' understandings provides greater accountability and performance assessment of the teachers' practices. Reflection personally, with peers and colleagues, can be confronting, but the partnership provides ongoing opportunities to develop mechanisms to teach the PST how to reflect, and the continuity of the partnership provides ongoing opportunities after every lesson. The form and structure of programs varied. In one case, the PST used reflective rubrics to promote broader and deeper reflection—exploring aspects such as the students' learning, the PST questioning, the organizational and technological aspects, pedagogical strategies, and science concepts of the lesson. In another case, the teacher educator used

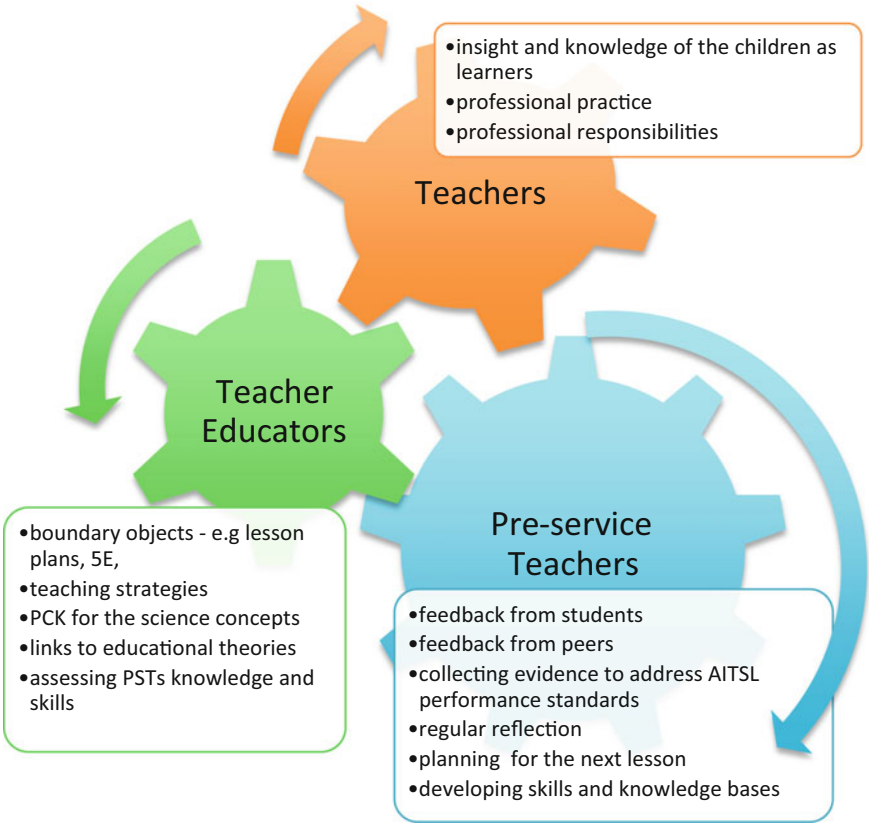

Fig. 4.2 Representation of communities of practices arising from the school–university partnership

the *Gibbs Reflective Cycles* and another used the model proposed by *Schon.* The use of post-it notes, individually, then shared with peers and groups enabled a quick and visual record of reflections. The PST took photographs of the post-it notes as a record for their later reflection. Other students used video clips for reflection. With weekly reflection, PSTs grew in confidence and gradually reflected more deeply and more critically. The community of practice provided the opportunity and fostered the skill of reflecting.

The movement across university and school contexts can be thought of as a boundary crossing, and the teacher educator is a boundary spanner. Boundary objects that assist PST in their boundary crossing could include, for example, assessment tasks—portfolio artifacts and tools such as 5Es framework, an appreciation of the subject and pedagogical knowledge and skills contributing to the PCK needed to teach a particular science concept. Because "all learning involves boundaries" (Akkerman and Bakker 2011, p. 132), this construct may be useful when considering the growth from novice to confident teacher.

4.8 Enacting and Applying *Theory in Practice*

In recent years, the linking of theory and practice is a common aim of teacher education programs; however, achieving this goal often proves to be challenging, especially when practice-focused time in schools occurs in blocks of time that sits outside the university discipline course work. Effective linking of theory and practice is better enabled when access to theory and practice occurs concurrently, a notion supported by Darling-Hammond (2006), who reports that PSTs who take course work concurrently with fieldwork:

> are better able to understand theory, to apply concepts they are learning in their course work, and to support student learning." (p. 307)

The STEPS project has examples of PST preparation that include many of the learning opportunities identified in the PCK literature including authentic teaching opportunities, collaboration with peers and teachers, getting feedback from students, time for reflection, and looking at students learning with respect to PSTs' teaching. It is significant that the school-based programs between schools and universities can provide these learning opportunities.

Importantly, the school–university partnerships are more than providing PSTs with an authentic experience of teaching science; the acknowledgment of partnership infers a shared vision—and a shared responsibility. Rossner and Commins (2012, p. 2) describe "the collaboration of professional conversations, collegial learning and aligned processes" when describing a school–university partnership.

The first theme theory and practice was reported extensively by university staff, teachers, and principals. It epitomizes the most significant strength of the school-based projects which is providing opportunities to connect theory and practice. Data is selected to illustrate some of the subthemes of theory and practice, namely

- Sequencing of the theory with the practice—learning, trialing pedagogies, reflecting, and learning;
- Sense-making, integration, and connection-making of the theory with the practice;
- The role of the science educator in connecting the community of learners to theory and practice.

Examples from science educators and PSTs representing three of the five cases illustrate the subthemes.

4.8.1 Example 1: Science Teacher Educator—Kathy

Kathy has been a teacher educator in science teacher education for more than 10 years. She has been teaching a class of about 30 PSTs in a school-based setting every year over that time. She explained how the school-based context provides a safe setting for PST to trial pedagogical approaches that she has been teaching:

> It's really important for them again it's that practicing teaching, it's not just learning the theory and learning about it in a classroom with no context they can actually go out and do what I've been asking them to do and practice what I've been preaching. (Kathy, Teacher Educator, Deakin)

Kathy emphasized the importance of the sequencing with PST learning pedagogical techniques, trying them out in the classroom, and then reflecting in pairs, in groups, and as a class.

> Because the pre-service teachers actually get to go out and practice what they're learning about so it kind of bridges that theory/practice gap so it's not just them learning about it in isolation and then expecting them to put it into place when they go out on their practicum or when they eventually graduate, they can do it straight away. (Kathy, Teacher Educator, Deakin)

Learning occurs through implementing teaching strategies and reflecting. Kathy emphasizes the importance of having the opportunity to learn in a community of learners and not learning in "isolation." Through reflective practice, PSTs critically assessed their own practice. This was an integral part to bridging the theory—practice gap. Kathy explained:

> We do a lot of work on reflective practice so looking at Gibbs Reflective Cycles and those sorts of things and looking at critical incidences that have happened in that lesson that they've just taken and also just get them to reflect on that and it's a lot of think pair/share sort of stuff so they might do it individually or with their partner and then they have to report back to their peers on the rest of the class and we have a lot of discussion. So it's just a big debrief of what they could be doing, what they could do better, maybe how it might inform them for next time, how they might change it up next time, all those sorts of things or [how] they can perhaps take the direction of their lessons or building relationships and all that sort of stuff as well. (Kathy, Teacher Educator, Deakin)

The enactment of theory in their own practice provides PSTs with opportunities for sense-making and the assimilation of ideas. Identifying the best and most appropriate pedagogical approaches for particular learners and for particular content is indeed challenging, even for experienced teachers, and needs careful consideration. Discussing these issues and trialing and reflecting together helps PSTs gain insight into the complexity of teaching. Developing reflective skills helps PST to develop an understanding of the interplay between these issues. Kathy's comment above shows how the science educator can assist PSTs to make sense of their actions and responses and also provide the educational research perspective that helps to justify and explain the teaching actions. This is also illustrated in Example 2 below.

4.8.2 Example 2: Teacher Education Coordinator and Teacher Educator—Micko and Alexa

Micko is a coordinator, and Alexa is a teacher educator in a clinical model of a teacher education program for PST education. Interview data reveals strong evidence of the theme theory and practice. In this example, Micko explained how the "extended and continuous practicum experience, it's sequenced and interlinked in that way to draw it together, to build that nexus we believe is unique." The timeliness of the sequencing of learning teaching skills, such as a particular pedagogy, or a questioning style or a method of giving feedback, and then using those skills in the classroom focused the PSTs' learning. Micko emphasized the value of concurrent instruction models—in which students "try it" in an authentic classroom situation:

> So then we follow this pattern, two days in schools followed by three days in university on campus studies for about eight or nine weeks and then the block. So there's a very immediate application of the theory to the practice and the practice to then inform and interrogate I guess the theory to substantiate the theory. (Micko, Teacher Educator, Uni of Melb.)

The data reveals good evidence of the connections between research and practice. Alexa, for example, reported the application of theory in practice in assignments in which the PSTs were:

> applying the sorts of things that they learnt, they were trying out the things that we'd done in the tutes, we'd done in the lecture and the strategies that we'd worked on. (Alexa, Teacher Educator, Uni of Melb.)

Alexa explained how educational strategies (e.g., Predict–Observe–Explain), educational frameworks (e.g., 5Es—Engage, Explore, Explain, Elaborate, and Evaluate), and the Australian Curriculum Standards are integrated into the lectures, tutorials, and assessment tasks. This integration is critical to make explicit the connection between theory and practice. Alexa commented how "it was really good to see them [PSTs] trying out [educational strategies] and then talking about it in their assignment at the end of the placement." Similar to Kathy, Alexa reported the importance of the conversations among PSTs as a community of learners:

> So the students in the tutorials would talk about things that they had done and things related and what we were doing on the spot to doing it and I think it also enables you to set assignments more realistically and at different times. (Alexa, Teacher Educator, University of Melbourne)

The teacher educators' comments emphasize the importance of the timeliness of connecting the theory with the practice. Concurrent instruction models are critical in providing these opportunities.

4.8.3 Example 3: Science PSTs—Erin and Carly

Comments by two PSTs, Erin and Carly, who each experienced different school-based programs, provide insight into the theory and practice theme. These PSTs' comments revealed the value of the school-based experience, validating links between theory and practice about student behaviors and enacting theory in practice. For example, Erin reinforced the authentic experience of working with students:

> we've learned about the kids' [sic] reactions towards science because if we just did this in tutes at uni with uni students you wouldn't get the pure experience of working with kids. You get their true reactions and reflections on things as opposed to just like the theory of someone else had told us how kids would react to things and we actually get to see it for ourselves how they like science or they don't like science. (Erin, PST, UTas)

Carly emphasized the importance of hands-on learning opportunities where she could immerse herself in the activities to make the links to theory herself. She explained:

> what I really enjoyed was you have the chance to experience everything, it wasn't just where they stood up and lectured and say 'this is what you would do. (Carly, PST, UTas)

Similar to Erin, Carly also valued gaining insight into the student's understandings:

> it gave you a really good understanding of what you'd expect from the students, what sort of questions would come up, all those sort of things and it also allowed you to trouble shoot a little bit going 'oh this could be tricky' and that sort of thing. (Carly, PST, UTas)

The PSTs' comments reveal the sense-making, integration, and connection-making that the PSTs are making as they connect the theory with their practice. This substantiates the observations of teacher educators and coordinators above, who also recognize the increased potential for the school-based approach to provide opportunities for theory–practice nexus that is authentic and meaningful for PST learning.

4.8.4 Example 4: Science Teacher Educators—Damian and Paul

All the science teacher educators who were interviewed explained how they supported PSTs as they taught their first science lesson and beyond. The science teacher educator is a key in bridging this gap between theory and practice. Damian, a teacher educator, explained how he forged these connections.

> I led that through the range of professional behaviours that they need to be involved in as well as learning the actual curriculum material and the pedagogical methodologies which are like questioning and voluble representations and so forth. So they hear about those things they put it into practice and they can see that they can actually do them and I think that allows

> them to write some really good reports and their final piece of work by and large was very good. (Damian, Teacher Educator, Deakin)

Damian's comments reinforce the complexity of the task of teaching science for PSTs. The data has provided greater insight into the important role of the science teacher educator. The data supports the conception that it is the teacher educator who provides active leadership for the effective connection between theory and practice that ultimately builds PST confidence and competency to teach science. Paul, another teacher educator, described how he helped PSTs in their planning of science lessons.

> It's practical and it's theoretical and it's all wrapped up in the sort of situation where the students are working with real children in a real situation. I modelled the planning that the first four weeks they were supporting the planner that the school had in place.

The PST can find teaching science confronting because they are commonly unsure of scientific knowledge and unfamiliar with scientific thinking. It is central to success that the pre-service teacher is supported in learning the "science" as they learn how to teach science in authentic school-based settings. The connection between the science knowledge and pedagogical knowledge is fundamental to the school-based programs in which PSTs develop PCK, and this epitomizes the links to educational theory.

For the discipline of science, the science teacher educator plays an essential role in developing specific PCK, something achieved, in part, through encouraging PSTs to reflect on their teaching and identify how and where educational theories are evident in their practice. The teaching experience can provide insight into the educational theories, and the educational theories can then be applied to their practice. This describes and values the linking of theory and practice as mutually informing, theories informing practice and practice informing the theories. Identifying the theory in the practice and vice versa is not always easy, and educators, peers, and teachers assist PSTs to engage in discussion and reflection on their practice.

4.9 The Role of the Educator in Enacting *Theory in Practice*

Teachers' professional knowledge includes differentiating the pedagogies for various disciplines. Science is indeed a discipline with a distinctive pedagogy, and not all qualified primary teachers are confident in advising PSTs in how to teach science. The expert PCK and science content knowledge of the science teacher educator is a key to their role in supporting PSTs. The comments from Kathy, Micko, Alexa, Damian, and Paul provide insight into the role of the science teacher educator in modeling planning, and teaching science as well as connecting the community of learners. Recognizing that the strategies, frameworks, pedagogies used teaching science are distinctive is pivotal in appreciating the PCK for science. PSTs commonly rely on the science teacher educator for advice on recognizing and explaining the key science concepts because they are often unfamiliar with this science content knowledge. They also rely on the science teacher educator's advice about the most appropriate pedagogical approaches for the particular science content and the student cohort. In

designing authentic school-based learning experiences, the literature suggests that the role of the university teacher educator is crucial in supporting PSTs (Howitt 2007) by, for example, providing science PCK expertise that may not otherwise be readily available from many primary teachers; modeling the theoretical ideas and principles underpinning their disciplines, "to ensure their pedagogy is consistent with purposes as educators and with current learning theories" and "often serve as compass points … for new teachers" (Whitcomb 2003, p. 16).

Loughran et al. (2012) distinguish teaching from pedagogy, where they consider that compared to teaching, "pedagogy has more to do with understanding the relationship between teaching and learning in ways that foster students' development and growth" (p. 4). Targeting this relationship is how the nexus between theory and practice can be addressed, and Loughran (2002) purports that it is through reflective practice on concrete teaching examples that such a nexus is achieved. It is difficult, if not impossible, to achieve such a nexus using the practice of reflection if there is no authentic school-based experiences embedded in the areas of teaching that are being targeted (e.g., in this case, science). Thus, partnerships between universities and schools become an essential component in addressing the theory–practice divide. This integration of theory and practice, achieved by reflection, and enabled through partnerships, can better prepare PSTs to "handle the problems of everyday teaching through theory-guided action" (Korthagen et al. 2006, p. 1021).

4.10 Interpretive Framework of Partnerships Between Universities and Schools

A significant outcome of the Science Teacher Education Partnerships with Schools (STEPS) Project is the creation of an Interpretive Framework designed to guide and inform the partnerships between universities and schools that support science teacher education programs. It is being developed from the case study data, informed by the educational research literature, and is designed to help support judgments about current practice and provide a framework for initiating practice.

The Interpretive Framework is a framework for examining and understanding practice and for conceptualizing, structuring, and implementing practice. The visual representation—(Fig. 4.3) (from Jones et al. 2016) shows the nature of partnership, e.g., growing partnerships, types of partnerships, and principles for partnerships. The descriptors of numerous components provide terminology to help differentiate the levels of participation and commitment to the partnerships. The Interpretive Framework consists of guiding partnership principles and pedagogical principles.

The four aspects of the Interpretive Framework are:

- Growing University–School Partnerships (GUSPs);
- Representations of Partnership Practices (RPPs);
- The Guiding Principles;
- Principles of Partnership Practice and Growth Model.

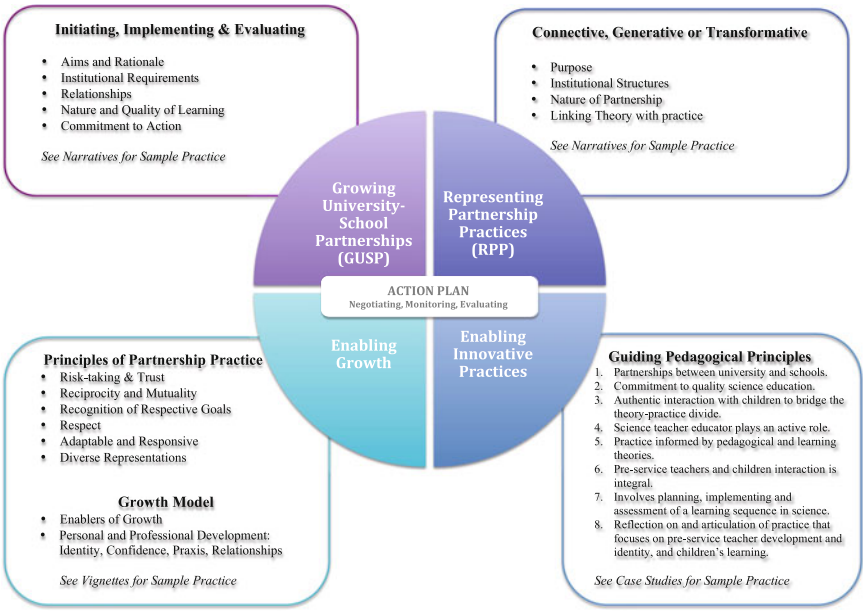

Fig. 4.3 Interpretive Framework—University–School partnerships

4.11 Theory and Practice in the Interpretive Framework

Partnerships provide authentic teaching experiences with potential for PSTs to link theory and practice. The analysis of the data revealed the pivotal role each partnership played in the success of the school-based program. This information was used in the development of the Interpretive Framework that describes the processes needed for a successful science education program for pre-service primary teachers. Partnerships and the potential learning opportunities to link theory and practice became core in the development of the Interpretive Framework. The Interpretive Framework is based on the diverse and dynamic nature of the various partnerships in this study, but has scope for application to partnerships in other settings (Jones et al. 2016) (see Part III of this book). Chapters 5 and 6 explore further the development of the Representations of Partnership Practices (RPPs) and Growing University–School Partnership (GUSP) components of the STEPS Interpretive Framework, respectively, based on the analysis of the role and importance of partnerships in the school-based programs. Chapter 7 provides an example of the decision making processes that are required to make partnerships work, showing how a partnership may be built from the ground up to bridge the theory-practice nexus.

4.12 Conclusion

This chapter describes the ways in which the partnership arrangements examined in the research lead to strong educational growth in terms of PST confidence and capacity to learn how to teach science. In particular, this learning occurred through the reflection PSTs were able to engage in through their authentic teaching of science to students in the school setting. The authenticity of this experience provided the concrete opportunities for PSTs to reflect on their experiences that Loughran et al. (2012) call for. Moreover, it attends to the opportunities that Darling-Hammond (2006) asserts that teacher education programs need in order for PSTs to analyze and apply theory; reflect on their subsequent practice; and have further opportunities to retry and improve. These school-based experiences provide time, opportunities, and support for primary science PSTs to reflect on their science teaching experiences in light of theory in order to foster an enhanced sense of praxis. This essential linking of theory and practice, an area of teacher education that usually attracts extensive criticism for its lacking (Mintzes and Wandersee 2005), is achieved through the extent and quality of the university–school partnerships that were established.

Fundamental to the success of university–school partnerships are a number of what we have termed "Principles of Partnership Practice." These principles, examples of which emerged from the project data and are exemplified in the excerpts reported in this chapter, demonstrate key principles on which effective partnerships are based. These Principles of Partnership Practice cover areas of risk-taking and trust; reciprocity and mutuality; recognition of respective goals; being adaptive and responsive to respective, changing needs; and accommodating diverse representations of partnerships. They are fundamental aspects for achieving effective learning and sustainable practice. These are both essential for encouraging the ongoing practice of partnerships, which require significant work to establish and maintain. The role of the teacher educator was also found to be instrumental to the success of the partnerships and for PST learning. Our findings support what Whitcomb (2003) describes as "the teacher educator's role, as pedagogical actor, in helping teacher candidates develop and enact that knowledge" (p. 18).

There are however many challenges and few incentives for school and university partnerships to grow. Investing in future teachers is a noble cause, and while most teachers are keen, they are challenged with bureaucracy, time-poor, and focused on the learning of the students in their care. The recommendations for more partnerships make no provision to support the schools or teachers in this endeavor. The Principles of Partnership Practice outlined above and the critical role of the teacher educator in developing, administering, and monitoring effective praxis are two useful outcomes that can guide the use of university–school partnerships for the linking of theory and practice in teacher education.

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Chapter 5
Representing Partnerships Practices

Christine Redman and Coral Campbell

Abstract A range of partnership types is explored in this chapter. The purposes and characteristics of a partnership determine the degree to which a partnership needs to be embedded within the partner organisations. This chapter presents the 'Representing Partnerships Practices' (RPP) element of the Interpretive Framework. The RPP is useful to guide thinking about the desired nature of a particular partnership. The RPP recognises that a range of purposes, intended outcomes and commitments that can be afforded by partnerships, and that all have a value, which is determined by how it meets the needs of each partner. In the RPP, partnerships are described as being Connective, Generative or Transformative. Examples of practice are used to illustrate the opportunities, benefits and possible limitations of each of these partnership typologies in affecting quality learning outcomes for the different partner stakeholders. At all levels of partnership, it is important to ensure that the partnership itself is managed and fostered.

Keywords Partnership practices · Connective · Generative · Transformative Science teacher education · Interpretive framework · Primary science · Pre-service teachers

5.1 Introduction

Building on Chap. 4, a range of partnership types is explored in this chapter. The purposes and characteristics of a partnership determine the degree to which a partnership needs to be embedded within the partner organisations. This chapter presents the 'Representing Partnerships Practices' (RPP) element of the Interpretive Framework.

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The RPP table is a useful guide to thinking about the desired nature of a particular partnership. RPP as a construct helps to make explicit and recognise that a range of purposes, intended outcomes and commitments that can be afforded by partnerships, and that all have a value, which is determined by how it meets the needs of each partner.

The need for strong links between universities and the profession has been recognised in previous research by Smith (2011) which examined the impact of 'work integrated learning' on work-readiness. Other research by Ure et al. (2009) identified a range of tensions and ambiguities inherent in traditional practicum partnership arrangements and made a number of recommendations concerning the need for closer collaboration between universities and schools.

Kenny (2010), in earlier research, discusses how science partnerships in science teacher education programmes can improve pre-service teachers' confidence to teaching in addition to improving their knowledge of pedagogy and science content. The role of the university lecturer as a key support person is important to enable PSTs to design authentic learning experiences for children (Howitt 2007). In particular, providing the background science expertise, often not readily available from many primary teachers (Kenny 2012), is one important aspect of support. Productive relationships are developed in partnerships between in-service teachers and pre-service teachers, and often this results in the in-service teacher viewing the partnership as a means of providing them with professional learning. Mutual learning becomes the basis of the relationship if there is early establishment of direct contact between the participants, and the supervisory element of the partnership is reduced (Jones 2008; Kenny 2012; Murphy et al. 2004). We are arguing for discipline-based partnerships—for science but potentially for other curriculum areas—as an important adjunct to current practice that can open up models for more effective practicum organisation.

The STEPS project investigated a number of school–university partnerships and derived explicit data which were interrogated for similarities, difference, strengths and weaknesses. Cross-case analysis assisted to define the partnerships. While this research points to critical success factors leading to productive relationships in specific programmes, the purpose of the proposed project was to establish those factors that are inclusive of a variety of partnership arrangements and pedagogies.

5.2 Representing Partnership Practices

This chapter discusses the structure of the 'Representing Partnerships Practices' (RPP) elements of the Interpretive Framework, which is useful to guide thinking about the desired nature of a particular partnership. The RPP recognises a range of purposes, intended outcomes and commitments that can be afforded by partnerships, and that all have a value, determined by how it meets the needs of each partner. The partners in these partnerships are, broadly, the university and the school. However,

Table 5.1 Representations of partnership practices (RPP)

	A. Purposes	B. Institutional structures	C. Nature of partnership	D. Linking theory with practice
1. Connective	Engagement based on provision of curriculum or other service need	Partnership activities are short-term and opportunistic and sit within existing structure	Both partners provide short-term services with a focus on one partner's needs but with mutual benefits and value for all	Both partners recognise schools as important sites for PSTs to link theory and practice
2. Generative	Partners recognise opportunities for mutual professional learning	Partnership activities are considered long-term and are planned and catered for in the teacher education and school programs	Partners jointly plan the structure of the school-based practices to the benefit of both	Opportunities exist for both partners to reflect on practice that may be linked to theory
3. Transformative	Partner involvement based on active professional learning	Partnerships are embedded in the ongoing structures and practices of the institutions	Partners take joint responsibility for mutually agreed practices and outcomes that are embedded in their respective core outcomes	Both partners engage explicitly in reflective inquiry guided by theories of professional identity development

within the partnership, the stakeholders are the university educators, the school staff, the PSTs and the school students. The RPP can be more broadly applied using typology and components into other partnerships.

The RPP (Table 5.1) (from Jones et al. 2016) depicts a typology of practices. These types have been described as Connective, Generative and Transformative and are based on the following four specific components:

A. Purposes of the partnership
B. Institutional structures
C. Nature of the partnership
D. Linking of theory with practice

The types of partnership and the four components identified as descriptors of each partnership type have arisen from a close and detailed understanding of the partnerships examined within the project—a total of five separate cases of partnerships. The table which represents these elements presents differing types of practices, each with its own value and arising out of the desired purposes and educational outcomes. It is not a hierarchy with suggested levels of partnership maturity.

The descriptions in each cell have been derived through analysis of the practices of the case study partnerships. Initially, a cross-case analysis highlighted similarities and differences between cases in terms of the types of partnerships. A further analysis of the interview data was undertaken. This analysis included interrogating the responses of all interviewees, but particularly those of the principals and the university educators, to highlight the aspects which were valued within the partnership and which were perhaps less relevant to the other participants.

The table describes differing types of practice and is not arranged to imply increasing value of the partnership. It is not meant to suggest a pathway that a partnership must move through in order to reach maturity.

5.3 A Typology of Partnerships: Connective, Generative and Transformative

As indicated, in the RPP table, partnerships are described as being Connective, Generative or Transformative, based on the characteristics of the partnership as collaborative or cooperative, the degree to which a partnership is embedded within the partner organisations and the extent to which links between theory and practice results in professional identity development through reflection on practice. Examples of practice are provided to illustrate the opportunities, benefits and possible limitations of each of these partnership typologies in affecting quality learning outcomes for the different partner stakeholders and from the perspectives of the different stakeholders.

Descriptions of the types of partnerships may assist those who might be considering entering into partnerships to consider the desired outcomes, structures and level of responsibility taken by each partner. It also can help those within existing partnerships by providing a language to talk about often undocumented and amorphous practices.

5.3.1 Connective Partnerships

Cooperative in nature, connective partnerships offer participants the opportunity for a positive outcome for each partners. Each partner identifies key benefits from the partnership. Connective partnerships develop when one of the partners expresses a specific need with the other is able to meet, providing a service or amenity to accommodate that need. Often these partnerships may be ‘one-off’ or short-term in nature as they sit within existing structures which are less flexible. In these partnerships, both partners recognise the importance of schools as sites for PSTs to understand the relationship between theory and practice. Meeting short-term needs, these partnerships never-the-less provide opportunities for development into more-long-term partnerships of a generative or formative nature.

5.3.2 Generative Partnerships

Generative partnerships commit to a longer-term or deeper arrangement within and across the partnership. While still cooperative, levels of commitment and participation on the part of both partners are increased. The commitment to longer-term involvement leads to the generation of new or different practices across both partnership organisations. In recognising mutual benefits, responsiveness to each other's needs enables the development of programmes which may involve modifications to existing structures or flexibility of approach. In practical terms, reflection on practice which is linked to underpinning theory, becomes a way of operating for PSTs. In-service teachers who engage in what is happening in their classroom with the PSTs also are provided with opportunities for consideration of their pedagogy. These partnerships meet important long-term needs and are well-established in both the school and university planning.

5.3.3 Transformative Partnerships

Partnerships which focus on the active involvement of both partners are said to be 'transformative'. They are collaborative and focused on planning and delivery of curriculum for the purpose of professional learning and are generally embedded in the programmes of the institutions. Collaborating partners have an interest in working together in a cooperative way, to reach outcomes aligned to fundamental aspects of the teaching and professional learning. Critical reflective practice, guided by the theory–practice nexus, is promoted and, over time, the collaborative experience develops their professional identity.

5.4 Descriptions of the RPP Components

These components emerged from the data and were consistently demonstrated across each of the typologies. The descriptions function to clarify what comprises each of the components.

A. ***Purposes of the Partnerships***

The 'purpose of partnerships' references the reasons partners provide, and in particular, schools, for participating in the school-based partnership. This can vary from a minor need of the school, for a 'top-up' to their science curriculum, for example, through to a more significant involvement which is based on active professional learning.

B. ***Institutional Practices***

'Institutional practices' refers to the structures that exist within each institution and how they are managed and/or adapted to facilitate the school–university partnership. These structures may inhibit or promote the depth of the partnership activities. For example, partnerships may be short-term and self-serving (minimising disruption to 'normal' business) or may become embedded in ongoing practices of the participating institutions.

C. ***Nature of Partnership***

The 'nature of the partnership' describes and characterises the level of cooperation or collaboration between partners to service a need or engage in joint effort and commitment to partnership outcomes. Mutual benefit is the primary focus, but this may include more in-depth and in-breadth practice and outcomes.

D. ***Linking Theory and Practice***

The level of involvement of each partner in reflection on theory and practice and opportunities for professional identity development. PSTs require opportunities to practice skills and develop pedagogical knowledge. Theoretical constructs become more real in the classroom situation. For a more in-depth learning, both partners may engage in reflective inquiry.

5.5 Using Evidence to Describe the Partnership Typology

The following section provides sample data sets that illuminate the perceptions and thinking of the key stakeholders who have reflected on their experience of the partnership. The perceptions provide an understanding of the different types of contributions these partnerships have made, and how they have been valued. Different people, in different roles and with different accountabilities, duties and rights, perceive a range of benefits and possibilities have been afforded to them. Different stakeholders offer their points of view and share their personal insights and what is of significance to them.

The following section provides a *narrative* to help make explicit and describe each cell providing an authentic context and reflecting the potential differences that can arise within the scope of conceivable partnership models.

5.5.1 Features of Connective Partnerships

Connective partnerships are often the first form of partnership developed between two interested groups or institutions (Table 5.2).

Table 5.2 Components of a Connective partnership

A. Purposes	B. Institutional structures	C. Nature of partnership	D. Linking theory with practice
Partners recognise opportunities for mutual professional learning	Partnership activities are considered long-term and are planned and catered for in the teacher education and school programs	Partners jointly plan the structure of the school-based practices to the benefit of both	Opportunities exist for both partners to reflect on practice that may be linked to theory

A. **Purpose of the Partnership**

These partnerships tended to arise from an identified need on the part of one or other of the organisations involved. It was the loosest form of partnership where there was recognition of the intrinsic value of the partnership for the purpose of fulfilling a requirement of each group. Partnerships at this level were not necessarily based on an ongoing commitment to the relationship, rather to the short-term 'here and now' benefit. There are examples of these partnerships developing further over time; however, there are also examples of partnerships which remained at this level of commitment over quite a few years. In terms of the schools, this need was often related to the fact that the science curriculum was not strongly adopted by all teachers and this partnership allowed students in the school to participate in science lessons. Principals value the partnership and recognise that elements of science teaching and learning that may not be readily available in the school environment can be provided, and that there are benefits for the school programme and the students (Kenny 2012). From the point of view of the university, placing PSTs in classrooms to teach science enabled the PSTs to experience the teaching themselves, something that was not always possible through normal placements.

> We do teach science but the bulk of our science curriculum is done through Deakin… It's a bit like the swimming program not as intense and not as regular and that's why we love the Deakin program. It focuses us, teachers will follow on and finish off lessons that may have been started by the Deakin Science. There's often times when Deakin Science practicals will pique an interest in the students and the teacher especially when we're doing things like Space or there's a cooking theme happening the science really cashes in. So, it's a real win/win I guess. (Aaron, Principal, Deakin)

B. **Institutional Structures**

Partnerships of this type involve activities which are short-term and opportunistic and sit within existing structures. PSTs will introduce activities to support existing broad science curriculum, but do not necessarily plan with the school's curriculum in mind. In terms of the school benefits, teachers spoke of the team teaching element which happened in many schools, the opportunity to hand over to someone with a different approach and to broaden student's experiences with other teachers in this case the PSTs. PSTs commented

on the value of learning to teach science through actually being involved with a school and students. Teachers and PSTs relished the opportunity to work together. Teachers valued another professional working as a source of fresh ideas for science in the class. PSTs valued the chance to put theory into practice.

> Planning a sequence with another teacher. Another learning sequence as a resource. The opportunity to have 2 teachers working in the room together. New ideas!!! (Nina, Teacher, UTas)

> We went out into schools and taught. It was the biggest learning experience for me… We were a bit sick of theory and wanted to bring it all back and relate it. …It was really valuable to me. (Alby, PST, UTas)

C. **Nature of Partnership**

In these partnerships, there is a real vision of schools and teachers working collaboratively with PSTs and university educators. Both partners provide short-term services with a focus on one partner's needs but with mutual benefits and value for all. There is a commitment to making certain the partnership is working. With teachers and PSTs seeing the value of the science teaching, both are motivated to engage with each other and the requirements of the task. Teachers working together with PSTs were seen as a positive for both, and the students in the class, who had more avenues for asking questions, seeking feedback and exploring ideas.

> Absolutely, team teaching allowed for double the normal amount of student/teacher interaction and meant children had more avenues for asking questions, seeking feedback and exploring ideas. (Patto, Teacher, UTas)

The contribution of the partnership to primary school student's experience of science and science education is seen as a positive outcome and addresses well-documented concerns with students' disenchantment with school science (Tytler 2007).

D. **Linking Theory to Practice**

In this partnership, both partners recognise schools as important sites for PSTs to link theory and practice. The theory–practice nexus is the point where PSTs start to realise how the various educational theories they have learned about actually apply in a practical situation. For science education, they experience how ideas of social-constructivism play out during their teaching. They see the benefit of providing experiences from which students can build their understanding. They see the value of reflecting on their teaching and experiencing ideas around models of teaching—inquiry, conceptual change, etc. In particular, principals felt that working more closely with the university strengthened the professional ties and it supported the strategic goal of improving science curriculum and teacher competence with science.

> Excellent opportunity to support beginning teachers in their growth and development. (Fionn, Principal, UTas)

> (To) ensure the children get to develop some scientific concepts this term, and motivate me to get a bit more science back into the curriculum! (Nellie, Teacher, UTas)

Teachers and principals recognised one of the substantial elements of the partnership was the contribution to progressing future science teachers' positive experiences (Tytler 2007) and to provide experiences of pedagogy in practice (Ure et al. 2009). Teachers were able to provide support for PSTs with authentic teaching tasks such as assessment which built their confidence to teach science.

> I think all teachers should do it, it's so vital, especially for when we start assessing science. I did it because I had no confidence… I was scared… but the class gave me confidence …The classroom experience was good because it was ok to make mistakes, and be supported to learn. (Patrina, PST, UTas)

Schools recognise their responsibility in helping to prepare the next generation of teachers, and the important role that classroom experience plays in linking their understanding of theory learnt at university with their classroom practice.

> I like the fact that the university and the PSTs are building that relationship, building their knowledge. It's another school they get to go into, so they visit schools for their formal rounds but it's another school and a different context and every schools got a different culture and vibe so it just gives them another look. (Adam, Principal, Deakin)

The principals have identified their appreciation of both their capacity and responsibility to contribute to science teacher education and its implementation in classrooms (Argyris and Schön 1996) and the shared responsibility for this task.

5.5.2 Features of Generative Partnerships

Generative partnerships demonstrate increasing commitment from both partners, responding to each other's needs and generating new practices which are of mutual benefit. Table 5.3 provides an overview of a generative partnership and the components which are integral to its success.

A. **Purposes of the Partnership**

The opportunity to work together enables both partners, the PSTs and classroom-based teachers to contribute to shared understandings. Joint reflection on practice

Table 5.3 Components of a generative partnership

A. Purposes	B Institutional structures	C. Nature of partnership	D. Linking theory with practice
Partners recognise opportunities for mutual professional learning	Partnership activities are considered long-term and are planned and catered for in the teacher education and school programs	Partners jointly plan the structure of the school-based practices to the benefit of both	Opportunities exist for both partners to reflect on practice that may be linked to theory

is a demonstrable outcome of this generative partnership. Through the development of new perspectives, the possibilities for changed practices are enhanced. Teachers involved in the generative partnership describe the motivation underpinning science education and the opportunities for learning "I am learning from her and she is learning from me…mutual learning" (Rachel, Teacher, UTAS). Other aspects which were highlighted by the participants were related to opportunities to observe others in the classroom and learning through reflecting on that observation.

> In my 3rd year Prac the teacher I had enjoyed teaching science and we did a fair bit of science and it built my confidence. Watching how other people do it gives you confidence. That combined with the unit we did gave me enough confidence. (Roz, PST, UTas)

Teachers and PSTs recognised that the benefits are many, for all participants, in a learning environment which has shared outcomes (Jones 2008; McNamara et al. 2007).

B. **Institutional Structures**

As the partners develop an awareness of each other's interests and needs in the partnership, there is a trust built up which furthers a willingness on both sides to enhance the partnership. This results in the integration of the programme into other aspects of the school and the arrangement of the school timetable around the programme. An example is where PSTs provide family science nights for the school or take over lunchtime science clubs.

> … it had been going for at least three or four years before my time here and it was something that a lot of people talked about… One of the things that I was really excited about was the fact that the actual tute was running here and then the practical side was done with our children… Even though there may not have been the great follow up to start with, that evolved over time and it actually excited our staff and got our staff talking and thinking about how we can run science in our school, and how we can use the Deakin program to better suit our kids and our curriculum. Over the years it's evolved into that program still running and then I guess dovetailing into a science evening that we invite Deakin Science students along to help us run and it really showcases the work they've done, the work that our children have done, and that our community and the value that it has on science… for me there were a lot of upsides to the actual program. Number one is we had some expertise in the teaching of science, number two it covered our quota on our curriculum for science and, number three it kind of up-skilled our staff on what to do and what to look for and how to run science lessons. (Aaron, Principal, Deakin)

This principal has reflected on the school–university partnerships and the benefits experienced in his setting and signals that the partnership has been productive. The school staff evolved into critical friends of the partnership and as time passed, reflected and reviewed the experiences more formally, resulting in more formalised outcomes (Korthagen et al. 2006).

C. **Nature of Partnership**

Programmes have a way of changing over time as needs change or possibilities present themselves. In response to feedback and requests from schools, Deakin's

programme has shifted from giving an open choice for topics, to developing topics that fit in with the school's theme or inquiry.

> Managing this from a partnership point of view would take some planning I guess. I see PSTs working with our students in small groups, working on earth sciences, I saw a group working on water, another group solar power, etc. I'm wondering if there's a way of negotiating with Deakin so that the work that the PSTs are doing links to our integrated studies planner so that the work … extends or supports the other scientific enquiry that's happening at the same time…
>
> I think there'd be some benefit if there was some sort of feedback or discussion at some point throughout the program that involved the classroom teachers, to talk about what the students were doing what they were observing and then feed that into the classroom teacher and have some discussion. (Arabella, Principal, Deakin)

Here visions arise, and goals are being actively reviewed, with an expectation that further mutual opportunities may exist. In a partnership where mutual respect, trust and outcomes have been developed and are shared, Darling-Hammond (2000) would anticipate that more effective practices can be developed.

D. **Linking Theory with Practice**

The meaningful experiences exhibited in primary school partner classrooms led to positive conceptions of science within veteran teachers. This increased confidence was and important implication of the partnership impacted PSTs, veteran teachers and ultimately primary students.

> I found that that's been one of the benefits of the program is that our teachers actually are feeling more confident about teaching science and working with the kids in that regard….
>
> I think it's also maybe teacher confidence. We have so much PD surrounding literacy and numeracy and we have coaches in the region who come out and do that sort of stuff but science has not necessarily had the same…. (Felicity, Principal, RMIT)

The mutual need and benefits from the partnership for science education has been acknowledged for PSTs, school students, school staff and university staff, and has been contrasted with the support usually provided for literacy and numeracy (Goodrum et al. 2001).

5.5.3 Features of Transformative Partnerships

The final type of partnership is the transformative partnership which is clearly identified by the higher level of commitment to the partnership outcomes. Table 5.4 outlines the components of the partnership.

A. **Purpose of the Partnership**

When teachers saw they could work with the PSTs and bounce ideas, it provided an opportunity to reflect on their own teaching of science and begin to look for more opportunities to teach science and to develop conceptual learning sequences.

Table 5.4 Components of a transformative partnership

A. Purposes	B. Institutional structures	C. Nature of partnership	D. Linking theory with practice
Partner involvement based on active professional learning	Partnerships are embedded in the ongoing structures and practices of the institutions	Partners take joint responsibility for mutually agreed practices and outcomes that are embedded in their respective core outcomes	Both partners engage explicitly in reflective inquiry guided by theories of professional identity development

> It allowed me to reflect upon my own teaching by observing and assisting. It reinforced just how different children learn and how much they rely on their prior knowledge and experience when completing tasks – particularly when predicting and recording observations and results. (Pansy, Teacher, UTas)
>
> Definitely a change in attitude. I found a fantastic book in our school library full of science activities and sheets ready to go for the children to fill in when they completed the experiment. It also has a teacher section for every experiment explaining what to look for and some guiding questions. I feel confident to take science now because of this book but it was watching James take science with my class that encouraged me to seek out a book such as this. (Sabina, Teacher, UTas)

The teachers reflect on the change in their capacity, confidence and commitment to teaching science education. The partnership experience has been 'mutually informing' (Australian Council of Deans of Education 2004, p. 3).

B. **Institutional Structures**

Where schools and universities work together in a way that is valued by both, overtime the programmes are more likely to be embedded within the ongoing structures and practices of both institutions. For example, the ongoing partnership associated with the University of Melbourne clinical model has resulted in schools depending on and modifying practices.

> So, the partnership has been very important for us and it means that we can develop our units with your guidance and that's been a very, very important part of our school and university partnership. (Jane, Teacher, University of Melbourne)

The various partnerships have distinctive elements of pedagogical practice which over time have become valued by members of the partnership and have had implications for the planning practices of (McLean Davies et al. 2013).

C. **Nature of Partnership**

University staff were uniquely positioned to observe student–teacher growth over the long-term. In this case, a full year involving a traditional science methods class followed by, or including, the primary school partnership placement. The time in

schools seemed to accelerate student teachers' understanding of the role and responsibilities of the teaching professional.

One of the things I've noticed this year is the incredible changes in my uni students from when I first meet them in Science 1 and then how more confident they are at the end of Science 2. I felt like they'd become teachers in a way, they're much more confident. … I see it in the ways they act in class so it's just a really positive thing and they have lots of positive stuff to say about it. (Andy, STEPS project team, RMIT)

The partnership here has been aligned with changes in the professional identity of the PSTs. The practices of the programme have been supported on-site by the university staff, and this has contributed to informing the PSTs professional identity formation (Kenny 2010).

D. **Linking Theory with Practice**

In this partnership, the partners use their experiences through the partnership to inform their pedagogy through reflective practice. This may result in tertiary partners making changes to the explicit teaching of science education to PSTs, or for teachers, informal professional learning sessions may form part of school meetings. In some instances, teachers undertake further more formal Professional Learning opportunities or enrol in postgraduate studies linked to the programme.

PSTs develop a science portfolio of the teaching and learning and assessment activities which they use as part of a job application after graduation. Some PSTs take on science leadership roles in their future employment in schools, indicating their growth as a primary teacher of science education…

> My PSTs assessed the students at the conclusion of the unit of work. This was most helpful to me as I needed this feedback for my mid-year reporting. It was also a very valuable thing for the PSTs to do as part of their own self-assessment. (Pansy, Teacher, UTas)
>
> In my first year out I got given science coordinator so I took on a science leadership role and went to network meetings and talked to other teachers…. It's taking me in a direction I didn't expect. The experience has increased my confidence…Going in and actually teaching science. (Yvette, PST, UTas)

Kenny (2010) states that the qualities of the school-based experiences are significant factors contributing to the development of PSTs teaching philosophy and professional identity.

5.6 Conclusion

This chapter discussed the structure of partnerships which were encountered during the STEPS project. Authentic partnerships were interrogated to provide the components of the table which represented elements of partnership practice existing in multiple schools around Victoria. The partnerships were clearly developed around a number of recognised requirements: each partner knew why the partnership was

necessary (purpose), institutional structures which enhanced or impeded partnerships, how the partners responded to each other in the partnerships (the nature of the arrangements) and the opportunities for professional growth of both partner organisations through managing the theory–practice nexus.

While the partners in this chapter are the university and the schools, within the partnership, the stakeholders are the university educators, the school staff, the PSTs and the school students. The partnership arrangements directly affect each stakeholder, and each stakeholder involvement changes the nature of the partnership. Partnerships are fluid arrangements—sometimes moving into deeper commitment, sometimes moving to less commitment. There are no 'right' partnerships except those which suit the needs of each of the partner institutions involved.

The RPP proposed within the Interpretive Framework has been a valuable tool for other partnerships, and the typology and components can be more broadly applied to other partnerships. In particular, understanding the typology of a partnership can assist in the growth and maintenance of existing partnerships by providing a language to talk about current practices and the sometimes undocumented and amorphous practices which exist. The growth of partnerships will be discussed in more detail in Chap. 6.

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Chapter 6
Growing University–School Partnerships

Mellita Jones and Gail Chittleborough

Abstract The ways in which the Science Teacher Education Partnerships with Schools (STEPS) project identified and represented a guide for growing university–school partnerships are presented in this chapter. Based on evidence from the STEPS research into the independent school-based science teacher education programs of five Australian universities, components for initiating and sustaining successful partnerships were identified and described. These components are: (1) partner identification of aims and rationale for entering the partnership; (2) institutional requirements and constraints that govern partnership activities; (3) the nature and extent of the relationship between partners; (4) the nature and quality of the learning; and (5) a commitment to action to achieve the desired outcomes. The relevance of these components across three phases of partnership work, initiation, implementation, and evaluation, is also described alongside concomitant *Action Planning Tools* that can assist partners' discussion and negotiation of the phases and components. Collectively, the components and phases form the Growing University–School Partnerships (GUSP) element of the STEPS Interpretive Framework. The GUSP encompasses essential planning aspects and helps to ensure that all partners' needs and roles are considered and that the partnership achieves the desired benefits for all. Initiating, maintaining, and growing partnerships can be challenging; however, the process and tools summarised in GUSP and presented in this chapter provide a guide for others wishing to establish a new partnership or to review and/or develop an existing partnership.

Keywords Partnerships · Growing partnerships · School-based · Teacher education · Interpretive Framework

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6.1 Introduction

The Science Teacher Education Partnerships with Schools (STEPS) project that is the premise for this book led to the development of an Interpretive Framework (Fig. 4.3) for examining and guiding partnership practices as one of its key outcomes. As explained elsewhere in this manuscript, the Interpretive Framework is a document that can be used to facilitate the planning, initiation, growth and evaluation of university–school partnership practices. Emerging from the exploration, analysis and synthesis of data from the practices of the five Australian universities involved in the STEPS project, the Interpretive Framework consists of four key elements that collectively guide effective university–school partnership work in teacher education. These components are: Growing University–School Partnerships; Representing Partnership Practices (RPPs); Enabling Innovative Practices; and Enabling Growth (detailed in Chap. 8), as theorised in the STEPS Interpretive Framework document (Hobbs et al. 2015) and enacted with the assistance of the Action Plan, a set of tools to guide negotiation, monitoring and evaluation of partnership work. This chapter describes the GUSP component of this framework, describing how it emerged from the data collected in the STEPS research project as well as summarising how it can be used to inform the work of those interested in pursuing and/or growing partnerships.

6.1.1 STEPS Beginnings

The STEPS project team of teacher educators from five universities in Australia came together on the basis of their established, individual science teacher education programs that incorporated some form of school-based science learning for PSTs. The aim of the project was to explore, analyse and synthesise the established and successful partnership programs for the cogent and unique features that contributed to their individual success and subsequently to inform the development of the Interpretive Framework. The project arose in response to national (and international) criticisms regarding the quality of teacher education, particularly in terms of the theory–practice gap, and research indicating that confidence, knowledge and time spent teaching science in the primary years of schooling are consistently low (e.g. Goodrum et al. 2001). Thus, this team of teacher educators sought to deliver programs of science teacher education that might assist in addressing these issues. Acting independently in the formative years of their respective programs, each teacher educator realised the importance of schools in providing the authentic teaching and learning experiences to achieve their goals as teacher educators of science. The research subsequently conducted stemmed from the desire of the team to inform the literature around school-based teacher education, and to provide a framework to guide the practice of other educators interested in pursuing similar partnership work.

Established in the preceding chapters of this manuscript are the theoretical underpinnings and rationale for universities and schools to work more closely, in partnership, to enhance outcomes for teacher education programs. It has been well established in these chapters, and indeed, in the extant literature in the field, that partnerships are a critical component of attending to the *quality* debate in teacher education (e.g. Darling-Hammond 2012; Korthagen 2011, 2016; Loughran and Hamilton 2016; TEMAG 2014; Zeichner et al. 2016). Partnerships between universities and schools provide a suite of opportunities that are fundamental to learning about teaching that cannot be achieved authentically in any way other than integrated work between universities and schools. Examples of these opportunities include: mastery experiences (Bandura 1986) that are linked to identity formation as a teacher; authentic experiences of putting theory into practice; and first-hand, concrete experiences on which to reflect, analyse, discuss and improve practice (Korthagen 2011; Loughran and Hamilton 2016). These and other benefits, as well as cautions of partnership work in teacher education, have been considered more fully in previous chapters. This chapter builds on the established argument that partnerships are indeed a crucial way forward for teacher education practice and looks to inform the ways in which partnerships can be successfully initiated, maintained and grown.

6.1.2 The STEPS Project

The STEPS Interpretive Framework provides a holistic, structural outline to guide universities and schools in establishing and sustaining partnership work. In its development, the STEPS project team considered their individual, long-term success in working in partnership with schools. These considerations involved thinking about and collating the unique and cogent features of the various partnership experiences of project team members that were examined through questions such as (Hobbs et al. 2015, p. 17):

- How are partnerships grown over time?
- What are different types of partnerships, and what are their respective purposes and values?
- What is fundamental to the pedagogies that can arise within partnerships?
- What is needed for partnerships to achieve quality learning outcomes and changed practices?

In considering the questions above, the STEPS project team shared elements of their own experiences in building and growing partnerships within teacher education through individual case descriptions. It is significant that all five universities involved in STEPS were independently using some types of school-based approach to teaching PSTs *how to teach science* in primary schools. The school-based teaching programs were considered by the teacher educators to be the best way to support the PSTs to develop science knowledge, confidence to teach science, and opportunities to link theory and practice in meaningful ways. The systematic sharing of practice

allowed a critical analysis of data through cross-case analysis, to identify the trends, commonalities, strengths and weaknesses of the various school-based programs.

In addition to collating and analysing data on their own programs, the project team spoke with a range of other stakeholders including PSTs, classroom teachers, and school principals who had been a part of these partnerships. Insights from other teacher educators regarding "goodness of fit and usefulness for other partnerships in the education sector" (Hobbs et al. 2015, p. 20) also mediated the findings. These data were analysed for themes and informed the development of the different elements that make up the Interpretive Framework as a whole.

One important result of the overall analysis of data was the change in thinking and reporting by the researchers about the programs of study operating in schools, from the term "school-based approach" to "partnerships approach". The school-based programs may have been initiated and organised by the teacher educators, but they required commitment from all the participants, thereby making the programs *partnerships*. Recognition of this commitment and the change in lexicon from school-based program to university–school partnership was significant. Terms in the data that represented the school-based programs as partnership work included: sharing, enabling, collaborative, confidence building, integration, relationships, growth, knowledge sharing, co-ordination, advocacy, support, contributions, communication, connectedness, mutual benefits, and understandings between partners. Once the research team became cognizant of the partnership quality of the programs as being pivotal to the success of their practice, further exploration of the various partnerships was undertaken in an effort to identify key characteristics for success.

6.2 Partnerships

Partnerships involve two or more stakeholders working together with a shared vision. Members of a partnership need to be committed to a set of shared outcomes, even if the impetus and key benefits of the partnership work are ultimately different. A university–school partnership that provides the basis for the school-based experiences "connotes a collaboration of professional conversations, collegial learning and aligned processes" (Rossner and Commins 2012, p. 2). The rationale and goals of a partnership influence the fundamental aspects of how the partnership is developed to ensure the collaboration leads to the set of shared outcomes that address each stakeholder's needs.

Partnerships between universities and schools were core to the science education courses explored in the STEPS project. The many features of partnerships that were highlighted in the scrutiny of the data were initially condensed into four fundamental components for initiating and sustaining effective partnerships between schools and universities. The following sections of this chapter present the project team's findings to discuss the development of these four initial components for initiating, implementing and evaluating partnership work between universities and schools. The data presented emerged from the thematic analysis of case study and interview data

from a range of partnership stakeholders. Methodological processes are outlined in greater detail in Chap. 3, but essentially involved a cross-case analysis drawing on each university's individual case description and thematic analysis of interview data from PSTs, classroom teachers, school principals, and teacher educators.

6.3 Components of Successful Partnership Work

The practice of each university–school program was examined through case study and interview data from which four initial components emerged as providing support for successful partnership work. These components were identified as important in the stages of initiation and ongoing partnership work and included: (1) aims and rationale; (2) institutional requirements; (3) relationships; (4) nature and quality of learning. Each of these components is presented and discussed below, alongside excerpts from the data that supported their identification in the team's analysis.

6.3.1 Identifying Aims and Rationale for Entering a Partnership

As has been noted elsewhere (e.g. Hobbs et al. 2015; Jones et al. 2016), the aims and rationale for a given partnership must be held central to all actions undertaken in initiating, implementing, and evaluating a partnership. Clearly defined aims and rationale for working in the various partnerships in STEPS helped to ensure that all stakeholders understood what the partnership was trying to achieve and enabled all stakeholder's needs to be identified and considered. For example, Charles, a principal in a Tasmanian school and Gail, one of the teacher educators, described the rationale for their particular involvement:

> Science is a priority in 2007. Science enables us to teach inquiry thinking. Science is a way to lead boys into literacy. (Charles, Principal, University of Tasmania)
>
> Most PSTs were not getting any experience in teaching science during their practicums in school. The school-based program was introduced to respond to this situation and to ensure that all PSTs had experience in teaching science over an extended period of time… the school-based program is designed to allow PST an opportunity to build confidence in teaching science. (Glenys, Teacher Educator, Deakin University)

It was essential that time was given for open discussion of this fundamental aspect of establishing and maintaining the strong and successful partnerships. Most of the initial work in identifying the aims and rationale for various partnership members occurred in the initial stages of planning the partnership arrangement. It was in this discourse of each partner's needs and desired outcomes that respect for one another's programs and roles was established, something that also helped to establish what Zeichner (2010) calls for in a "non-hierarchical interplay between academic,

practitioner and community expertise" (p. 89). Appreciating the differing needs of all participants in the partnership highlighted a level of mutual understanding. Miranda, a teacher educator from University of Melbourne, differentiated the value of the model itself from the value to individual participants and reflected on the importance of recognising the needs of all:

> …we're working collaboratively and we're working in a model that isn't just about our students saying this is what we need, this is what we want, this is what the university says we have to do, it's all for us, me, me, me, it's about giving back to the school as well. So it should be that it's this mutually beneficial model which again prepares our teachers, it's not just about me in my classroom it's about the broader school community and giving back…

The data showed that while stakeholders expressed their own goals and their own needs, their understanding of shared goals of the program varied and they were considerate of others with whom they were in partnership. The examples provided demonstrate the ways in which the aims and rationale underpinned the successful initiation, as well as the ongoing work between partners in response to reflection and changing needs.

6.3.2 Institutional Requirements

Regardless of the desired outcomes of either partner member, partnerships were ultimately governed by the affordances and limitations of what each organisation could and/or would allow. Universities and schools are busy institutions and have a range of requirements that shape the way in which a partnership can be organised. Aspects such as timetabling, curriculum and physical and human resources, to name a few, were reported as both enablers and constraints to the success of the partnerships. For example,

> So our issues are timetabling, time management and getting a space so they can have their lecture and as for me that's just day to day school maintenance and management. (Anthony, Principal, Deakin University)

> The Teacher fellow and the Clinical Specialist seek to find a class teacher who can be a Mentor teacher and who is teaching science in their class planner in term one and two. This is difficult because schools tend to design for a term focus and our university semester cuts across two terms. Our Teacher Candidates are finishing their teaching before the end of term two. This has created issues for our Teacher Candidates and why sometimes the Mentor teacher will provide a small group of students to the Teacher Candidate. ("Clare", Teacher Educator, University of Melbourne Program)

The consideration given to institutional requirements, and the willingness to accommodate the institutional demands, varied from school to school and between universities and across programs. Some had greater capacity and/or willingness to adapt their programs to accommodate the partnership work. For example,

> I suppose it's problematic from the point of view that we might be doing a humanities inquiry and suddenly the candidates have to teach a series of science lessons. I have never had a problem here I just liaise with them. (Joyce, Assistant Principal, University of Melbourne)

> Sometimes schools will agree to have Deakin students come in but then Grade 5 will be out on camp and they'll have sports day and sometimes there can be quite large gaps. … So I think if the schools understand that we really need to not have that time broken up, for ten weeks to go as much in a row as we can I think that would really improve the Deakin student's delivery. (Janice, Teacher Educator, Deakin University)

Many schools reported having participated in school-based science programs for many years, and they drew on this experience and the existing relationships between the stakeholders to help plan their curriculum and activities accordingly. Similarly, university educators liaised with university and school staff with ample time to allow for preparation for the program.

Early and clear identification of institutional requirements was essential for effective planning and implementation of partnership work both in the initiation stages and throughout the partnership work. Firstly, when planning was thorough and incorporated what was and was not feasible, smoother implementation of the partnership was generally achieved. Secondly, having clear and comprehensive information regarding the respective constraints and affordances better enabled partner members to respond effectively to any issues or unforeseen circumstances as they arose. On these occasions, flexibility and adaptability were hallmark characteristics of effective members of a partnership. Moreover, a responsive and adaptable outlook throughout implementation and in the evaluation stage of a partnership meant that constraints that changed or emerged during or post-implementation could be considered in future iterations of the partnership. At times, they even acted as an impetus for change within organisations, at which point we see partnerships as becoming transformational (see more on this in Chap. 5—Representations of Partnership Practice). Generally, all stakeholders did what they could within the constraints they faced. The positive attitude and willingness to accommodate the partnership work was seen as worthwhile. This was captured by one principal's comment:

> we try to be as accommodating as we can be because we see real benefit in this partnership as I said it's a win/win for us all. I hope that's your perception as well' (Lewis, Principal, RMIT)

6.3.3 Relationships

Positive, supportive, responsive relationships between partnership members were core to the level of success of the partnerships. Respect, trust, reciprocity and responsiveness were among the key principles of partnership practice that helped to build the relationship between partners (see more of the partnership principles in Chap. 4). These factors influenced the level of involvement and risk-taking that each partner brought to the partnership, and tended to increase over time. Levels of engagement tended to vary between individuals both within and between schools involved. Catering for the levels of respect, trust, reciprocity and responsiveness at different stages of the partnership was important to foster the positive growth in these elements—a cyclic phenomenon where a show of respect, trust, reciprocity and responsiveness

further built respect, trust, reciprocity and responsiveness. This growth was demonstrated in comments like:

> after the first semester of involvement, the school, and others in the locality, were requesting that the science program continue at their school. (Cora, Teacher Educator, Deakin University)
>
> it's the level of consistency. So if you say you're going to do something we trust that that will happen. (Lyle, Principal, RMIT)
>
> I think it works very well really and I guess it works well because we've had that partnership built up over a number of years so we've got the relationships, the rapport, the same lecturers tend to come out to our school so they arrive at the school and you already know them and they know you, they know how we work here, they're familiar with the spaces and the children. (Jacinta, Classroom Teacher, Deakin University)

To account for the changing nature of these principles of partnership practice, there needed to be a negotiation of the nature of the partnership, including the level of involvement each partner had in the planning, implementation and evaluation of the experience. This notion connects to what the STEPS project team identified as RPP. The RPP element of the STEPS Interpretive Framework enables an examination of the level of co-operation or collaboration between partners and, indeed, the level of engagement of individuals within the partnership. The negotiation associated with the roles and responsibilities each individual had in the partnership ultimately determined the partnership typology as connective, generative or transformative. With experiences of success, the levels of respect and trust between partner members tended to grow, and this often led to a desire to alter the nature of the partnership whereby one or other of the partner members, or indeed all partner members, wanted to increase the level of responsibility and the nature of the role(s) they took on. In this way, the nature and extent of the partner relationships evolved in response to the way in which the partnership was experienced. For example, after five years in the partnership, one principal spoke of wanting increased involvement of his teachers to leverage the professional learning potential the program might have. This occurred only after he and his teachers witnessed the success of the program for a number of years:

> more and more and people are seeing the benefits, the engagement of the kids and as the understanding of the pedagogy develops you would want to say 'well we can keep working together on this and get something out of it'. (Trevor, Principal, ACU)

The changing nature and extent of the relationship between partners, as a result of the increasing respect and trust between partner members, made the relationships component an important one in terms of the partnership longevity, sustainability and impact. While levels of involvement may have been conservative at the commencement of a partnership, as the above comments reflect, there was certain potential for these levels of involvement to grow. Communication and responsiveness to one another's needs were essential aspects of achieving this. The importance of open and ongoing communication was captured in comments like:

> I think good communication and the opportunity to talk about it first, to say okay. I think there has to be something in it for both of us. (Candice, Classroom Teacher, RMIT)

> Yeah that's been made very clear [the structure of the program] and the support from uni has been good there's always been that touching base each session and there's been an open channel of communication if we needed to talk in between sessions. (Danielle, Classroom Teacher, University of Melbourne)
>
> The level of communication and the way students have come in, the way they've interacted, they've always been really professional and which sort of says they've been well prepared to say 'you've got to do this well' was always really impressive. There were just the simple things of the way they'd come into the office and just do the little things the sort interpersonal things well, so that's the ground work that's done to make sure that they're aware of how it needs to happen. (Trevor, Principal, ACU)

The responsiveness to desired changes in levels of involvement meant that the nature of the partnership sometimes changed as it was being implemented and sometimes upon its evaluation. This building of relationships led to the identification of the *Relationships* component of growing partnerships and gave it a deterministic power in sustaining partnership work. Also recognised through this component was the complementary element of partnership type, which is explored in detail in Chap. 5. The RPP and the relationships component described here are mutually informing and should be referred to alongside one another when exploring partnership work.

6.3.4 Nature and Quality of the Learning and Associated Pedagogical Principals

The nature and quality of learning component identified in the Interpretive Framework was quite specific to university–school partnerships and, indeed, to partnerships involving teacher education. This component was concerned with the pedagogical principles that underpinned the purpose of the university–school partnerships—that of providing an authentic, contextualised experience to grow PST confidence and make meaningful theory–practice links in PST education. Emerging from the science teacher education impetus, this component was focused on the ways in which PSTs engaged with students and students' learning in the classroom, as well as the types of pedagogies they adopted in these interactions. It was a component of partnership practice that was informed by both practical and theoretical elements and was influenced by evidence from partners' experiences alongside evolving research literature regarding quality learning.

Unlike other components, the nature and quality of learning tended to have a linear approach to its application. To meet practical requirements of a partnership, the number of PSTs and how they interacted with students were planned and established at the outset. These arrangements, which impacted on the nature of the learning, were then sometimes altered based on evaluative feedback and were often variable between programs due to the underpinning philosophies emphasised by different teacher educators. Thus, the number of PSTs and students involved in specific examples of practice was different across the programs. For example, some programs involved PSTs

working one-on-one with students on individual, inquiry-type projects. This allowed for highly individualised planning and teaching where PSTs could hone their ability to work with small groups of students and refine their teaching skills without the distractions of classroom and behaviour management that tend to arise in whole-class teaching situations. This was represented in one teacher educator's comment that to enhance the likelihood of PSTs gaining confidence in their science teaching, they were "given the opportunity to teach small groups of children" (Glenys, Teacher Educator, Deakin University).

Other programs saw PSTs involved in taking full class control and being responsible for all aspects of teaching: the classroom and behaviour management, and small group and whole-class learning. It was not unusual for these arrangements to be trialled in different ways over time. For example:

> This year to cater for the demand [from schools] and in response to pre-service teacher feedback that the experience still isn't authentic because they worked in such large groups, I have had them planning and teaching in pairs, with a few on their own. (Mary, Teacher Educator, ACU)

Each of these conceptualisations of how PSTs interacted with students showed that the variation in the number of PSTs involved was determined by teacher educators. Across the partnerships, PSTs were engaged in classrooms working on their own, co-teaching with the classroom teacher, working in PST pairs, or in small groups. Similarly, the grouping of students in schools was either in small groups or whole classes, or a combination of both.

Expanding on the nature and quality of learning was consideration of the types of pedagogies that PSTs applied in their teaching, as well as the ways in which they experienced their own learning. The nature and quality of learning experiences through the authentic classroom teaching were evident in PSTs' comments. For example,

> Effective teacher questioning is mindful of the purpose and the context. This is something that I discovered to be important in my lesson today. Through reading the literature I have learnt that you should make sure that you allow adequate thinking time for high-order questions, you should always attempt to respond positively and constructively to an answer, should use questions to challenge, extend thinking and raise curiosity, and you should plan questions before the lesson. I did plan the question before the lesson and had thought about the fact that some students may not understand the word 'justify' and so I was prepared for this situation. Through reflection I have come to realise the importance and place of questioning in the classroom. (Anna, Pre-service Teacher, University of Tasmania)

Anna's analysis and close attention to the student talk and her own responses provide insight into her developing understanding of the pedagogy of questioning. PSTs confidence was also effected by the classroom experience. For example,

> before coming into this unit I was a little bit, not hesitant, but a bit unsure when it came to teaching science and I probably had that sort of scary critical view like some of our students have about science being about chemicals and gases and that sort of thing when really science is so much more. It was really good to be able to show that with students too that a scientist isn't someone with a white lab coat that makes potions, a scientist is them they can be a scientist when they explore and when they work together and find things out.

> So that's definitely made me a lot more aware of that and honestly much more excited about teaching science. I'm certainly not hesitant anymore I'm ready to do it and I've already got lots of ideas yes it was very much a really positive experience of science teaching and learning. (Lilly, Pre-service Teacher, ACU Program)

While PST and students' learning are the fundamental drivers of university–school partnerships in teacher education, there is also potential for professional learning for classroom teachers and teacher educators through the partnership work. For example, the following comments demonstrate the learning of classroom teachers as a result of having the program in their schools:

> Every time you're watching them you're rethinking 'God I should be doing that' and no matter how old you are or how long you've taught it's changing all the time, there's always new stuff that you can be doing. (Lydia, Classroom Teacher, Deakin University)

> I suppose my concern would have always been that well these guys come in and they'd have the science and then we just go back and do what we were doing and it'd be just sort of an isolated involvement which would have had some benefit, probably lots of benefits anyway but it may not have been maximised and again that probably would have come down to the various teachers involved I suppose as to how much they engaged with and maybe over time that changed as they saw how it worked. (Trevor, Principal, ACU)

This professional learning "bonus" is dependent on the level of engagement and the type of roles and responsibilities taken on by the partner members. This links to the relationships component described earlier and, subsequently, to the RPP which is explored in Chap. 5.

6.4 Phases of Partnership Practice

As a number of the data excerpts in Sect. 6.3 show, the influence of time on the growth and development of the partnerships under study was important. It is related to the building of trust and relationships; it is linked to the evaluation and changes made to the organisation and implementation. These data pointed to the importance of iterations in partnership work, and that there were three different stages, or phases, within each iteration. These phases were identified as: the planning and organisation phase, termed *Initiation*; the practical phase of enacting the partnership work in schools, termed *Implementation*; and the reflective and evaluative phase, termed *Evaluation*. The opportunities and relevance of these phases in partnership practice are described further for each phase below.

6.4.1 The Initiation Phase

The initiation phase involved the initial brokering of the partnerships. This phase was crucial for setting the tone of the partnership and for establishing initial levels of trust and respect. In other words, if there is not already an established relationship

between partner members, then the building of relationships needs to be a key focus in this phase. As Kruger et al. (2009) note, the foundation to building trust is through the establishment of a shared understanding between partners and by ensuring the partnership is built around achievement of potential benefits to be gained for each partner. Careful negotiation was needed to procure this shared understanding; and the negotiation needed to cover a number of components such as: what respective roles would be undertaken, what factors would drive each partner, how did each partner envisage success, and even matters such as what constituted effective teaching in the view of each partner. It was also in this phase that partners discussed and decided on the people and resources available, and defined the partnership's outcomes. These points of discussion are represented by the components outlined in Sect. 6.3.

Over time, some members of the research team found that they needed to re-negotiate some of these aspects of the partnership, even in schools that had been participating in the relevant program for some time. For example, one school involved in a long-term partnership acquired a new principal approximately four years after the school's initial and ongoing participation. This required the teacher educator to re-establish a shared understanding and vision with the new school leader. This aspect of the initiation phase had to be re-visited to ensure the program's continuation in this school. Another of the teacher educators in the STEPS project team found a similar need to re-visit initiation discussions when new classroom teachers joined schools with whom they were in partnership.

These and other examples showed that over time, the goals and needs of stakeholders, and the differing levels of commitment to the partnership needed renegotiation as the partnerships matured and changed. For example,

> I see pre-service teachers working with our students in small groups, working on earth sciences, I saw a group working on water, another group solar power, etc. I'm wondering if there's a way of negotiating with [University] so that the work that the pre-service teachers are doing links to our integrated studies planner so that the work … extends or supports the other scientific enquiry that's happening at the same time…" "I think there'd be some benefit if there was some sort of feedback or discussion at some point throughout the program that involved the classroom teachers, to talk about what the students were doing what they were observing and then feed that into the classroom teacher and have some discussion. (Antoinette, Principal, Deakin University)

Feedback akin to this led to changes in each of the programs over time. They demonstrated how revisiting some or all of the components to re-negotiate particular aims, needs, roles and learning experiences were required to ensure the shared understanding, meaningful involvement, and desirable outcomes were maintained for everyone. As such, the initiation phase was relevant at different stages of partnership work, and not only at the literal beginning of the partnership arrangement. A broad view of initiation in this way, acknowledges that various individuals working within the partnership may be at different stages at different points of time. Such an acknowledgement helps to maintain and grow the trust and respect on which partnership work is founded. A *Partnership Negotiation Tool* (PNT) to guide initiation discussion and negotiation was developed on the basis of the component and

initiation phase data to better ensure the achievement of influential components for success linked to this phase.

Partnership Negotiation Tool (PNT), to support Initiation. To support *Initiation*, the STEPS research team drew on their experiences and some of the data generated from the interviews with other stakeholders to design a tool to facilitate discussions and negotiations associated this phase of partnership work. Regardless of who initiates the partnership, roles need to be identified and negotiations managed. The ways in which initial and ongoing contact is made need consideration. What records and how they are shared and maintained needs to be decided. The Partnership Negotiation Tool (Appendix 6.1) supports periods of significant discussion regarding each site's institutional needs, roles and responsibilities. This tool also aids a balanced discussion around desirable outcomes for each partner, and whether or not these outcomes are aligned in a mutually constructive way. For example, if a lead partner initiates contact with a vision of a particular partnership, the tool helps to ensure that this vision is informed by the other partner's ideas, needs and aspirations. It helps to ensure the question of "what can we do for you" is asked alongside the request of "could you do this for us?"

In addition to providing example questions that could assist the initiation of a partnership, the PNT also provides a template for partners to identify their own ideas and responses to the various components of partnership work (Appendix 6.2). This template facilitates the process of garnering a shared understanding of the partnership, and that mutually beneficial goals and outcomes are built into the partnership work. These considerations are essential for establishing the initial trust and respect needed as a basis for ongoing partner relationships.

6.4.2 The Implementation Phase

The implementation phase sees the partnership plan being put into action. It encompasses the period of time across which the various people involved actively pursue the intended outcomes of the partnership. In essence, it captured the period of time in which PSTs were teaching in schools. Implementation drew in additional stakeholders: the PSTs and students in the classroom who were not a part of the initial brokering of the partnership work. As such, PSTs' and students' involvement was essentially conceptualised, rather than being known during the negotiation stage. This made it very important for the partnership goals, tasks, and general functionality to be monitored throughout the period of implementation. Despite the level of planning, situations arose that required change, sometimes quite significantly, and often with little notice. These situations ranged from PSTs falling ill on a teaching day, a school assembly being called, a sports day or camp being scheduled, and other classroom-based factors that were unanticipated. Two excerpts from the data are provided to illustrate examples of the need for unexpected change and responsiveness:

> Sometimes with things that we do for instance when I'm growing seeds or something like that in my particular classroom it's very difficult to find places where I can leave things, …So within the classroom itself we have constraints. (Narelle, Classroom Teacher, Deakin University Program)
>
> if you're going to miss a day you have to be ahead of things, you have to have things in effect before you're gone but you really need to think proactively and communicate and all those things…I have to be ready for things that surprise now the schedule's changed in schools. (Amos, Teacher Educator, RMIT Program)
>
> I didn't have any issues contacting the girls if things had changed within our scheduling or anything like that, it was quite easy to contact them and let them know that we needed to change something and they were very flexible. (Mandy, Classroom Teacher, ACU Program)

Experience of the STEPS project team in working through the implementation period, mediated by interview data from the study, led to the development of a *Partnership Monitoring Tool* (PMT). The PMT is a tool that can guide partners to monitor factors important to the partnership's success during the implementation phase.

Partnership Monitoring Tool (PMT), to support implementation Monitoring the partnership and responding to arising concerns as partnership work is underway is important to help ensure that the partnership outcomes are achieved or moderated as needed. The PMT provides a guide to support this monitoring throughout the implementation phase.

As shown in Appendix 6.3, the PMT lists a series of questions that can be used as a form of checklist to consider the level of success different elements of the partnership are achieving. This checking also assists in the gathering of evidence throughout the partnership to aid future partnership work. Questions are outlined in the PMT to address components of aims and rationale, institutional requirements, relationships, nature and quality of learning, and commitment to action. Answering these questions may engender immediate changes (e.g. if communication methods between partners are not working, something else might be trialled and put into effect immediately). Alternatively, answers to the PMT questions may be used in the evaluation phase to guide discussion and decision-making for future iterations of the partnership program.

Utilising the PMT is likely to be an informal endeavour conducted by partner members in conversation with one another, or on their own as they reflect on the progress of the implementation phase. It would be beneficial for partner members to utilise this tool at various points throughout the implementation phase to help them consider whether or not their expectations are being met in a consistent and full manner. Alternatively, or perhaps in addition to this informal use, partners may decide to meet more formally and utilise the PMT (or parts thereof) to guide discussion. Ultimately, however, it is used; the PMT should assist in the identification and discussion of concerns arising during the implementation phase and should, subsequently, facilitate the modification of practices as the need arises.

6.4.3 The Evaluation Phase

Pursuant to the notion of evaluation more generally, the evaluation phase involves consideration of the partnership's practice in meeting intended outcomes. The key goals for the evaluation phase are to celebrate success and to inform better performance and enhanced outcomes in ongoing iterations of the partnership work. In achieving this, various strengths and weaknesses, the supportive and detractive elements of the partnership, were explored and examined. Some examples of success from different perspectives, and if they impacted any change, what this change yielded, are provided in the excerpts below.

> The relationship with [school] continued until 2012 when it became mutually apparent that the model no longer fit with the school structure and timetable. During the intervening years, [the school] went from a school that barely engaged with science to one that had specialist science teachers who provided science programs every week to all classes in the school from Prep upwards. (Amos, Teacher Educator, RMIT)

> I think it was a fantastic way to integrate the theory and research into best practice science teaching by actually planning, implementing and assessing a science unit within school environments. (Kerry, Pre-service Teacher, ACU)

Partners drew on their own personal perspectives, their shared understandings and the perspectives of others (e.g. PSTs, students, school leadership, parents) to inform their assessment of the partnership's success. Primarily, the teacher educators take on the responsibility for implementing changes associated with feedback. Some examples of changes made/requested in response to evaluation included:

> the partnership is intended to shift to involve the partner school more in providing feedback to the pre-service teachers, working with school-recommended topics, and involving the school leadership team more with the students. In addition, the emphasis of the learning task, while still focused on the child-PST interactions, will link more to the graduate teacher standards. (Cora, Teacher educator, Deakin University)

> One year I had a teacher email me an expression of dissatisfaction with the result the students who had worked with her had received on the task. This led to me providing a more detailed overview of not only what students were required to do, but how they were being assessed. Generally, the two-way communication and effort to understand each other's' needs I think, has strengthened the notion of partnership. (Mary, Teacher Educator, ACU)

> I just think I'd like it to be measured for the staff as well, I think it would be a really good two-way partnership, at the moment I think it works for the kids, works for the trainee teachers, I don't think it's working for the teachers only because it hasn't been encouraged perhaps. (Warren, Principal, Deakin University)

Overall, evaluation impacted the development of all programs in the study. Many participants noted this in some way, including in the ways demonstrated in the above comments, as well as more general comments like "we've seen it evolve over the time at [school]" (Trevor, Principal, ACU). A summary of evaluation practices is provided through a *Partnership Evaluation Tool* (PET), which is explained further below.

Partnership Evaluation Tool (PET), to support implementation Informed by the project team's experiences alongside data from the STEPS research, the PET

(Appendix 6.4) was developed to assist partners in their assessment of partnership outcomes. Use of the PET allows this evaluation to be conducted in a comprehensive and productive manner that attends to the core concerns of each participant. Evaluation often occurs upon the conclusion of a given period of work, which would be after the implementation phase in the model we are presenting here. Evaluation occurring after the fact like this enables a more careful and considered response to overarching partnership goals and parameters. In this way, it differs from the more immediate responsiveness that might occur during the implementation phase. Evaluation may still occur during implementation, but here only changes that need to be (or can be) addressed are enacted. Less urgent and more complex changes generally come about from the more formal evaluation that occurs after the fact—what Schön (1995) terms as "reflection on action".

Regardless of when or how change is implemented as a result of evaluation, it is important that these changes are informed by evidence. Sustainability of the partnership depends on a continued and common understanding and agreement of what the partnership is aiming to achieve and who is committing to what to ensure its success. The PET can be used to guide such formal evaluation processes, as well as for less formal, group or individual reflection on the partnership outcomes.

As shown in Appendix 6.4, the PET follows the same format as the previous tools, the PNT and PMT. A series of guiding questions are posed as a stimulus for thinking about the different components of partnership work. Consideration to each of these components allows for thinking and discussion about the ways in which aims and outcomes were met, institutional requirements facilitated or hindered progress, the nature of the relationships, and the nature and quality of the learning. Discussion around each of these provides an invitation for each partner to re-assess their level of involvement and what they can and/or are willing to do to better address those elements of the partnership work that proved to be more challenging, and how to leverage those aspects of practice that enhanced the level of success.

The result of effective evaluation practices is that the partnership will be sustained for as long as each partner desires, with or without modifications, depending on the outcomes of the evaluation. Partnerships that are morphing in terms of aims, requirements, relationships, nature and quality of learning, and levels of commitment are likely to experience both more challenges as well as enhanced outcomes in the long term. Only through evidence-driven evaluation practices can informed decisions be made as to the need for and extent of modification in partnership work.

6.5 Commitment to Action

A successful partnership requires a commitment to action from its members. Schools and universities are very busy workplaces, so clearly articulated levels of commitment from all stakeholders are important for success. Understandably, the level of commitment changes in response to the stakeholders' needs, making them dynamic. For many years, the school-based programs examined in the STEPS project (univer-

sity–school partnerships) have operated informally—based on personal relationships and commitments between the people involved, without formally identifying these relationships as partnerships. The analysis of the data from five university–school-based programs has helped to clarify the partnership characteristics of the programs. Commitment to action was a fundamental aspect of these partnerships.

Partnerships are often negotiated by school/program leaders, and thus some participants (e.g. PSTs, classroom teachers) may be thrust into the partnership rather than electing to be a part of it. One of the university's course directors explains the consequences of the decision by the teacher educator and the school principal to establish a school–university partnership:

> So at the school's end they've got to be committed, they've got at least acknowledge it and want to do it. From the University end the university has to put in place or has to have in place the administrative support which I'm not sure is there. The Lecturer has got to know what they're doing and I have no doubt Mellita knows exactly what she's doing. The students (pre-service teachers) also have to be prepared to do it because there will be those that fail because they don't want to put in that kind of practice. (Sally, Teacher Educator, ACU Program)

To assist in defining who is committing to what in a partnership and provide a "stakeholders' pledge" to action and achievement of the desired outcomes, an *Action Plan* accompaniment to the other components identified as important in partnership work was developed. The Action Plan consists of the three partnership tools described in Sect. 6.4 of this chapter: (1) the PNT, to support initiation; (2) the PMT, to support implementation; and (3) the PET, to support evaluation. Each tool is aligned, respectively, to the three phases of the partnership: initiation, implementation and evaluation. The tools are each structured through guiding headings, subheadings and key focus questions that aim to assist partner negotiation throughout the establishment and maintenance of the partnership.

Most partnerships will be initiated by one or other of the partner members, although it is also possible for a partnership to emerge from a mutual idea grown through professional conversation. We encourage the Action Plan to be utilised by both partner members as a shared document to assist in establishing the partnership, and to aid ongoing reflection and discussion in the implementation and evaluation phases. If there is a clear lead partner, then this person might be the one to introduce the Action Plan Tools; however, its use is intended for any member of a partnership, and the tools can be used either formally, in meetings/discussions where both members refer to the document, or informally, where the tools are utilised as a checklist to assist in setting meeting agendas and/or to reflect on meeting outcomes. The tools contribute to the overall Action Plan and were considered by the STEPS project team to be an additional key component to successful partnership work. As such, the *Commitment to Action* component was written into the Interpretive Framework's element of Growing University–School Partnerships.

6.6 Growing University–School Partnerships (GUSPs)

Collectively, the initial four components, three phases and commitment to action areas identified and discussed in this chapter constitute the GUSP element on the STEPS Interpretive Framework. The GUSP is presented as an array of components and phases in Table 6.1 (from Jones et al. 2016) that depicts the relevance of each component for each phase of partnership work.

Initial consideration of the three phases of partnership work and their associated tools might suggest an inherent linear progression. We argue, however, that for partnerships to succeed, these phases must be iterative and need to be open to consideration at all times. The need for this open and iterative approach is necessary because of the potential for various factors associated with the GUSP components of partnership work to change at any time such that partnership members need to be immediately responsive rather than waiting for later opportunities to ameliorate issues. This openness provides the potential for partnerships to grow and flourish.

Table 6.1 Growing University–School Partnerships GUSP

	A. Aims and rationale	B. Institutional requirements	C. Relationships	D. Nature and quality of learning	E. Commitment to action
1. Initiation Phase	Identify mutual and differing needs and provide rationale	Identify requirements, constraints and enablers governing the approach to partnership development	Negotiate roles and responsibilities and define value and parameters defining the nature of the partnership	Conceptualise an approach to PST interactions with children	*Initiate contact Negotiate actions (see Partnership Negotiation Tool)*
2. Implementation Phase	Be mindful of the needs and rationale and be responsive to emerging needs	Manage, compromise, justify and respond to requirements (limitations and possibilities)	Maintain and work with partners to meet individual and differing needs of partners	Enable interactions with children that reflect subject-related and general content and pedagogy	*Monitor and reflect on current levels of commitment and involvement (see Partnership Monitoring Tool)*
3. Evaluation Phase	Evaluate the needs and rationales for their continued relevance and future possibilities	Evaluate against institutional requirements, and consider different possibilities and approaches	Evaluate the nature of the partnership to respond to current and future needs and possibilities	Evaluate the nature of interactions drawing on a range of evidence, including key stakeholders' reflections and educational research	*Evaluate commitment and respond with change as necessary (see Partnership Evaluation Tool)*

6.7 Conclusion

This chapter outlines the GUSP part of the STEPS Interpretive Framework for partnerships in teacher education. We have identified five key components that need to be negotiated, explored, discussed, monitored and evaluated in order for successful university–school partnerships to be initiated, maintained and grown over time. We have considered these five components across three core phases of partnership work: initiation, implementation and evaluation; and demonstrated how an open and iterative approach to these phases assists in growing long-term sustainable partnerships.

The GUSP acknowledges the challenges that partnerships can face, both through negotiating institutional requirements and in noting, discussing and responding to issues that might emerge. The Action Tools explicated in the embedded GUSP component of Commitment to Action provide a structure and a language to aid this discussion and response. Utilising a guide when issues need to be raised such as that provided through the GUSP and its accompanying Action Tools ameliorates what can often otherwise be a difficult and awkward conversation. A shared understanding that challenges will be recognised and invited to be addressed through these tools adds confidence and respect to the way a partnership might unfold.

Our experience of long-term successful partnerships in teacher education indicates that the challenges faced are completely worthwhile, and the intended and incidental learning is incomparable to that achieved without a growing university–school partnership. We hope the GUSP element of the Interpretive Framework provides a tangible and accessible way for partners of both existing and potential partnerships to celebrate and grow their work.

Appendix 6.1: Partnership Negotiation Tool

"Issues for Discussion" and brief summary of project to be shared with partner prior to initial contact:

- Who we are, project description, request for discussion about their needs and requirements, willingness to be part of a partnership
- Who is initiating the partnership, and how will initial contact between potential partners be made?
- What type of partnership is being envisioned (Connective, Generative, Transformative)?

GUSP Component	Questions to Guide Initiation (from STEPS)
Aims and Rationale Identify mutual and differing needs and provide rationale	*How do you cater for science in your school?* *What would you like changed about the way you cater for science in your school?* *What can we do to support your school with science teaching?* *What our pre-service teachers coming and teaching science to your students, and your teachers are able to observe, be of benefit to you?*
Institutional Requirements Identify requirements, constraints and enablers governing the approach to partnership development	University *What timetabling/staffing issues arise?* *What support mechanisms are available at the university?* *What resources are available to support the program?* School *How will this program align with your curriculum requirements, teaching program?* *How does the school structure influence the way the partnership will run?* *What are the schools' expectations of tutors and students: codes of behaviours, policies and procedures, discipline processes, parking, access to school and students, access to resources, school plan, signing and out* *Do parents need to be informed?* *Do you see any barriers/situations/events/structures that might interfere with the program?*
Relationships Negotiate roles and responsibilities and define value and parameters defining the nature of the partnership	*What specific key processes, activities and people will be required?* *What is expected of pre-service teachers?* *What is expected of teachers and principal?* *What is expected of the teacher educator?* *What is the time commitment for teachers and schools? And tutors?* *What level of involvement will each member have?* *Who are the key contacts for each partner?* *Is there benefit in the tutor coming to speak to staff?* *What benefits would are desired for the different partner members involved?* *What sort of communication will work?* *Who will be involved in planning, teaching, reflection & feedback?* *How will staff be recruited into the program?* *What should happen throughout the program to ensure everything is on track?* *Should we plan for this to be a long-term or short-term partnership?* *How will the teachers interact with university students and tutors and for what purpose?*
Nature & Quality of Learning Conceptualise an approach to learning in line with the focus of the partnership	*How does the intended program relate to school curriculum?* *What learning experiences and learning outcomes are expected for the school (science programs, students, teachers, principal) and university (PSTs, teacher educators, science education units)?* *What is needed to support the learning outcomes?* *What feedback is needed? How will this be obtained?* *How will the schools obtain evidence of what has occurred?* *Eg. Written report, unit plan, student outcomes*

Appendix 6.2: Partnership Negotiation Tool Template

Lead Partner	Invited Partner
A. Rationale *Identify mutual and differing aims and provide rationale*	
B. Institutional and Program Demands *Identify requirements constraints and affordances governing the approach to partnership development* i. Requirements	
ii. Institutional enablers	
ii. Institutional constraints	
C. Relationships *Negotiate roles and responsibilities and define value and parameters defining the nature of the partnership*	
D. Nature and Quality of the Learning *Conceptualise an approach to learning in line with the focus of the partnership*	

Appendix 6.3: The Partnership Monitoring Tool

Are there milestones we need to be considering along the way?
What feedback is needed? How will this be obtained?
How will the partners respond to feedback?
At what point will reflection be useful? What will this reflection look like?

GUSP Component	Questions to Guide Monitoring of Implementation
Aims and Rationale Be mindful of the needs and rationale and be responsive to emerging needs	*Has what you expected from the partnership eventuated to date or have your expectations changed?* *Are we meeting the needs of your school?* *Are we best responding to your needs relating to science education?* *Have the needs of the school changed with respect to our partnership?*
Institutional Requirements Manage, compromise, justify and respond to requirements (limitations and possibilities)	*Is our presence in the school and the activities of PSTs in keeping with school requirements?* *Is there need for modification of the program – either in terms of the PST experiences within the classroom or in terms of PST learning?*
Relationships Maintain and work with partners to meet individual and differing needs of partners	*Are partner members happy with the progress?* *Are you happy with the way everyone is interacting?* *Is there enough support from each member of the partnership?* *Is communication between the partners working?* *Are the roles of each member clear?*
Nature and Quality of Learning Enable interactions with students that reflect subject-related and general content and pedagogy	*Are the current professional learning needs being met?* *Is the current interaction between teacher and PST meeting the learning needs and outcomes?* *Is PSTs' contribution to classroom teaching adequate for enable learning?* *Are there any issues or concerns that need to be addressed?* *How are the students in the classroom responding?* *Is there any further support that the University could offer?* *Are there curriculum links that can be fostered more?*

Appendix 6.4: The Partnership Evaluation Tool

What data will provide a means for evaluation? Who will take responsibility for what? (what, how, when, why)
How will data be distributed and to whom, for what purpose?
How do each partner need to respond to the evaluation?
What is working well? What could be improved?
Who will take responsibility for changes, how will agreement be made about the changes needed?

GUSP Component	Questions to Guide Evaluation
Aims and Rationale Evaluate the needs and rationales for their continued relevance and future possibilities	*Has the rationale for partners' involvement changed?* *Have the partner needs been met?* *Is the partnership relevant to the needs of the school?* *Are there future needs of the school that can be meet through the partnership?*
Institutional Requirements Evaluate against institutional requirements, and consider different possibilities & approaches	*Has the delivered curriculum of the program, met with requirements of the university and the school?* *Can the program be modified to better meet the needs of participants?* *How can participation in the program be leveraged to provide students with greater recognition of graduate attributes?*
Relationships Evaluate the nature of the partnership to respond to current and future needs and possibilities	*Is there capacity and interest in the partnership be made ongoing?* *Are there ways we can improve the way each partner interacts?* *Can the methods/nature of communication be improved?* *Is everyone focused on the shared goals/expectations?* *Is each partner happy with his or her current role? Can roles be altered/enhanced to better meet needs/expectations?* *Are there ways in which the partnership could be more powerful?* *Are there any other ways in which the relationship can be improved?*
Nature and Quality of Learning Evaluate the nature of interactions drawing on a range of evidence, including key stakeholders' reflections and educational research.	*What science learning has occurred (for school students, PSTs, teachers)?* *Has the program provided for the learning needs of the PSTs and the school?* *What was the quality of the experience for PSTs, for example, teaching students, interacting with school staff, collecting and assessing students' work as evidence of learning?* *Has the feedback and interaction between teachers, PSTs, teacher educators and principal been adequate in meeting the expected learning outcomes? Which interactions have been most fruitful, which have been less effective?* *What future learning needs could to be considered? What changes would be needed to enable further learning?* *How will the partners respond to feedback?*

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Chapter 7
A Partnership Journey Narrative: The Case of Damtru, Science Teacher Educator

Mellita Jones

Abstract This chapter depicts the journey of establishing and enacting a particular partnership arrangement. It details the roles of lecturer, teacher, pre-service teacher, and school children in the different stages of partnership practice to illustrate how the partnership was established, maintained, and evaluated. The narrative style takes the reader on a journey through the considerations, decisions, and experiences of being involved in a university–school partnership arrangement. The purpose of such a narrative is to provide a rich depiction of how a partnership is "lived" by its various actors. This depiction should enhance the reader's capacity to both interpret and apply the Interpretive Framework set out in this book to his or her own partnership practice, as well as gain some insights into the value and challenges inherent in partnership practices from the perspectives of those involved.

Keywords Partnerships · Teacher education · Pre-service teachers · Teachers Science teacher educators

7.1 Introduction

The driving philosophy held by all members of Science Teacher Education Partnerships with Schools (STEPS) Project team is that supported university–school partnerships are fundamental for meaningful, authentic, and pedagogically sound learning about teaching, both in general, and specific to science. In particular, teacher educators view partnerships as critical to bridging the age-old theory–practice divide that bedevils discourses around quality teacher education. As we have highlighted throughout the chapters in Part I of this book, such a view of partnerships in teacher education is held by a number of stakeholders, including those involved in teacher education policy and review (see, e.g., TEMAG 2014; Department of Education and Training 2018).

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The notion of partnerships is increasingly evident in the rhetoric of institutional and industry-based work practices. This rhetoric is perhaps most notably synthesized and presented in Patrick at al. (2008) government-funded work-integrated learning (WIL) report. WIL is "an umbrella term for a range of approaches and strategies that integrate theory with the practice of work within a purposefully designed curriculum" (Patrick et al. 2008, p. iv). It requires a WIL Placement—a form of learning "that requires the student to be situated in the workplace" (p. iv) and is further described by the authors as "valid pedagogy and as a means to respond to demands by employers for work-ready graduates, and demands by students for employable knowledge and skills" (p. v). As was experienced by members of the STEPS team in envisaging and enacting their own examples of WIL—that is, curriculum specifically designed to best prepare pre-service teachers (PSTs) for their work in school classrooms by situating them in school classrooms for at least a part of their coursework—WIL also recognizes the myriad of ways in which partnership and work-integrated learning can be visualized and enacted.

This chapter explores some of the different considerations and formats in which university–school partnership work might evolve. In achieving this, the perspectives of partner stakeholders are described for the formation, implementation, and evaluation of a quintessential partnership that is drawn from the experiences of the STEPS Project team and reported through the science teacher educator avatar, "Damtru." Reference to the key components of the Interpretive Framework presented in detail in other chapters of this book demonstrates their relationship to Damtru's partnership work. The partnerships informing the STEPS Interpretive Framework were all university-initiated and informed by research drawing on school principal, school teacher, and PST perspectives; therefore, the narrative presented in this chapter is focused on the perspectives of these stakeholders. These perspectives are reported through the eyes of Damtru, in the same way that it is through the collection of evidence by the STEPS team to validate the depiction of the partnership work informing the STEPS Interpretive Framework. Further research into the experience and perspectives of school children, parents, and the wider school community was not a focus of the STEPS Project analysis, so such data is needed to broaden the narrative beyond the immediate stakeholders involved in the planning, implementation, and evaluation of curriculum that privileges the university–school partnership approach.

7.2 A Partnership Experience Narrative

This narrative, showing the unfolding of a partnership between a university teacher educator and local schools, is a compilation of the data generated by the five universities involved in the STEPS Project. It is presented through the five key elements of the Growing University–School Partnerships (GUSP) component of the Interpretive Framework. Each element of the GUSP is considered with respect to the initiation, implementation, and evaluation stages of the partnership work portrayed.

7.2.1 The Aims and Rationale for a University–School Partnership

Damtru, a science teacher educator determined to provide an authentic, meaningful, and effective learning experience for his PSTs, contemplates the odious theory–practice divide plaguing teacher education. In one attempt to address this divide, he implements a micro-teaching approach for half of the course's tutorial sessions. He tasks his students to work in pairs or threes to plan and implement a 30 min science learning activity that reflects the teaching and learning theories and approaches he has covered in the unit. Reading his students' evaluations of the recently completed course, he reviews feedback on the micro-teaching presentations: "I enjoyed this unit. The activities were practical and relevant" writes one student. "It was valuable to practice how to run a lesson of science" writes another. Most responses, in fact, demonstrate a general level of acceptance and satisfaction with the unit and his teaching. And yet, it is the minority of responses that come in the form of criticisms that both interest and challenge him most:

> Tutorials should not have students pretending to be a certain grade level.
>
> It is unfair to expect us to teach as if we were teaching preps. We are teaching uni students not children!
>
> The way our peers interacted in our lessons is not realistic. They had to be cooperative with what we were doing. It isn't the way actual children would respond.

Addressing such reasonable and warranted feedback sets Damtru on a mission to increase the authenticity and relevance of the science teaching experience for his PSTs. The first and most obvious step, he supposes, is that the teaching needs to be situated in school classrooms, with real children. Only in this authentic context will the PSTs experience the authentic response of children to their teaching and only then would they have a credible experience of what it is to teach primary school science. Reading Bandura's (1977) seminal work regarding sources of efficacy information reinforces this as a judicious strategy. Firsthand experiences of success in authentic settings are one of the strongest sources of efficacy information according to Bandura (1977), along with the adjuvant sources: vicarious experience (witnessing a peer's success), social persuasion (encouragement), and physiological factors.

Other considerations Damtru makes as he conceptualizes this classroom-based approach to his teaching is whether to have PSTs plan and teach an activity, a lesson, or perhaps a whole unit of science. Also, should they work with small groups or with whole classes of children: is the key purpose to hone teaching skills and abilities and to question individual children; or is it better to have PSTs practicing their management of whole class science learning? Is there a strategy in which elements of both could be achieved; for example, having a relatively large group of PSTs (say five) work with a class of about 25 children? They could plan a unit of science to achieve continual conceptual development, take turns in leading whole-class elements of an individual lesson, and take responsibility for a small group of children to implement small-group activities and monitor and respond to individual children's learning. Damtru

settles on this approach in order to try to balance the benefits of experiencing whole class and small group teaching.

With his own rationale conceptualized, Damtru is able to articulate the key aims of his proposal to situate at least some of his science education unit in the primary school setting. He sets out to recruit interested schools in hosting or even working collaboratively with his students. Recruitment requires permissions from at least school principals, if not umbrella educational authorities. Email is often a first and easy strategy for such recruitment, although, as Damtru discovers, one must cast the net wide in this type of "fishing" expedition. He finds that only schools that he has previously had some involvement with respond to his initial callout. Even then, they are often only the schools with a particular focus on science. Hence the process of recruitment can be hit and miss.

One of the critical learnings from this, thinks Damtru, is to consider the aims and rationale that different schools might have for engaging in such partnership work. Setting up an initial conversation with school leaders could be a strategic approach to recruitment in order to identify their particular needs and thus shape the experience to be mutually beneficial. Damtru sees evidence of this in the sorts of responses he receives from the schools that agree to be involved. For example, one principal comments: "We're a small school, we need to get our name out there with the programs that we're doing so we're happy to have the relationship between the university and us out there and known through the community." This school is, subsequently, happy with any format for the science teaching, as it is predominantly the publicity about having a partnership that most motivates their involvement. Another school notes that science is "an area that we struggle to cover so when [Damtru] came we jumped at the chance to get involved."

Other schools approached in this early initiation stage of the science partnership program mostly did not respond at all to the invitation. This demonstrated, at the very least, the program needs to be providing something to the schools to spark their initial interest in committing to a partnership. However, with sufficient schools involved, Damtru happily proceeds in working with those that have expressed their interest and embarks on organizing the details of the partnership work.

Over the period of implementation, and indeed after a full iteration of a partnership, it is important to revisit the aims and rationale for each partner. Feedback from PSTs leads to a change in the size of the grouping in Damtru's planning of the PSTs' involvement. "It's not realistic" one PST notes in a unit evaluation. "We don't have four other teachers in the class with us when we graduate—we need to be able to do it all for ourselves." Damtru is concerned with feedback like this as he recognizes that it reflects the wider research stating how low levels of confidence impacts both the quantity and quality of science teaching in primary schools (Freeman 2013; Goodrum et al. 2001). To provide an experience more closely reflecting that likely to be faced once in the profession, Damtru decides to alter the groupings so only two PSTs work with a whole class of children. This should enable some peer support for planning, teaching, and reflecting, but also increase the authenticity of the experience by increasing the teacher-to-student ratio. Drawing on his knowledge of self-efficacy literature, Damtru hopes that this change will better reflect the opportunity for PSTs

to experience Bandura's (1977) mastery source of efficacy information in a way more commensurate with conditions faced by graduate teachers. As such, Damtru shifts his aims and rationale for the program, which is now influenced more significantly by the goal to increase PSTs' confidence to teach science by providing mastery experience opportunities that mirror classroom conditions more closely.

Similarly, over time, schools report an increased level of commitment to the partnership program. One reason for this stems from the increased trust that grows from experiences of success in working with Damtru. This is captured by one classroom teacher's comment:

> I trust that now that I've been three years in the program I know what to expect and I'm not going to be let down and it's going to be consistent, it's going to be educational, it's going to be fun for the children. So I don't have that hesitation. (Classroom Teacher)

In general, increased trust leads to increased take-up within schools, and this in turn often leads to a re-positioning of the school's aims and rationale for being involved. Schools begin to speak of evolving the partnership to better meet their own curriculum planning goals and for enhancing teachers' science professional learning. For example:

> There may have not been the great follow up to start with, that evolved over time and it actually excited our staff and had got our staff talking and thinking about how we can run science in our school and how we can use the university program to better suit our kids and our curriculum. (School Principal)

More formal evaluations with teachers and principals also lead to a change in the aims and rationale for continuing partnership arrangements. For example, one principal speaks of wanting to evolve the partnership by having teachers work more collaboratively with PSTs to experience the planning, team teaching, and reflection on science units, and to use this as more formal, school- and classroom-based professional learning.

The impetus for partnership work, and indeed, its evolution over time, is intrinsically linked to the aims and rationale of partnership stakeholders. Damtru's experience, described above, highlights the need for the clear articulation of one's aims and rationale, and clear communication with other partner stakeholders to ensure opportunities exist for negotiation and compromise to best create a meaningful and sustainable partnership experience for those involved.

7.2.2 Institutional Requirements

Permissions and considerations of various institutional requirements are the next step in initiating a partnership. These requirements can make or break a partnership, and often, perseverance and commitment to the partnership are the only way in which some requirements can be successfully negotiated. Damtru must model creativity, flexibility, and adaptability in this element of partnership planning. His own students

have a university timetable and often part-time work or other outside commitments that they need to honor. What is fair and ethical to ask of them outside of normal class hours? This creates a number of questions including those associated with timetabling considerations. For example:

- Can university science classes be scheduled within the school's normal teaching hours to better enable students' availability to go to a school for the teaching component?
- Should the science program be offered as an after-school activity?
- Could university cohorts be timetabled with one day free of classes each week to allow for school-based course work?

In addition, schools have a range of constraints to be considered such as, lunch and recess times, specialist programs, camps, sports days, set assembly times, and other commitments that may restrict their availability. Indeed, timetabling requirements for each institution is one of Damtru's most challenging constraints. "Timetabling I think is a real issue because it has negative impacts on other units" states one teacher educator. Also, "sometimes schools will agree to have [PSTs] come in but then Grade 5 will be out on camp and they'll have sports day" (Teacher Educator), so being adaptable to changing needs as they arise becomes important as the partnership is implemented.

Damtru decides to manage the timetabling issues by collecting information from schools early in the school year. This information includes details about the length of the school day, grade levels to be included, lunch and recess periods, and other timetabling considerations that arise in each institution. He uses this information to inform his own timetabling requests at university. Most of the time, this forward planning enables coinciding school and university periods to be created and thus enables PSTs to spend some of their science university course schedule in the school setting.

Another requirement of Damtru's institution is concerned with the more traditional block practicum placement periods, which, his university warns, are already difficult to come by and cannot be compromised by schools' involvement in these science-dedicated programs. Damtru needs to secure an agreement that the schools will still be willing and available to participate in these other important university–school partnership needs. In addition, there is no funding to pay classroom teachers for supervision of PSTs for the science program. This means that teachers need to be willing to host PSTs without the financial benefit that is usually accorded to the teacher or the school in the block placement periods. Alternatively, Damtru could try to ensure he is the supervising teacher in the classroom, freeing the classroom teacher from all responsibility. This would require his PSTs to be all working with the same class, so he is able to be present—an Australian legal requirement for un-qualified teachers working in schools. A further alternative is that the classroom teacher maintains supervision and responsibility for the students, but the teacher educator maintains responsibility for the PSTs. Damtru decides to ask if teachers would be willing to host PSTs in their classrooms, particularly if the assessment and

reporting expectations of a supervised teaching round are removed, and they are there only for the legal supervision requirement of the children. This does not present a problem for Damtru's planning. As teachers willingly host the PSTs, many become involved themselves, if not actively in the planning and teaching, then at least in providing PSTs with informal feedback.

In addition, he thinks, he could offer a source of school and classroom-based science professional learning which could occur through their involvement. This leads Damtru to important planning considerations around relationships, and the nature of the roles that different members of the partnership might adopt.

7.2.3 Relationships

In negotiating the details of the partnership arrangement, Damtru works closely with the classroom teachers who have elected to be involved. His hope is that classroom teachers will be directly involved in the teaching experience, and perhaps even the planning and reflection processes as well. In this way, Damtru sees the partnership as highly collaborative, and potentially, a source of science professional learning for practicing teachers and PSTs alike. After all, he thinks, the literature claiming the low confidence and abilities of primary school teachers across the board is quite well established; and in addition, partnerships that are collaborative in nature are considered to be both effective and sustainable (Kruger at al. 2009). He offers his proposal to the schools involved, outlining how the roles of the classroom teacher and PST could be closely aligned: planning together, team teaching, and reflecting together. He offers his own expertise to provide advice and feedback throughout the experience, and to assist in accessing and learning to use relevant science equipment, an issue that is often key in teachers' avoidance of teaching science (Jones and Carter 2007). He also notes the professional learning opportunity he himself would have in working in such a collaborative "triadic" manner, keeping abreast of strategies, ideas and issues that are current for teachers in the school and classroom.

Early in the partnership negotiations, there is reluctance, revealed through the silence and lack of uptake of Damtru's collaborative partnership idea.

> I can't see us getting the time to plan with the students first of all especially in this school because we wear so many hats. So I really couldn't see that happening because how would we accommodate that. (Classroom Teacher)

Damtru initially saw the potential for his proposal to be an opportunity for transformative learning experiences for those involved: classroom teachers, PSTs, and, of course, school children. The initial iterations of the partnership approach were, however, more akin to what Furlong et al. (2000) describe as "complementary," that is, characterized by a lack of joint responsibility between partner members, and more so by an inclination toward "service provision" of one partner for the other. This manifested by the schools providing access to classrooms and children, and the university

providing science curriculum delivery. For example, one principal commented how the university provided

> Some expertise in the teaching of science, [and] covered our quota on our curriculum for science and it kind of up-skilled our staff on what to do and what to look for and how to run science lessons. (School Principal)

Partnerships characterized by this service-provision type of approach have been described as "Connective" by Hobbs at al. (2015). In addition to being service-oriented, connective partnerships also tend to be short-term rather than ongoing and managed within the existing structures and requirements of each institution. This is certainly the way in which Damtru's partnerships with schools began. With multiple iterations, however, time enabled experience with, and trust in, the partnership to grow. This led to partner members thinking about ways to evolve their roles and change the nature of the relationships to ones that were more collaborative. Such ideas tended to stem from principals in particular. For example,

> the ideal blue sky would be that teachers and the [PSTs] would actually have that real time together to do some more planning and organising and sharing of ideas. That they somehow would see themselves more as a collaborative partnership, that I think for us as a school it would be really good for us to really talk with and develop our teachers as mentors but not as owners of the knowledge but how do we explore with these new people so that both of us grow. (School Principal)
>
> Sometimes I think there's a disjoint, that's it about, there's not enough time to collaborate and to come to shared ideas … (School Principal)

As noted, it is the development of trust over time that eventually leads to increased uptake of both the science program in general and the collaborative professional learning specifically. This leads to increased levels of collaboration, dependent on the individual classroom teacher or school involved, that falls somewhere on the continuum between complementary and collaborative. Some later iterations of the partnership reveal feedback such as

> It's this mutually beneficial model which again prepares our teachers, it's not just about me in my classroom it's about the broader. (Teacher Educator)
>
> I actually worked collaboratively with my [classroom teacher]. There were three other Grade 5 teachers so I worked with them for the brainstorming, they talked about stuff that they had done in the past and I was able to bring some of what I had and what I knew, sort of things from my own background so we sort of designed it together. (Pre-service teacher)

This evolution of partnerships, defined by the changing nature of the relationships between partner members and the roles that they gradually take on over time, is indicative of a growth model. It suggests that while partnerships might begin as "connective," they can also be "generative" in that with time, new and different opportunities are generated through ongoing work together. Sometimes they even evolve into the initial transformative ideal that Damtru had in mind, whereby classroom teachers and PSTs experience mutual professional learning.

> Every time you're watching them you're rethinking 'God I should be doing that' and no matter how old you are or how long you've taught it's changing all the time, there's always new stuff that you can be doing. (Classroom Teacher)

> Well it's affected my learning positively because you get to see what student teachers are doing well and you reflect upon your own practices by doing that and also you get to learn a bit more about specific science areas and how it's all divided up and that sort of thing. (Classroom Teacher)

One teacher even comments that their whole school does their yearly calendar planning around when the science program occurs. They also develop their curriculum inquiry-topics for the particular school term to align their aspirations for the science teaching. Going to these sorts of lengths is indicative of the long-term thinking that the partnership engenders, and of the extent that it is planned and catered for in the school program.

Initially, Damtru experienced disappointment in his lack of success in establishing transformative partnerships with schools, whereby all partners would engage actively in the partnership as a form of professional learning, collaboratively planning, teaching, and reflecting with one another. Over time, however, he witnesses the importance of establishing strong and trusting relationships, and he came to understand that these relationships grow out of experiences of success and knowledge of one another as committed and reliable professionals. Relationships, hence, are critical in determining the nature of the partnership, and with strong and trusting relationships, greater creativity and innovation can be attempted, all which impact the nature and quality of learning for everyone involved.

7.2.4 Nature and Quality of Learning

With an adequate number of schools recruited and enough PSTs to cater for each classroom, Damtru begins to think of how he will refine the teaching, learning and assessment in the course to suit the negotiations that have taken place in establishing the partnerships. Important is his need to honor the underpinning principles of personal and social constructivism (Vygotsky 1978) that informs his pedagogy. He begins by revisiting the goals of the unit and how the school partnership experience will assist his achievement of these goals. Following the "backwards design" process adapted from the principles of *Understanding by Design* outlined by Wiggins and McTighe (2011), he considers the evidence that would be needed to demonstrate the achievement of these goals. This leads to his planning of how to tie the in-schools experience with assessment in the course. Principles of quality teaching guide educators to create meaningful assessment that is constructively aligned to teaching and learning processes (Biggs and Tang 2011). For Damtru, this makes the integration of the school experience and his students' assessment an important aspect of the course design. Damtru knows that with the model he is implementing, of multiple pairs of PST each working with a whole class of children, and teaching at the same time, he will not be able to assess PSTs' actual science teaching. He decides, instead, to design the assessment around: (a) the students' planning of a sequence of science lessons, a mini-unit; and (b) their reflection on children's learning and their own science teaching practice.

Another key principle guiding his pedagogy includes his vision for meaningful and authentic teaching and learning interaction between his PSTs and the children in schools. He also views his own role as an expert facilitator as important, both in the planning stages and to guide critical reflection after weekly teaching experiences. This makes the concurrent nature of university-based, theoretical learning and school-based, practical application an important feature of the design. This, Damtru believes, would provide the best opportunity for his PSTs to understand and integrate theory and practice, and for him to scaffold and support meaningful reflection on their experiences. A further key principle to which Damtru is committed is that the planning and teaching of the science needs to be sequential: a series of conceptually connected science lessons rather than a suite of "bubble and fizz," "one-off" types of experiments. While the latter of these is known to be fun and engaging, it would not contribute to the development of children's science conceptual understanding. For this reason, Damtru wants to ensure his PSTs develop their skills and knowledge in planning a unit of work.

While unit planning can be, and commonly is, used as a form of assessment in curriculum pedagogy units, the commitment to the partnership in this instance is to also ensure opportunities for authentic implementation of unit plans and subsequent opportunities for critical reflection on practice. The desire to create meaningful theory–practice links and to build PSTs' confidence to teach science is also key drivers of the approach. Feedback from PSTs indicates the success of the university–school partnership in achieving these goals. For example:

> This has been the only subject where we've been explicitly able to put those things into practice and we've had the okay from our teacher to support us and a mentor. (Pre-service Teacher)
>
> You work with a partner like a real teacher—you're working with someone else to plan our unit. We hadn't planned a science unit before so that was great to be able to know how to do that and when I go into teaching I'll know how to do it. I've actually gone into a school and delivered a science unit. (Pre-service Teacher)
>
> So I think it's opened my eyes to the wonderful things that you can do through science and it's made me feel more confident approaching it in a school setting; and honestly much more excited about teaching science. I'm certainly not hesitant anymore I'm ready to do it and I've already got lots of ideas yes it was a very … really positive experience of science teaching and learning; I think without the amount of experience that I had I wouldn't be able to meet the needs of the students like I'm able to now. (Pre-service Teacher)

Classroom teachers also witnessed the growth in PSTs:

> I liked seeing the student teachers and you could actually see them gaining confidence each week. (Classroom Teacher)

In addition to their observations about PSTs' growth, teachers also noticed the level of enthusiasm and learning the children experienced. One school dealing with particularly disengaged children commented:

> Look at these children; these are children that are not confident, they're not confident about their learning. Yes they're making a ramp, a skate park for their skate boards, so of course it's a boy thing too, but they loved it and there was a lot of science happening there because they

> have to talk about forces, anything and everything. Those children as I said to you are not confident, yet they were just so engaged and so excited and just chatted about it. (Classroom Teacher)

Other comments characteristic of the learning children experience reflected the quality of learning due to the sequential nature of the teaching, the nature of the questioning and investigating, and, similar to the example above, the way in which children who were not always necessarily engaged in their learning had a newfound interest in the science experience. For example:

> The lessons were really sequential and built up the children's knowledge and they had fantastic practice and really engaged the children and the children learned so much as well. It wasn't just coming in and doing a science experiment it was lots of thinking behind it. (Classroom Teacher)
>
> The whole thing is to get kids to drive their own learning and they do that by asking questions and we might not know the answers so 'alright where can we find that' and off they go and start looking and 'that finds us to another thing' and 'well why does that happen' kids are just engaged. (Classroom Teacher)
>
> I got to see what I didn't know about quite a few of the kids … one little boy whose literacy is very poor but was so engaged and listened and focused and I hadn't picked up that interest before. (Classroom Teacher)

Moreover, the learning of PSTs from the integrated approach to theory and practice was widely recognized as contributing to quality learning about teaching. Teacher educators, classroom teachers, and PSTs themselves all noted the effectiveness of the partnership approach to their learning. Elements of theory–practice and the immediacy of the practice due to the concurrent model were important factors contributing to the level of learning:

> It's really important for them again it's that practicing teaching, it's not just learning the theory and learning about it in a classroom with no context they can actually go out and do what I've been asking them to do and practice what I've been preaching as such … So it really is bridging that theory/practice gap because it's easy to learn about assessment in a lecture or a tute but then how do you actually put it into play in a classroom with lots of kids. (Teacher Educator)
>
> We follow this pattern, two days in schools followed by three days in university on campus studies for about eight or nine weeks and then the block. So there's a very immediate application of the theory to the practice and the practice to then inform and interrogate I guess the theory to substantiate the theory. (Teacher Educator)
>
> You could see progression of their teaching it moved because of the way they communicate with the kids, they were much more comfortable, I know at the start they were very nervous and very structured whereas towards the end they were just flowing, they knew what they had to do, they knew the kids, they felt comfortable. (Classroom Teacher)
>
> I think it was a fantastic way to integrate the theory and research into best practice science teaching by actually planning, implementing and assessing a science unit within school environments. (Pre-service Teacher)

Feedback akin to this from classroom teachers, principals, and PSTs demonstrated to Damtru the overall success of the partnership program in achieving quality learning experiences for everyone involved. Although, it is also important to note that quality is not a guaranteed outcome of the partnership. Success is dependent on partner members being committed to the various actions associated with their roles.

7.2.5 Commitment to Action

Regardless of who instigates a partnership, or how connective, generative, or transformative it might be, everyone involved in a partnership has to be committed to some form of action. Actions throughout periods of negotiation, implementation, and evaluation are all important for success and sustainability of partnership work. It is also through a commitment to action that a common understanding of the partnership goals, processes, and outcomes is achieved between partner members. Further, commitment throughout all phases of the partnership work, initiation, implementation, and evaluation, enables practice to shift when and as needed. Only through commitment to action does the partnership experience growth and sustainability, as it is through such commitment that trust, respect and responsiveness is achieved.

As initiator of the partnership, Damtru firstly commits to recruiting a sufficient number of schools and classrooms to cater for his PSTs. He also commits to the negotiation of the partnership, adapting his initial ideas for the partnership to incorporate the needs and goals of the schools involved. Schools also think about their commitment to the partnership, and more broadly to the profession when considering their involvement:

> I think it's part of our commitment to pre-service teachers, I think it's a quality training ground for them, we like to support student teachers. (School Principal)

Once instigated, everyone maintains their commitment to the roles they have agreed to take on. While the partnership is in its implementation stage, Damtru monitors his PSTs to ascertain their learning needs and provide support where needed. He also ensures that PSTs themselves are committing to the partnership so as not to let the school down or compromise children's learning. This involves discussions with the PSTs and classroom teachers throughout the teaching period. It sometimes also includes discussions with the children to ascertain what they are learning through the experience. Classroom teachers are committed, if for no other reason than a legal one, to remaining in the classroom for general supervision purposes. However, due to the vocational nature of the teaching profession and the sense of responsibility most teachers have, they tend to further commit to providing PSTs with feedback on planning and teaching, and often assist in more direct ways during the teaching, particularly when there are children with particular learning needs. Evaluation practices further enable these aspects of partnership monitoring to be reviewed and refined over time. One teacher educator reflected on the various levels of commitment needed to make the partnership successful:

> So, at the school's end they've got to be committed, they've got to at least acknowledge it and want to do it. From the University end the university has to put in place or has to have in place the administrative support … The Lecturer has got to know what they're doing … The [PSTs] also have to be prepared to do it because there will be those who fail because they don't want to put in that kind of practice. (Teacher Educator)

Commitment to action is all-encompassing once a partnership is formed. The partnership's success is dependent on the actions that all partner members take. Ultimately, when these actions are in the best interests of the children's learning, then commitment and success follow naturally.

7.3 Conclusion

Damtru's journey through the establishment, implementation, and evaluation of a university–school partnership for the purpose of achieving quality science education for children and quality science teacher education for PSTs depicts the challenges, compromises, and the success of this sort of partnership work. There are many different forms of partnership, and the one depicted here shows but a modest level of the thinking and conceptualization needed to enact a successful partnership through its various stages. Regardless of the particular structure of the partnership, the types of thinking, decision-making, and processes reflected in Damtru's journey through his own partnership experience are likely to be similar.

The narrative of Damtru's partnership journey reflects aspects of initiation, implementation, and evaluation. It demonstrates the challenges in firstly, settling on a structure that best reflects "ideal" practice, whatever that may be, and then the modifications that might be needed to balance this practice with the needs and goals of partners. Despite the challenges that partnership work presents, Damtru's journey also highlights the overarching benefits of persevering with partnership work in the teacher education context. The work-integrated learning (WIL) approach (Patrick et al. 2008) ensures that the theory–practice predicament in teacher education is successfully and comprehensively addressed. Moreover, the quality of the learning experience was noted by teacher educators, principals, classroom teachers, and PSTs alike. PSTs felt prepared and rewarded by their experiences of planning, implementing, and reflecting on a unit of science, and teachers noted the depth of learning and engagement of children.

The narrative of Damtru also reinforces Bandura's (1977) notion of mastery experience as a powerful source of efficacy information. This was reflected in the widespread success of the experience of teaching science in schools in increasing PSTs' confidence in their ability to teach science. With the work of many self-efficacy researchers indicating the relationship between self-efficacy and the decision to be involved in particular activities, and even, for teachers, the selection of particular pedagogies (e.g., Bandura 1977; Goddard 2003; Jones and Carter 2007), the positive influence of the university–school partnership for science teaching is an important one

that, hopefully, goes some way to alleviating the poor reputation and long-established paucity of quality science teaching in primary schools.

The STEPS Project was an initiative of science teacher educators pursuing quality science teacher education for PSTs, which, ultimately stems from a concern for quality teaching and learning practices of science for children. The research design saw data collected from teacher educators, school principals, classroom teachers, and PSTs. This has limited the nature of the narrative that can be offered to one from the teacher educator's (Damtru's) perspective. Further research into narratives from other stakeholders including children and parents would benefit the field and provide more in-depth considerations into the effectiveness of university–school partnerships both in general and specific to science education.

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Chapter 8
Growing Through Partnerships

Linda Hobbs and Coral Campbell

Abstract While partnerships in teacher education are essential for ensuring adequately preparing teachers, the effects of these partnerships are difficult to capture. The STEPS project analysed five models of a school-based approach to teaching primary science education. These five partnership models were developed to give pre-service teachers a supported, authentic experience of teaching science to school children. The effects of these teaching opportunities for pre-service teachers are explored in this chapter as "growth": where growth occurs, how this is evidenced, and what is needed to enable growth. A series of vignettes documenting the experiences of pre-service teachers, teacher educators, teachers and principals were developed from interview data, from which a series of themes emerged. A meta-analysis of these themes revealed some common elements across the vignettes that seemed to mark the professional growth of the various stakeholders in terms of shaping their identity and confidence, praxis and relationships. Growth must be evident, measured and documented if the effort to initiate and maintain such partnerships is going to be worthwhile. The question of how to measure growth occurring as a result of partnerships is interrogated in this chapter through the use of data and is linked with current research literature. A growth model is presented, as is an accompanying set of variables that can be used to measure the effects of education-based partnerships.

Keywords Partnerships · Evidence of growth · Science teacher education
Interpretive framework · Primary science · Pre-service teachers
Identity · Confidence · Praxis · Relationships · Enabling growth

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8.1 Introduction

As has been shown in Chap. 1, the discourse around partnerships in education, and especially partnerships between universities and schools, is firmly rooted in their promise of bridging theory and practice through praxis. Praxis enables a practitioner to transform their teaching practice from an enactment of skills and processes to a reflective enactment of theory into practice. The STEPS project represents five examples of partnerships between universities and schools to provide pre-service teachers (PST) with an authentic experience of teaching science that links theory with their developing sense of science teaching practice through ongoing reflection. The focus is principally on PST growth, rather than on the benefits for the members of the partner schools per se. However, these school-based experiences also offer benefits for schools. In addition, school-based approaches to science teacher education offer different learning experiences to the typical classroom; the type of growth and the variables used to measure growth are not the same.

The term "growth" is preferred to the more specific term "change". Growth implies a pathway of development where there is a building on, extension, broadening, or increase in complexity. Change, however, implies a more specific shifting in direction or form and may also be part of growth. In a sense, growth respects the entry point in a way that change does not. Each of the PSTs—and the partner school teachers—undertaking these school-based experiences brings with them prior experiences, attitudes and knowledge in relation to science and teaching science. These prior experiences provide the foundation for future experiences (Dewey 1938), shaping and even directing our attention to certain things in an experience. As these entry points (i.e. their prior experiences, attitudes and knowledge) are individually determined, it follows that each person's growth through an experience will also vary. In this chapter, we propose a growth model that enables exploration of the growth of PSTs during school-based approaches, as well as how the partnerships with schools create this environment of growth.

This chapter explores the growth that can occur as a result of these types of partnership arrangements, and asks the questions:

- What variables can be used as evidence of growth during partnerships?
- What types of growth can occur for PSTs? and
- How can partnerships create an environment for growth?

Through examination of the interviews with PSTs, other teacher educators, the STEPS team, and the school teachers involved, we identified a number of variables that appeared to be markers of PST growth, namely identity, confidence, praxis and relationships. Vignettes and descriptions of common experiences and ideas are used to illustrate growth against these markers.

The chapter begins by looking at how growth has been measured and depicted in teacher education, especially in relation to partnerships. Much of the research in this space has focused on the formal practicum arrangements; these are to be distinguished from the school-based approaches to teaching the content of courses and units, which

is the focus of the partnerships and activities reported in this book. The next section draws on current literature to identify how analysis of such partnerships has focused on certain variables in order to provide evidence of impact.

8.2 Effects of Partnership Programmes—Whose Growth? Whose Practice?

What evidence can be used to foreground the effect of partnerships on growth? There is much advocacy for partnerships in education, although there is debate on the most effective models for preparing teachers (e.g. Darling-Hammond and Bransford 2005; Ure 2009) and how such models can promote continuing professional learning for the teachers involved. This debate hinges on the proportion of university to school experience that is deemed most effective for the schools and universities involved (Donaldson 2011). While educationalists and governments are positioning partnerships as being key to the successful preparation of teacher-ready graduates (House of Representatives Standing Committee on Education and Vocational Training 2007; TEMAG 2014), precise tracking of the effects of such partnerships is not clearly defined in the literature. While there is broad agreement about the nature of effective partnerships (e.g. Darling-Hammond and Bransford 2005; Kruger et al. 2009), and the assumed positive effects of partnerships on PST readiness for the profession (e.g. TEMAG 2014), what evidence is there of these effects? As indicated in Chap. 2, much of the research and commentary on university-school partnerships and their effects on PST development centre largely on exploring the nature and effects of the formal practicum and its many formats. Some formats include the clinical model focusing on clinical investigation and remediation translated from medicine to education (see, e.g, Redman 2014); models focused more on "praxis and enquiry" (e.g. Hooley 2011); professional development schools in the United States (Darling-Hammond and Bransford 2005; Goodlad 1993; Walsh and Backe 2013); "School Centres for teaching Excellence" involving universities working with clusters of schools (Rowley et al. 2013); and opportunities for PSTs and teachers to collaborate (Jones 2008). In recent years, some of the models of practicum have moved towards university–school partnerships that have benefit not only for PSTs but also for the school teachers. For example, Walsh and Backe stated that initially the professional development schools in the USA had the needs of the university as the primary impetus, but more recently, the focus has shifted to the schools' needs. In Australia, Lynch and Smith (2012) compared the benefits of a traditional practicum with one where there was greater collaboration with teachers so that there was a joint strategy for preparing teachers as well as "ongoing professional development of the teaching profession" (p. 134). Such partnership arrangements would be considered generative or even transformative (Chap. 5) if the effects are far-reaching within the school and university, embedded and sustained.

While this chapter is not exploring benefits for teachers, the environment at the school and the attitudes of the teacher and school leaders influence the conditions within which the PSTs operate and develop their own practice. How this environment enables growth is critical for understanding not just the growth that has occurred, but also how to maximise the potential for growth. The partnerships explored in this book are alterative models of unit instruction rather than alternative approaches to the practicum. Because limited research has actually explored the learning gains for PSTs in these types of partnership models, the variables used to examine the effectiveness of the formal practicum can be useful in identifying the markers for growth in our partnerships.

A number of studies are used to ascertain how other research projects have evaluated other types of partnerships between universities and schools, mostly those associated with formal practicum arrangements. Much of the data collected relies on self-report, perceptions, and post-reflections on experiences from graduate teachers rather than as PSTs. PSTs/graduate teachers, teachers, school leaders and teacher educators feature across the studies, depending on the focus of the analysis. A number of variables are used across these studies of the formal practicum that measure growth for PSTs, and the environment needed to produce growth. Measures associated with PST growth or change included the following:

1. Perceptions on knowledge and skills gained to face responsibilities of being a teacher (Rowley et al. 2013)
2. Knowledge and understanding required by teachers, including perceptions of teacher readiness (Lynch and Smith 2013; Rowley et al. 2013)
3. Teaching ability, classroom skills and skills beyond the classroom (Lynch and Smith 2013; Rowley et al. 2013)
4. Feelings of being part of a school community (Rowley et al. 2013)
5. Conceptual and practical links between university content and needs of classroom practice (Lynch and Smith 2013).

Items 1, 2, and 3 relate to the expertise a teacher needs to be teacher-ready; these can be examined through PST confidence, self-efficacy and other judgements of capability. In Rowley et al. (2013), for example, perceptions of the effect of the experience on development of the teacher standards were measured using a questionnaire. Item 4 relates more to relationships within the school and positioning as a teacher, which can provide some insight into PSTs' developing identities. Item 5 refers to bridging the gaps between theory and practice, encapsulated in the notion of praxis where there is reflection on theory and practice.

Measures associated with the environment needed for growth included: the quality of provision schools were able to make for PSTs (Rowley et al. 2013); communication processes (Lynch and Smith 2013); logic of the programmes, roles and functions (Lynch and Smith 2013) similarly to what is represented in the GUSP in Chap. 6; and varying types of relationship (similar to the RPP in Chap. 5), including degree of input of and outcomes for teachers within the programme, and sharing of resources such as expertise and facilities (Kruger et al. 2009; Lynch and Smith 2013). These

environmental qualities and processes differ depending in part on the nature of the partnership and are not only relevant to formal practicum arrangements as described in these publications, but also to less formal partnerships as was the case for most of the models described in this book.

In the next section, we outline the process we undertook in identifying the key variables that are captured in the growth model proposed in this chapter.

8.3 Looking for Evidence of Growth

Following development of the GUSP (Chap. 6) and RPP (Chap. 5), a series of analyses were used to understand the outcomes for the different stakeholders—PSTs, school teachers and principals, teacher educators and course coordinators. Chapter 2 outlines the methodology used to generate the data. From the analysis of the interviews with the various stakeholders, we constructed a series of vignettes that captured key themes emerging from the data. The vignettes were written to highlight the key findings that might be most relevant for the different stakeholder groups, and which had been emphasised through a number of dissemination and feedback events at conferences, workshops and surveys. For example, some of the key messages that were highlighted were how to make the partnerships components of the models work, how to promote the partnership to schools, and the value of the learning experiences for PSTs and for teacher educators who want to make authentic links between theory and practice. These ideas became themes, which we used to categorise the interview transcripts. Vignettes were then prepared as:

- Vignette 1: Messages for teacher educators focusing on partnerships and relationships, emphasising trust and reciprocity, risk-taking, communication and feedback;
- Vignette 2: PST experiences focusing on shifts in confidence, learning to understand and teach science, and valuing the teaching of science;
- Vignette 3: Teacher educator perspectives on integrating education research into practice, emphasising the need for primary science education and the affordances of the school-based model; and
- Vignette 4: School perspectives on their expectations and outcomes of having strategic relationships with the university.

The full vignettes with links to the data can be found on the STEPS website (Hobbs et al. 2015). The next stage of analysis was to examine the key variables, or markers, for PST growth emerging from the vignettes. We found that teacher educators and PSTs talked about changes in *identity* and *confidence*, the need to develop the capacity to work in *relationships* with various people, and growth in their ability to learn, plan, teach science and then reflect on their science teaching (*praxis*) (particularly in Vignettes 2 and 3). Teacher educators made observations of the value of partnerships for growth in these areas (particularly in Vignette 3), and schools observed the benefit of these partnerships in terms of the relationships

that can arise (particularly Vignette 3). PSTs identified the value of the learning experience in helping them work with others and develop relationships with their peers, the students, the teachers and their teacher educator (particularly Vignette 2).

In addition, survey data using pre- and post-items relating to *confidence* levels highlighted where growth had occurred (reported also in Herbert and Hobbs 2018); given that confidence is one of the biggest barriers for PSTs (Howitt 2007), we identified this as a key marker for growth. Confidence is a pre-condition for identity development, so they are invariably linked, however, changes in confidence may not necessarily result in identity changes. Four variables were therefore identified as useful for providing evidence for PST growth: identity, confidence, praxis and relationships. We have named these the "loci of growth".

We were also interested in what conditions were needed to enable this growth might occur. From the vignettes, *communication* was seen to be essential, as was the careful *coordination* of the programmes so that all partners were aware of their roles, purposes and timing of events. Articulating how the teachers, teacher educators and PSTs *collaborated* was also important. These characteristics were evident in Vignettes 1 and 4. Coordination, collaboration and coordination were therefore regarded as being enablers of growth; that is, they provided the conditions needed for growth to occur.

Personal and professional development was evident as changes in behaviour, improved *expertise* and changes in *attitudes* and *values*. These were particularly evident in Vignette 2.

In the following sections, we provide evidence against each of the loci and enablers of growth to illustrate, both the effect of the school-based approach to teaching primary science education during initial teacher education courses, and how important each of these components is when conceptualising growth in relation to university–school partnerships. We draw on the vignettes, and survey and interview data, to show growth against these loci, and how the enablers of growth provide the conditions for PST growth. At the end of each section are summarizing points that are collated into table in the discussion that can be used as variables for examining growth in university–school partnerships. We then look at the relationships between these constructs and pull them together into a growth model in the discussion.

8.4 Loci of Growth

Each of the four loci identified is described below using the literature to provide a theoretical framework as well as data to show the growth of the PSTs.

8.4.1 Identity

According to Gee (2010), identity development occurs as a teacher recognises themselves as a certain kind of teacher; this occurs as they interpret their common everyday experiences. Primary science education units or courses could be characterised as inducting PSTs into the practices of the primary science teacher, although, recognising that primary teachers are usually generalists in Australia, they generally do not identify as subject teachers like secondary teachers. Therefore, growing a science teacher identity perhaps places the learner at the intersection between the developing teacher and subject. This is in keeping with popular mythology of the primary teacher as teacher of students and the secondary teacher as teacher of the subject. In her discussion of the process of identity development for a subject teacher, Hobbs (2013) identifies the critical role of participation in what Gee (2010) calls the "big D" Discourse of what it means to teach that subject[1]:

> Professional identity develops not just through this participation but also through the interpretation or recognition of that participation by self or others. Teachers' sociohistorical interactions with their subject equip them with competence and confidence in their teaching. (Hobbs 2013, p. 275)

Discourse here refers to the "ways of combining and integrating language, actions, interactions, ways of thinking, believing, valuing, and using various symbols, tools and objects to enact a particular socially recognisable identity" (Gee 2010, p. 29). Primary PSTs are less likely to identify positively with the Discourses associated with science teaching, partly due to lack of opportunity to practice; however, through school-based experiences where they can observe and create environments for student engagement with science phenomena and ideas, they are more likely to begin to recognise themselves participating in this Discourse. This participation can potentially broaden a teacher's view of themselves as a teacher who can, indeed, enjoy, value and be competent in learning and teaching science. Through such experiences, the PSTs can begin to develop what Ibarra (1999) calls provisional identities which they can try out and potentially carry with them into their teaching career. Beauchamp and Thomas (2009) identify the close relationship between role, identity and notions of self, and they charge initial teacher education courses with the task of providing experiences that are conducive to developing new or expanded identities:

> One must struggle to comprehend the close connection between identity and the self, the role of emotion in shaping identity, the power of stories and discourse in understanding identity, the role of reflection in shaping identity, the link between identity and agency, the contextual factors that promote or hinder the construction of identity, and ultimately the responsibility of teacher education programs to create opportunities for the exploration of new and developing teacher identities. (p. 176)

Two student experiences are used here to illustrate the potential of these experiences to build confidence and enrich PSTs' understanding of what it means to be a learner and teacher of science. Erin's experience encapsulates how success can

[1] As distinct from 'lower d' discourse referring to the general way we talk about something.

lead to increased confidence and affirmation of her ability to translate a passion for science into the classroom. Erin's vignette is an adaptation of a case study presented in Hobbs and Kelly (2016) that highlighted the important links between knowledge and passion when developing a science teacher identity. Katy's vignette illustrates the power of the science teaching experience to both raise science as a powerful context and stimulus for learning, for her and her students.

Erin and her partner planned and implemented a unit on sustainability. Erin explained that she disliked science at school, but was turned onto science while completing VCE where she was inspired by her study of Biology. She took her love of learning science into her teaching degree:

> So I got a real passion for wanting kids to understand how good science can be because I don't think it's taught enough in primary schools and it's not taught in a way that's interesting for them. There can be a lot of writing or a lot of just learning definitions and things like that so I guess I have a lot of passion for kids to want to learn why science is so interesting and why we should learn it instead of just that it's another thing that we have to learn. (Erin, PST, UTas)

Evident also in the above excerpt is Erin's desire for children to know the value of science takes on a pedagogical dimension as she draws on her own learning experience during the school-based science teacher education unit to shape the learning of her students.

Erin recognised that her passion for science and teaching science was not initially felt by her peers, who "didn't get involved in it" to begin with; however, with time, she noticed that the pedagogical motivation that comes from seeing students getting excited through hands-on activities made it "more exciting" for her and her peers: "it was fun when we were doing models and things like that where they would come out and they'd all "ooh aah" about what we were doing and ask questions". Such responses from the students were fundamental in shaping her positive response to the experience. The students were demonstrably stimulated during the hands-on experiences and gave them thank you cards with comments about "what they'd enjoyed about the experience with us and how they'd learned more and that they thought that it was really cool and hands-on and they loved it". Such feedback from the students affirmed Erin's (and her peers') ability to plan engaging and effective learning experiences in science. Erin was proud of their achievements with the unit.

While Erin's critical turn towards science preceded this unit, the school-based teaching experience provided an opportunity for shifting her passion for learning science to a passion for teaching science, with affirmation that she can do it effectively.

Katy and her partner taught a unit on "mini beasts" to a small group of prep students. The class was an open-plan classroom, so they combined with another teaching team that occupied the same space to plan and implement the unit. In comparison to Erin, Katy highlighted the change she had gone through in the way she sees herself in relation to science. She came to this unit with a history of poor exposure to positive experiences of science, feelings of low self-efficacy, and low levels of engagement and probably interest. In the following she reflects on the relationship between attitudes (mindset) and ability:

> Yeah definitely I think, myself as a student, I don't have much memory of science in primary school and I think when I got to high school I'm not sure that I ever felt like I was good at it, like it wasn't one of my strengths and so it probably didn't engage me as much as it does now. I think I have a lot better understanding of how your mindset towards a certain subject area really impacts on your ability to learn in that subject area. (Katy, PST, ACU)

She valued this experience of teaching science to students, and being supported by the teacher educator to integrate science with other subjects and inform her practice with some helpful theories. She found this an eye-opening experience, raising the possibilities of science as providing worthwhile learning experiences for students. Positive experiences led to a growth in confidence, which further led to new ways of seeing herself as, no longer just a learner of science, but someone capable of enacting theory-informed, integrated curriculum in a way that "suits my educational philosophy"; the role of teaching science is finally seen to resonate with what she holds sacred:

> As I mentioned looking at the best practice I learnt from the research around science education, like SIS or POLT[2] or the 5E's,[3] there's two that are slightly different models but I think definitely because I think it was really nice to do that unit in a really quite constructivist manner which really suits my educational philosophy. It's my instinct to integrate subject areas if I have the choice anyway just because that's the way that I, I don't know, I feel like you can go deeper into it if you're incorporating multiple curriculum areas. So I think it's opened my eyes to the wonderful things that you can do through science and it's made me feel more confident approaching it in a school setting… You never hear about science achievement and I suppose maybe that's one of the reasons why it gets a bit neglected. So I guess it showed me how easy it was, not easy but how important and how rewarding and valuable it is not only for the students and learners but also myself as a teacher and a learner. Yes to really try and create something fun and engaging in an integrated way.

Katy's critical turn occurred when she saw how "rewarding and valuable" science could be for her as a "teacher and a learner". Her provisional identity as a teacher who can teach science is bound up in her increasing capacity to integrate and teach in a constructivist manner—alignment of beliefs (science as valuable and fun, best practice teaching as constructivist and integrated) play a strong role in shifting her attitudes towards science, and this has set the foundation for her provisional identity.

Both vignettes illustrate the power of teaching science to students to change the way PSTs see science—*seeing science through the children's eyes.* Such a shift in perspective arises out of a pedagogical commitment, a desire to grow as a teacher and be able to positively impact the learning of students. For Katy in particular, teaching science successfully and observing her students' learning reshaped the residue of her (somewhat negative) experience of learning science to position science as valuable and her as empowered and inspired by the potential of science to engage her charges.

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[2]The Science in Schools (SIS) Project, reported in Tytler (2009). Generated the SIS components of effective teaching and learning which were later modified as the Principles of Teaching and Learning (PoLT) components that were adopted and promoted through the Victorian Department of Education in 2006 (accessible http://www.education.vic.gov.au/school/teachers/support/Pages/polt.aspx).

[3]5E Instructional model (developed by Bybee 1997).

A shift from science learner to teacher of science was also evident in Erin's narrative, where there was a relatively high degree of self-efficacy arising out of what Bandura (1977) calls "mastery experience", that is, first-hand experience of success. These shifts occurred over the course of the unit, although further data would be needed to identify where the critical moments occurred; however moments of success (or failure) and revelation were identified by students above as being critical in shaping the teachers' understanding of the role of teacher of science, and how they see themselves in relation to this role.

As demonstrated in these accounts, growth in identity is evident as:

- Consolidation of a sense of self as someone who can learn and teach science;
- Seeing the power of science to engage and excite students;
- A greater understanding of their role as a teacher of science; and
- Alignment or new links between PSTs' commitments and philosophies of teaching and their conceptualisation of the task of teaching science.

8.4.2 Confidence

There were a number of instances of improved confidence in both the survey and interview data. As illustrated in the previous section on identity, improved confidence was linked to shifts in a PST's self-concept as someone who can learn and teach science. Confidence is also associated with self-efficacy, as an improved sense in one's ability to be effective at learning and teaching science. This was particularly evident in Katy's growth in response to her positive teaching experiences.

Improved confidence was often tied to a successful experience teaching science. Many PSTs reported that they experienced the positive impact of science teaching in classrooms, where students' engagement and enthusiastic participation affirmed the PSTs' ability to plan and implement effective science lessons. The following student explained how nervous she was prior, but as a result of high levels of classroom engagement, declared growth in confidence level:

> I guess I was so nervous and didn't get much sleep the night before my first lesson … The kids were really engaged … it was quite good content … So I guess probably the confidence was the biggest thing … I've been much more relaxed; yes absolutely I feel a lot more confident. (Joanne, PST, Deakin)

Because of the importance of confidence to PST development (Howitt 2007) the pre- and post-tests asked questions about PSTs' confidence in a number of teaching-related items. Herbert and Hobbs (2018) describe that this analysis was performed on surveys completed by 108 PSTs completing the pre-survey and 107 PSTs completing the post-survey, including 30 PSTs who completed both the pre-survey and the post-survey, with pairing established by matching identification codes. Four of the five school-based models were involved as the unit involving the partnerships in the fifth university had ceased during the year of data collection. Survey results showed that there were significant gains in PST confidence to undertake the various tasks of

teaching science. Published elsewhere (Herbert and Hobbs 2018), paired t-tests and effect sizes of pre- and post-survey items showed that on nearly all items there was small to medium gains, and some large gains in PSTs' confidence. In the pre- and post-surveys, PSTs were asked to respond on a 5-point scale (1 = Very underconfident, 5 = Very confident) to eight items asking "*How confident do you feel about doing the following?*"

- Learning science content
- Undertaking and supervise experiments with students
- Planning science lessons
- Creating an engaging classroom environment
- Managing the behaviour of a group of students
- Undertaking critical reflection on my science teaching
- Establishing and building on students' science understandings
- Being excited about the science I am teaching.

In addition, they were asked "How confident are you to teach science?" on a 10-point scale (1 = very underconfident, 10 = very confident). Herbert and Hobbs (2018) used box plots to show that there were significant differences between the pre and post-surveys, supporting the decision to employ parametric analysis.

As reported in Herbert and Hobbs (2018), t tests were performed on these items and effect size calculated. Table 8.1 shows the means and standard deviations for each item for both the pre- and post-surveys and the associated effect sizes and p values generated by the t tests. Effect size has been included to support and complement the p value resulting from the t test. Cohen's D effect sizes (Cohen 1988) were calculated to gauge the degree of effectiveness of the school-based experience on changing PSTs' confidence. Cohen (1988) categorised effect sizes as "small, d = 0.2," "medium, d = 0.5," and "large, d = 0.8" (p. 25).

It is important to note that the pre-data indicated a moderate level of confidence on all items. However, there were statistically significant gains for the following aspects of teaching science, with p values less than 0.005: *learn science content*; *undertake and supervise experiments*; *plan science lessons*; c*reate engaging classroom environment*; *manage behaviour of a group of students*; and *establish and build on students' science understandings*. The effect sizes for these aspects indicate a small to medium degree of effectiveness of the school-based experience on increase PSTs' confidence to teach science. One item, *Plan science lessons*, produced a large effect size; also for this item, there appeared to be a reduction in the standard deviation, suggesting that there was a tendency to move towards the positive. In fact, for all items apart from those marked with[1] or[2] there is a noticeable reduction in the spread of responses. For items marked as[1], there was little change in the spread of responses, and for the item marked as[2], the spread actually increased, possibly because the experience of dealing with students who presented challenging behaviours may have led to failure of some PSTs to further develop their confidence to deal with such behaviour.

Growth in student confidence is important for identifying development and arises out of recognising improved teaching skills. The interview data showed further evidence of confidence gains. The regular contact with schools and the regular classroom

Table 8.1 Changes in PSTs' confidence (as reported in Herbert and Hobbs 2018)

Confidence to: (5-point scale) 1 = Very underconfident 5 = Very confident	Mean		Standard Deviation		*p* value	Effect size
	Pre	Post	Pre	Post		
Learn science content	3.78	4.13	0.84	0.69	0.001	0.45
Undertake and supervise experiments	3.85	4.31	0.73	0.63	0	0.69
Plan science lessons	3.47	4.18	0.92	0.70	0	0.87
Create engaging classroom environment[1]	4.05	4.29	0.67	0.65	0.001	0.36
Manage behaviour of a group of children[2]	3.91	4.07	0.66	0.74	0.09	0.23
Undertake critical reflection on their own science teaching[1]	3.92	4.15	0.79	0.76	0.03	0.30
Establish and build on students' science understandings	3.48	3.93	0.82	0.75	0	0.58
Teach science (10-point scale)	6.68	7.53	1.68	1.43	0.0001	0.55

[1]No noticeable change in standard deviation
[2]Standard deviation increased

experiences contributed to the confidence and enjoyment levels because PSTs felt more confident: "I really liked that we got the chance to meet the kids and decide on what they were interested in and go on from there; we actually get to see it for ourselves" (Roz, PST). Also, confidence in their professional growth as teacher:

> I go into teaching I'll know how to do it … I've delivered a science unit and when I go for a job interview I think confidentially I'd land a successful science position because of this, this and this . (Garth, PST, Deakin)

In summary, growth in confidence is generally tied to a successful teaching experience, and is evident as:

- Confidence in a practice informed understanding of what and how to teach science;
- Confidence in their preparedness as a classroom teacher;
- Confidence in their ability to have a positive effect on student learning and engagement; and
- An excitement about what they are teaching or at least in being able to teach science to students.

8.4.3 Praxis

Praxis is the process by which theory is realised and enacted. A challenge for initial teacher education is to incorporate opportunities for PSTs to engage in praxis where practice is authentically and seriously informed by theory; this is the case especially for science given that PSTs rarely have the opportunity to teach science during their formal placements (as discussed in Chap. 1).

Other data showed praxis being enabled by tutor guided planning and reflection. Evident in Katy's account is the reference to educational research, in particular best practice as promoted through the SIS (Tytler 2009) and PoLT (Department of Education 2006) components of effective teaching and learning. Also, the 5Es instructional model (Bybee 1997) and constructivism were mentioned, both of which are incorporated into all of the school-based models identified in Chap. 3. Comments in interviews revealed that participants were able to link the theory and practice elements of their teaching. For example, a PST reflected on their experience: "I think it was a fantastic way to integrate the theory and research into best practice science teaching by actually planning, implementing and assessing a science unit within school environments" (Katy, PST, ACU).

One tutor, Paul, explained how he interwove these theories with the PSTs' teaching experiences:

> There was a whole lot of links between theory and practice, because we were pushing the 5E's learning model and the students [PSTs] quickly picked that up and realised that it was a good way to teach, and the theories behind the assessment theories were put into place fairly quickly.

Praxis was also enabled through real opportunities to practice their teaching through a weekly cycle of planning-implementation-reflection: "It's practical and it's theoretical and it's all wrapped up in the sort of situation where the PSTs are working with real children in a real situation" (Paul, teacher educator, Deakin). They can interact with the university tutor and (in some models) the classroom teacher before and after their teaching. Then, in the reflection afterwards, important connections can be made:

> the fact that they're actually doing this every week and then they've got the ability to reflect on it before they go and do the next week. The fact that then they've got a university staff member around with whom they can interact while teaching and in the reflection afterwards, I think that sort of connection is really important. (Damian, Teacher Educator, Deakin)

Paul described this cycle in the following way:

> We had a lot of open discussions … and we'd be throwing ideas backwards and forwards so that the students [PSTs] could reflect on what they've done and what they've seen but they also at the end of the teaching session instead of having a formal debriefing session we just basically stood around for a bit and each pair were saying 'okay well that went well but we could try this next week'. So I was encouraging them to do self-reflection just immediately after the teaching and then the following week we did a group reflection where people came up with ideas that would work. (Paul, Teacher Educator, Deakin)

The teacher educators became aware of students linking theory to practice through their assignments: "I really liked seeing when I was marking the assignments that they were trying out the things that we'd done in the tutes and lectures, and the strategies that we'd worked on" (Teacher Educator, University of Melbourne). The assessment tasks were evidence of PSTs developing a theory of practice that is informed by theory.

Another critical element of praxis is the interaction with students, as identified by Paul above, "working with real children in a real situation". According to a principal, the model provides "great opportunity for intense explicit work with the students' (Arabella, Principal, Deakin), drawing upon students" real-life experiences to make sense of the world around them. It gives the PSTs a more realistic view of what the science is and how to teach science. It makes the connection between the theory and the practice more real and effective. Paul also described the process of learning that results from such teaching experiences:

> The students [PSTs] have to work out where the children's strengths and weaknesses were, they could modify their teaching so if there was a child who needed extra help they could identify that child and offer help if it was needed. So they basically developed better monitoring skills, they realised the importance of assessment skills from the point of view of diagnostic assessment and formative assessment where you observe what the children are doing, how the children are going about it and then you modify your teaching style to reflect this. (Arabella, Principal, Deakin)

In addition, some PSTs highlighted that they were able to experience planning, and then be flexible in response to students' learning needs: "you can see that it's still going to work even if things don't go exactly to plan" (Erin, PST).

In the PST post-survey, data showed the most valuable aspects of the school-based experience was developing their confidence and competence in planning (mentioned by 22/101 respondents), teaching (45/101 respondents), and assessing or reporting on student learning (9/101 respondents). A total of 20/101 respondents also highlighted learning content themselves as being valuable (e.g. "Having to learn science" "The importance of content knowledge prior to teaching") or helping students learning science content (e.g. "Seeing the conceptions that the student's already held, and planning to address these to reach the 'aha' moment"). The evaluation of our

school-based models did not include an assessment of our students' science content knowledge because the experience and support is principally focused on content for teaching that merges through teaching and reflecting on teaching. Evaluation was largely self-report, but respondents signalled that the knowledge most gained was knowledge of science content (11/105 respondents), knowledge and skills of teaching (42/105 respondents), and knowledge of children, working with children and teaching science to children (18/105 respondents). Boarder than specific knowledge and practice, 28/105 respondents mentioned gaining more experience in the classroom, of teaching generally, and especially of teaching science. This experience was often linked with gaining confidence (e.g. "this course gave me the opportunity to not only teach grade 5 and 6 but also to have the sole focus of science. I gained not only science experience and knowledge but my confidence in teaching science to students increased steadily").

Reflection is an important part of making the most of these experiences. A total of 20/101 respondents mentioned the value of reflecting on their teaching and being able to "trial", "experiment with", "experiment with what worked", "understand what is important and what isn't", and "test expectations". This is active, informed reflection in response to experience. Further to this, being able to relate theory to practice emerged out of this reflection (indicated by 20/105 respondents): "Putting our knowledge into practice through a practical assessment", "We were able to use so many of the different tools we have been taught and see how they work and how children engage with them", "how to implement an inquiry approach using the 5E's model and using representations", "ability to teach science constructively", "the realities of inquiry learning", "understanding of my own scientific literacy".

These data highlight how the school-based model provides a way for PSTs to have a focus on observation and implementation of theory that has been applied in classes, and in their readings, and when preparing their assignments. While much of this data is self-report, and only from a relatively small sample of PSTs, the data signals an increase in a practical use of theory, knowledge required to teach, and knowledge of science, all required to undertake the complex task of teaching science, and which, for some of these students, had seemed like a daunting proposition. One student summed up their experience: "Teaching a sequence of lessons to the same children for seven weeks was a wonderful experience. We got to know the children and even anticipated what each child's answers would be. I gained more insight into a classroom teaching and learning than the two weeks of rounds."

The PSTs are practising teaching, not just learning the theory and learning about it in a classroom at university with no context. It provides an opportunity for the entwining of theory and practices so bridging the theory/practice gap. It involves more than simply learning about teaching in isolation and then expecting teaching to be put it into place when they go out on their practicum or when they eventually graduate. There is a conscious shift away from the traditional model of learning about science teaching and learning followed by enactment on placement (which is rare) and after graduation. School-based tutorial or university lectures or tutorial that are interspersed with teaching students provides important opportunities for practice informed discussion and reflection on theory. Praxis is therefore evident when PSTs:

- Plan with a knowledge of theory;
- Enact, trial, and implement theory in their teaching;
- Reflect on their practice in light of theory; and
- Develop a realistic and practice informed understanding of what is involved in teaching science, including how to observe students and their learning as they respond to teacher moves.

8.4.4 Relationships

Teaching is ultimately a relational act (van Manen 1990). In these school-based experiences, there are opportunities for PSTS to develop relationships with the students, the teachers (more emphasised in some models), their peers through teamwork, and the tutors.

According to van Manen (1990), pedagogy is ultimately and foremost "the study and practice of actively distinguishing what is appropriate from what is less appropriate for young people" (p. 25), and that every action or not carried out by the teacher has significance for students "because as teacher we stand in relations of influence to our students' (p. 26). An unwritten pedagogical contract between teacher and students requires trust that each is committed to the process of teaching and learning. Darby's (2005) study of students' perceptions of engaging pedagogy found that relational pedagogy that engaged students required teachers to be: passionate and enthusiastic; orchestrator of a comfortable learning environment where the teacher is friendly and non-threatening; and supportive, encouraging, attentive to their learning needs and understandable by students. While this data were for Year 7 (first year of secondary school in Australia), the PSTs' relationships with the students hinged on these factors—for PSTs who could not be passionate, comforting and supportive, there was less satisfaction with the teaching experience. However, as was evident in Erin's account, the PSTs gained positive feedback from students, such as through "thank you cards" from students, demonstrated appreciation for the teachers' ability to create positive and productive relationships with the students.

Planning and teaching together with peers required teamwork skills. Teacher collaboration is critical in primary schools, both in terms of planning and delivering curriculum; however, teamwork as a structure for learning tasks and assessment at universities is often underappreciated by students due to differences in work ethic and ways of working, and difficulties in negotiating social roles (Richmond and Striley 1996). In our data, we found examples of enthusiastic reporting of successful teams planning together, researching science concepts and resourcing lessons with materials, and discussing students learning needs: "I had two people who I was working with, we're really good partners so we shared a lot of information and we were able to build upon each other" (Roz, PST). On reflection Roz also recognised that Joanne's experience was one of negotiation and compromise but in a way that was experienced as supportive and edifying, although she confessed reservation to begin with:

> I wasn't really quite sure how I was going to go with team planning, but I actually really enjoyed it, … Everyone was very supportive; I had to plan with other people … We had to get together with somebody else … and work out a comprise, so that was really good I guess. (Joanne, PST, Deakin)

Carly highlighted the value-adding nature of working with other teachers who can act as resources, joint collaborators in innovation and problem solvers. The opportunities for reflection on practice were an important enabler of this type of collaboration:

> I actually worked collaboratively with my PLT. There were three other grade five teachers so I worked with them for the brainstorming; if it didn't work you can take it back to uni the next day or the next week and share and having that resource of people. (Carly, PST, UTas)

The PSTs who reported on successful teamwork shared collegiate experiences of knowing the students and making more informed decisions together. Certainly, the school-based experience has advantages that cannot be gained in the University environment; Damian, describes how he believed that in the Deakin model, the small teaching groups of primary school students ensure that relationships and rapport are built over time:

> They learn to make their relationships with the students and they're testing their questioning skills, their planning skills and all that, a whole range of things. So I think from that point of view this is then an extremely valuable model. (Damian, Teacher Educator, Deakin)

Relationships with teachers and tutors were also built on this need for resources. As demonstrated in the previous section, the tutor plays an important role in supporting PSTs praxis, so the relationship between PST and tutor is underpinned by the same expectations as the relationship between PSTs and their students: supportive environment where the tutors understand the information and theory needed and being encouraging and attentive to PSTs needs; creating comfortable, non-threatening and non-judgmental environment for PSTs to share their successes and failures; and modelling of enthusiastic and passionate science teaching. The tutor's role in this problem-based learning space where the PSTs are given a problem (to plan, teach and evaluate a learning sequence) is to facilitate PSTs' growth with scaffolds that are gradually removed. In each model, PSTs need substantial support initially in understanding the nature of the task. This support is gradually reduced as PSTs map out a path for the unit and their own learning and engage in professional dialogue with their peers. The PSTs' role in the relationship with the tutor is to assume increasingly more responsibility in their own learning.

As demonstrated above, growth in PSTs' ability to develop workable and effective relationships is evident as:

- Productive, collaborative professional interactions with peers during the problem solving required to plan, teach and evaluate a science sequence;
- Passionate, comfortable and supportive relationships with students that create an environment where students want to engage and learn and where students demonstrate appreciation for the efforts of the teacher to inspire and facilitate their learning; and

- PSTs taking increased responsibility in their learning to plan, teach and evaluate science while under the guidance of teacher educators who provide the structures, processes and opportunities that steer PSTs towards contemporary science practice.

8.5 Personal and Professional Development and the Loci of Growth

Transformations in behaviour, expertise and attitudes towards science teaching and learning are a fundamental goal of science teacher education. In fact, it is a fundamental goal of teacher education and teacher professional learning more generally. Observing changes in these areas is the way in which personal and professional development of teachers and PSTs is revealed. In the data presented above, there was also evidence that when identities shifted, confidence grew, praxis developed, and relationships are formed, there is a resultant change in behaviours, such as a willingness to teach more science, greater levels of expertise, and the development of more positive attitudes towards science teaching and learning. One teacher educator noted the changing "attitude towards science content itself and then I think that starts to erode away the notion that they have that teaching science is difficult or beyond their reach" (Teacher Educator, RMIT). For PSTs, the experience had the effect of changing their outlook on science teaching; Katy stated "So I think it's opened my eyes to the wonderful things that you can do through science and it's made me feel more confident approaching it in a school setting", also "It helped me heaps—it helped me just to see how the students react to certain things, that they're all different and what to expect when you do certain experiments" (Erin, PST).

PST personal and professional development as teachers of science is evidenced as changes in:

- Attitudes towards science and teaching science, and commitment to teaching science in the future;
- Beliefs about what constitutes effective science teaching; and
- Self-perceptions in their developing expertise in planning, enacting science curriculum and reflecting on their teaching and on student's learning gains.

8.6 Enablers of Growth

Creating an environment for this type of growth and development is not a simple task. Changing from the traditional university-delivered model of primary science teacher preparation towards a school-based model requires specific attention to developing fruitful partnerships as discussed in previous chapters, but also a programme of activities and support materials to ensure the PSTs learning needs are met. Inherent

in developing an environment for growth in these school-based experiences are three processes: collaboration, coordination and communication. Without these, PSTs can flounder, teachers and school can get frustrated by the lack of organisation, and learning opportunities for the PSTs and students can be hijacked by lost time and unclear roles and goals. The GUSP (Chap. 6) can be used to guide the establishment, monitoring and evaluation of collaboration, coordination and communication.

The importance and dimensions of the enablers of growth are discussed below. Evaluation of school-based programmes can focus on these as variables pointing to the likelihood of an environment to produce growth at the loci discussed above.

8.6.1 Collaboration

Collaboration between partners invokes the Principles of Partnership Practices described in Chap. 3. How the collaboration is established, maintained and evaluated is outlined in the Growing University-School Partnerships (GUSP) (Chap. 6). The type of collaborations needed depends on the type of partnership being established, as described in the Representations of Partnership Practices (RPP) in Chap. 5. For the PSTs involved in our school-based models, collaboration is needed at multiple levels in order to create an environment for PST growth.

Collaboration between the teacher educators and school, among PSTs, and between teachers and PSTs, arises when the relationships within the partnership are productive. Echoing the growth loci of relationships, for PSTs, teaching in teams provided peer support: "to deliver something like we did in such a short space of time we really needed that collaboration…Yeah I wasn't really quite sure how I was going to go with the team teaching but I actually really enjoyed it" (Joanne, PST). Teacher educators recognised that they were working collaboratively with schools: "we work collaboratively and we work in partnership with schools" (Micko, Teacher Educator). In such arrangements there is a sense of "collaboration between teachers and improving teacher instruction or the instructional quality" (Trev, Principal). Also, in some instances there was collaboration between the PSTs and the school teachers: "I actually worked collaboratively with my PLT (Professional Learning Team). I was able to bring some of what I had and what I knew, sort of things from my own background so we sort of designed it together" (Carly, PST).

Collaboration as relationships between partners also grow and evolve over time. Time allows for trust in one another's capability and commitment to be tested, and when experiences continue to be positive the collaboration is enhanced. The importance of trust was mentioned by the following teacher: "Trust definitely but more than that, it's the level of consistency. So if you say you're going to do something we trust that that will happen. If we say we'll be ready" (Leanne, Teacher). The data also showed that enhanced relationships can lead to increased levels of commitment and growth in the partnership, as is illustrated by the following quote from a teacher reflecting on their ongoing relationship with Deakin:

> It works well because we've had that partnership built up over a number of years so we've got the relationships, the rapport, the same lecturers tend to come out to our school so they arrive at the school and you already know them and they know you, they know how we work here, they're familiar with the spaces and the children so that continuity has been really good. (Leanne, Teacher, Deakin)

Reciprocity is important to the collaboration between the universities and the schools. As discussed as part of the Principals of Partnership Practices described in Chap. 3, reciprocity is experienced when the needs of each partner provide the motivation for both partners to commit to an ongoing relationship. Partners need to see the benefits that the partnership arrangement brings to their core business. But also, the more each partner tries to view the arrangement from the needs of their partners' as well as their own needs, the stronger and more sustainable the partnership arrangement can be. It is this mutual benefit that defines the reciprocity that partnership arrangements need for success. One principal, Aaron, identified the reciprocal nature of their collaboration with Deakin:

> There's a bit of two-way learning about Deakin students being able to run their practicum and learn about classroom management and learn about how to deliver the lesson and then our teachers are getting that almost like a refresher on 'this is what you can do and this is how you can teach this in science', so there's a little bit of a two way street….

A number of actions on the part of this particular school have the potential to enable PST growth: visits to the classroom before the lessons so that the PSTs are informed about the needs of the class of students, linking of PST lessons to the teacher programmes by the classroom teacher, shows of appreciation, and involvement in other activities at the school (in particular a science night that the PSTs can volunteer for):

> Both myself and [another leading teacher] often go in, we talk to the students at the start of the program, we lay down our expectations, we talk to them about what our school is about. We talk about the sort of children that we've got, that we've got really connected and engaged kids and get excited about working in science. I make myself available to lecturers and all students… We go in a couple of times during the actual program, sometimes on my request, sometimes on the tutor's, and then at the end we do a big thank you. All the Deakin Uni students that help out at the science evening also get a Certificate of Appreciation from us that I think can go a long way in their résumé too when they're applying for jobs.
>
> We do teach science, but the bulk of our science curriculum is done through Deakin. It focuses us. Teachers will follow on and finish lessons that may have been started by the Deakin students. There's often times when Deakin Science practicals will peak an interest in the students and the teacher especially when we're doing things like Space or there's a cooking theme happening the science really comes in. So it's a real win/win I guess. (Aaron, Principal, Deakin)

These types of activities have the potential effect of improving PST employment possibilities, greater understanding of the role of a teacher, and PSTs know their contributions are appreciated, are affirmed by classroom teachers who learn from the PSTs, affirmed by the school's appreciation of their contributions.

While not all schools across the five models work in this way, the collaboration required to make the partnership work also create an environment for growth. The

collaborations required will be specific to the partnership, and even to the specific school, because even within a single model at a university the different partner schools will place different demands on the collaboration. However, across the five models, it was evident that collaboration creates an environment for growth by ensuring all partners recognise some benefit in the partnerships so that PSTs feel acknowledged, valued and effective in delivering quality science learning experiences for the students.

8.6.2 Coordination

Co-ordination requires sychnronisation and integration of activities and responsibilities of the various partners, such as the many institutional requirements incorporated in the GUSP (Component 2). Timing, for example, was a significant issue given that both schools and universities work with tight timetables, as reflected by the following teacher educator: "being able to organise the whole process of getting the students out to different schools…so it's a lot of administrative organisation" (Teacher Educator, Deakin University). A relationship relies on consistency in this co-ordination of timing as it demonstrates an appreciation of the demands of the other partner: "So keeping that consistency, finding the correct time slot, giving us ample time to organise, they're our priorities" (Teacher Interview, RMIT).

Ensuring that a partnership runs smoothly and is successful can be quite demanding on the people involved. There is a significant amount of work involved including that of recruiting willing partners, determining the needs and desires of each partner, and establishing a programme that addresses these needs and desires:

> I think it is as with anything a fairly significant mammoth task. (Sally, Teacher Educator, Deakin)

> being able to organise the whole process of getting the students out to different schools…so it's a lot of administrative organisation that we have to do. So I think there's not so much limitation if you've got enough schools and enough support in terms of getting the students out in small enough groups for them to be able to carry out the school-based activity…you have to have enough schools who want to take you in and let you come in with your students and let you have the facilities for you to debrief. So that can be quite challenging as a co-ordinator of that kind of program. (Elsy, Teacher Educator, Deakin)

Beginning a programme like this can also be risky in ensuring that there are enough PSTs and enough students to meet everyone's needs. These types of considerations require commitment and flexibility from everyone involved and partners may need to alter those aspects of their programmes that they can if they want a partnership to proceed:

> So at the school's end they've got to be committed, they've got at least acknowledge it and want to do it. From the University end the university has to put in place or has to have in place the administrative support, which I'm not sure is there. The lecturer has got to know what they're doing and I have no doubt Mellita knows exactly what she's doing. The students

> also have to be prepared to do it because there will be those that fail because they don't want to put in that kind of practice. (Zara, Teacher, ACU)

Partners need to negotiate some challenging aspects such as timetabling and consider how other programmes that each partner delivers will fit in/around the partnership arrangement:

> Well yes I think sometimes the schools don't understand that the program needs to be delivered consecutively. Sometimes schools will agree to have Deakin students come in but then Grade 5 will be out on camp and they'll have sports day and sometimes there can be quite large gaps. So I think if the schools understand that we really need to not have that time broken up, for ten weeks to go as much in a row as we can I think that that would really improve the Deakin student's delivery.

Acknowledging that initiating and maintaining these partnerships can be time-consuming and require close attention to, clear and consistent coordination contributes to an environment supporting PST growth by:

- Ensuring that all partners understand their roles, timing of events, and nature of the learning expected and by who; and
- Minimising risks and dealing with challenges as they arise.

8.6.3 Communication

Feedback and communication are needed between all key stakeholders: university tutors and students, and school teachers, principals and students. Communication was central to ensuring the needs and demands of the school and university are built into the developing relationships. Also important was ongoing communication and opportunities for feedback in order to maximise the learning taking place for students and to ensure that the relationship continues to be beneficial for the students, the teachers, and in meeting the unit objectives. For example, one teacher explained that, "[Uni] students contacted me prior to teaching and asked what the kids had done and what they hadn't done so they could try and cater for that and avoid that happening" (Teacher, Deakin University). Communication is needed for developing and maintaining trust, and in achieving reciprocity where each partner is aware of and respectful of the needs of the other partner/s: "the support from uni has been good. There's always been that touching base each session and there's been an open channel of communication" (Teacher, University of Melbourne) where the teachers and teacher educators can "address the issues together" (Teacher, Deakin University).

Good communication between the University representative, principals and the teachers involved, are central to the relationship. Good communication when establishing a relationship can help to dispel apprehensions from principals and teachers that might have developed from past experiences of working with partner organisations, such as other universities. This first communication establishes the nature of and expectations for future interactions. Discussions with the classroom teachers

prior to teaching about the topics, the approach, and expectations are central for teachers to feel this is a worthwhile activity for their students to be involved in:

> I remember we were actually a bit hesitant to begin with because we had the university come before you guys and it was just a disaster… Then when RMIT came across and the first time they came in it was like an introductory, sat down with the teacher, had a discussion with the teacher 'this is what we're going to teach', that was the difference between both universities and I guess the approach to teaching science in the classroom which was great. So I think that first initial consultation with the classroom teacher was an automatic 'feel at ease it's going to be okay' and once that communication is set the program. (Matthew, Teacher, RMIT)

Schools need to know that they can influence the nature of the relationships and the type of experiences that their students are involved in. By listening to schools, there is greater opportunity for the work of the students to be valued because the content might tie into the curriculum, and there is greater potential for the classroom teachers to extend and support the work of the students.

Good feedback means satisfaction, which hopefully translates as sustainability of the programme: "It's been quite good, a couple of the schools actually invited us back this year because of the success from last year so they obviously value it" (Paul, Teacher educator). Teachers and principals are attuned to whether issues arise; Joan (Teacher) and Warren (Principal) commented on how they "never get any criticisms or negative feedback" (Joan) and that "kids are really happy, I've only ever got positive feedback" (Warren). Getting the principals and teachers onside is central so positive feedback about what the students are doing with science gives principals and teachers assurance that it is working:

> The Principals are on side, the classroom teachers involved were on side, the students enjoyed working with their small group of children, it varied from about two children up to about nine or ten depending on which school we were at and the teachers themselves were quite happy to talk to the students and vice versa picking up bits of information, stuff like that. (Paul, Tutor, Deakin)

An open line of communication between PST and teacher works best if the flow of information goes both ways: "you want teachers to be in the background but also there needs to be an open line of communication for the student teachers and the teacher just for it to work" (Rod, Teacher). The teachers appreciated the teaching ideas that students offered through their lessons, as well as being briefed on the concepts and standards that their students were covering. Teachers also felt comfortable when their knowledge of the different learners in the classroom are sought, respected and built into the relationships developed between their students and the PSTs.

Students appreciated the feedback, guidance and support of the classroom teachers. Such feedback has the effect of assisting in the immediate teaching of the unit, promoting reflection on that teaching, and providing a positive memory of the school and the experience:

> well I think we've sort of gone beyond what you expected us to do with feedback, you just wanted us to have the students in the classroom, or in our lesson area and let them teach and go through the process and allow them time but I'm hoping that we're giving them feedback

> as well and providing a positive environment and a memorable environment so when they hear our name or our school's name again in the future that they have positive memories. (Bob, Teacher, ACU)

This opportunity for feedback arises out of attentiveness to what the students are doing (instead of using that hour as time release) which the teacher might then extend later. Finding that balance between giving the students space and having input to proceedings is needed to make it work. Feedback from the teacher educator was also valued by students in relation to the teaching that was going on, the lesson plans that were being constructed and generally how the students were going.

Some of the teachers new to the partnerships suggested that the "Program needs to spell out all aspects of how it was expected to run" (Gennifer, teacher), with a need to have better communication of their role and who they might contact if they needed to clarify something. Where programmes were more established, the teachers appreciated the open lines of communication and building relationships with the university staff: "[the expectations have] been made very clear, and the support from uni has been good. There's always been that touching base each session and there's been an open channel of communication if we needed to talk in between sessions" (Danielle, teacher).

Recognising that communication acts at multiple levels, and involves different people at different times, the above discussion has illustrated that communication creates an environment for student growth by:

- Ensuring initial negotiations and regular contact between university and schools focus on relationship building;
- Providing feedback on suitability of arrangements in meeting the needs of each stakeholder; and
- Providing students with feedback on their teaching.

8.7 A Growth Model for Science Teacher Education

Growth, and its intrinsic link to university-school partnerships, are represented in the Growth Model (Fig. 8.1) (from Jones et al. 2016). The Growth Model shows how, in the context of school-university partnerships, the enablers of growth (collaboration, coordination and communication) create the conditions for growth to occur at clear loci (identity, confidence, praxis and relationship), as evidenced through PSTs' personal and professional development (behaviour, expertise, and attitudes and values).

Table 8.2 provides a framework for interpreting these gains. Drawing on the analysis presented in this chapter, Table 8.2 provides a summary of the markers of growth and the variables that can be used to examine the effect on PST personal and professional development. Also the conditions that are needed to enabling growth are summarised.

The Growth Model, and the elucidation of potential variables as objects of interest when evaluating the outcomes of such partnerships in Table 8.1, can help to

Table 8.2 Variables for examining growth in university-school partnerships

Growth in:	
Identity	• As consolidation of a sense of self as someone who can learn and teach science • Seeing the power of science to engage and excite students • A greater understanding of their role as a teacher of science • Alignment or new links between PSTs' commitments and philosophies of teaching and their conceptualisation of the task of teaching science
Confidence	• In their practice informed understanding of what and how to teach science • In their preparedness as a classroom teacher • In their ability to have a positive effect on student learning and engagement • As an excitement about what they are teaching or at least in being able to teach science to children
Praxis	• Plan with a knowledge of theory • Enactment, trialing, and implementation of theory in teaching • Reflection on practice in light of theory • Development of a realistic and practice informed understanding of what is involved in teaching science, including how to observe children and their learning as they respond to teacher moves
Relationships	• Productive, collaborative professional interactions with peers during the problem solving required to plan, teach and evaluate a science sequence • Passionate, comfortable and supportive relationships with children that create an environment where children want to engage and learn and where students demonstrate appreciation for the efforts of the teacher to inspire and facilitate their learning • PSTs taking increased responsibility in their learning to plan, teach and evaluate science while under the guidance of teacher educators who provide the structures, processes and opportunities that steer PSTs towards contemporary science practice
PST personal and professional development as teachers of science is evidenced as changes in:	
Attitudes	• Towards science and teaching science, and commitment to teaching science in the future
Beliefs	• About what constitutes effective science teaching
Expertise	• As self-perceptions in their developing knowledge of planning, enacting science curriculum and reflecting on their teaching and on student's learning gains
Partnerships enable growth by creating an environment where there is:	
Collaboration	• Ensures all partners recognise some benefit in the partnerships so that PSTs feel acknowledged, valued and effective in delivering quality science learning experiences for the students
Coordination	• Ensures all partners understand their roles, timing of events, and nature of the learning expected and by whom • Minimising risks and deals with challenges as they arise
Communication	• Ensures initial negotiations and regular contact between university and schools focus on relationship building • Provides feedback on suitability of arrangements in meeting the needs of each stakeholder • Provides students with feedback on their teaching

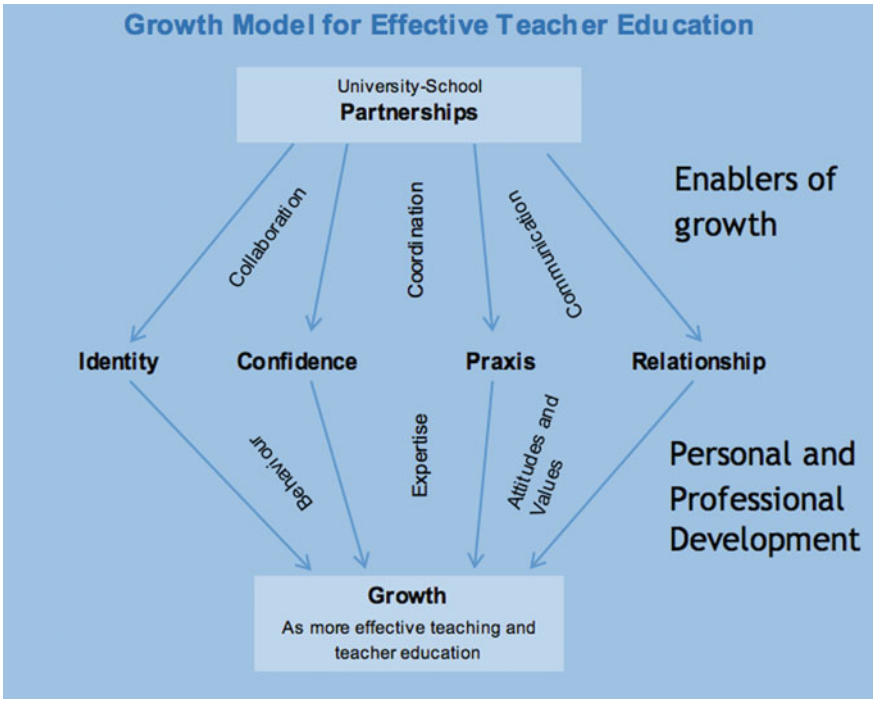

Fig. 8.1 Growth model for university-school partnerships

generate more effective teaching and teacher education in two ways. Firstly, the analysis identifies and defines the markers of growth that can be achieved through well-constructed partnerships. The actual effects on PSTs, and therefore what can be claimed by proponents of such partnerships in initial teacher education, can be pinpointed. The enablers are needed to ensure that such partnerships create the conditions for growth. Certainly, poorly run partnerships between schools and universities can have disastrous effects on PSTs because of the confusion that can be created when the nature of the learning task is unclear due to a lack of communication. Also a lack of collaboration due to personality differences and strained relationships between PSTs, or between PSTs and the students, for example, can limit opportunities for growth.

Secondly, as has been illustrated in this chapter, the Growth Model and the variables can be used to design research/evaluations intended to generate evidence of the effect on partnerships on PST growth (what actually can be gained). Of course, further tools to examine these variables would need to be sought by the researchers. In the analysis presented here, the interviews with teachers, PSTs, teacher educators and coordinators of the degrees, along with pre- and post-surveys of the PSTs generated predominantly qualitative evidence. While the experiences of only some PSTs were drawn on in this analysis, generally the experience for students was

considered positive, as was illustrated through the gains in confidence to undertake various aspects of teaching science. Other tools may be needed for more robust analysis of some of the variables; for example, self-study (Brandenburg 2008) could be used to examine all of the variables, self-efficacy surveys (Bandura 1977) can give insight into identity and confidence (Palmer et al. 2015), and observations or video stimulated recall could examine more closely changes in praxis (Kruger et al. 2009). Attitudinal and beliefs surveys/questionnaire could provide evidence of change. Also self-perceptions surveys, such as SIS (Tytler 2003, 2009) of PoLT (Department of Education 2006) component mapping, or other surveys based on the national teacher standards (Rowley et al. 2013) could examine perceived changes in expertise. When considering the effect of the partnerships, evidence used to track changes in identity, confidence, praxis and relationships as evidenced through changes in attitudes, beliefs and expertise, can be used to promote and justify the additional resources needed to initiate and sustain these approaches to science teacher preparation.

8.8 Conclusion

Partnerships are complex, and designing partnerships requires being clear about their purpose, how the partnership will impact on professional growth of PSTs, but also benefits for others (teachers, schools, teacher educators) involved in the partnership. The partnership practices of five universities represented in the STEPS project were initiated to deal with the reported low confidence of PSTs in relation to science (Howitt 2007). Each university developed their partnerships independently; however, central to all was a desire to provide experiences that might disrupt students' negative perceptions of science and to foster at least "provisional identities" (Ibarra 1999) in relation to science where PSTs can begin to see themselves as being able to teach science. To achieve this, teacher educators work with schools to provide time and space for PSTs to interact with students over some weeks.

There is a need, however, to identify which variables are useful for examining growth and therefore justifying adoption of partnership approaches. Such information is particularly important when partnership models are used as alternatives to more traditional on-campus tutorials and lectures; taking the tutorials and learning experiences into schools adds its own logistical constraints and institutional barriers that can seem insurmountable in some circumstances, therefore the learning outcomes for PSTs, and the growth that arises from such experiences, need to outweigh the costs involved in overcoming such barriers. If we are to invest resources in establishing and maintaining these partnerships and new approaches to teaching, we need to show that they work, both in terms of what growth can occur, and how school-based approaches within partnerships can create the conditions for growth.

To this end, it was important to understand how the partnership and pedagogical elements of the programme contributed to PST growth and change. People enter into partnerships because they recognise the value they can play in facilitating professional growth. Using partnerships to create learning opportunities that lead to

professional growth requires an awareness of the potential for partnerships to support innovation in pedagogy, as well as an understanding that partnerships develop, strengthen and evolve over time. For the university-school partnerships represented in the STEPS project, the overarching aim for growth was to improve the quality and effectiveness of teaching and teacher education. The partnership provides the context for growth, and growth manifests through enhanced identity as a teacher of science and increased confidence to plan and teach science effectively. This growth was evident in the data presented in this chapter, where there is evidence of the PSTs gaining confidence through experiencing success in teaching science. Also, growth in identity and confidence, as well as praxis and relationships, is enabled through collaboration, co-ordination and communication between partners. These three "enablers of growth" were a necessary part of ensuring the success and sustainability of the partnerships. The following chapter (Chap. 9) draws on the perspectives of the different stakeholders to explore this issue of sustainability further.

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Chapter 9
Sustaining School–University Partnerships: Threats, Challenges and Critical Success Factors

Sandra Herbert, Christine Redman and Christopher Speldewinde

Abstract The purpose of this chapter is to consider the threats and challenges which impact on the sustainability of a partnership. By identifying elements that contribute to success and underpin the future sustainability of the relationships, an understanding of how the theoretical framing (Interpretive Framework) for university–school partnerships draws together the facilitation and maintenance of partnerships is gained. The focus is a consideration of each of the aspects of the Interpretive Framework, as outlined in earlier chapters, and a discussion of the threats and challenges evident in data drawn from partnership stakeholders including teacher educators, pre-service teachers, teachers and principals. Three key issues drawn from the data are raised and analysed and are presented as sub-themes. These sub-themes are the elements required for: sustainability; measuring sustainability; and threats to sustainability of partnership practices.

Keywords Partnerships · Sustainability · Science teacher education
School-based approaches · Teacher education · Interpretive Framework · Primary science · Pre-service teachers · Critical success factors

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9.1 Introduction

This chapter explores further how key stakeholders, as individuals, are active partnership participants in school–university partnerships. The preceding chapters have provided detailed information about the STEPS Project and its outcomes. Chapter 1 reviewed the rising tensions and contradictions inherent in the discourse surrounding the 'theory-practice nexus', which is informing current directions in teacher education in Australia. Chapter 2 outlined the STEPS Project as a response to the concerns expressed in Chap. 1, its objectives and intended outcomes, and the longitudinal and iterative methodology utilised to develop the cross-case analysis of these five distinct practices. Chapter 3 provided a detailed account of the structures, approaches, and arrangements of each of the five models examined in the research. The cross-case analysis of the case studies of each approach was used to identify key themes resulting in the development of a partnership model, the STEPS Interpretive Framework. Chapter 4 described ways in which partnership arrangements examined in the research lead to strong educational and attitudinal growth in terms of pre-service teacher (PST) confidence, professional identity and self-efficacy and their capacity to learn and teach science. The degree of embeddedness of the partnership within the partner organisations is captured in the Representation of Partnership Practices (RPP). These components, which make up the Interpretive Framework, are discussed in Chap. 5. Chapter 6 outlined the processes for developing partnerships, how to maintain them, and the opportunities, challenges, and pitfalls, that are endemic to partnership work through the Growing University–School Partnerships (GUSP) elements detailed in the Interpretive Framework. The outcomes of the partnerships studied are represented in Chap. 8 as a series of vignettes examining the growth of the PSTs.

The purpose of this chapter is to identify and consider the nature of threats and challenges, which can impact on the sustainability of a partnership. By identifying elements that contribute to success and underpin the future sustainability of the relationships, the reader will gain an understanding of how the theoretical framing as considered in the Interpretive Framework (see Chap. 4) for university–school partnerships draws together the different approaches that support the facilitation and maintenance of partnerships. The focus here is to consider each of the aspects of the Interpretive Framework as outlined in the earlier chapters and to describe and discuss the nature of threats and challenges as evident in the data sets drawn from project participants. This data includes the voices of teacher educators, PSTs, practicing teachers and school leaders. Three key issues drawn from the data are raised and analysed and these become sub-themes. These sub-themes are the elements that are required for increasing the likelihood of the sustainability of a partnership; accessing and enhancing the quality and health of a partnership and its potential for being sustained; and the range of blockers that can impede the sustainability.

Sustaining effective university–school partnerships requires an understanding of the assumptions, expectations and needs of each participant. Each setting is distinct, with features that may be common to all schools, but they will also have features that

can be seen to be distinctive and unique to their own settings. Each school setting may have different priorities and foci, and these may take precedence at different times of the year, and they change and differ from year to year. A school's program cannot be assumed to be the same each year. Good clear communication is essential. This communication will more likely ensure that both partners understand the reasonable expectations of the other. The university requirements of the partnership are also likely to undergo modifications, so the school partnership members may also need to be alerted to changes that may impact on the intended outcomes.

The complexity and changeability of partnerships is a key factor that warrants attention and needs to be considered when constructing partnerships. Foregrounding the range and diversity of expectations and needs of each partner is essential and contributes to the potential satisfaction and success of the partnership. Conversations regarding potential variations, where individuals may be involved in different ways, are required to clarify and share expectations between all members of the partnership. Otherwise, people may be unexpectedly impacted upon by unforeseen constraints and affordances. This requires clear lines of communication to cover the different types of responsibilities and outcomes. Notably, ill-considered constraints and affordances may either enable or alternatively might constrain certain elements and practices of the partnership. The differing needs of each partner will create expectations that need to have been explicitly shared and understood to sustain the building of the relationship. Communication and clear lines of reporting will contribute to sustaining an effective relationship.

This chapter identifies the range of elements that contribute to a partnership's success and underpin the future sustainability of the relationships. When examining a university-school partnership its contribution to the identified needs of the different stakeholders, as detailed in the GUSP Table, supports the evaluation of this process. The table is discussed comprehensively in Chap. 6 and presents the elements that comprise a growing partnership, as these arose and became evident as common features during the STEPS Project data analysis. A partnership relationship can be considered through the development of shared aims and a clear rationale; identification of the instructional expectations and the roles and responsibilities of participants; how interactions will occur between members of the learning community; and how collaborative decisions will be negotiated for mutual benefit, documentation and dissemination.

The phases in the GUSP reflect aspects that can arise in the phases of initiation, implementation and evaluation. The evaluation phase of the GUSP (3A) encourages each partner to examine and justify the relevance of the existing program. It enables consideration of the appropriateness of the next iteration of the program and identifies opportunities for future improvements. These actions ensure any unusual or unforeseen activities or events can be addressed and resolved before they become problematic. A review of the productive elements and constructive enablers and impediments of institutional expectations can be addressed when focusing on 3B of the GUSP.

The roles and responsibilities of the different participants are an important focus and are brought into discussions when appraising the capacity of the partnership

to respond to present and future expectations of members of the partnership (3C). Foregrounding the ongoing need to be assessing the range and types of interactions between stakeholders and the links to educational research that arise as evidence of the quality of the partnership (3D) is a key element that ensures that research informed practices pervades the thinking of the partnership participants. Different elements, evident in different actions and at different sites, will be required to be examined and evaluated by the different partners and the GUSP is designed to assist this.

9.2 What Is Partnership Success, What Can It Look like?

Success is a very subjective notion. It depends on the expectations of the individual and the intent of the partnership. In fact, Newman (2014, p. 192) indicates that there is an ongoing search for a "universal definition of 'success'—one which most likely does not exist". In the public domain, there needs to be a division of elements being considered to specify components of a program to understand successes or failures. The elements of this partnership model that offer opportunities for success has utilised Suchman's (1994) concepts of boundary crossing involving "encountering difference, entering into territory in which we are unfamiliar and, to some significant extent, therefore, unqualified" (p. 25). This model recognises that PSTs, academics and teachers are all experiencing the boundary crossing phenomenon and that this requires multiple opportunities for collaboration and conversation between the participants. These collaborations evolve from initially having shared purposes, and eventually, they start to revolve around all participants working together to enable PSTs to achieve specific learning goals. Bloomfield and Nguyen (2015) described sustained partnerships as those that have practices of "reciprocity and mutuality [that is achieved over time], "through a process of negotiation" (p. 24) and the eventual establishment of common goals.

Partnerships may have been established with the intent of providing authentic teaching opportunities for school-based science education for PSTs. The teacher educators involved in the STEPS Project came together through a common interest to provide quality and effective science teacher education for PSTs. Together they worked to develop a set of guiding pedagogical principles to follow in order to achieve this aim:

1. Embedded within a partnership between university and schools.
2. A commitment to quality science education.
3. Authentic interaction with students in schools for the purpose of bridging the theory–practice divide.
4. Science teacher educator plays an active role in supporting the PST in school settings.
5. Science teacher educator and PST practice are informed by pedagogical and learning theories.

6. Interaction between PSTs and students is integral to a science-related unit.
7. Involve planning, implementing and assessment of a learning sequence in science.
8. Reflection on and articulation of practice that focuses on PST development and identity, and student's learning. These understandings are explored and explained in Chap. 6 (Hobbs et al. 2015).

There are many different types and models for partnerships, and success can be assessed in many different ways. Different stakeholders share different concepts of what constitutes success for them. Schools, for example, may have a range of reasons for engaging in school–university partnerships, and these reasons form the basis on which they determine success may be better assessed. For the school, the intent of the partnership may be to improve the school's relationship and learning outcomes through a university partnership. The school may be seeking to increase the amount, or quality, of science education opportunities the students, and their teachers, experience. Success in that context may mean that when PSTs teach students science that the partnership is deemed to be a successful one. A school may enter into a partnership seeking professional learning for their teachers, so success would look very different and be assessed differently. These schools would judge success through the degree of professional learning which teachers report on, and ideally later, implement. Ultimately, there can be a range of measures for determining success depending on the school's reasons for engagement in the partnership.

Similarly, teacher educators may have a range of reasons for their involvement in a partnership. The partnership may have arisen as a result of a direct request from a school or the teacher educator's recognition of the value of providing more effective and authentic learning and teaching engagement with science content and pedagogy for their PSTs. Success in this circumstance may be assessed through the work produced and in meaningful classroom experiences for their PSTs. PSTs have less control in the establishment and maintenance of a partnership but may assess the success of the experience through diverse criteria such as the amount of time needed to prepare and resource lessons; their experience of working with students, and in developing their capacity to be responding effectively to any issues of behaviour management; or perhaps their own desire to improve their science content knowledge. Success of the partnership for PSTs is both personal and professional and again dependent on the PSTs' expectations and experiences.

Given this diversity of stakeholders and the diversity of partnerships, the notion of success can be seen to be pragmatic, personal, professional and subjective depending on the nature of the partnership and the expectations of the stakeholders. The GUSP provide insights that help to determine what aspects of the partnership may be deemed successful by some stakeholders and not by others, or it may be deemed moderately successful by all stakeholders. Success then can be perceived differently by the stakeholders, and the overall success of a university-school partnership can be determined and judged according to the willingness of the stakeholders to sustain the partnership over time.

> There's the continued willingness to be engaged … So one of the success factors would be that it does keep going and we are invited to come back next year. The teacher and others in the school would continue to be interested in hosting pre-service teachers. (Valerie, Teacher Educator)
>
> They are always keen to have us back and change around their program so we can fit in. They see value in it as well it's not as though I'm pushing myself in. They're pretty keen to have us there so it's transformative in that way. (Barry, Teacher Educator)

In addition to the willingness of the school to continue their involvement, other measures of success presented were largely based on anecdotal feedback from teachers and PSTs, through interviews, surveys and focus groups. While some of the programs required the PSTs to assess their students' performance and to present evidence of student learning as part of their assessment in the school-based unit, none of the participants, including the STEPS teacher educators, had directly observed the effects of the programs on student performance in the classroom.

The success of the partnership relationship has significance at the level of supporting others and enabling change. Ensuring the partnership is successful requires careful consideration of a number of elements to ensure sustainability is likely. Key stakeholders currently involved in partnerships or who desire to be involved in partnerships have identified important features of a school–university partnership to it to be regarded as successful.

9.3 How Is the Success of University–School Partnerships Measured?

The nature of a university–school partnership can be a determinant of sustainability, and all partners need to experience benefits and value. To determine the types of benefits stakeholders experience in a school–university partnership requires regular, ongoing evaluation of the nature of the partnership to ensure it responds to the current and future needs of each partner is crucial for the partnership to succeed. These measures can include a range of anecdotal evidence and any observable engagement, to assist in determining what success is evident for the in-service teacher and their students. When judging the success of their school-based programs, teacher educators interviewed who were external to the STEPS project indicated a reliance on multiple forms of data to ascertain the success of their programs including:

- assessment materials provided by the PSTs;
- formal university conducted PST evaluations and;
- school-based anecdotal evidence.

The triangulation between these forms of data and the continued enthusiasm of the schools and PSTs served as one means of validation for the school-based approach and provided evidence of the different types of benefits available to all the partnership participants. The primary concern of the teacher educators was the potential opportunities for learning for their PSTs. The untested, but not unreasonable, assumption

here is that improved teacher performance in science education would lead to better learning outcomes for PSTs, as well as the students they teach.

For PST development, the sustainability of a school–university partnership is measured by actions such as observation; debriefing and reflection; and surveys.

Observation by a third party such as the teacher educator or mentor teacher may assist to target and measure expected teaching behaviours of PSTs to supplement anecdotal descriptions provided by the PST of their own performance. The partnership allows the teacher educator while at the school site to observe teaching practice in real time (Arthur et al. 2003, p. 163). Teacher educators have noted the benefits of this:

> [It's] me being out there are watching, I'm looking that they're engaging with what's going on. With a group of two or three pre-service teachers, it's quite easy to just take a background role. I'm looking at how they're engaging, I'm looking at their questioning, their confidence in how they are engaging and talking with the students. (Carl, Teacher Educator)

As much as the PST can benefit through observation, the in-service teacher can also benefit:

> I think observing anyone else's teaching is always a good thing because you can reflect upon what they've done well and what they haven't done. It might not necessarily give them feedback about the bad things but you might think to yourself 'oh I do that maybe I shouldn't do that anymore, maybe that doesn't work the best', or giving five minute warnings or two minute warnings and say how much time they've got left. (Bob, Teacher, ACU)

It also allows principals and school leaders to interact, observe and provide real-time feedback to the PST:

> They love it, my observation because I get out and wander around pretty much every week just to see. They like it because there's some interesting activities, they're activities that perhaps can't replicate across a class of twenty kids but are manageable with a small group of half a dozen. So they're actually getting some good hands on activities and they like the small group stuff, the kids like the opportunity to work in small groups and they love having three or four teachers taking them. (Aaron, Principal, Deakin)

Involvement in a school-based program of PST education has been shown to promote self-reflection and professional development (Peters 2011, p. 6). Teacher educators interviewed for the STEPS Project echoed similar sentiments as to why partnerships and reflection go hand in hand:

> Reflection is a big part of what we are really talking about, so I'm looking for them to reflect on their practice, what went well, what didn't, how they are going to improve for the next session and then a lot of the indicators of how they are going some from the write up of the reflection. (Carl, Teacher Educator)

> [PSTs would get] …more teaching time but also with the bonus of them having to come back and deconstruct and reflect. (India, Teacher Educator)

Surveys too acted as an important tool to understand the range of elements within the partnership. This included how PSTs respond to partnership practices, how PSTs develop and how partnership development can occur:

> We have the pre- and post-surveys that they fill out and also we've had focus groups and teacher educator diaries and interviews. So, we've used some of the information to assess how it's going and in each case it's been quite a positive response overall. (Michelle, Teacher Educator)
>
> Over the years we've just used the STEBI (Science Teaching Efficacy Belief Instrument). Generally over the years all we've been interested is whether students see themselves reconceptualising science. Their views of self and their views of science and the STEBI always been a good instrument for them to self-reflect on the changes that occur within the subject and what has contributed to those changes and generally the commentary that comes from students. (Allan, Teacher Educator)

For schools, the sustainability of a school–university partnership is measured by "effective communication, flexible funding, local autonomy and the continuity of the partnership" (Peters 2011, p. 8). Further to this, Kruger et al. (2009, p. 33, 97) have identified that trust, mutuality and reciprocity are key drivers but in terms of their measurability this is left to qualitative accounts rather than key indicators and quantitative measures.

9.4 Factors Contributing to Success of Partnerships

9.4.1 Giving Pre-service Teachers the Opportunity to Teach Science

PSTs often have little or no opportunity to teach science in their normal practicum. One reason for this is that many primary school teachers lack confidence and experience in teaching primary science and avoid teaching science (Tytler 2007) and may lack the capacity to support the PST. When PSTs are given the opportunity to teach science in primary schools, it serves several different purposes. It provides an authentic science education experience for PSTs in teaching students; offers students access to learning science; and has the potential to enhance classroom teachers' confidence and knowledge in teaching science. It responds to three significant areas of concern: issues about the effectiveness preparation of PSTs (Chubb 2013; TEMAG 2014); disquiet about the lack of adequate science education in primary schools manifesting in negative student attitudes, decreasing participation in post-compulsory science subjects, (Tytler 2007); and a projected skills shortage in science-related fields and a shortage of qualified science teachers (Tytler et al. 2008).

Common to university–school partnerships that have been established to provide PSTs with the opportunity to teach science is the notion of an authentic learning experience for PSTs. This occurs when the PST teaches science to school students, receives, reflects and acts on the feedback from their students, peers, teachers and teacher educators:

> PSTs have an authentic experience of teaching science… They are able to observe their peers teaching science which gives them an opportunity to learn about different teaching

> styles… They receive feed-back from their peers, a class-room teacher (or mentor), and their university educator. (Agnes, Teacher Educator)
>
> So I guess it showed me how easy (teaching science) was, not easy but how important and how rewarding and valuable it is not only for the students and learners but also myself as a teacher and a learner. Yes to really try and create something fun and engaging in an integrated way. (Katy, PST)
>
> So there's a bit of two way learning about [pre-service teachers] being able to run their practicum and learn about classroom management and learn about how to deliver the lesson and then our teachers are getting that almost like a refresher on 'this is what you can do and this is how you can teach this in science', so there's a little bit of a two way street. (Aaron, Principal)

A school-based experience can facilitate a connection between theory and practice actively mediated by the teacher educators involved in the partnerships. Twelve of the twenty external teacher educators interviewed in the STEPS Project referred to constructivist, inquiry-based learning, usually in the context of 5Es approach (Bybee 1989) with the school-based teaching providing an opportunity for their PSTs to apply their understanding from their university studies in practice. Eight TEs explained that opportunities to reflect on their teaching of science had been an effective way to assist PSTs to link the theory and practice of teaching science. These external teacher educators considered that university–school partnerships provided access to a valuable learning environment that cannot be emulated easily:

> …we are gaining something that we benefit from but wouldn't otherwise have which is access to children and also access to the school environment. To the context in which we do the tutorial and the context in which we are is most important. It is the mutuality of it. (Ivan, Teacher Educator)
>
> There's the benefit of the just-in-time nature of it. At the moment when I teach them, it's eight months, six months whatever to when they make it into a classroom. (David, Teacher Educator)
>
> When our students are doing it, it's not an add-on. There's no smoke and mirrors, it is actually situated in the school's curriculum and the reports that are developed on children's learning are then given back to the teachers. So to me that is authentic, real life and we know the literature around teaching science around early childhood, primary is often about resource management and the like and their understanding of content. (Harry, Teacher Educator)
>
> I think it was a fantastic way to integrate the theory and research into best practice science teaching by actually planning, implementing and assessing a science unit within school environments. (Katy, PST)

While the learning potential for PSTs from the school-based science activities was obvious, there was also the potential for professional learning for teachers:

> It is good professional development for the teachers who are involved in the mentoring of the pre-service teachers in the schools. (Matthew, Teacher Educator)
>
> I'm using this as an opportunity to show [the teachers] that there's some really fun little activities that show some good science and it's easy to use with equipment that is easy to get your hands on. (Barry, Teacher Educator)

These quotes illustrate the benefits to the various stakeholders that is understood when PSTs have the opportunity to teach students in school settings. PSTs can

become aware of the challenges of teaching science in a school environment. For teacher educators, it provides an opportunity for praxis embedding theory in practice and practice in theory. For teachers, it provides them with professional learning opportunities and hence builds their confidence and knowledge to teach science more confidently through PSTs' modelling of well-planned and theorised science activities with their students.

Finally, and significantly, school students experience a range of benefits: opportunities to participate in science learning activities which may not otherwise have been offered; engagement in science-based thinking, as well as developing science skills and attitudes; the thrill of discovery, and the joy of learning about the world around them; as well as interactions with PSTs who perhaps are positive role models for science and perhaps then are also raising aspirations for university study.

9.4.2 Willingness/Enthusiasm

Partnerships are dependent on the willingness, enthusiasm and expectations of the stakeholders to be involved in the partnership. Bloomfield and Nguyen (2015) describe the result of a partnership that has developed over time as "the sustained nature of the program, now its fourth year, has supported the progressive building of community characterised by trust, openness and a willingness to engage in critical enquiry over time" (p. 38). The attitudes of partners in partnerships are noted here as factors that are significant. Partners build trust, over time, and need to demonstrate their willingness to be active in a partnership.

Often, the initiation and maintenance of a partnership relies on the ongoing willingness of the people participating in the partnership. This can require additional time and effort which are invested to overcome any unexpected issues as they arise. In the first instance, the willingness of the principal and the teacher educator is critical in the initiation of a partnership. Responsibility for the ongoing maintenance of the partnership then devolves to the classroom teacher, and teacher educator who might be preparing the PSTs with approaches that may be different from the existing school-based practices, initiated by the teacher educator who set up the partnership. Finally, PSTs need to be willing to ensure that they understand and meet the commitments required of their teaching of science. These responsibilities include planning, preparation, punctuality and professional conduct.

> Oh I loved science before but I hadn't been so involved in the environmental side. I did Biology but we focused more on Human Biology so I knew more on that side than the environment but I love that kind of getting involved in what's involved in the world and kids are involved in that every day so it's good for them to learn about it. (Erin, PST)

> A willingness to participate. So you've got to have the people, so the lecturer who is willing and can then tell the students to go. (Alexa, Teacher Educator).

> [PSTs] loved the experience. They found that they did learn so much about science and it did dispel their fears which they had brought with them. If you're are talking about identity it did change them about the way they saw themselves as science teachers and how to teach science. (Agnes, Teacher Educator)

9.4.3 Communication

Communication is understood here to be the single most important factor contributing to the success of a university–school partnership. It is the most frequently mentioned factor used by the external teacher educators using school-based partnerships. Communication though, is a broad term. It will impact on several aspects of the partnership. Initially, communication is essential for the establishment of a clear understanding of the expectations of all parties and a supportive leadership. This results in all stakeholders identifying benefits from their partnership participation, so that everyone involved understands their responsibilities, so that they participate in an informed and willing manner.

> The school's community has to be aware these pre-service teachers are [at the school] and that having and an impact on the children's learning is a good thing. I know the principal and deputy principal have spent a lot of time keeping their community informed of what it means and they keep them informed. (Harry, Teacher Educator)

> A partnership infers that the partners are working towards a common goal - which in acknowledging and promoting the teaching and learning of science - for PST's and the children. This is achieved by having clear communication with the principal and the teachers and the PST and tutors about the obligations, expectations and relationships that are integral to the program. (Golda, Teacher Educator)

These quotes have illustrated how these partnerships can extend beyond classrooms, including the broader school community, parents and friends of the school. The 'common goal' needs clear communication so that all stakeholders see and understand the range of benefits available in the partnership.

9.4.4 Respect/Goodwill

Respect and goodwill in time become embodied in a truly collaborative environment enabling partners to engage in a school–university partnership that is mutually beneficial to all. These forms of partnerships have a transformative effect upon teacher education and expose possibilities for teachers and teacher educators desiring to collaborate to support PST development in ways that respect each other's distinctive contributions (Kruger et al. 2009, p. 13). Universities have a dependent relationship with partner schools to find PST professional experience placements that are based upon the goodwill of those partner schools (Peters 2011, p. 1). Here, participants

in partnerships explain how they view respect and goodwill as key components of partnership success:

> Respect between the university, myself and the school. So, there's not an idea of a divide, we are moving beyond boundaries. (Ivan, Teacher Educator)
>
> The goodwill of the school is really important. You need a teacher in the primary school that understands the importance of it and will invest in it, so there is a little bit of organisation that has to happen. You need a lecturer at the university that understands the importance of it too. Someone who is prepared to put in that background work to make it happen. The students take it on board because it is an assessment task. (Carl, Teacher Educator)

These quotes illustrate the extent that partnerships develop habitual practices of give and take. The development of collegiate approaches arises as people work together. These attitudes will help to sustain a university–school partnership and come to symbolise the willingness of the stakeholders to be flexible to ensure a positive experience both for the school, its teachers and the learning of their students, and also for the university, its teacher educators and its PSTs.

9.4.5 Mutual Benefit/Mutuality

Kruger et al. (2009, p. 13) claim "mutuality and reciprocity have the potential to transform teacher education". Basing partnerships upon mutuality is not accidental rather, mutual and inclusive partnerships between all partners including teachers, PSTs, teacher educators, broader school communities, education systems and universities, bring possibilities for desirous relationships supporting development of all parties. Kruger et al. emphasise that partnerships left to the individual are unlikely to succeed and that all parties need to agree to be active contributors.

> One of the important things if you are using a school-based model is that it is good professional development for the teachers who are involved in the mentoring of the pre-service teachers in the schools. (Niall, Teacher Educator)
>
> We're working collaboratively and we're working in a model that isn't just about our students saying this is what we need, this is what we want, this is what the university says we have to do, it's all for us, me, me, me, it's about giving back to the school as well. So it should be that it's this mutually beneficial model which again prepares our teachers, it's not just about me in my classroom it's about the broader school community and giving back. (Micko, Teacher Educator)
>
> I am learning from her and she is learning from me… mutual learning. (Rachel, Teacher)

Mutuality has become a repeating factor that can be expressed from different perspectives as different stakeholders value different experiences and opportunities. Some value the learning for students, while others value the benefits for the teachers in their school, and others understand the implications for the school community. A successful partnership should be able to identify a range of aspects arising from the relationship that benefit a number of different stakeholders.

9.4.6 Role of the Teacher Educator

Establishing relationships with the schools seems to be very important for school-based approaches. In university–school partnerships, the initiator for the science programs was usually a teacher educator. These long-standing relationships or partnerships can be facilitated by involvement in other programs which provide a link.

> One of the schools has been there ever since and that's a close school so it's very convenient. We've always had a very relaxed relationship with them. Two of the other schools I was approached by ex-students who wanted their school to be involved. (Ivan, Teacher Educator)

Where such a pre-existing relationship does not exist, teacher educators may encounter difficulties in finding willing schools and establishing relationships:

> Generally it's been who do I know or who has approached me or who knows somebody who might be interested in providing a place or helping me navigate a place for our students to gain some more in school experience and that's kind of the overriding concern with all of these kinds of partnerships we're working on is to provide additional time for our students in whatever context. So they're with real kids more than the structure of the program allows. (Valerie, Teacher Educator)

In this section, we have explored those factors that have been identified as key contributors to the success of university–school partnerships established for the purpose of providing PSTs with opportunities to teach science to students in primary schools. So the questions arising from this discussion are concerned with the sustainability of school-based programs.

9.5 What Blocks Success?

In many cases, in addition to the elements required for a successful school–university partnership to operate, there have been issues and blockers identified which can impede the sustainability of a partnership. While the cornerstones of school–university partnerships are collaboration, trust, and mutuality, prevailing conditions can impact upon the partnerships' success. Cultural differences between schools and universities can lead to resistance (Burton & Greher 2007, p. 16). Communication breakdowns, conflicting values and a lack of commitment to the amount of time and energy to the partnership can block success. Organisational factors relating to program planning and teacher recruitment, providing clear expectations for professional experience, and issues around workload, time, space and resources may all act as blockers to success (Peters 2011, pp. 7–8). These issues are either able to be overcome or can be managed as part of the sustainability of the partnership. The 'Australian Federal and State government' has been increasingly "exerting strong pressure on schools and teacher education institutions to more specifically account for their forms and practices of partnerships" (Bloomfield & Nguyen 2015, p. 39). Issues that arise in partnerships need to be raised, considered and discussed, and

then they are more likely to be modified and the model changed to take account of the needs of participants. Models can be changed and then are more likely to be contributing to the sustainability of a partnership, ensuring longevity and usefulness.

Common issues identified are: timetabling and changing university course requirements; logistical problems where teacher educators and PSTs travel long distances to schools; increased workload; the diversity of the PST cohort perhaps undertaking distance or online learning; and resourcing.

9.5.1 Timing Issues/Timetabling

Peters (2011, p. 8) mentions that the availability of time and the timing of sessions can influence not only teachers willingness to act as mentors for PST, as this also creates an additional unavoidable workload associated with supervision, it can add then to the reluctance to participate in school–university partnerships. The teacher educator needs to be informed of the implications of these activities on their time:

> Time and resources are huge restraints. There is only the same time allowance on our work plans for engaging in this unit but it is much more time consuming compared to delivering lectures and tutorials. There are never enough resources to support our students wonderful ideas and I supplement the budget every year. The time tables of schools do not align with ours and it is very difficult to get blocks of consecutive weeks to go to the schools without losing time to other events. (James, Teacher)

There are increasing numbers of PSTs completing their initial teacher education in a variety of modes with growth in online enrolments. These differing models impact on school-based programs.

> We've finally got permission to go to the other campuses next year but our courses have been restructured. The first unit of Science and Technology they want to do externally so that's going to make it very difficult. Not quite sure how we will go about it. (Lila, Teacher Educator)
>
> We also have external students, we have students that are indigenous that study through the remote aboriginal teacher program. I work with them so they are never on campus, it's an on line course and then those students are expected to do it within the context of their home communities so very much contextually based. (Allan, Teacher Educator)
>
> One of the constraints is this notion of the on-line students not participating so it is not an experience that all the students in the MTeach would have. (Davina, Teacher Educator)

The size of the PST cohort can influence the initiation of a school-based program. India (teacher educator) was concerned with how large numbers could be accommodated in the program. She saw a fourth-year elective as one way of managing this problem as there would be fewer PSTs involved and that it would also provide a degree of specialisation in science which might be to the PSTs advantage in gaining later employment. Similarly, Matilda (Teacher Educator) claimed that her university's policy of rapid growth in student numbers had made their pre-existing school-based activities, built up over many years, too difficult to maintain.

> [In the past] we saw them [pre-service teachers] four times one semester every year for four years and we linked second year and third year and fourth year placements so it was always authentic…next iteration … we lost our integration. We went across…five campuses and on-line as well so it's become incredibly complicated… you have an awful amount of sessional staff…I would have been the only permanent staff working…so the rationale was to make sure it was on-line, be flexible and to be big… It's about economics of scale…we would keep saying how's this going to work for the students and we'd be told don't worry about. (Matilda, Teacher Educator)

These concerns around coping with numbers of PSTs are also expressed in the quote by Melanie below.

> With students working in pairs and having 46 classrooms involved made it exhausting to be involved in the visits to classrooms. I used to manage 2–3 visits over the 5 weeks for each group. This year I only managed 1 visit per group and only for 30 min each. (Melanie, Teacher Educator)

9.5.2 Logistical/Workload Demands

Logistical factors related to PSTs attending a school-based program include the transport of PSTs and teacher educators to the school. This signals the need for attention to matters like adequate parking at the school; and challenges of moving or sourcing equipment and supplies. In some cases, historically, PSTs have purchased materials to use in their classes. In addition, difficulties can arise if the school is not close to the university and PSTs have to return to on-campus classes. However, these issues in establishing and maintaining the school-based programs place demands on those teacher educators coordinating the programs. It may become particularly demanding if the program requires a high level of teacher input, such as providing feedback to PSTs or arranging equipment and resources.

> I've realised working with primary schools, you need to work in quite long-term forward planning In this particular year, from a view of the university establishing partnerships, I think it's become apparent that these things don't happen overnight. You have to take the time to build the relationships and get to know when the planning meetings are on. (Andrew, Teacher Educator)

> The last thing you want is teachers putting up their hands and saying we want you to come, work with our kids but then they don't engage with the process. In other words, it's just perpetuating that problem that there tends to be a low efficacy and maybe a low priority to science. (Allan, Teacher Educator)

Some teacher educators coordinating school-based programs identified the constraint of the increasing difficulty of getting access to schools due to demands placed on schools for the practicum placements. The practicum is an arrangement of teaching time made between schools with universities to provide PSTs with a block of time providing classroom teaching experience. Some school-based science education programs were operating alongside or independently of the practicum. Note that one of the key drivers of these programs arose due to the lack of opportunity for PSTs to engage with science while on their practicum (or school experience):

> …we can't be guaranteed that something will happen during school experience. I think our pattern here would be probably two thirds of students would graduate without having taught science. So that means there's an imperative in subjects like science education. (Allan, Teacher Educator)
>
> It's time, it's schools, I know some of the partners are having trouble getting into the school. I think you have to be strategic in how you approach the school. (Lorelle, Teacher Educator)

Likewise, school-based programs impact on other teacher educators directly involved in working with the PSTs in the school. The workload demands on teacher educators are increased if they are required to undertake observational visits to the schools; conduct their classes in the school; and transport equipment and materials. At the moment, many of these programs operate on the goodwill of teacher educators:

> I think the distance is certainly is an issue. We have such big numbers of students so it might be difficult to organise to ensure you got good teacher mentors. Clearly we are hoping for that but it doesn't always happen. I think that's pretty crucial if the students are going to be in the schools for long periods. (Niall, Teacher Educator)
>
> Transporting of resources each week to the school to conduct the workshops is sometimes difficult when transferring a large amount of equipment or heavy equipment from a car. (Sally, Teacher Educator)
>
> … actually teaching beyond the university so moving equipment and things out to the school and the time and effort involved in that and finding parking. (Ivan, Teacher Educator)
>
> I'm the only one doing it. (Alexa, Teacher Educator)

These workload issues influence the teacher educator's willingness to initiate and maintain university–school partnerships. It would seem from the range of difficulties raised above that creating school-based programs could prove to be challenging. However, teacher educators are typically motivated sufficiently by the powerful learning opportunities these school-based learning approaches offer to their PSTs and are prepared to resolve any issues that arise. Ivan reinforced this view.

> It is fairly cumbersome and difficult to organise. We go for much longer than we would in the university context. …. So it is a lot more effort, the point being, if you are interested in education, the learning benefits swamp the extra effort in doing it because it is such a rich experience. (Ivan, Teacher Educator)

9.5.3 Resources

Issues related to resourcing may constrain a university–school partnership. There are workload implications for teacher educators who typically invest more time in setting up and maintaining a partnership than allocated, or acknowledged, in their teaching workload. In addition, financial costs of materials and equipment need to be considered. Equipment and materials are central components of science education programs. Discussions need to be held that establish the necessary processes for dispersing costs of equipment and then its transportation, storage, maintenance and replenishment. It is not unusual for PSTs to fund the cost of classroom materials. Interviewees explain their concerns as:

> The other thing worth mentioning, it was a pretty expensive model from the university point of view. The school got a lot out of it but because we could only take small groups into school, it made it costly. (Brianne, Teacher Educator)
>
> In a mentor based program where mentors (scientists) come from outside of the university, it can be difficult to source mentors. (Alexa, Teacher Educator)
>
> The funding allowed for tutors is limited and the school-based program demands more time commitment – by the tutors who have to liaise with the school, collect equipment and transport it to the school – and they are generally not paid extra for the time that this takes. This year, some extra salary was negotiated in recognition of this extra effort required. (Ivan, Teacher Educator)
>
> I had a couple of experiments in mind and I actually sort of ran them past the students before I got the materials. (Carly, PST, University of Melbourne)

These factors are an unnecessary complication, potentially impacting negatively on the potential success of the in-school program. Careful planning, negotiation of the times the PSTs are in class, car-pooling, awareness of resources available at the university and in the schools and budgeting all can minimise these problems.

9.5.4 School Constraints

Schools may view having large groups of PSTs in the school as a problem. The numbers can interrupt the normal operation of other classes; availability of suitable spaces; and workload implications for teachers.

> There is an imposition on what the classroom teacher has planned and what the PSTs are doing. (Abigail, Teacher Educator)
>
> I think in a time where that voluntary nature of pre-service teacher supervision is becoming more challenging there has been amongst some of our local schools less interest in hosting students. (Wanda, Teacher Educator)

So these types of constraints may exist for both universities and schools and also can shape, and should inform, the organisation of a partnership. Timetabling, curriculum and resources are examples of blockers to the partnership arrangement. It is critical to partnership success that early and ongoing identification by all partners, occurs to monitor as many constraints and affordances as possible. As changing constraints, if and when they become apparent, during the partnership implementation periods occur, appropriate and prompt responses by partners occur. This can lead to better planning for future partnership iterations and is also necessary later in the evaluation phases.

9.6 Discussion of Critical Success Factors

The data presented above indicates that the critical success factors for a university–school partnership aligned with the set of partnership principles embedded in the

Interpretive Framework. These principles were presented and explained in Chap. 6: Risk-taking and Trust; Reciprocity and Mutuality; Respect; Recognition of respective goals; Adaptability and Responsiveness to changing needs; and Diverse representations.

9.6.1 Risk-Taking and Trust

In a successful partnership, the partners are prepared to take the risks necessary to establish a partnership. All partners need to be able to trust that the organisation and management of the experience will be effective. Schools need to trust that PSTs will be capable of teaching a science sequence and will be reliable, organised, punctual and prepared for the in-class teaching as timetabled. The teacher educator should be prepared to ensure that the quality of the teaching and learning experience of PSTs remains high, thus ensuring a high-quality experience for the school students. Timely, open and honest communication between partners is crucial.

9.6.2 Reciprocity and Mutuality

Mutual, identifiable, benefits for each stakeholder in the partnership are necessary (Kruger et al. 2009). These benefits can be viewed from the perspective of each stakeholder, for example dedicated science learning experiences for school students that the PSTs bring to the classroom; classroom teachers having opportunities to observe the contemporary teaching of science education, that is informed by current research (Peters 2011; Tytler 2007); school leaders need to recognise that the partnership is enhancing their school improvement strategies; PSTs receive valuable, authentic experiences contributing to the positive formation of their teacher identity, self-efficacy, experience and knowledge of teaching science (Chubb 2013); and teacher educators gaining information from observing their PSTs (Arthur et al. 2003) and the valuable experience of observing changes in school and classroom structures, trends in students' interests, capabilities and engagement, and technologies that are entering classrooms that can be embedded in their own programs.

The focus of the partnership should remain on these benefits and not be lost in the administrative detail required to maintain the partnership.

9.6.3 Recognition of Respective Goals

It is important to identify and cater for the main goals of each partner, that is, the quality of the learning experience of the school students; and an authentic learning experience for PSTs. Recognition of these primary goals lays the foundation on

which the partnership should be structured and maintained over time through ongoing discussions (Bloomfield & Nguyen 2015).

9.6.4 Respect

Respect is the key to the success of a university–school partnership (Kruger et al. 2009). There is respect in the risk-taking process and the building of trust over time; respect for the needs and the goals of each stakeholder; respect for one another's goals; and respect for the types of partnerships that can be established at different stages of the relationship.

9.6.5 Adaptable and Responsive to Changing Needs

Over time partnerships change in response to changing goals and circumstances. A successful partnership negotiates through these changes to adapt to changing structures and processes. In the evaluation stage, adapting and responding to changing needs and/or new ideas can help the partnership evolve and this builds and contributes to the partnerships' chance of having sustainability. Communication is a significant factor in a partnership's continuing sustainability. It impacts all stages of the partnership, from the establishment of a clear understanding of the expectations of all stakeholders to the adjustment of arrangements in response to changing circumstances at schools and universities.

9.6.6 Diverse Representations

Successful university–school partnerships are diverse in nature. Any partnership deemed successful by its stakeholders must be valued as successful since as Newman (2014) reports there is no universal definition of success. The degree of sophistication of the partnership arrangement is not important. There is a need to identify the nature, and guide the formation and implementation of a diverse range of partnerships, and to value each type of partnership for the value it brings its stakeholders at a given point in time.

9.7 Conclusion

There are a diversity of approaches and types of partnerships, some more co-operative, others more collaborative. Each serves a particular defined purpose which

may be short-term or long-term. The practice of initiating, maintaining and evaluating any type of partnership can be underpinned by the set of principles addressed in the previous section to guide the partnership practice.

This is the final chapter in Part 2 of this book describing the Interpretive Framework as a partnership model initially based on the science education context. Next follows Part 3 which explores ways in which the partnership model is relevant to other educative-based partnerships are exemplified. The chapters in this section provide mini-case studies of how the model is being applied to other partnership arrangements both within and external to education and teacher education. The application of the partnership model outside of educational contexts requires a reassessment of the language, intention and relative usefulness of the different parts of the model.

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Part III
Application of the Partnership Model in Other Contexts

Introduction to Part 3—Rationale for Testing Applicability

The development of the Interpretive Framework originated from research centred on the school-based science education context. However, it soon became apparent that the model could be readily adapted to other contexts. This section of the book considers how components of the Interpretive Framework can be, and have been, reviewed and modified to suit other partnership situations. All of the chapters in this section refer to partnerships with schools. Chaps. 10–12 are partnerships between schools and universities for the purpose of teacher education, similar to those partnerships analysed through the STEPS Project. Chapters 13 and 14 explore the applicability of the Interpretive Framework to partnerships involving schools, with discipline experts in Chap. 13, and as part of a professional development programme delivered by a university. Chapter 15 has been included to show how the Interpretive Framework can be applied to education-oriented partnerships not involving schools. This chapter is valuable because it highlights the generalizability of the Interpretive Framework tools and methodology. The key elements of the Interpretive Framework can be adapted to support learning partnerships in other contexts and professions.

All aspects of the Interpretive Framework are important. For other university–school partnerships, the guiding pedagogical principles are useful once the specific discipline focus on science education has been removed. For example, *Commitment to quality science education* can become *Commitment to quality education.* The other principles are relevant to university–school partnerships in that they confer importance to authentic interaction with students and teachers, learning theories, theory–practice links, university educator involvement, planning and reflection on implemented practice.

In particular, the Growing University–School Partnerships (GUSP) invites consideration of key components related to how to initiate, implement and evaluate partnerships of all various types. In this area of the Interpretive Framework, it is important to establish what the aims of the partnership are, taking into account each

partner's requirements so that the relationships between contributing partners can develop and enable a strong partnership which is committed to action and positive outcomes. The Representations of the Partnership Practice (RPP) provides structures to indicate the connectivity of the partnership and further considers the level of commitment of each partner through the purposes and the nature of the partnerships. The Interpretive Framework provides a number of principles which govern successful partnerships and intersect with the nature of the partnership. The principles deal with the institutional interactions relating to trust, reciprocity, respect, adaptability and recognition of respective goals. The development of these principles within the partnership can lead to more successful outcomes for the partnership as a whole. These aspects are all considered in the following case studies which exemplify the adaptability of the Interpretive Framework to other contexts and highlight the flexibility of the model as it is applied to new partnerships.

Chapter 10
Teacher Education at Trinity University Meets the STEPS Interpretive Framework

Shari Albright, Angela Breidenstein and Josephine Ryan

Abstract This chapter investigates the principles and practices which have guided the highly regarded Professional Development School (PDS) partnerships at Trinity University, San Antonio, Texas, USA, and analyzes them in relation to the STEPS Interpretive Framework. The analysis is undertaken as a dialogue between an insider from Trinity University seeking to articulate the significant features of their partnerships and an outsider teacher educator making connections to the STEPS Interpretive Framework. Trinity partnerships have emphasized principles, including education as "transformation," the centrality of "relationships," and strong university leadership. Analysis of Trinity approaches in terms of the STEPS Framework suggests that faithfulness to overriding partnership principles has promoted strength and resilience in its partnerships with schools, indicating that the framework is justified in proposing principles and practices which can guide successful partnership development no matter where it takes place.

Keywords University-school partnerships · Professional Development Schools Teacher education · Transformational education

10.1 Introduction

This chapter takes as its focus the highly regarded Professional Development School (PDS) partnerships embedded in the Master of Teaching (MAT) programs at Trinity University, San Antonio, Texas, USA (Darling-Hammond 2006, 2010; Koppich

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2000). It explores the key principles and practices that have featured in the Trinity partnerships and analyzes them in relation to the STEPS Interpretive Framework. This process allows us to see the value of the framework in understanding the partnerships that have been integral to creating Trinity's reputation for providing high-quality teacher education such that Trinity was among Linda Darling-Hammond's seven "exemplary" teacher education programs in the USA (2006). The chapter too has been conceived and written as a partnership, with Shari Albright and Angela Breidenstein from Trinity University giving the analysis of Trinity's key principles and practices, and Josephine Ryan, an Australian teacher educator, seeking to articulate the ways in which these significant features relate to the STEPS Interpretive Framework. The Interpretive Framework has been developed on the basis of research in the Australian teacher education context, more specifically on the basis of partnerships in primary science teaching. In a volume dedicated to considering the value of the Interpretive Framework as a tool for developing and promoting "school-based approaches to PST education" (The STEPS Project 2015, p. 7), it is illuminating to consider how the STEPS framework does and does not apply to a partnership in the highly influential PDS tradition from the USA. Findings of the analysis suggest that university–school partnerships no matter where they operate are subject to similar challenges. Solutions, while local, are instructive for others to witness.

10.2 A Brief History of Trinity University's PDS Relationships (27 Years Later)

In 1989, heeding the call of the Holmes Group with *Tomorrow's Teachers* (1986), which argued for greater connections between universities and schools to improve teacher education, and even before the Holmes 1990 report *Tomorrow's Schools* (1990) which included a focus on the professional development school, Trinity University began to move to a more school-integrated teacher education approach. It redesigned its teacher education program to move from an undergraduate model to a MAT structure with a four-year Bachelor's in a content area (instead of education) and an extended and intensive full-year internship paired with Master's coursework. This structural change enabled the main site of the teacher education program to shift away from the university to schools.

In line with the Holmes Group perspective that teachers need to be given a bigger role in teacher education, Trinity's Department of Education also decided it was time to move from disparate sites for preservice teachers (PST) teaching placements toward the establishment of PDS partnerships that enabled more intensive relationships with a small group of schools. Key aspects included:

- A supportive university president, a visionary education department chair and two committed district superintendents willing to identify schools which were philosophically aligned with the university's approach

- The development of yearlong teaching internships for pre-service teachers (PSTs) in the PDS sites
- The designation of tenured and tenure-track faculty in the MAT program as "clinical faculty", with an expectation of significant time spent in a role as scholar –researcher–practitioner in the PDS settings, working with MAT candidates, their mentor teachers and the whole school.

Initially, four professional development school sites were established: Lee High School and Jackson-Keller Elementary from the North East District (NEISD) and Hawthorne Elementary and Twain Middle School from the San Antonio District (SAISD) allowing 26 PSTs to undertake their internships. Fast forward 27 years, and Trinity's MAT program and PDS partnerships are still strongly in place with 31 PSTs in the program (the MAT program enrolls between 20 and 30 students annually, and each semester approximately 20–40 undergraduates participate in practicum or field seminar courses).

10.3 Significant Moments in Trinity's Partnership History

Partnerships between universities and public schools need constant tending and developing in order to remain robust and effective. Throughout the 27 years of Trinity's partnerships, many have endured for 10, 20 and even all 27 years, which is due in large part to the stability of the clinical faculty. For example, Lee High School, one of the original professional development schools started 30 years ago, is still in place. One clinical faculty member, Angela Breidenstein, has supported this particular partnership through seven principals, two superintendents, three department chairs and four university presidents. Trinity's consistency in this relationship through Angela and through ongoing renewal of the partnership and its value has been the key.

Stepping outside of existing schools, Trinity partnered with local business and industry leaders to establish a new school that responded to the burgeoning need to prepare a more internationally-oriented workforce driven by the establishment of the North American Free Trade Agreement (NAFTA). The new school, the International School of the Americas (ISA), was developed with an international theme (Sergiovanni n.d.) and became the first public school of choice in San Antonio in the mid-1990s when themed high schools were beginning to develop. ISA continues to thrive as an innovation site and as a Trinity professional development school 22 years and five principals later (Quinn 2015).

One of the original PDS partnerships with Jackson-Keller Elementary, a nationally recognized model school as part of the Basic School Network (Boyer 1995), eventually dissolved its relationship with the university after principal and faculty turnover (in 13 years, there were three principals and four university clinical faculty). The successor PDS also struggled and that partnership eventually dissolved as well. A Trinity clinical faculty member involved in both partnerships wrote "When a PDS

Isn't Working: Confronting the Questions of Pulling Out" (Noman 2006) as a way to explore those difficult decisions.

This came in close succession to the dissolution of a 20-year partnership with Hawthorne Elementary, a highly innovative and independent public school. As a familiar story, the loss of key leaders at the school campus as well as at the university created a context in which the partnership was no longer mutually viable. Waning district support under the fourth superintendent since the partnership was formed also was a key factor.

Rather than remain in partnership with schools that were not committed to the PDS shared work, Trinity worked to identify a new PDS setting, which facilitated the collaborative hiring of a principal who was a Trinity graduate to collaborate on and reinvigorate a neighborhood school with declining enrollment as a new PDS school. Lamar Elementary School is now in year five of this new partnership and is thriving.

Most recently, to address challenges regarding teacher development and retention in urban schools, Trinity partnered with a local philanthropic consortium and SAISD to co-create a new school, the Advanced Learning Academy. The partnership supports a teaching residency for MAT students, a "talent pipeline" for new teacher development and retention (National Centre for Teacher Residencies 2017).

So, in keeping a tally of our PDS relationships for the last 27 years, one original partnership has lasted (Lee), one new partnership was created with NEISD (Jackson Middle School), three new schools were started and co-established with two school districts (ISA in NEISD and Lamar and ALA in SAISD), and four school partnerships ended (two in NEISD and two in SAISD). Even throughout the changes, however, the Trinity partnership with these two districts remains strong.

STEPS connections: Josephine Ryan

One response of the outsider to the account of Trinity's history of PDS partnerships is to note that they have been major risk-taking enterprises on the part of both the University and the district and school-based partners. The partnerships have involved major changes in practices for both: a school-integrated teacher education model by Trinity and schools undertaking major structural and curricular changes. The STEPS Interpretive Framework offers "Principles of Partnership Practice" and identifies "risk-taking and trust" as essential elements of partnerships. It seems this was achieved in the various Trinity partnerships, at least for a time.

Moreover, it is clear that most Trinity partnerships have been long-lasting. While details of the longevity of the STEPS case study partnerships are not evident in the report, the Trinity partnerships would certainly be at least equal in longevity when compared to other PDS relationships (Darling-Hammond 2004, 2010). It is clear in the brief narratives of Trinity experiences that the ongoing presence of committed individuals has been critical to the success and sustainability of the partnerships (Kruger et al. 2009). But in many cases, these partnerships have been sustained in some form, despite change or loss of personnel. It is also clear that the Interpretive Framework's concept of the ideal "Growth model" accurately represents Trinity's willingness to keep looking for new partnerships when one is lost.

The STEPS Principles list a range of general attributes which are needed for lasting partnerships, such as respect, reciprocity, adaptability. While Trinity's success suggests that these qualities were present, an outsider is curious to know how these ideals are demonstrated in the day-to-day practices of the partnerships.

10.4 Guiding Principles

In this section, we outline the "Guiding Principles" that underpin Trinity's university–school partnerships. Clearly there is no fail-safe formula for PDS relationships, but we do think that there are some factors that contribute to successful partnerships. The two important principles that have been guiding concepts for our PDS partnerships have been (1) that the partnership between the university and the school has aspirations to transform the school and (2) maintaining collaborative relationships between school and university personnel is paramount to the success of the partnership.

10.4.1 Aspirational School Transformation

The goal of contributing to and participating in school transformation has been a guiding force as we engage in our partnerships. It was never just about finding placements for our MAT students, but the idealistic and practical vision was one of aspiring for school transformation and that the support of transformation was essential work for university education faculty and programs. Our belief about PST learning is that it is good for interns to see the "real world" of schools and to see schools striving for improvement and transformation. We regularly talk in classes, student and family ceremonies, and school meetings about "schools as they ought to be" or "could be" and for candidates not to be content with how schools currently are. That said, the schools need to be functional and healthy, even in their struggles, in order to serve as effective clinical placements for candidates.

In line with this transformational view of schools, each of the original school partners took on different models for innovation that were being discussed nationally: one elementary school was a Basic School (Boyer 1995), another was a Core Knowledge school (Hirsch 2010), a middle school was connected to the middle school movement, and a high school implemented a variety of high school programs. Research was collaboratively conducted, presentations were made by school and university faculty at national conferences, and each school was seen as a laboratory for theory implemented in practice for the benefit of student learning, teacher practice, and school transformation.

Examples of such innovation and transformation include the transformation of the comprehensive high school (Lee) into academic houses with paired administrators and teachers leaders in each house; the whole school adoption of critical friends groups at ISA and the use of those microprofessional learning communities

to shape the macrolearning community of the school; the decision to retain grade-level teaming in the middle school despite district funding cuts; the implementation of alternative methods of teacher and student grouping to achieve teaming, and the development of four-year student portfolios based on performance outcomes with student-led conferences and exhibitions of learning (ISA).

Currently, we continue to seek to be an active contributor in each school who promotes the usually elusive yet ever-possible effort toward school transformation. We ask ourselves: What can we do to contribute to each school's efforts on behalf of students, teachers, and families? How can we identify inequity and work for more equitable practices and outcomes? We are realistic in acknowledging that the vision for a school's trajectory (as held by various stakeholders) is not always open to this kind of questioning, as school re-invention or transformation is accompanied by risk and uncertainty (Breidenstein et al. 2012). Moreover, the current policy environment, especially in relation to urban schools, has directed attention to testing and assessment; leaders often focus on short term, "technical fixes" rather than more significant school improvement (Fahey and Ippolito 2015; Heifetz 1994). Still, for Trinity, the idea of striving for better, more equitable, more just schools is always our aspirational vision.

Therefore, we are always ready to support, contribute to, and join school transformation efforts in our PDS schools, and we have learned that this vision and its enactment need to start with the school and have little chance of success if solely pushed by us. We watch, listen, wait, and plant seeds. And, if we find the school is not providing a healthy climate for teacher practice or a positive climate for student learning, then we will speak up to help identify the problem and possible responses. If there is no interest in addressing the problems or enacting responses, then the conversation starts to turn to assessing the viability of the partnership long-term.

STEPS connections: Josephine Ryan

Trinity's partnerships in many respects affirm the value of the connective, generative, transformative typology which the Interpretive Framework posits. However, Trinity faculty's belief that the partnership must always aspire toward transformation does in some ways question the Interpretive Framework contention that the categorization is not a hierarchy. It would seem that, for Trinity, connective partnerships where a university and a school agree to achieve limited goals such as placements for PSTs or a short-term enhancement of the school science program are useful activities, but the long-term transformational goal remains. However, as the account above suggests, there is a need for patience in developing an "embedded" partnership so that transformation is in some ways an ideal rather than always present. Certainly, Trinity's experience would affirm the Interpretive Framework's assumption that a partnership must involve change in practices on both sides, even if short term and limited. The Interpretive Framework also suggests that a minimum requirement is that there is a recognition that the partnership allows PSTs opportunities to link theory with practice in the classroom and the school. Trinity faculty argue that if the practice experienced at the school is too negative, then it is time to address it or move on. The STEPS Interpretive Framework supports this approach in that mutual benefit

is an essential element. Universities who are routinely in limited placement-based partnerships often find themselves with little control over the quality of mentors (Le Cornu 2015).

10.4.2 Partnership as Relationship

It is important to stress that scrutinising the viability of a PDS partnership is a last resort. The first point of reference for Trinity is always that engaging in a PDS partnership is being in a relationship. Conceptualising PDS interactions as relationships–as more than a partnership–says something about their permanency. It is not something you easily dissolve, walk away from or undo. All of the factors we identify below are factors that have been important in developing and sustaining relationships, running diagnostics when there are challenges, and in making decisions to end a relationship.

10.4.3 Relationship-Building Enterprise

We believe that it is worth staying through the ebb and flow of relationships and school development to keep the PDS going–you stay if at all possible. We recognize the potential of every school. We also have a realistic orientation to the work and our part of the equation, acknowledging that working with us is not always easy either. We ask a lot–we have high expectations, we put principals and teachers in a fishbowl of observation and scrutiny, we poke around in all aspects of the school's work, and we have research-based and practical opinions that may help or may aggravate. So from both ends, it is an active, relationship-building enterprise day-in and day-out.

10.4.4 Communication in Complex Relationships

To add to the complexity–there are many people involved in the relationship and at several levels. So perhaps a part that is not always anticipated and that we have learned over time is how many relationships are at work in a university–school partnership.

The following relationships (at the minimum, there are of course many more) have to be established, cultivated, and tended: university president–school superintendent, university president–department chair, department chair–school superintendent, department chair–clinical faculty, clinical faculty–principal, department chair–principal, clinical faculty–teachers. We have also learned that with all of these participants in play, the university team (the department chair and clinical faculty) must ensure we are communicating well and that our side of things is coherent. We check in frequently and share information and progress.

10.4.5 Exclusive Relationships

Also, the issue of exclusivity is one which must be addressed. As noted earlier, when the program was redesigned and PDS relationships were formed, we stopped the practice of sending PSTs to a variety of schools across the city; instead, we said we were forming PDS partnerships and exclusively placing interns in those schools. And we saw the whole school as the partner, not just the mentor teachers (Darling-Hammond 2004). So, we committed to the entire school–to be a consistent, involved, present partner. We also ask that the schools show some exclusivity in return–that they not host PSTs from other programs. When all placements are centered in just a few schools, including undergraduate and graduate placements, then many teachers are needed and we do not want to "compete" for the "best teachers" or any teachers. We do make exceptions at the principal's request, particularly at the comprehensive high school in fields in which we do not certify (e.g., physical education). This exclusive relationship is often questioned by new principals, new superintendents, and others, but we see this it is an important element in the partnership.

STEPS connections: Josephine Ryan

The emphasis that Trinity puts on relationships as key to partnerships coheres with the Interpretive Framework's analysis of the process of partnership development, Growing University–School Partnerships (GUSP). In this framework, the development of relationships is integral to growth in partnerships such that "data revealed that over time, as relationships strengthened, the nature of partnerships often changed, with greater levels of commitment evident and increased active roles taken on, especially by classroom teachers" (Jones et al. 2016, p. 115). While the stress on relationships does not seem surprising, Trinity's emphasis on exclusivity is striking. Such a goal fits with the ambition of transformative partnerships. The Interpretive Framework does not include consideration of specific issues of approach such as whether to negotiate for exclusive relationships, but the issue could be part of the agendas identified in the initiating and implementation phases of GUSP. Trinity's aim for exclusive and transformational partnerships leads an outsider to ask "How can the University manage such ambitious partnerships?"

10.5 Roles that Contribute to a PDS Relationship and Support Aspirational School Transformation

The approaches that contribute to our PDS relationships, we would posit, match those that contribute to school transformation. Listed below are some roles and resources that have been integral to the achievement of innovation and transformation. In response to each identified essential feature, there is an analysis on how this fits in with the elements of the STEPS Interpretive Framework.

10.5.1 Supportive University Leadership

The education department chair (or it might be the dean or similar in other contexts) works at the macrolevel with the superintendent and university president to build and leverage support for the PDS partnerships, including negotiating contracts and agreements, dealing with increasing paperwork and legal implications. It also means articulating the difference between a partnership and relationship, working beyond "connective" (Jones et al. 2016, p. 115) partnerships to generative relationships with transformational aspirations, as well as seeking the funding that is essential for educational change. A cornerstone of Trinity's success in PDS work is that the clinical work in the schools is recognized by the University leadership, including its Commission on Tenure and Promotion, and other university entities, so that the clinical faculty are supported in their work. Trinity supports the Department of Education's statement on scholarship that specifically addresses, accounts for/expects, and rewards work in professional development schools.

STEPS connections: Josephine Ryan

The Interpretive Framework indicates that institutional support and resources are enablers or hindrances to partnerships. The institutional recognition Trinity offers to those who undertake partnership work is unusual (Le Cornu 2015) and provides useful background to Trinity's achievements. Analyses of teacher education note that paucity of recognition and rewards given to the work of connecting universities with schools undermines teacher quality (Darling-Hammond 2006). Trinity's exceptional commitment of resources suggests what is needed for sustained partnerships. While STEPS case studies do not include accounts of dissolution of partnerships, it would seem that the continued availability of resources such as institutional support is a decisive factor.

10.5.2 Collaborative Relationships with School District Leadership

In US schools, the district superintendent is a key authority and leader (Leithwood et al. 2004), sending messages within the district about the significance of the relationship with the university and the value of the PDS. Not only does the principal follow these cues, but so do other important entities such as the human resources department. If the superintendent trusts the partner and the relationship, it might result in a school having more freedom to innovate than other schools. For example, the Trinity partnership facilitated a National Board Candidacy process at Lee HS and ISA that supported teachers through the process and resulted in a district stipend enthusiastically supported by the superintendent and only available at that those schools. Trinity's Department Chair has taken the lead in terms of promoting positive relationships with school district leadership through the long-standing

practice of convening all of the superintendents in the city for a monthly Superintendents' Forum, a setting that also gives the chair a monthly opportunity to encourage communication among all superintendents and to check in with the two PDS district partner superintendents (NEISD and SAISD).

STEPS connections: Josephine Ryan

The practice of a university regularly hosting local school leaders at a forum such as Trinity University suggests the kinds of actions which enable universities and schools to develop relationships beyond the pragmatics of teacher accreditation, which all too often dominate (Le Cornu 2015). Moreover, a forum such as Trinity hosts is a real-world example of the kind of communication that is an "enabler" of the growth of partnerships such as outlined in the Interpretive Framework.

10.5.3 Committed School Leadership

We believe the PDS relationships have been most successful in situations where the incoming principal knows about the Trinity presence and sees it as an opportunity. In a few cases, Trinity was formally involved (serving as a participant in the principal interviews, for example) or informally involved (serving as a consultant with the superintendent) in the principal recruitment and selection process. Ideally, we would recommend the university partner be part of the hiring committee. The principal and school are in a fishbowl as a PDS school, so we think it is better that the principal not only be aware but also interested to be part of a different kind of school and in the relationship. Conversely then we expect that the same take place in university hiring, and we therefore invite teachers, principals, and superintendents to take part in all of our searches (clinical faculty, other professors, department chair). We also include the principals and district human resources directors on our advisory committees and in other accreditation and assessment efforts.

STEPS connections: Josephine Ryan

The idea that universities and schools might go so far as to collaborate in the other's recruitment practices would be seen as extraordinary in contexts where collaboration is much more limited. The STEPS case study partnerships were centered on the science teaching areas of partner schools so that schools' hiring practices are likely to be beyond their concern. But it is important to note that both Trinity and the STEPS Interpretive Framework describe partnerships as dynamic so that being open to new possibilities of collaboration such as assisting with finding expert staff has the potential to be a win–win for each of the partners and therefore would seem an idea not to be discounted.

10.5.4 Clinical Faculty as Insider-Outsider

The lynchpins of Trinity's PDS partnerships are clinical faculty: tenure-track professors who are expected to be adept at working across the university and K-12 settings to teach in the MAT program, supervise and work with intern teachers in their placements, collaborate with and support mentor teachers, as well as support schools in their work and innovation efforts. In Trinity's view, it is essential that they are on-site nearly full time and become part of day-to-day life of the school and teachers' work. This includes attending, sometimes facilitating or leading, school professional development, curriculum planning, or other meetings. They can become a thought partner for the principal, especially as they are often at the school but not a member of the faculty so they have an insider–outsider perspective. Clinical faculty embody a scholar–practitioner/practitioner–scholar role and translate theory, research, and practice across university and K-12 contexts. The significance of their on-the-ground ongoing, regular, consistent interaction and collaboration cannot be understated, and they might be considered an essential hub of many networks (Daly 2010).

Through the frequent interactions with interns and mentors, with nearly weekly observations and debriefing during the lead-teaching period and several assessment conferences throughout the placement, the clinical faculty are engaged in ongoing shared coaching and developmental dialogue with teachers. We see this then influencing the mentor teachers' practice and that of colleagues on the grade level, planning team, department, and other configurations. Clinical faculty seek to understand the day-to-day challenges of teachers in order to help address those challenges in beneficial ways (including being a conduit to the school's leadership team) and of course to inform their teacher preparation work. By being so closely connected to classroom and school practice, clinical faculty remain current in their practice and their understanding of the realities of schools, countering the "ivory tower" criticism. Their role is significant both in developing and maintaining quality internships through their consultation with principals regarding suitable mentors and, beyond that, developing and supporting the schools' teachers and the schools' learning initiatives for both students and adults in the school. Overall school learning is also enhanced with the presence of two adults in the classroom, the teacher and the intern.

STEPS connections: Josephine Ryan

The details of Trinity's partnerships demonstrate further ways in which teacher education partnerships can be far more than placements. In this regard, the Trinity's approach matches the STEPS Interpretive Framework's emphasis on high-quality science curriculum and pedagogy. Trinity's clinical faculty's engagement in enhancing their partner schools' programs is a role which many university teacher educators do not have institutional support to fulfill (Le Cornu 2015). Moreover, Trinity's definition of "transformational" is describing more comprehensive whole school change than involved in the STEPS case studies. From an Australian teacher educator's perspective, it is sobering to see that whole "transformational" partnerships such as Trinity's are based on almost full-time school commitment by university personnel.

This is not to demean more limited relationships which often prevail in Australian teacher education (Kruger et al. 2009; Le Cornu 2015). Indeed, the STEPS partnerships show evidence of bringing about valuable changes in practices for both partners. However, given the often limited university support for teacher educators spending more of their time in schools, the Trinity model is almost utopian.

10.6 Honoring Teachers' Roles

While principals can change frequently, we know that a steady cadre of teachers stay and are the backbone of the PDS relationship, having strong influence on the school's culture and professional learning community. Their support for the partnership is essential. Trinity has explicitly recognized and honored teachers' roles in the partnerships through ensuring their participation in initial MAT design committees and on the PDS steering committees. Annually, mentor teachers are appointed as "clinical faculty" to the university in a ceremony and reception led by the university president and department chair; this ceremony provides them with a letter of appointment and university library privileges. Mentor teachers are not paid a stipend nor do they receive university credits as they might in other settings. We focus resources on the whole school and open up opportunities to mentor teachers and all PDS faculty (such as conference participation, teacher leadership roles, teacher professional development). Mentor teachers participate in orientation and support meetings, and we have found that good mentor teacher development is very similar to teacher leadership development and professional learning community development.

STEPS connections: Josephine Ryan

The account of ways in which mentor teachers are honoured within Trinity partnerships offers practical ways to acknowledge teachers' roles and to use the partnership to enhance their professional development, practices which research suggests are rarely seen in school–university relationships (Ryan and Jones 2014). The STEPS Interpretive Framework points to the importance of "recognition of respective goals" and "respect," and the Trinity model shows how these general qualities might look in practice.

10.7 University Responsibility for Resources

In relation to funding PDS partnerships, the approach of Trinity University has been to take a leadership role in pooling resources from the university, districts, and schools. This includes both monetary and in-kind resources. The university also takes the lead in applying for grants to support the partnerships, whether university or school-level grants; the university helps to write and/or support the grants. In response to

the uncertainty of grant funding, the decline of funding for public education by the state, and the different expectations of millennial students in competitive higher education, in recent years the University has begun to dedicate budgeted funds to PDS accounts that are held at the university and managed by the clinical faculty in consultation with the department chair and PDS principals. This allows consistent funding and facilitates short- and long-term planning. Annually, PDS schools receive approximately $20,000 to support the partnership. Trinity also provides significant in-kind resources such as faculty expertise (clinical and other faculty) and consultation for school initiatives; provision of Trinity students who serve as mentors/participants in the schools; availability of Trinity facilities and library privileges. To promote a spirit of shared purpose between public schools and Trinity, the university regularly hosts secondary student events and ceremonies.

STEPS connections: Josephine Ryan

As noted in relation to other aspects of partnerships, Trinity practices offer details of what a general feature such as "resources" might mean in practice. In Australia, while school-university partnerships are consistently recommended in government-funded reports as key to successful teacher education (e.g. Teacher Education Ministerial Advisory Group 2015) rarely do governments offer funding to support them (Le Cornu 2015). The STEPS Interpretive Framework notes that partnerships cost in terms of time, materials and travel for both teacher educators and PSTs. Large-scale partnerships such as when a whole teacher education program is integrated with schools as is the case for Trinity there is need of considerable resources, a fact perhaps downplayed in the optimism of the STEPS framework. It should be noted that Trinity's teacher education is still a relatively small (and high fee-paying) in comparison to that in many universities so that it is perhaps unfair to suggest that other universities could adopt their approach. However, Trinity's practices in terms of offering recognition and rewards to its teacher partners suggest ways that other universities might honor their role so that the relationship can be more than the transactional task of shared supervision.

10.8 The Future of Partnerships

It is indicative of the changing educational context that in 1989 our PDS relationship with each school and district was signed by the superintendent and university president at the end of a four-page document; our 2016 agreement to establish the Advanced Learning Academy with SAISD and a local philanthropy is an 80 page document which was vetted by attorneys for each entity. We had to identify targets and metrics for MAT intern performance, student performance, and school performance as well monthly reports and other documentation. In 1989, most of our relationships with major local funders involved a handshake, a cheque, and informal reporting–unless the funder wanted to visit the site for a tour or meet the student scholarship recipients at a reception.

The increasing testing emphasis, instigated in 1983 with the *Nation at Risk* report (National Commission on Excellence in Education 1983) and embedded in the 2001 *No Child Left Behind* Act (United States Department of Education 2017) legislation, has impacted on schools, and therefore, PDS partnerships, in that achievement metrics frequently define success. Currently, students are tested in every grade from third to eleventh, and this year, schools will be issued a report card. The expectations are for immediate outcomes, and yet we know that school transformation is not instantaneous. There is also a tension inherent in metrics that ask for collaborative professional learning communities and climate results and at the same time identify individual teacher performance via student testing outcomes and other factors. We are aware that to continue the work, we, as proponents of PDS school partnerships, need to develop ways of describing, assessing, and promoting the relationship. The experience of PDS partnerships at Trinity is that it is important to view school transformation as well as PST learning as ongoing processes rather than end points. Some partnerships have ended, but this does not mean the program is not a successful one. The aspiration toward transformation remains.

Josephine Ryan STEPS connections

The analysis in this chapter suggests that, while there are points of tension, there is a high degree of compatibility between the principles and practices of the long-lasting and admired partnerships at Trinity and the STEPS framework. In an era where sometimes crude accountability can dominate both schools and universities, the ambition and optimism for transformational education which both Trinity and STEPS exemplify in their partnership work are sources of inspiration. It has been suggested in the STEPS analysis, as well as other research (Kruger et al. 2009), that the dedication of highly motivated individuals is important in establishing and maintaining partnerships. In fact Kruger et al. argue that this reliance on individuals can mean that partnerships do not last beyond these individuals' engagement. Analysis of Trinity's approaches suggests that the program can be bigger than individuals involved and that the STEPS Interpretive Framework is accurate in arguing that there are principles and practices which can guide successful partnership development.

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Chapter 11
A New Zealand Collaborative University–School Partnership: Applying the STEPS Framework

Beverley Cooper, Bronwen Cowie and Coral Campbell

Abstract This chapter considers how the Interpretive Framework was applied to Waikato University's *Community University–School Partnership* (*CUSP*) program, retrospectively. As a well-documented partnership program, the Interpretive Framework was applied to the aspects of the project to see how these aligned. As well as highlighting the synergies between the Interpretive Framework and the CUSP, there were a number of differences which arose and these are discussed as considerations of adding further complexity to the Interpretive Framework.

Keywords School-university partnership · Practicum · Systems · Leadership

11.1 Introduction: New Zealand ITE as a Context

Within this contribution, we reflect on the STEPS Interpretive Framework (Hobbs et al. 2015) in the light of our experience of implementing a collaborative university–school partnership at The University of Waikato. This partnership involved the redesign of the Bachelor of Teaching (BTchg) Normal school practicum program for year 1 PSTs. In New Zealand, Normal schools were established by the 1870s' Education Act as schools with specific roles in supporting Teacher Training Colleges. Teachers in these schools receive a salary allowance to recognise their expertise and the role they play in supporting teacher education programs. The collaborative university–school partnership (CUSP) program arose in response to a desire by these schools and the university to offer a practicum program that better met the needs of

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both students in the schools and student teachers. Changing the practicum pattern for year 1 PSTs had implications for all the courses in the first year of the BTchg program; it relied on and resulted in a reconceptualisation of the role of the partner schools and the university in the delivery and assessment of the program. In the following sections, we elaborate on the process of negotiation and enactment of the new model of practicum which involved PSTs, in pairs, spending a full day per week in a school for two semesters culminating with a three-week practicum block.

11.2 Initiating and Negotiating the Collaborative University–School Partnership (CUSP)

The first stage of the STEPS model focuses on initiating and negotiating partnerships, implementing and then evaluating the partnerships. In the STEPS Interpretive Framework, five components were identified which describe the most likely processes and thinking required at each phase of the development (Fig. 11.1). These types of processes are iterative and remain responsive to the needs of all key stakeholders. Descriptions of the processes involved in developing these types of partnerships help others who might be considering adopting such partnerships to be aware of what thinking and planning are needed over time. It also can help those within existing partnerships by providing a language to talk about often undocumented and amorphous practices.

Elaboration of the five components is described below.

- *Aims and Rationale*—Identifying aims and rationale ensures that each partner's core requirements are accounted for in the establishment of a partnership arrangement.

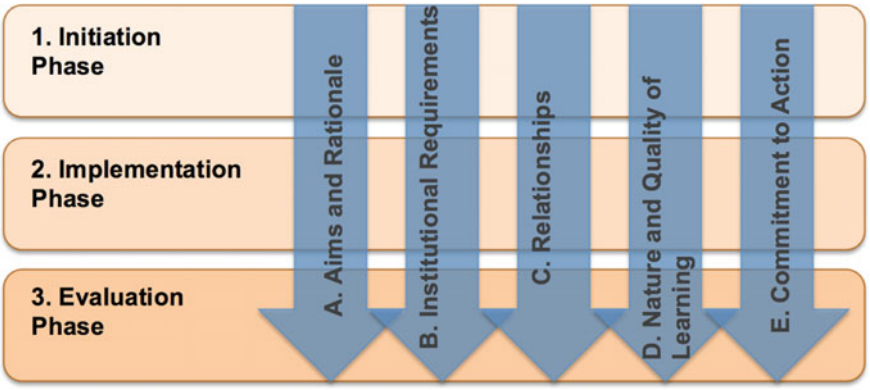

Fig. 11.1 Growing university–school partnerships (from Hobbs et al. 2015)

- *Institutional and Unit Demands*—Both universities and schools have a range of constraints that may shape the way in which a partnership can be organised and these must be identified and considered to ensure the success of a partnership.
- *Relationships*—An essential aspect of initiating a partnership arrangement is to define the type and nature of partnership that is desired/possible, considering the role each partner is wanting and able to commit to.
- *Nature and Quality of Learning*—The nature and the quality of the learning arising through the partnership is the core purpose of the arrangements.
- *Commitment to Action*—This emphasises that the various partners generate common understanding of what they are committing to through negotiation and discussion.

The University of Waikato has always valued its relationships with its six local Normal primary schools who have supported the Faculty of Education to deliver a placement program which involves PSTs engaging in micro-teaching in a range of curriculum learning areas over the first year of their program. A four-week practicum was also completed in the first year of the program in different school contexts. Prior to CUSP, this micro-teaching involved the university requesting times that PSTs could teach groups of students of particular class-level university-prescribed lessons, with teacher educators observing their interactions. These taught lessons and PST reflections often formed a basis for assignment work. While well supported by the Normal schools, this process disrupted classroom programs and focused on PSTs as learners rather than children as learners and was often referred to by schools as 'child banking'. A revision of the *New Zealand Curriculum* (Ministry of Education 2007), coupled with the introduction of *National Standards* in numeracy and literacy (Ministry of Education 2009a, b), exacerbated the impact of this practice on school programs and increased school reluctance to disrupt curriculum to meet university practicum and coursework needs. For example, many schools delivered their mathematics and English program in the morning yet the University was requiring the schools to provide an opportunity for PSTs to complete tasks for other curriculum areas such as Arts or science at that time. As a consequence of the increasingly difficulty of finding appropriate times for curriculum tasks to be completed in schools the Associate Dean Teacher Education and first author of this contribution, Beverley Cooper approached the schools to ask them to be part of a university review of its practicum program. She presented a possible model for a new approach that took cognisance of the expertise of the Normal schools and their experiences working with PSTs over a sustained period. The schools agreed to explore this model, and over six months in 2011, university staff and school leaders from the six local Normal schools met regularly to co-construct a new school practicum program. Through re-appraisal of the situation, there was a re-negotiation of the requirements of each institution and the elements which the CUSP project found necessary to adopt aligned with those suggested in the STEPS Interpretive Framework.

The 2011 meetings provided an opportunity for differences in agendas and perspectives to be shared and acknowledged and a set of high-level principles to underpin the new collaborative university–school partnership initiative, referred to as CUSP,

were established. These principles centred on the need for priority to be given to student's learning, shared decision making, and the sharing of responsibilities between school and University staff for PST practicum learning and experience. The co-constructed CUSP program resulted in PSTs in the first year of the three-year Bachelor of Teaching program being placed in pairs in the same classrooms for one day per week for the academic year. It was agreed University assigned teaching and assessment tasks would be completed when appropriate as part of the normal classroom program and that a three-week practicum block at the end of the year would be completed in the same classroom as PSTs had got to know the learners, associate teachers and school and classroom routines.

11.3 Implementation

Several practices supported the implementation of the CUSP program as a partnership between schools and the university (for further details see Cooper and Grudnoff 2017). Partner school leaders and their university liaison person are appointed as Associate Lecturers of the university and named in the official university calendar as honorary staff members to give status to the positions. A formal memorandum of understanding which sets out the responsibility of the faculty, the school and the PSTs has been developed for each partner school. Subsidised postgraduate study has been provided to school mentors. The faculty lecturer and the associate lecturer take joint responsibility for the in-school program and decisions around PST placement in classes. The BTchg program's first professional practice paper is co-taught on site in the school context during the first semester of the year 1 by the school associate lecturer and the university lecturer associated with the course. The CUSP schools and university faculty meet twice each semester to ensure requirements for PSTs are manageable for schools and to give opportunities for tasks to be reviewed based on this feedback. These practices have facilitated close working relationships and enhanced the communication between the university and schools. Principal comments indicate that, for them, there is a greater sense and reality of shared responsibility for PST learning, with the process now seen as a partnership.

> The process of CUSP development has involved dialogue over time. We looked at issues and became proper partners. Teachers are now more valued and [placement] requires a greater involvement of liaison teachers. (Case study School B Principal 2016)

Teachers have also commented on the value of working in partnership.

> I think it's wonderful for [the university lecturer] to be coming in and planning with me. I thought it would be huge amounts of work and I'd be busy, and it's not like that at all. She is amazing to work together with to plan ahead. If she can't be there I will carry on under her guidance, and if I can't be there she will do the same. (Associate Lecturer, March 2012)

Faculty lecturers have recognised the benefits of working in partnership and developing trustful respectful relationships.

> Because of the way the associate lecturer and I worked in the first semester I feel very comfortable going into the school. I now have that true understanding and trust with the staff of the school. It's always about relationships. (Faculty Lecturer January 2013)

Associate lecturers and classroom teachers who work with the PSTs have taken on more responsibility for the assessment of the final three-week practicum block, with the judgement about PST capability now a joint school and university decision. Teachers are confident in presenting their judgement because they have interacted with and observed their PSTs over the long term and they have an understanding of their PSTs' learning. The CUSP program has led to a further research project where university faculty and schools are looking to develop a deeper shared understanding of how to support judgements of practicum performance based on the work of Haigh and Ell (2014). The associate lecturers in the schools are leading the research in their schools supported by the Associate Dean.

Our experience is consistent with the first stage of the STEPS Interpretive Framework which emphasises the need for negotiation to identify mutual and differing needs of each member of a partnership and from this to agree on the underlying principles (rationale) for the partnership. It also supports the need for clarity around respective roles, responsibilities and requirements. This stage was also important for identifying enablers and constraints. In the case of CUSP, discussion of these aspects contributed to the decision for PSTs to be part of the school program for a whole day per week. This was thought to minimise disruption to the school programs and to allow students to gain a better insight into school programs. Students were to be placed in pairs to allow PSTs to provide each other support and to reflect on practice together.

11.4 Evaluation and Monitoring the CUSP Program

The CUSP project is distinctive in that research on the process and impact of CUSP was part of the initiation, negotiation and subsequent stages. The University and the CUSP schools each considered that the CUSP development needed to be researched from the onset so that we could establish the impact for teachers, schools, PSTs and teacher educators and the faculty. Consequently, the initiative has been fully researched for four years over two program cycles (Harlow et al. 2014). The faculty Associate Dean Teacher Education in consultation with the Director of the Wilf Malcolm Institute for Educational Research (WMIER) chose to do this through a developmental evaluation approach (Patton 2011). Developmental evaluation is particularly suited to investigating and supporting innovation in complex environments. The developmental evaluator works as part of the implementation team and assists the team by generating data that track experiences and developments, surfacing issues and opportunities that arise in the course of the implementation. Developmental evaluation aims to provide real-time, or close to real-time, feedback to program staff, thus facilitating a continuous development loop. Data generation for the develop-

ment evaluation has included document analysis, researcher attendance at planning and review meetings, case studies of two partner schools, focus group interviews of PSTs, associate lecturers and faculty lecturers as well as surveys of mentor teachers and PSTs over the three years of the program.

The CUSP research has highlighted: the importance of developing mutually respectful and trusting relationships between the university and schools and between faculty and school staff; the value of sustained practice for PSTs, mentor teachers and learners; and, the importance of seamless learning to break down the perception of the theory/practice divide (Cooper and Grudnoff 2017). The research has also highlighted the issues in developing a shared understanding across all individuals in the partnership, particularly mentor teachers, as well as the commitment and persistence needed by key members in the partnership to support and deeply embed cultural shifts by both the university and schools. School and university staff four years into the partnership, are committed to the initiative and recognise the positive difference the program has made to PST learning, associate teacher learning, relationships between the schools and university, and the benefits to children in classrooms.

> [PSTs] belong, they are valued because the teachers say they are adding value to the children's learning. (Case study School H AL).
>
> Our associate teachers have had to reflect on their own practice so they can make the learning clear and to reflect on their practice, chat about reflections. (Case study School H AL)
>
> Year 1 school-based experience is much better since CUSP. Everyone is more satisfied. The teachers are happier…there is better quality school experience now. People feel more ownership (Case study School T Principal)

Our surveys of associate teachers and in-depth case studies of two schools indicate that schools are very positive about the CUSP placement and practicum arrangements because of the flexibility they provide to schools to accommodate university tasks, the fit for purpose and authentic experience it offers PSTs, and the genuine relationship PSTs are able to develop with a class, the class teacher and, in many cases, the school as a whole.

> It is easier not having to change the timetable around; the tasks fit with the learning program better; associate teachers can plan for them and fit them in (Case Study School T Principal)

On the other hand, some curriculum lecturers found the CUSP model challenging, particularly in its first year, because it disrupted many of the practices they had developed for how student in their courses would work in schools with students. Some of these lecturers engaged in small projects to explore teacher views of the impact of CUSP. Three such projects are briefly described next.

The Arts in CUSP research study ran alongside the implementation and evaluation of the CUSP program in the second half of 2013 (Harlow 2014). It was conducted by six members of the Arts team who participated as practitioner researchers. School visits and teacher interviews were undertaken by the Arts lecturers to explore current practices, assumptions and attitudes to the Arts disciplines. These interviews aimed to identify strategies teacher educators could use in their work as partners with associate teachers and schools to support PSTs to have successful placement experiences

when teaching one of the Arts—dance, art, music and drama. The teacher educators also explored the ways in which an authentic dialogue could be established with associate teachers that would lead to improved support for everyone concerned—PSTs, teachers and teacher educators. This research study enabled the Arts lecturers as practitioner researchers to understand what was happening in the Arts in schools and to explore ways of building a dialogic relationship with CUSP teachers to find better ways to communicate the Arts placement task requirements to associate teachers.

The CUSP program provided impetus for a school to invite a faculty science lecturer to work with them to develop the pedagogical content knowledge of the school associate teachers and to strengthen the school's science education program (Hume and Furness 2017). The resulting year-long collaborative investigation featured the use of an intervention known as Content Representation (CoRe) design (Hume and Berry 2010) as a means of professional learning for teachers and as a curriculum design tool. The university researcher provided expertise in science content, inquiry learning in science and CoRe design facilitation while the teachers were knowledgeable about their students, their school context and how best to introduce the intervention and determine its impact. Findings indicate the repeated use of CoRe design in curriculum design and implementation (at classroom and school-wide levels) strengthened aspects of the teachers' pedagogical content knowledge (PCK) for science teaching, improved their sense of self-efficacy in science teaching, and achieved the school curriculum goal of a coherent school-wide science program. Evidence from classrooms verified that students were engaging in science inquiry with interest and enthusiasm. These outcomes were immensely satisfying to all parties. The research team considers this partnership experience and outcomes can serve as a model for other schools, emphasising the importance of relationships and time, and the value of a tool that supports the development of shared understanding and commitment.

A third project that evolved from the CUSP program focused in on PST learning as a process of identity development. A CUSP lecturer as a researcher followed a small group of students over the three years of their BTchg program and into their first year as a beginning teacher. This project challenged the notion of the associate teacher and PST relationship as an expert/novice construct and affirmed legitimate peripheral participation as a generative way to reconceptualise the practicum experience as a mutually beneficial co-learning partnership (for full details see Cobb and Harlow 2017).

Building on the CUSP initiative, in 2013 we designed an exemplary postgraduate initial teacher education program. The one-year Master of Teaching and Learning (MTchgLn) degree involves PSTs being placed in pairs in one partner school context for four days in a 10-day cycle for six months followed by a 10-week full-time experience in another partner school. The intention of the program was to have a closer link between school practice and academic learning through PSTs' sustained relationships with partner schools over the academic year. A similar process to the CUSP program occurred involving meeting with schools over a 6-month period to co-construct the practicum component of the program. The practicum experience is pivotal to the program. It involves sustained guided engagement with groups of

students including those from priority groups (Māori and Pasifika learners, those from low socio-economic backgrounds, and students with special education needs) centred around teaching as an inquiry stance, building of relationships with students and their community, using research informed pedagogy, gathering evidence related to achievement and developing adaptive expertise.

11.5 Reflection on the STEPS Interpretive Framework

When we reflected on the initiation, implementation and evaluation of CUSP and associated projects we were able to identify synergies with the STEPS typology of practices (STEPS Interpretive Framework p. 24). The CUSP program began because both the Normal schools and the University anticipated benefits from reconceptualising the year one practicum and placement for learners in classrooms and for PSTs. There was already a shared long-term commitment to working with PSTs to ensure high-quality learning and teachers were cognisant of the university practicum requirements. This is consistent with the *generative stage* described by the STEPS Interpretive Framework (p. 24). The CUSP program has moved the partnership to the *transformative stage* where both school and university are involved in the planning and delivery of the curriculum and have a vested interest in its success. All partners are involved in regular review and the developmental evaluation is informing the continual refinement of the program. The involvement of schools in follow-up research projects is an indicator of shared commitment to furthering our shared understanding and ongoing improvement.

11.6 Representing Partnership Practices from the STEPS Interpretive Framework

Table 11.1 provides a way of considering how partners in any school–university partnership view their role in the partnership through a range of factors such as the purpose of the partnership, the institutional structures, what type of partnership exists and how they each link educational theory with contributing practices. The elements of this table are considered with respect to the CUSP process in the New Zealand partnerships.

The importance of mutual professional respect and trust between participants at all levels of the system of stakeholders—PSTs, school- and university-based leaders, teachers and teacher educators—was reiterated across the CUSP process. Making time and space for university–school conversations and clarifying the mix of university and school roles and responsibilities while enacting and innovating a strong university–school partnership is a complex process, as others have found (e.g. Allen 2011). The CUSP experience endorsed that developing shared understanding and

Table 11.1 Representing partnership practices for the CUSP process in the New Zealand partnerships

	A. Purposes	B. Institutional structures	C. Nature of partnership	D. Linking theory with practice
1. Connective	Engagement based on provision of curriculum or other service needs	Partnership activities are short-term and opportunistic and sit within existing structure	Both partners provide short-term services with a focus on one partner's needs but with mutual benefits and value for all	Both partners recognise schools as important sites for PSTs to link theory and practice
2. Generative	Partners recognise opportunities for mutual professional learning	Partnership activities are considered long-term and are planned and catered for in the teacher education and school programs	Partners jointly plan the structure of the school-based practices to the benefit of both	Opportunities exist for both partners to reflect on practice that may be linked to theory
3. Transformative	Partner involvement based on active professional learning	Partnerships are embedded in the ongoing structures and practices of the institutions	Partners take joint responsibility for mutually agreed practices and outcomes that are embedded in their respective core outcomes	Both partners engage explicitly in reflective inquiry guided by theories of professional identity development

capacity across *all* stakeholders is essential if we are to sustain authentic partnerships, enact innovation and support the academic and practice rigour needed from ITE programs. In these aspects of our experience, find echoes in the STEPS Interpretive Framework which clearly highlights these as important.

In thinking how the CUSP experience might differ from the STEPS model, we identified the need to consider opportunities for initiation and negotiation with stakeholders at different levels and with different responsibilities within the system that was the partnership. There was a need for the University and school leadership to agree on particular goals and processes. In our case, this high-level agreement was reached fairly rapidly as the benefits for both school and university were considered to outweigh the risks. However, there was also a need for agreement with and shared understanding of the program principles and practices by those charged with enacting the partnership, especially associate teachers who work with the PSTs and the university-based teacher educators of the various courses. Not unexpectedly, it was a challenge to get every associate teacher to buy into the program, especially given

changes in personnel in the schools across the years. The same was true within the university setting, where university-based teacher educators experienced challenges arising from the need to change their practice and course delivery which, in their perception, was already supporting PSTs to learn to teach effectively.

To conclude, this text looks at a New Zealand collaborative university–school partnership (CUSP) and how the principles of the STEPS Interpretive Framework could be located within this project. It was found that CUSP exhibited all of the elements of the STEPS model and went further. CUSP required partnership negotiation at the level of system: school system leadership and university-level leadership. This is an important aspect which could be considered for a further elaboration of the STEPS Interpretive Framework model.

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Chapter 12
The Case of the Catholic Teacher Education Consortium: Using the STEPS Framework to Analyse a School–University Partnership

Sarah Nailer and Josephine Ryan

Abstract The following case study investigates the STEPS Interpretive Framework for its value in illuminating a long-standing and evolving university–school partnership, the Catholic Teacher Education Consortium (CTEC). The presentation of a model of key features for "successful" teacher education partnerships, as proposed in the STEPS Interpretive Framework (Jones et al. in Teaching and Teacher Education 60:108–120, 2016, p. 109), challenges us as participants in a partnership to reflect on what has been achieved, to consider what we have not accomplished and to plan future action based on these insights.

12.1 The Partnership: High-Quality Teachers for Areas of Social Need

The idea for the Catholic Teacher Education Consortium (CTEC) came out of discussions at a meeting in 2011 of Chapter, an advisory group that forms part of the governance structures of Australian Catholic University in Victoria, Australia. This group includes senior staff from the University, Catholic Church representatives from the Archdiocese and Catholic school principals. Members of the group were concerned that numbers of applicants to Education courses from the north and west of Melbourne, which encompassed significant areas of socio-economic disadvantage, were not as high as they could be. This issue combined with the known future growth of Catholic secondary schools in this part of Melbourne led to a decision to pursue a partnership agreement between the University and Catholic secondary schools in this region.

By 2012, a Memorandum of Understanding was developed with 14 school principals who committed to an initial two-year pilot project, commencing in 2013, with a

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plan for another two years pending the progress of the partnership. Sector leadership, Catholic Education Melbourne, also joined the partnership. Relative to some other school–university partnerships, which might be aiming for relatively limited goals such as improving the quality of placement experience (Ryan and Jones 2014), this project had big ambitions from the beginning. The overall ambition of the project was "to ensure sustainable numbers of teachers to meet the growing needs of northern and western suburbs Catholic secondary schools" (Ryan et al. 2015, p. 1). Immersion of PSTs in these school communities was the primary approach embedded in the CTEC program. The partnership also contained a number of elements related to the goal to ensure sustainable numbers of teachers in the focus area including encouraging students in the schools in the north and west to consider tertiary studies in general and ACU Education in particular for their post-school future. The immersion approach adopted in the project design is in keeping with the rationale that a teacher needs to understand the social context of their students (Sleeter 2014). To this end, CTEC schools committed to providing Community Engagement and Professional Experience placements for a cohort of PSTs for each year of their 4-year Bachelor of Teaching/Bachelor of Arts (BT/BA) course with consideration given to further cohorts if the pilot was successful.

A further and well-regarded element has been school-based tutorials for the CTEC PSTs (Ryan et al. 2015). Such partnership elements, which enable PSTs to engage in a variety of ways with the work of schools in addition to mandated placements, are supported by the STEPS Interpretive Framework as significant for successful partnerships (Jones et al. 2016). The CTEC model went further in offering paid employment opportunities in the schools for the PSTs in the third and fourth years of their course. The presence of CTEC PSTs, successful at the tertiary level, in the schools was seen as providing valuable role models to encourage secondary students to aspire to university, and perhaps return to teach in the area. While there was no promise of graduate employment for the PSTs, and no commitment on their part that they must seek such employment, it was the long-term aim of the project to promote the schools as future workplaces for CTEC PSTs and collaborate to develop teachers who were well prepared and wanting to work in these contexts.

The years 2013 and 2014 saw the successful recruitment of a cohort of between 20 and 25 PSTs each year to the project. In 2015, there were a number of changes, both in attempts to recruit PSTs and in the structure of the BT/BA. The decision was made to invite PSTs for Semester 2 of their first year rather than right at the beginning of their commencement at University. This did not turn out to be a successful strategy as insufficient numbers of PSTs (eight) applied for the program. This was not enough to run a dedicated tutorial.

The other challenge to the program was that Community Engagement, previously a compulsory undertaking for second-year students, was removed from the BT/BA course. This meant that the strategy of immersion through 80 h of Community Engagement in CTEC school communities in addition to placement, which was key to developing teachers well prepared to work in the focus schools, was undermined, potentially damaging the partnership. The STEPS framework notes that such challenges to partnerships are more easily accommodated if there is an "institutional

culture of support for the partnership" (p. 114). While the full impact of the loss of the Community Engagement has yet to be ascertained, the CTEC experience to date has revealed a capacity on the part of university teacher educators, school staff and PSTs to adapt to changing conditions to maintain the partnership. In the case of Community Engagement, this meant collaboration to ensure that some community work opportunities remain in the form of short-term volunteer work. Some CTEC PSTs have taken these up even though they are not part of their prescribed course. In terms of the lower numbers of CTEC PSTs, the university is seeking ways of better promoting the program.

At the time of writing, CTEC has sustained itself through the four-year program of the first group of PSTs who will be ready to graduate at the end of 2016. At this point, the program looks secure with the CTEC Steering Committee, which includes school, Catholic Education Melbourne and university representatives, recommending expansion.

12.2 Using the Interpretive Framework: Initiating, Implementing and Evaluating

The ambitious nature of the CTEC partnership lends itself to exploration using the Interpretive Framework developed as part of STEPS. The Interpretive Framework was developed to assist in the "initiation, implementation and evaluation of school-university partnerships" and provides a range of points to consider at three broad stages of partnership work (Jones et al. 2016, p. 109).

12.2.1 Initiation

In terms of the initiation phase, the Interpretive Framework suggests that at this stage there is a need for the parties to engage in communication about shared purposes and individual constraints so that a perceived "win win" for each of the parties involved is achieved (Jones et al. 2016, p. 115). The partnerships on which the STEPS Interpretive Framework is based were all initiated by university teacher educators seeking to improve their programs. CTEC does not fit this pattern in that its initial drivers were members of the University's governing body seeking to enhance the University's mission to Catholic education and school principals in the north and west of Melbourne who wanted to attract high-quality teacher education graduates to their schools. Yet the model is accurate in pointing out that a partnership grows when each of the partners sees their aims and interests as being promoted through the work. The teacher educators who were asked by their University leadership to take major responsibility for designing and implementing CTEC saw the advantage that the partnership provided to develop high-quality teacher education "through integra-

tion of university-based and school-based learning" (Butler et al. 2014, p. 5). This integration has been noted as a key driver of other school–university partnerships (Allen et al. 2013), and also cited as critical by the recent Teacher Education Ministerial Advisory Group (2014). The provision of start-up funding by the University offered an opportunity to build on prior partnership work in primary schools in low SES communities (Butler et al. 2013), which had lapsed because of not been given ongoing support. An individual from the previous program grasped the possible "win" that CTEC offered and was recruited to lead the project.

12.2.2 Implementing

Given the demands of creating agreements with 14 (later 16) schools, the resourcing of the CTEC pilot in the form of a project officer was highly valuable. The significance of resources such as material support and time to partnerships has been highlighted by researchers (Darling-Hammond 2005; Le Cornu 2015) and there are many aspects of the Interpretive Framework such as within the "Commitment to Action" phase where resources, while not highlighted, would seem to be essential. The partnerships on which the Interpretive Framework is based depended, in their initial stages, on the labour of individual teacher educators motivated by a desire to improve their PSTs' learning. This has been noted as a feature of many school–university partnerships (Hartsukyer 2007; Kruger et al. 2009). The Interpretive Framework does not analyse these efforts from a materialist point of view but such an analysis is undertaken by Nuttall and Brennan (2016) who highlight the cost to the teacher educator of maintaining good relationships with schools. Data from CTEC supports the STEPS partnership analysis that for teacher educators, despite the cost in terms of time and energy in undertaking the partnership work, there are intrinsic rewards in seeing high-quality PST learning (Jones et al. 2016). CTEC teacher educators saw themselves as developing PSTs "who had that understanding of Catholic social teaching, who understand what it is to go back into a community and teach curriculum through a Catholic lens." (Interview with ACU teacher educator cited in Ryan et al. 2015, p. 26).

We have argued elsewhere that working in university–school partnerships involves an "ethical practice that is open to and includes all the parties involved" (Ryan et al. 2016, p. 189); that is, collaboration involves responsibility beyond self-interest. Such a commitment is embedded in the Interpretive Framework in that the activity of creating and sustaining partnerships is undertaken for the sake of both immediate goals of the separate partners (such as schools aiming to improve science teaching through including PSTs in the curriculum), as well as more long-term shared goals such as improving the quality of new teaching graduates. Analysis of CTEC data shows that ACU, Catholic Education Melbourne and school participants shared such a goal. A principal articulated the belief that CTEC was about "investing in our Catholicity and our education system" (Principal interview in Ryan et al. 2015, p. 27).

In terms of the Growing University School Partnerships (GUSP) component, the Interpretive Framework describes CTEC well when they argue that "Relationships"

developed and maintained are key to growth. For CTEC, each group of participants (University, sector leadership, staff in schools and PSTs) articulated the significance of ongoing relationships to the partnership. These relationships were especially important to the teachers and PSTs who actually lived out the partnerships in schools. A teacher said "the ongoing nature of it I think is fantastic" (Teacher interview 2014). A PST said "I wanted the relationship side of it as well. I didn't want to go into a school … and I didn't really know anyone … I wanted it to be how it's been with CTEC like building a relationship and sort of them wanting you to be there" (PST interview 2015).

12.2.3 Evaluating: Researching the Catholic Teacher Education Consortium

From the inception of the CTEC partnership, a longitudinal research project was designed to learn more about the impact of this type of partnership in teacher education. The systematic and ongoing evaluation of partnerships is noted as significant in the GUSP component of the Interpretive Framework (Jones et al. 2016); and in CTEC, the collection, analysis and publication of data about the program through regular meetings between partners and annual reports have enabled participants to stay in touch with each other's experience. The early decision to take a case study approach to the research was useful because this methodology included the collection of a range of data sources allowing for a detailed picture of the program to be developed (Harland 2014). Evidence relating to the enrolment of secondary students from CTEC schools was collected. Questionnaires with PSTs allowed the research team to ensure that data from almost all the participating PSTs was collected. More in-depth data was collected through individual and small group interviews with PSTs, school staff (including principals, PST coordinators and careers staff), ACU teacher educators and professional experience office staff, as well as Catholic Education Melbourne participants. In this chapter, quotes are drawn from the interview data. Employment outcomes for the first cohort will be available at the end of 2016 and will enable analysis of the success of the goal to increase the numbers of graduates applying for and being employed in Catholic schools in the north and west of Melbourne.

12.3 Typologies of Partnership: Representations of Partnership Practice (RPP)

12.3.1 Transformative Ambitions, Connective Practice

The second aspect of the Interpretive Framework focuses on typologies of partnership, described as Representations of Partnership Practice (RPP). It provides an exploration of three different types of partnership: connective, generative and transformative. The authors found this to be a useful heuristic for understanding the partnership aims and practices of CTEC. Jones et al. (2016) highlight that there is not a hierarchy in terms of partnership practice, the more relevant question is whether the partnership meets its goals. When looking at the initiation of the CTEC partnership and the range of elements featured in the Memorandum of Understanding agreements signed by the partners, it would seem that the goals of CTEC aimed to be transformative. The Interpretive Framework defines "transformative" partnerships as those which are highly embedded in both institutions and which lead to changed practices in both institutions (Jones et al. 2016, p. 115). The range of features such as the immersion of PSTs in school communities and the social justice focus, while not novel in terms of international partnership practice (Darling-Hammond 2005; Jones and Ryan 2014), meant a significant alteration of the current practice of the university and schools. The agreement to evaluate the project in terms of participant experience, tertiary enrolments and in terms of employment outcomes is a measure of the expectations of change.

Whilst the ambitions of the program were for a transformative partnership as defined by the Interpretive Framework, the challenges of partnership activity have meant that at times the operation of the partnership would be more accurately described as "generative" or "connective" (Jones et al. 2016, p. 115). During the four years of the project, at times and between some of the partner schools and the university, it was limited to providing placements for students in a cooperative way without there being significant additional immersion of the PSTs in the school communities. In some cases, this occurred because expectations about giving CTEC PSTs assistance to get involved in school activities were not clearly communicated to those who were being asked to carry them out. Teachers felt they did not have sufficient information to allow them to organise Community Engagement placements which were supposed to enhance the PSTs' preparedness to teach at the schools.

> I think there's still a lot of work to be done. I'm not sure whether it's just me, because all the information goes to the principal and then is fed into me. I'm not sure whether I've just been kept out of the loop, but I don't feel like I've had much information from any of the involved partners. (Deputy Principal, 2014)

PSTs agreed that

> It was almost like we were a bit of a hassle to have, to be totally honest.
>
> Like I don't think we ever turned up somewhere where they knew we were coming, even though we'd email saying we're confirming we're coming like the day before. (2nd Year PST, 2014)

Such difficulties are not entirely surprising. The different organisational cultures of universities and schools resulting in difficulties in inter-institutional communication are documented in other partnership research (Allen and Wright 2014). The difficulties of communication which hampered implementation of the novel Community Engagement arrangements in CTEC were not reported by PSTs in relation to their standard Professional Experience placements. It seemed that this arrangement was more familiar and created little confusion. PSTs across the cohorts were overwhelmingly positive about their standard placement experiences when they came to schools with the special CTEC label. The feeling was captured in the quote below:

> Something that's really good that's come out of being part of CTEC, you're sort of wanted when you go to the schools. (3rd year PST, 2015)

The STEPS partnership Interpretive Framework suggests that it is the commitment of the partners to collaborate which enables enhanced experiences for PSTs. A participant in a focus group interview suggests that the CTEC partnership meant that they received extra support and they appreciated it.

> When you talk to other people we're definitely the lucky ones, we're definitely the ones that have been looked after and organised well. (3rd Year PST, 2015)

The Professional Experience placement, as an element of the CTEC partnership, represents the connective typology according to the STEPS Interpretive Framework. The Community Engagement placement on the other hand is asking the schools and the universities to change their practices in finding a role for the PSTs that is not a traditional teaching placement. This represents one of the transformative elements of the partnership and is where the challenges were mostly found. Despite the challenges that existed in developing the Community Engagement placement, when these were overcome the participants recognised the transformative nature of this aspect. Schools and PSTs could see the immense value in this additional placement. A PST highlights the benefits below:

> that was a massive benefit for us because then we sort of got to know the community of the school and then go back and teach in the school so I think that was probably one of the biggest things. (3rd year PST 2015)

This PST also noted that "other people didn't get that opportunity. That was massive".

The PST Coordinator from one of the schools discussed the combined effect of having the PSTs at the school for both Community Engagement and their Professional Experience placement as part of CTEC:

> She's made a connection with the school and I think that's really important too in terms of where her career and her future ambitions and goals might be and she's fitted in really well with the school. So, yeah, I think it's worked both ways, that idea of partnership. So we've learnt a lot from her but also I think she's been able to learn a lot from the college. (PST Coordinator, 2014)

It is interesting given the transformative ambitions of CTEC that at times even the minimum connection of cooperation to provide placements did not materialise. Reasons for failure to supply placements were such issues as a CTEC school did not have appropriate mentors and/or was overloaded with PSTs from other institutions or the timing of placements was not suitable. The Interpretive Framework notes that difficulties with matching schools and universities' resources and timetables are perennial areas of difficulty with school–university partnerships (Jones et al. 2016). Sometimes too, no CTEC PSTs wanted to be placed at a particular CTEC school. Such an occurrence illustrates the problem CTEC sought to address: that of too few appropriately prepared teachers in Melbourne's north and west. The designers of CTEC hoped that the features such as support to engage in the school communities and possibly be employed would attract sufficient PSTs. Also it was hoped that increasing tertiary participation from CTEC schools would mean an increase in teaching enrolments from the area. It must be noted that situations where CTEC schools were not matched with PSTs have not frequently occurred. PSTs saw CTEC as an opportunity to ensure their future employment, for a number of them in schools in the area where they grew up (or even in their old school). One of the PSTs from the first cohort saw joining CTEC as an opportunity to contribute to creating educational opportunities for others.

> From my experience and when I was a student where actually you know we wanted an education and by being part of the CTEC cohort I'm able to actually give back. (3rd Year PST, 2015)

As noted whether the PSTs and schools will be rewarded for their commitment by CTEC participants finding employment in CTEC schools is a question yet to be answered as the first graduates will finish in 2016.

12.3.2 Generative Activities

Jones et al. (2016) describe generative partnerships as those where "new or different practices arose in school/university programs as a result of the partnership" (p. 115). While connective partnerships are considered those that are generally one-off, a longer-term commitment is considered indicative of a generative partnership (Jones et al. 2016). Opportunities for mutual professional learning are also identified in generative partnerships. CTEC has seen a number of instances of this type of activity and these outcomes certainly suggest the value of the partnerships even if the major transformative changes do not occur. For example, the school-based tutorials saw principals identify further opportunities for them and their staff to get involved in

the partnership work. One of the principals of a host school suggested he would like to see the teachers participate in knowledge exchange with teacher educators and PSTs. In discussing the on-site tutorial at their school, the Principal said:

> I think I wouldn't mind if some of our leadership people or even a first year teacher went in and said this is what I really struggle with in the first term… I think that would be great for them to hear and it would also mean that [school] is involved in that and is contributing to it 'cause at the moment we're really providing a room. (Principal, 2014)

Other "spin-offs" from CTEC included a collaboration between some of the schools and the University to apply for an external research grant. This was through recognition of potential mutual interest in a particular area of school improvement and the opportunity to connect university researchers experienced in this area with school sites looking to improve their practices. This type of opportunity was identified by one Principal as a benefit of being involved in the program. The Principal said, "We really do value the relationship that we have with [the university]" and "we're looking more broadly, beyond the CTEC project".

The Principal was also talking about opportunities for research projects and said:

> These are universities that we're going to form these alliances with and we'll look to work on projects that are mutually beneficial. (Principal, 2015)

ACU also offered a Mentoring Professional Development program that could be credited to a Master of Education to CTEC teachers. This outcome served both teachers looking to improve their qualifications and the university wanting to improve PST experience and promote enrolment into its postgraduate courses. These examples of generative activity suggest the potentiality of partnerships to promote a range of desirable outcomes for universities and schools. The Interpretive Framework's claim that there is no hierarchy in partnerships seems to obscure the fact that a purely connective partnership where each partner receives a benefit but there is no commitment to change is necessarily limited.

12.4 Guiding Pedagogical Principles

In the CTEC program, agreement to a guiding set of Pedagogical Principles was not integral to the agreements of the schools and University to work together. Unlike the partnerships on which the STEPS analysis is based CTEC was a broad agreement about ways placements could be enhanced for PSTs with the classroom curriculum and pedagogy of the schools not immediately impacted. The STEPS partnerships enabled changes to the schools' science teaching practices in the short and perhaps the long term. It is worth noting that the STEPS partnerships had a freedom to work in the realm of classroom pedagogy because they were operating outside of the Professional Experience placement loop. This meant they were in a position to offer the schools more than they were asking for in return. Schools, understandably, might welcome partnerships whereby PSTs are contributing to their programs

without adding the additional workload involved providing accredited Professional Experience placements (Le Cornu 2015).

12.5 Conclusion

While the STEPS Interpretive Framework was developed out of a range of school–university partnerships aimed at enhancing the teaching of primary science, the principles are broad enough to enable their use in analysing a very different partnership, CTEC. The emphasis on the initiation stages helps to highlight one of the strengths of CTEC, that it was developed out of the mutual interests of schools, the sector and the university. The typologies of partnership described by the Representations of Partnership Practice (RPP) helped the authors to ask the questions around what the aims of the partnership were and to what degree they have been met. Acknowledging the ambitious scale and transformative nature of the goals suggests why it is a challenge to achieve these goals with only limited resourcing. The role of stable, ongoing relationships in the success of school–university partnerships is highlighted in both the reporting on the STEPS partnerships and in the Interpretive Framework (Jones et al. 2016) and confirms a strong theme in the CTEC research findings. The authors feel that further work could be done in utilising a tool such as the STEPS Interpretive Framework in partnership with the schools and sector leadership in order to evaluate the partnership to date and plan for the future.

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Chapter 13
Negotiating Partnerships in a STEM Teacher Professional Development Program: Applying the STEPS Interpretive Framework

Linda Hobbs, John Cripps Clark and Barry Plant

Abstract This chapter describes the use and modification of the tools of the STEPS Interpretive Framework as part of a teacher professional development program for STEM teachers. The tools were used to assist with establishing partnerships with schools that were important for determining the content, timing and nature of the professional learning program cycles. The use of the Interpretive Framework as a mediating tool that both changes the nature of the activity and is also changed by the activity is discussed.

13.1 Introduction

This chapter is a case study that examines the process of operationalising the Science Teachers Education Partnerships with Schools (STEPS) Interpretive Framework and the Partnership Negotiation, Implementation and Monitoring tools as part of the *Successful Students—STEM Program* (STEM Program). The partnership discussed is between a team of academics from Deakin University, Australia, and teachers from ten local secondary schools, as part of a professional development program designed to build the teachers' capacity to teach STEM in years 7 and 8 (ages 11–14).

Two tools developed by the STEPS project, the Partnership Negotiation Tool (PNT) and Partnership Monitoring Tool (PMT), were particularly useful in facilitating dialogue between partners so as to ensure that the content and structures of the professional learning were relevant and responsive to school and teacher development needs. Formalising the first steps and monitoring process contributed greatly

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to building trust, mutuality, respect and responsiveness, and thus the development of the partnership.

The Interpretive Framework can be understood as a mediating tool that modifies the activity (the STEM Program) but is also modified by the activity; "The definition of a tool…remains a thing used as an agency for some concluding event" (Dewey 1981). Theories of tool mediation have been developed by Pierce (Prenkert 2010), Vygotsky (1978), Popper (1972) and Dewey (1981). Within the framework of cultural–historical activity theory, knowledge and skills are distributed across social groups, so the same tool can operate in the activity system of the academic team and that of the teaching teams. Development takes place through the creation and use of such tools as the Interpretive Framework. In third-generation cultural–historical activity theory (CHAT), the interaction between and across activity systems forms the unit of analysis. Tools, such as the Interpretive Framework, that work within this interaction and change the nature of the activity and are, in turn, changed by it. The contradictions that arise between and within these activity systems give rise to contradictions that are negotiated in this space and form the basis for development (Engeström 2014).

This chapter is an analysis of that process of mutual modification and adaption. We describe how we modified the tools to suit our context and needs, and how they were then applied to achieve resulting outcomes. The Generative nature of the partnership is then discussed, informed by the Representing Partnership Practices (Chap. 4). Finally, we evaluate the Interpretive Framework in terms of its application within partnerships associated with professional development programs.

13.2 The Successful Student STEM Program

The STEM Program (2015–2017) is one of 11 initiatives of the *Skilling the Bay Program* in Geelong, funded by the Victorian state government (http://www.successfulstudents-stem.org.au/). *Skilling the Bay* was established in 2011 in response to the closure of a number of major manufacturing industries, and the transition, hopefully, to a new, knowledge-based economy by focusing on skills development, workforce participation and education.

The STEM Program was developed and implemented by a team of researchers from the School of Education at Deakin University. The program funding supported teacher professional development, Project Officer staffing and administration, partner school programs (such as excursions), a STEM into Industry program and teacher participation in a national STEM Education Conference in 2016. The program aimed to:

- increase the sophistication of teachers' incorporation of STEM practices into their teaching;
- develop student awareness of and aspirations in STEM careers;

- improve the amount and quality of student participation in STEM activities and studies;
- improve students' confidence in subjects like science and mathematics; and
- sustainably incorporate more STEM practices into school programs.

The program involved ten partner schools from the Geelong region, focusing explicitly on Year 7 and Year 8 teachers of mathematics, science, or digital and design technologies, as well as teachers in positions of leadership who can support the change process of the STEM teaching within the school. Teachers undertook four intensive professional development cycles, with each cycle providing two intensive days focusing on building teachers' capacity in STEM practices and pedagogies. Each school team then planned and implemented a STEM initiative appropriate to their school, returning after 8–12 weeks for an additional day to report on their initiatives to the other project schools on the third day.

Schools decided their own focus for improving STEM, such as subject-specific innovations (e.g. focusing on mathematics or science only), innovations requiring integration of subjects (e.g. developing activities that involve teaching across science and mathematics) or innovation across a suite of subjects that promoted particular STEM pedagogies (such as design-based learning), with the intention that, as the program progresses, the teachers focus on not only their own development, but also act as change agents in their school to lead sustainable STEM innovation. In addition, a Deakin Project Officer worked with schools to support their developing practice and a Secondary STEM Teacher Network was established.

The professional learning cycles and the ongoing support were key to developing the school's STEM innovation. The four professional learning (PL) cycles focused on different aspects of the change process (see Table 13.1). These were supported by the Secondary STEM Teacher Network meetings which were open to all teachers in the region.

13.3 Putting the Interpretive Framework to Work—Adapting and Applying the Partnership Negotiation Tool (PNT) and Partnership Monitoring Tool (PMT)

The PNT was used to support two processes: the selection of schools into the program; and establishing rules of engagement and nature of the program. These two processes are outlined below.

Table 13.1 The STEM Program Professional Learning schedule

Professional learning event and "focus"	Timing	Days
Initiation and planning day	2015 term 2	½ day
Cycle 1 "Pedagogies and contemporary STEM practices"	2015, term 3	2 + 1 days
Cycle 2 "Assessment, up-scaling and leading change"	2016, term 1 + 2	2 + 1 days
Cycle 3 "Sustaining change"	2016, terms 3 + 4	2 + 1 days
Cycle 4 "Embedding practice and generating evidence of change though action research" Showcase a celebration day	2017, terms 1 + 2	2 + 1 day
Network meetings (quarterly)	2015, terms 3 + 4 2016, term 1, 2, 3, 4 2017, term 1, 2, 3, 4	1¾ h per meeting

13.3.1 A. Selecting Schools: Partnership Establishment Process

Because of our decision to design the program in response to schools' needs, we engaged with schools early to establish what needs existed within the Geelong region. The outcomes of this initial engagement informed how we promoted the program to schools. Following this pre-selection process, we called for Expressions of Interest to participate and eventually selected ten schools to participate in the program. Soon after, we began our dialogue with the partner schools. The timeline is summarised in Fig. 13.1, and the selection process is outlined in more detail below.

Pre-selection process: Informal meetings were arranged with an initial set of five possible partner schools (November 2014 and January 2015) to discuss the rationale for the program, establishing schools' perspectives on STEM and how relevant the program might be for their individual school. During this phase, the usefulness of the PNT for the school meetings was evaluated and it was progressively modified to make it more applicable to the negotiations underway.

We began with preparing the two-column tool as per the STEPS PNT and included Deakin's commitment in Column 1, and guiding questions for the school to respond to in Column 2 (see Appendix 13.1).

We then gave the PNT to the principal at one school to complete prior to the meeting. While they did put in some information, it was minimal and we found the face-to-face conversation to be more useful than written responses. The PNT was not very useful at this early pre-negotiation stage because it was asking things about a partnership that had not yet been established. The template was too rigid to support

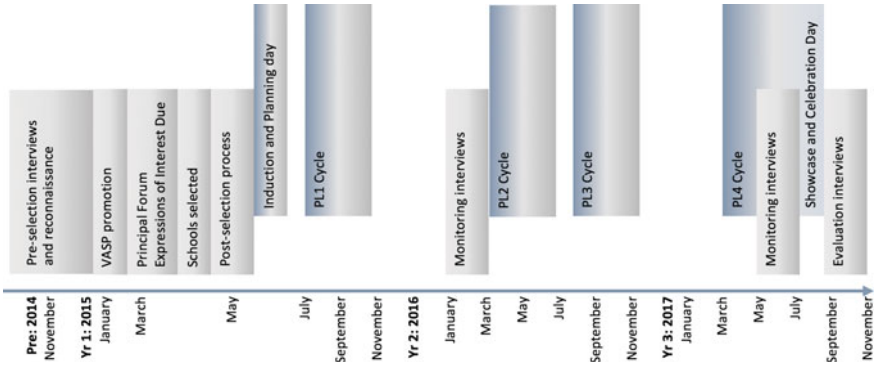

Fig. 13.1 Timeline of partnership negotiation, monitoring and evaluation (grey) and professional learning events (blue)

conversations with the principal about how STEM might be useful for dealing with issues facing their school. As a result, we ended up using the PNT as an interview schedule with the principal rather than as a template for them to complete.

Expression of interest process: Having engaged some of the schools in discussion about the possibilities of professional development in January of Year 2 of the project, the STEM Program team addressed the Victorian Association for Secondary Principals (Government schools only), Geelong Region, to promote the program and encourage them to consider involvement in the program. A formal "Principal briefing" was then held in March for principals and leading teachers from all secondary school sectors. The forum provided information on the nature of the program, the funding model, and a formal school selection process was launched. Expressions of Interest were received by end of March, and ten schools came on board during April.

Post-selection process: Selected schools were sent the Partnership Negotiation Tool to complete, with eight schools formally submitting them, and this information was used by the STEM Program to arrange a series of "first steps" meetings with each school (including the participating teachers and someone from the leadership team) in order to:

- determine what school needs were likely to be met by the program;
- establish what structures and human resource-related issues would enable the program to run smoothly, and identify possible challenges;
- determine the school contributions to the program and the limits; and
- establish the key processes, STEM-related subjects and specific teachers that would be involved.

These meetings began the important process of building relationships with the teachers and enabled us to understand the needs of the individual teachers and the schools, which of the STEM subjects were the intended focus, and how they were intending to operate as groups in their school. There was great variety across the schools in terms of the subjects involved (science or mathematics or integration),

and who constituted the teaching team (year-level teams, multidisciplinary teams, teams with teachers and leading teachers), and level of experience of the participating teachers (relatively inexperienced teams, to very experienced teams, to teams of a mixture of experience). This information also highlighted the variation in the rationale and purposes given by schools for their involvement, and therefore impressed the need to ensure that the approach to STEM professional development had relevance and cogency.

In considering the STEPS partnership principles, the use of the PNT and these "first steps" interviews initiated a process of developing *trust* between the various school partners and the Deakin STEM Program team. Both partners were taking a *risk* in committing to the program. It was important that, in each case, the PNT clearly outlined what Deakin University was contributing to the partnership to support the achievement of the goals of each school (see Appendix 13.1); therefore, the PNT facilitated recognition of the respective goals of the partners. This process can be understood in terms of "relational agency", where we worked together to "expand the object of activity"—the goals of the program—through aligning our interpretations and responses (Edwards et al. 2010, p. 31). This alignment in turn allowed the development of reciprocity and mutuality.

The professional development cycle was informed by other similar professional development programs run by Deakin: a two-day intensive, followed by 10–12 weeks of teachers' trialling and evaluating an initiative, then a reporting day. However, the content of each cycle was designed to be *adaptable and responsive to the changing needs* of the teachers. The pre-selection interviews, the re-developed PNT and the first steps interviews laid the foundation for this adaptability. The teachers indicated through regular evaluations that they appreciated the content of the two-day intensives, and in particular the opportunity to share practice with the other schools, planning time, and the various activities, frameworks and reflective tasks they were asked to do. Over time, the teachers grew to trust that the STEM Program could deliver. One teacher commented later in the program that they did not fully trust that the program could have real impact until the second professional learning cycle. This demonstrates how trust arises out of a relationship that can only develop with time, when the product on offer is seen to be meeting teachers' needs, and when they begin to see evidence of change in their own knowledge and practice.

13.3.2 B. Partnership Monitoring Process

The Interpretive Framework identifies the need to monitor progress during the partnership, and in the STEM Program the partnerships needed regular contact, clear directions and targeted support. Monitoring of the partnership was done both formally and informally.

Informally, the Project Officer played an important role in maintaining regular contact through email and occasional attendance at schools with schools to ensure teachers were aware of key dates, events and teacher tasks. The Project Officer was

considered a "STEM expert", and his knowledge of STEM teaching and learning made him very useful for teachers in planning, implementing and reflecting on initiatives arising at schools. Concurrent with his support role in the teacher change process, the Project Officer monitored the partnership elements of the initiative. These involved:

- the STEM Program team meeting their obligations by ensuring the teacher learning program through the interviews and STEM teacher network meetings were responding to emerging school and teacher needs; and
- the schools meeting their obligations to the program by developing initiatives that they could report on during the reporting and planning days, while recognising the institutional requirements and school leadership actions that constrained or enabled teachers in developing curriculum together, implementing programs, collecting evidence and recruiting other teachers to the change practice.

Formally, a series of monitoring interviews during PL2 Cycle with each of the schools was needed to monitor progress. These interviews were conducted at each school and involved at least two of the STEM Program team, the participating teachers and members of the leadership team (e.g. heads of subject departments, assistant principal, principal). The aims of these meetings related to three areas are:

- **Formative evaluation**: to inform maintenance and further development of the program, feeding into the third and fourth professional development cycles;
- **Building evidence**: to gather data on progress to date against the STEM Vision framework, in particular, how STEM was being framed at their school (e.g. as integrated or subject-specific), their plans for new curricula and pedagogies, incorporation of the STEM practices, and involvement and induction of other teachers and subject areas; and
- **Relationship development**: to build relationships with the school leadership team, make principals aware of the initiatives that were being developed by teachers; and raise the profile of the participating teachers as potential leaders of STEM in their school who exhibit change in their knowledge, practice, confidence and competence in promoting and talking about STEM teaching and learning.

In these meetings, the STEPS Partnership Monitoring Tool (PMT) was used as the basis for developing an interview protocol. Three focusing questions, each with sub-questions aligned with the STEPS PMT questions, are shown in Table 13.2.

The effects of using the PMT in these meetings have changed both for the STEM Program team and the schools. The STEPS interpretive framework enabled the team to consider the important elements of the partnership and has enabled the program to move more rapidly beyond simply delivering contemporary research and practices towards actually supporting the change processes occurring in the schools. While it is well understood that effective professional development is longitudinal, tailored and offers reflective opportunities (Darling-Hammond 2006), framing the program as a partnership from the beginning has resulted in stronger relationships that purposeful and positive outcomes.

Table 13.2 STEM Program partnership monitoring questions mapped against the STEPS PMT

STEM Program monitoring interview questions	STEPS PMT questions: *How will you…*
How is the STEM vision developing at your school?	Ensure the specific processes, activities and people are achieving the intended outcomes?
What additional assistance the STEM Program team can provide to support the continuing implementation of project?	Ensure everybody's needs are met? Monitor constraints and affordances? Ensure that what is happening in the group is working? Ensure the relationship expectations of what is being contributed are meeting the other partner's expectations?
How can we collect key information to assist in the production of the school's record of participation in the STEM Program project?	Ensure the relationship expectations of what is being contributed are meeting the other partner's expectations?

For example, at School 5 the partnership monitoring meeting using the PMT:

- conveyed to the leadership team that the program was more significant than they at first realised, and led to a realignment of the school's priorities at the beginning of 2017, for example by appointing a STEM leader in the school; and
- continued the empowerment of the participating teachers by giving them confidence (along with the pedagogical knowledge and skills); thus, the school had more confidence in one of team members and she became the science leader.

By the reframing of the embedding and professional growth, we were able to see the institutional changes to structures to move towards how this then can become embedded. See what was happening at each school, but then working out what support was then needed in PL3 and PL4 cycles.

13.4 Describing the Nature of the Partnership

The challenge of the program has been to develop a partnership model that is open enough to cater to the individual needs of the schools, but cohesive and comprehensive in its direction and commitment. The partnerships could be considered Generative in that they are largely cooperative in nature. The intention was for the STEM Program team to work with the teachers to enable them to be more capable and resourced STEM teachers who can lead curriculum innovation in their school. The extended time of the PD enabled teachers to gradually generate new practices and increase their understanding of what STEM is and how it can look in their classrooms. The initial work in developing the partnerships prior to the PL cycles was essential in establishing the expectations of both parties that are needed for a Generative partnership.

The design of the program enabled the intensive PL days to be responsive to the schools' needs; the Project Officer was essential in keeping "an ear to the ground" to establish what the specific needs were in terms of types of activities that might be of value for teachers. Similarly, the teachers were responsive to the needs of the STEM Program team to ensure we had adequate information and data to establish the next PL cycle or to meet our reporting requirements. An example of this was seeking additional funding to add the fourth cycle in order to increase the potential for embedding the initiatives in the schools; initially, the intention was to have one half day, but additional funding provided for another 2 + 1 day cycle. Most schools (eight of the ten) felt the need and desire to undertake an additional cycle, and committed to both gathering data on their initiatives through an action research process, reporting this at the typical reporting day, but also creating a video highlighting the success of their program for a culminating Showcase event. For the teachers, this event served to give teachers a forum to articulate their developing capacities as STEM teachers and leaders, and for the STEM Program team to positon Deakin as facilitators in the enhancement of STEM education in the region.

Additionally, there was mutuality in terms of respecting each other's' roles and valuing what each of us brought to the partnership. For example, one teacher said, "you seemed to know what we needed".

There was also evidence of teachers reflecting on their practice, and particularly in their increasing uptake of the language being promoted by the program—reference to the STEM skills and increasing use of the pedagogies of problem solving, design-based learning and representations, was made during teachers' reports on the reporting days. As a result, the partnership, and the professional learning that was enabled through it, has a potential to meet the long-term needs in most of the schools. The action research project undertaken by teachers in the fourth PL cycle was particularly useful for schools to reflect back on the problems they were facing, e.g. reduced student engagement, and to better position their STEM innovations as potential solutions.

In terms of the Representing Partnership Practices (RPP) (Chap. 5), the *Generative* partnerships between teachers and the Deakin team can be summarised in the following ways:

- *Purposes*: Partners recognised opportunities for mutual professional learning. This has evolved over time—e.g. mutually improving academics' and school teachers' understanding of what STEM is and how it can be implemented at schools.
- *Institutional structures*: Partnership activities were considered long term, that is, for the life of the 2.5-year program, and were resourced by the university through academic allowance to run the program, and catered for at the school level through the commitment of two to four teachers participating in planned professional learning days, commitment to developing innovations by these teachers, and concerted efforts by the teachers to embed their initiatives into the school curriculum.
- *Nature of Partnership*: The PNT and PMT processes were critical. Teachers' needs are considered when planning each PL cycle, as informed, by reflection, on outcomes of previous cycles, focus group interviews with schools prior to some cycles

to establish needs, and feedback from teachers through the Project Officer. The Project Officer also provided ongoing support, and other resources were made available to meet the school needs, e.g. provision of digital technologies for coding activities, student ambassadors from Deakin to provide role models and support schools programs, facilitate access to Deakin facilities, and a STEM teacher network for all teachers in the region in order to open up further networking possibilities for the teachers. In addition, over time there have been relationships established between the different schools though the intensive PL days where there was an expectation established for teachers to report, share and learn from each other.

- *Linking theory with practice*: The development of the STEM Vision framework (reported in Hobbs et al. 2018) was essential for the Deakin team to clarify the focus of the program, and to inform activities and tools that would be meaningful to teachers and assist with their learning.

13.5 Evaluation of the Tool

This case study illustrates the cultural–historical activity theory (CHAT) principle that the tools we use, such as the PMT and PNT, in our activities are not independent of the activity. They change the nature of the activity and are changed by the activity. "The mediating artefacts include tools and signs, both external implements and internal representations such as mental models" (Engeström 1999, p. 381). Thus, in developing a partnership, the tools presented in the STEPS Interpretive Framework enabled the program to develop from a simple professional development program delivering contemporary research and practice to a sustainable change in STEM practices and pedagogy within the schools by identifying the key questions/issues, in CHAT terms *motive*, and showing that it is a process and thus providing a road map and schedule for the journey.

In turn, the tools in the Interpretive Framework were also changed as they were modified and evolved through the stages of their use, first by trialling before formal use, then during the subsequent face-to-face follow up meetings and finally during where the PMT was operationalised to support monitoring and maintain the process. The tools were adapted in order to meet the diverse needs of individual schools while remaining broad enough to maintain common themes for all schools so that they were able to each other and feel part of a single coherent program.

It is important to acknowledge that the tools were embedded in institutional history, and these both enabled and constrained the program. As the instigators of the partnership caught up in the academic life, we did not fill in our side of the tools as completely as we could have. On the obverse, we were able, as academics, to use the experience of this program to develop new models of STEM education.

This case study illustrates the importance of a clear structure to inform thinking about how to engage with partner schools in order to gain a clear understanding of their needs and rationale for being involved. However, beyond this, the relational nature of the STEPS tools enabled them to be adapted to both the individual schools' needs and the program as it developed.

Appendix 13.1 STEM Program Partnership Negotiation Tool

Deakin University	School H
A. Aims and Rationale	
Identify mutual and differing aims and provide rationale	
Why be involved in the program? What needs are likely to be met your involvement? · Improve student uptake of mathematics, technology and science by students by improving attitudes, knowledge and skills · Increase science and mathematics teacher capacity and generate knowledge about improving practice · Raise profile of Deakin within Geelong community and as a preferred destination for Geelong students	*Why be involved in the program?* · To ensure SCHOOL is delivering first class educational opportunities to all students within the STEM areas · To build teacher capacity and confidence in the teaching of STEM-related disciplines · To increase student engagement in STEM careers and pathways · To improve student learning outcomes in the areas of maths and science · To improve the uptake of science and mathematics electives and VCE subjects · To improve student attitudes towards STEM subjects at SCHOOL H, provide more engaging delivery of skills and content *What needs are likely to be met by your involvement in the partnership?* · The involvement in a strong professional network of math/science teachers · Improved pedagogical practice with STEM-related subjects · An increase in perceived teacher capacity and confidence in the teaching of STEM-related disciplines · A greater awareness and understating of STEM-related career pathways and relevance to real life so that students have a greater understanding of these before they lock in their electives *How do you cater for STEM-related subjects in your school?* · Science and mathematics taught as compulsory subjects up to and including Year 10 · Science electives made available to students from Year *9* onwards, theoretically enabling students to select subjects in line with their interests · 1:1 laptop program with core and elective ICT subjects taught 7–12 · Excursion opportunities offered to students on occasion · Extensive VCE subjects offered within the STEM areas · Professional development opportunities offered to staff *What would you like changed about the way you cater for STEM-related subjects in your school?* · Upskilling/regular coaching provided to teachers who are teaching out of method · Real-life, current career pathways integrated into each maths and science topic to emphasise relevance and increase student engagement · Increase in CORE Science time allocation at Yr9 · Possible focus on science disciplines at Yr10 (physics, biology, chemistry and environmental)

B. Institutional and Program Demands	
Identify requirements constraints and affordances governing the approach to partnership development	
i. **Requirements**	
What requirements do you have that determine involvement? · Report to Skilling the Bay that the Program is progressing adequately · Work in partnership with schools. Deakin representatives, and Geelong industries	*What requirements do you have that determine involvement?* · Building of an effective team with strong protocols for sharing best practice with others · Cost factors in releasing staff · Staff movement within the middle year's program · Value-added benefits for staff involved · Clear expectations and guidelines for all involved including timeframes · Collaboration to increase engagement for students through links to the university and industry
ii. **Institutional enablers**	
What structures, processes and HR-related issues will enable this program to run smoothly? · Project Officer as a boundary spanner · Academics will have teaching buy out, experience in science pedagogy and teacher development · STEME team with expertise	*What structures, processes and HR-related issues will enable this program to run smoothly?* · Time release that is reflective of the importance that is being placed on this to enable implementation · Clear expectations about the commitment expected by the teachers, both in terms of time and workload · Clear expectations and guidelines for all involved including timeframes *What can we do to support your school with the teaching of STEM-related subjects?* · Provide tried and tested resources · Provide examples of current and in-demand STEM careers · Facilitate access to guest speakers from a range of STEM-related fields · Latest educational research in the areas of best practice teaching methodologies, particularly within STEM subjects · Relating to how students would utilise STEM in the real-world, university units and applications
iii. **Institutional constraints**	
What structures, processes and HR-related issues might threaten or challenge the program running smoothly? · STEM Program constraints—what is on offer: build teacher capacity, · Project Officer spread across 11 schools leads to time constraints · Length of project (2–3 years) · Needs to work within university calendar and activities · Academic commitments beyond the project · Timetabling/staffing issues	*What structures, processes and HR-related issues might threaten or challenge the program running smoothly?* · The program being an ad-on for time-poor teachers. It will need to be integrated into existing frameworks through ready-to-use resources and easily applied strategies · Currently, SCHOOL H staff are auditing the curriculum against the standards and completely redesigning our approach. Docs this lead to a double up of work? · As we move to adopt CATs as a major form of assessment, this COULD work even better by creating a contextualised approach to tasks. An example could be using professions as a starting base for CATs to be introduced · Could improve the curriculum maps and lesson outlines being designed during professional learning times, which could be discussed at domain meetings—specifically MY *How will this program align with your curriculum requirements, teaching program?* · STEM career pathways can be easily incorporated "Science as a Human Endeavour" strand of the curriculum · The school and in particular the Middle Years deals well with adapting to change and embraces opportunities. Creating more of an outlook on these subject areas can only support teachers and students in the long term. Time constraints with Curriculum Development and implementation with in the school should be supportive with these tasks, but again, time will tell · The school is supportive of ongoing PL and aligns well with the ongoing improvement to curriculum map focus *How does the school structure influence the way the partnership will run?* · The MY program at SCHOOL H and the existing Wednesday night meeting structure will enable knowledge to be shared and implementation to be facilitated. However, it is important that this is also extended to the SEALP group *Do parents need to be informed?* · Not at this early stage. When something more concrete is in place and a student involvement timeline and strategy is in place, then possibly · Parents would only be supportive of these opportunities as they demonstrate that Belmont High School is a proactive school that has strong link with the community and especially future career paths and academia beyond high school

C. Relationships	
Negotiate and define value and parameters defining the nature of the partnership	
What will you need to contribute to the relationship? What are the limits of the relationship? 1. Provide ongoing professional development to improve teacher capacity to use contemporary STEM practices in science; and 2. Assist school with building student aspirations for STEM-related subject BY Assisting the school to: · Develop engagement STEM-related learning experiences, · Develop curriculum · Increase engagement with industry and Deakin science students as ambassadors for Science and Deakin, and · Access to Deakin SEBE expertise and infrastructure. · Access and utilise industry-based practices and personnel	*What are you willing to put into the relationship? What are the limits of the relationship?* · Participate in relevant professional development opportunities · Trail strategies provided in professional development · Share resources with relevant teachers *What specific key processes, activities and people will be required?* · STEM team and Admin meetings · Development of team norms and protocols · Professionals and academics to share best practice. · Collaborating with all involved—sharing of maps, resources, CATs *What is expected of teachers and principal?* · An understanding of the time constraints and workload of staff · Ongoing support and attendance to develop knowledge and share experiences across the board · Also implementation of subject-based tasks and activities within the school setting · Collaboration with staff not involved in program but teachers within the domain *What is expected of the project teacher leaders?* · Reporting back from professional development sessions. Sharing resources and strategies obtained · Coordinating the implementation of initiatives · Ongoing support, provide guidance and act as mentors *What is the time commitment for teachers and schools?* · Participants will have the option of opting in or out of each learning cycle. It is the preferred position that each member commit for the 3 years for maximum benefit *What level of involvement will each member have?* · Equal and shared · It is expected that the team work in year level pairs and link closely with the other year level pair to ensure consistency in pedagogical delivery *Is there benefit in the Deakin team coming to speak to staff/STEM subject teachers?* · Couldn't hurt *What sort of communication will work?* · Email and regular structured meeting time *Who will be involved in planning, teaching, reflection and feedback?* · With the right scaffolding and structures, the STEM team can provide opportunity for the years 7 and 8 maths and/or science teachers to contribute to this *How will staff be recruited into the program?* · Done *What should happen throughout the program to ensure everything is on track?* · Regular conversations and opportunities to share learnings *Should we plan for this to be a long-term or short-term partnership?* · Long term *How will the teachers interact with university student ambassadors and for what purpose?* · Undergrads could come and support teaching and learning in the classroom · University professionals modelling best practice

D. Nature and Quality of the School STEM Improvement	
Conceptualise an approach to incorporating STEM practices into schools through interaction with the disciplines	
What specific key processes, activities and people will be required? · Suite of Deakin programs · Professional development program—ongoing and blocks · Science contribution · Maths contribution · Resources—REMSTEP units · Staffing—Project Officer, academics, doctoral students, student ambassadors · Industry partners who would be willing to come on board · CADET (Centre for Advanced Design Engineering Technology) · SEBE (School of Science, Engineering, and the Built Environment) · Project Officer: who will work with industries and schools to select STEM practices which need to be applied to classroom and embedded within the curriculum · Evaluation of impact, provide data for research · Pedagogical Strategy · Partnership Strategy	*What specific key processes and people will be required?* · Domain leaders and other staff within disciplines to support new practice *How does the intended program relate to school curriculum?* *What learning experiences and learning outcomes are expected for the school (science programs, students, teachers, principal)?* · Increased engagement and post-compulsory uptake in math and science subjects · Improved student outcomes in numeracy and math *What is needed to support the learning outcomes?* · Tried and tested strategies and learning resources · Supportive collaborative teams *What feedback is needed? How will this be obtained?* · Survey students, teacher observations *How will the schools obtain evidence of what has occurred? For example, written report, unit plan, student outcomes, presentation* · collection of survey data · collation of resources · student and staff anecdotes · CATs|, feedback about tasks

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Chapter 14
Scientists and Mathematicians in Schools: CSIRO, Australia

Coral Campbell and Russell Tytler

Abstract This chapter provides an example of another form of partnership: the Scientist and Mathematicians in Schools (SMiS) Program which is a partnership between schools and a government institute. It describes the current aspects of the program and how much of what occurs in the partnership with schools is subscribed through the STEPS model—the Interpretive Framework. The nature of productive partnerships and the possibilities for improvement in the SMiS are highlighted within the context of the use of the specific partnership tools developed from the interpretive framework.

Keywords Scientist and mathematicians in schools · Quality learning · Authentic partnerships · STEM

14.1 Introduction

International interest in STEM has increased significantly in recent years as a direct result of the declining participation in STEM-related occupations and the expected impact of this now and in the future. With a significant decline in STEM participation in schools, in higher education pathway choices and in careers, the challenge facing educators is how to meaningfully embed STEM-related content into teaching and learning in order to engage students at all levels of schooling (Marginson et al. 2013).

The Scientists and Mathematicians in Schools (SMiS) program is a major Australian initiative involving STEM professionals working in partnership with individual teachers in primary and secondary schools to engage students in quality learning in the STEM disciplines of science, mathematics and ICT. Since its inception as 'Sci-

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entists in Schools' in 2007, it has expanded to include mathematicians, engineers and more recently ICT professionals. In eight years to 2015, it dealt with in excess of 4600 partnerships. The program therefore represents an important innovation on the Australian STEM education scene. The SMiS team, managed by CSIRO,[1] provides support for matching STEM professionals and schools, setting up and maintaining partnerships through project officers in each state, running workshops, online support and a website. In 2014, the team won a CSIRO award for its support processes.

The CSIRO "Scientists and Mathematicians in Schools Program" including "ICT in Schools—a partnership program", aims to:

- bring the practice of real-world science, mathematics and the ICT profession to students and teachers;
- inspire and motivate teachers and students in the teaching and learning of science, mathematics and ICT;
- provide teachers with the opportunity to strengthen their knowledge of current scientific practice, mathematical and ICT applications;
- enable scientists, mathematicians and ICT professionals to act as mentors or role models for students;
- broaden awareness of the types and variety of careers available within the mathematics, science and ICT fields;
- enable teachers, scientists, mathematicians and ICT professionals to share ideas and practices with other teachers, scientists, mathematicians and ICT professionals; and
- increase scientists', mathematicians' and ICT professionals' engagement with the broader community, thus raising public awareness of their work and its social and economic importance.

These aims are not specific as to what sort of knowledge is exchanged between teachers, students and STEM professionals, but the intent of these aims seem to indicate the expectation that the partnerships comprehensively adapt to the needs of the partners and engage with the broader communities, raising awareness of the importance of STEM.

Research literature identifies a number of different models of partnership arrangements, each with their own approaches, theories, learning and assessment objectives and outcomes. For example, Trent (2012) identified that partnership trends in the USA responded to the "quality" of educational systems, whereas in the UK, partnerships tended to provide schools with greater input into teacher education.

Partnerships, described by Rossner and Commins (2012), require groups, individuals or organisations to be working towards a common or shared vision or goal. In Australia, Kruger et al. (2009) indicated that successful partnerships relied on the key factors of trust, mutuality and reciprocity. They defined these terms as:

- Trust—stakeholders believe that the partnership will bring anticipated benefits to each stakeholder, with a reliance that each partner will commit to the benefit of the project.

[1] Commonwealth Scientific and Industrial Research Organisation.

- Mutuality—depicts the support of each partner for the project and recognises that partners understand that working together does lead to gains for each.
- Reciprocity—speaks to the value each partner holds for the other and to the contribution the other brings to the partnership while recognising that each is different and distinctive (Kruger et al. 2009).

The STEPS Interpretive Framework (Hobbs et al. 2015) indicates that successful partnerships share a vision, use available resources equitably and balance power in decision-making processes between stakeholders.

14.2 The SMiS Partnerships

SMiS can be viewed as one of a suite of models of partnerships between STEM professionals and schools, which have achieved increasing prominence as concern with lack of engagement of students in STEM subjects and futures increases. In Australia, there are many such programs including university outreach initiatives, national competitions, investigative projects such as CSIRO's CREST program, and local initiatives involving individuals or industry or government agencies. Three key features characterise SMiS as distinctive amongst these initiatives: first, that the partnerships are between an individual STEM professional and a teacher; second, that the partnerships are long term; and third, the national reach of the project and its emblematic nature on the national scene. As part of the assessment of the SMiS program in 2015, aspects of the program were closely studied. These included a summary of the various contexts in which the Scientists and Mathematicians in Schools Program operated (as derived from survey data) and case studies of a number of the partnerships were conducted.

The report prepared for CSIRO included an analysis of (1) the structure of activities within partnerships as an audit of variation in partnership arrangements, (2) the outcomes for students, teachers and STEM professionals and the variety of partnership activities that led to significant outcomes, (3) teachers' and STEM professionals' experience of partnerships, and the conditions under which productive and sustainable partnerships were formed, and (4) responses to the support structures provided by CSIRO for initiating and supporting partnerships. In this chapter, we will draw to some extent on all these aspects of the research but will particularly focus on (3) and (4).

14.3 Overview of Partnerships

Generally, partnerships are set up by the CSIRO SMiS team on the basis of school requests for particular types of STEM expertise matched to volunteer STEM professionals' CV. Beyond this initial framing, the SMiS partnership model is charac-

terised by the flexibility of the partnership focus and activities. These are negotiated between the teacher and the STEM professional, and they range considerably in time commitment, types of interaction with teachers and with students, and the purposes of the partnership. Some partnerships involve short-term annual visits to run activities or give presentations, whereas others involve planning with teachers and helping with programs over a considerable time period. In some cases, partnerships last over a period of years and grow in significance as teachers and STEM professionals become familiar with their respective expertise and the possibilities that arise from this. In many cases, particularly in primary schools, the STEM professionals interact with multiple teachers, or even the whole school. Partnership arrangements tended to be different for primary schools compared to secondary, involving greater time commitment, more teachers and a less distinct topic focus. At the primary and lower secondary levels, the focus for science was often on inquiry and investigative approaches, and science as a human endeavour curriculum strand. For mathematics, the focus was also often on inquiry and problem-solving activities.

14.4 Partnership Outcomes

For students and teachers, the surveys identify a range of very significant benefits including engagement with reasoning in science and mathematics, increased interest, enjoyment, knowledge and confidence in these subjects, knowledge of how STEM professionals work and what they are like as people, and increased appreciation of STEM pathways and careers. Teachers claimed increased motivation and engagement in teaching science and mathematics and improved teaching processes, enjoyment of working in the partnership and increased student engagement. For primary schools involving multiple teachers in the partnership, the outcomes extended to improved teaching and increased profile for STEM in the school. For STEM professionals, the outcomes included the enjoyment of promoting their commitments and knowledge to a new generation of students and increased skills and confidence in promoting public understanding of STEM.

14.5 The SMiS Partnership Model

The research identified three distinctive features of the SMiS partnership model; the individual and collaborative nature of the partnerships, their flexibility in responding to local contexts and their ongoing nature, at times extending to 5 years or more. The one-on-one nature of the partnerships and the open time allowed the development, in the best cases, of distinctive programs that drew on partners' strengths, engaged with local resources and met local needs.

> My first term I ran an after school ipad club, second term I ran an after-school computer club, third term I performed research across the school community and this term we are planning to provide a fortnightly meet-up for teachers to gain coaching on use of technology in the classroom. (ICT professional)
>
> Our Scientist is becoming more involved in the actual planning of the Science Program at school. He in turn has shown increased interest in our school philosophy and culture and has made the effort to participate in some community events and Professional Development sessions. More and more our teachers are tapping into the wide knowledge and experience the Scientist brings to our school. (Science Teacher)

Partners described the development of relationships and initiatives over time that responded to growing realisation of the possibilities opened up by the partners' intersecting expertise.

> Utilisation of my skills has increased, I am now invited and attend planning sessions with teachers, frequently receive emails and advise teachers. (Scientist)

Looking at the survey returns and interviews concerning particular partnerships, it was clear that the STEM professionals often brought knowledge, skills and expertise that were distinct from the expertise that teachers themselves could offer.

> Once my partner teacher asked if I could talk about the search for MH370 - being as it was Bayesian statistics, & recently in the news. That was fun. (Mathematician)
>
> Students have access to a new set of knowledge and skills that allows us to consider projects that otherwise would not have been pursued. (Teacher in ICT partnership)

Teachers brought expertise in pedagogy and curriculum knowledge.

> My scientist partner and I are always looking at new ways that he can conduct science in my classroom. We try to integrate these into my science unit of work where possible. (Science Teacher)

Through these distinct sets of knowledge and skills, the partnerships thus opened up enriched learning opportunities for all stakeholders—the partners, students and their schools. The following two vignettes offer insights into the nature of some of these partnerships.

Partnership vignette: An outward facing school (Tytler et al. 2015, pp. 109–111): She (a teacher, Alice) had previous experience working in the SMiS program. Serendipitously, a parent approached Alice and informed her that she had "just" registered as a scientist in the SMiS program. The parent, named Kelly, works in nuclear medicine. Kelly contacted the SMiS team and a match was made. Alice was delighted to have a female scientist to dispel the students' stereotypical notion of scientists being male. Alice found Kelly personable, enthusiastic and willing to contribute to the planning of the partnership program. Kelly's role as an interested parent and partner scientist created a unique opportunity for the partnership.

Since Term 1 2014, Kelly has supported Alice and her colleague Philip and their students with two major projects and has worked with other teachers in the school in other ways. The projects are across subject areas, e.g. art, sustainability, science,

mathematics and include many school members. In the first project, Kelly worked with teachers and the Grade 1 students during science lessons on the topic of materials with a focus on recycling, to build an igloo out of plastic milk bottles. It was a mammoth undertaking and impacted on all students in the school—they could even sit inside the completed structure.

In 2015, World Ocean Day was acknowledged with a project involving students, other parents and teachers in this collaborative effort with a colouring competition, and the making of murals from recycled materials—litter collected from the beach. The students worked after school and at lunchtime on this project making murals, which were displayed at a Marine conference that focused on Healthy Oceans, Healthy Planet. Kelly spoke to the school community at assembly with regard to the litter the students drop in the schoolyard—she invited them to think about the things they are dropping, and they do go into the creeks and oceans. As a result, not only did a number of students (grade 3–6) commit to devoting some lunchtimes to the World Ocean Day mural project, two other parents with expertise in this area volunteered some time to the project.

In addition, Kelly has run other occasional science clubs at lunchtimes and has spoken to different classes and teachers about their current science topic. As a result of Kelly's suggestion, the school is participating in Terracycle—an initiative that recycles certain materials that would traditionally be considered non-recyclable—e.g. coffee pods, toothbrushes.

According to Alice, being comfortable with the uncertainty of what will grow out of this partnership and being willing to take risks has proved a key factor to the success of this partnership. Alice explains:

> It's messy, and so as the person guiding it you have to be comfortable in that space, of not knowing necessarily what is going to come up next. So right now, we have done the stage and a big thing around that and it's all finished, so now we are looking for a new thing, and when I say looking, we are all actively thinking where to go next and so it's an evolving thing and requires a high degree of creativity, flexibility and some-time.

Partnership vignette: A mathematical approach (Tytler et al. 2015, pp. 114–115): The partner-mathematician, Heather, has visited the school twice since the partnership began less than 12 months ago. She has addressed the year 12 students speaking about, among other things, how mathematics works in her area of employment (astrophysics), and how it is such a big part of getting *any* job. When Patrick spoke with these students afterwards he noted that this latter point resonated most with them. Patrick hopes that this message might be communicated to all students in the future.

Heather has also spent time with the students in year 8 and 9 speaking about how mathematics relates to astrophysics. Patrick was "blown away" by the impact Heather has had on the students so far and has begun planning with Heather to facilitate a project for the year 8 and 9 accelerated students with a focus on the mathematics involved in astrophysics. Some students have also requested that they have one-on-one time with Heather to discuss her area of expertise.

Other teachers in the school have been inspired and requested that Patrick "share" Heather with them. He anticipates that this will also happen as the partnership continues.

14.6 Setting Up and Maintaining Partnerships

While many of the SMiS partnerships are long lived and have brought significant outcomes for partners, the surveys also uncovered issues with partners' difficulties establishing communication and mutual understanding. In fact, a substantial minority of partnerships brokered by CSIRO do not proceed beyond the first contact.

> I made multiple attempts to contact the teacher, and offered to speak by phone to best understand their needs and how I could assist, but they only emailed at short notice for me to visit at one time/date, to speak to students about biology, which is not my field at all. They seemed not to understand, or want to understand what I could offer them, nor to be open about what their needs were.

There can also be challenges with developing a joint understanding about the mutual obligation implied by a partnership, or convincing teachers about the benefits.

> I am not much in contact with the teacher, I don't think she is having any benefit at all (unless she is reading my reports and replicating our experiments). (Mathematician)

> I do find that once Mathematicians in Schools partnerships establish themselves, they're generally ongoing and very productive and successful. But it can be really difficult to convince a teacher especially as to why (*a MiS partnership*) is a good idea and how it might work. (SMiS Team Member PO230)

This is perhaps not surprising and is consistent with findings from our previous research (Blake & Campbell 2009; Tytler et al. 2016) that showed problems with communication and understanding that often required persistence for productive partnerships to be developed. SMiS partnerships, like any school community partnership, involve professionals from quite different communities of practice learning to appreciate each other's perspectives and expertise. Negotiating a successful partnership requires a degree of "boundary crossing" that needs support and patience. STEM professionals and teachers were consistent in their description of key aspects of partnership success and sustainability as: a capacity to understand each other in the development of a shared view, preparedness to be flexible, and a commitment to developing a quality relationship that "works".

> This active partnership began in term 1 2014. The scientist, called Kelly works part time and was flexible with timing. She was willing to volunteer for 2 hours per week. Initially, Kelly and Alice met every fortnight, for quite a few weeks to discuss how Kelly could be best utilised in the school. These conversations were important in establishing the scientist's interest and skills, orientating the scientist into the school and gaining an understanding of each partner's objectives. (Case 2)

> I think, for both pieces of that partnership it's about the openness and willingness to communicate first and foremost. Even the teachers that I've spoken to that weren't really sure what they were going to be doing, or what the STEM Professional was going to be able to do, through the conversation they've obviously both learnt about each other, and they find the spot that suits both. (SMiS Team Member PO103)

Setting up and supporting partnerships is an important procedure managed by the SMiS team and a key aspect of ensuring partnership sustainability. The team has

developed a variety of processes to support partner matching and ongoing support including: personal contact with partners to provide advice and open communication channels, workshops and networking sessions, online resources such as webinars and social media, a newsletter, and showcases to provide exemplars and advice on partnership processes, and online support structures. Given the magnitude and geographical distribution of the program, these processes are difficult to monitor in a way that attends to particulars of the school and STEM professional contexts. As far as practicable, the matching and support processes have been developed to be automated, but of course this is not a straightforward undertaking given the complexity of providing support for the variety of professional and personal relationships that are beginning at any one time.

> I wonder if some more structure/definition could be given to how one might make contributions (as a professional); e.g. strategic/policy advice, project/implementation planning/assistance, specific education activities, etc. Such a structure can more readily set and manage expectations across all participants. (ICT professional)

> Perhaps some local contacts from successful partnerships to gain ideas of what to do to assist the school, what activities I could potentially do etc. (Survey Comment from STEM Professional)

A key factor in the sustainability of partnerships was the expectations of the partners as to their respective roles and what were the possibilities for productive activity:

> This is very difficult to generalise; each teacher-scientist partnership will be different. I have had partnerships which were extremely successful; others where the teacher assumed they were getting a "free teacher", or once, a "free research assistant", rather than a "science mentor". (Survey Comment from STEM Professional)

> More advice/assistance is the very early stage of the partnership. Maybe an assisted discussion with teacher and scientist to encourage ideas of what things they might do with the students etc. (Survey Comment from STEM Professional)

14.7 Aligning the SMiS Partnership Experience with the STEPS Model

The variation in embeddedness and richness of partnerships in SMiS, evidenced by the cases and quotes above, can be readily aligned with the STEPS framework, in particular the Principles of Partnership Practice (PPP, see Chap. 6) and the three types of partnership practice (see Chap. 5) which incorporate these principles (Hobbs et al. 2015, p. 41). These principles, which enable partnerships to grow and flourish include:

- Risk-taking and trust.
- Reciprocity and mutuality.
- Recognition of respective goals.

- Respect.
- Adaptability and responsiveness.
- Valuing the diversity in partnership representations.

The three types of partnerships—described as Connective, Generative and Transformative—are based on aspects which consider the purpose for the partnership relationship, the embeddedness of the partnership structures, the nature of collaboration or cooperation and the links to reflective practice around theory–praxis.

Connective partnerships are cooperative, with mutual partner recognition of the value of working together. They tend to be short term, but with opportunity for extension. With a greater level of commitment, **Generative** partnerships provide mutual benefits to all partners in a flexible arrangement. They are often longer-term partnerships. The final type of partnership indicates that all stakeholders commit to each other and to active involvement in goal-setting. This is a **Transformative** partnership.

First, many SMiS projects exhibit "connectivity" in that the project enables STEM professionals to work with teachers and students in schools. Even for some of the less-successful partnerships, the connective aspects of the partnerships are evident in the way things are organised for inclusion of STEM content into the classrooms. They appear to be less successful in terms of the level of development of the principles of partnership practice—many do not establish respective goals, and do not develop reciprocity and trust, with adaptability and responsiveness to each other's needs. However, clear beneficial aspects include visits and talks that familiarised teachers and students with the STEM partners' work. In some of the simpler connective partnerships, the activities are not talked about by the partners in a way that makes clear any value added to the curriculum or to stakeholders' learning.

However, in some of the quotes and case studies, one can discern a generativity in that the projects lead to new content or new practices that enhance the normal curriculum. Often, the developing partnership results in a transition from connectivity to generativity in that they offer teachers knowledge of contemporary practices and ideas in STEM, they provide mentoring and modelling for students, they provide information on careers, and sharing of ideas.

> The program became more ambitious as a long-term monitoring of what started as visits to wetlands. (Scientist)

> Initially we did a range of activities on chance and probability–now we have much more diverse problem-solving activities. (Mathematics Teacher)

> The partnership is working for the benefit of the students. They are enjoying sessions and being challenged in their mathematical thinking. (Mathematics Teacher)

Many more of the principles of partnership practice are exhibited in these partnerships which are usually established over a longer term or across multiple visits. In particular, what characterises these partnerships over the connective ones is the continuing development of relationships between the partners which lead to mutual respect and reciprocity.

For some partnerships, often mature ones, there is evidence of transformation of the STEM experience for students and teachers in that a new vision of science and scientific practice is established. In some cases, quite new practices occur, or changes in school curriculum culture:

> The profile of Science has lifted through the range of co-curricular activities offered and facilitated by the SIS. The SIS is adding to changing the culture and perception of who and what scientists do and this is really important from a gender perspective too. (Science Teacher)

> Several students have been given the option to do work experience with our partner scientist and as a result a couple have even gone on to study his field at … (Science Teacher)

Underpinning the aims of many of these partnerships is a transformative intent—to change the character of students' experience of school science and mathematics to better represent contemporary STEM practice, and through this to provide inspiration for teachers and students. A further transformative intent is to engage STEM professionals with the broader community in a way that raises awareness of the societal importance of STEM. In particular, the principles of adaptability and responsiveness to partner's needs as well as valuing the diversity in the way the partnership develops are well represented in these transformative partnerships.

Currently, the SMiS Project team is looking to streamline its processes for matching teachers with STEM professionals and its online resources for supporting partnerships. A major recommendation of the recent review (Tytler et al. 2015) was that partners need to be aware from the outset of the nature of productive partnerships and the possibilities inherent in the model, if expectations of the partners are to be productively aligned. It is in precisely this territory that the STEPS model is designed to operate. The STEPS model acknowledges the difficulties and challenges associated with sustaining partnerships; however, it has developed a set of critical success factors which can inform developing partnerships and mitigate against such challenges and threats within their contexts. Specific partnership tools (see Chap. 6) have also been developed which can be applied at the start of any partnership to broker the relationships, expectations and define common goals. Applying the understandings from the STEPs model can provide a pathway forward for enhanced partnerships within the SMiS projects, improving outcomes for the stakeholders, and improve growth and sustainability of the partnership.

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Chapter 15
Case Studies Exploring the Applicability of the STEPS Interpretive Framework in Other Professions

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Abstract In this chapter, we consider two case studies where the Interpretive Framework was applied to contexts other than education. The first case study was concerned with improving the professional experience programme for nursing and medical students who undertook placement at a healthcare organisation (HCO). In the second case study, the Interpretive Framework was applied to a project to establish two medical-legal partnerships (MLPs) to better support people with mental health issues to deal with legal problems. The adaptability of the Interpretive Framework becomes evident when, in the first case, it was used to evaluate and improve an existing learning partnership between the university and a HCO, while in the second, it was used to support the establishment of a new partnership between lawyers and mental health clinics. The stakeholders reported that the Interpretive Framework was, with minor adjustments to language, readily adapted to their contexts.

Keywords Evaluating partnerships · Interpretive Framework · Initiating partnerships

15.1 Introduction

While the STEPS Interpretive Framework initially arose from a teacher education context and was designed to help support judgments about current practice and

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provide a framework for initiating reviewing or evaluating partnership arrangements between universities and schools, as indicated in chapter one, the project team wanted to explore its applicability to other areas. The fact that the Interpretive Framework was developed on the basis of research about good teaching and learning and partnerships suggested that it may have applications more broadly within teacher education. In Chap. 1, we explored the broader notion of work integrated learning (WIL) and noted that many of the issues faced in teacher education were also evident in other contexts.

The Interpretive Framework articulates the importance of the theory–practice nexus and the notions of reflection and identity formation in building expertise and confidence in students. It also identifies nature and centrality of the relationships between the partners to bring this about. In this chapter, we report on two case studies where the STEPS Interpretive Framework was adapted for use by two different professional groups.

In the first case study, academics involved in nurse education at a university saw the potential of the Interpretive Framework to enable them to evaluate and re-invigorate their existing professional experience placement programme. In the second, a small research project to establish a working partnership between healthcare professionals and legal practitioners used the Interpretive Framework to inform key decisions about the purpose of the programme, the nature of the intended partnership and how the partnership would work.

15.2 Case Study 1: Healthcare Organisation (HCO)

Work integrated learning (WIL) in nursing courses comprises professional experience placements which are integral to the preparation of safe and capable undergraduate nurses. Students of nursing undertake a significant component of their course in health care venues off campus. While this professional experience is usually highly valued by students and practitioners, there are concerns reported in the literature in establishing the connections and building the relationships, between universities and external health organisations, to ensure nursing students and external practitioners are able to gain the most benefit from the experience (Siggins Miller Consultants 2012). This view is mirrored locally within the university where this case study occurred (Courtney-Pratt et al. 2011).

Establishing and maintaining partnerships and making connections between theory and practice have long been advocated within the health domain (Creedy and Henderson 2006; Miller et al. 2015; Patrick et al. 2008), and within generic workplace settings (Smith et al. 2009). It is well recognised within nursing courses that the quality of student placement experiences and subsequent learning is dependent on the quality of relationship between the education and health sectors (Courtney-Pratt et al. 2011; Taylor et al. 2015). Furthermore, the development of reciprocal and collaborative partnerships between academics and health practitioner colleagues is fundamental to the provision of quality placements for students (Miller et al. 2015).

In the Faculty of Health at the university where this case study occurred, students in many health-related degrees undertake work integrated learning (WIL) in the form of placements in a range of healthcare organisations (HCOs) outside of the university. This is a mandatory component of their course, where they are supervised by suitably qualified and capable staff. Each year, the university staff organise over 850,000 h of professional experience placement, with approximately 392,000 h of these undertaken by nursing students.

In this case study, shortcomings in the functioning of the professional experience placement experiences for supervisors and students at one of the HCOs were identified by the university staff. Feedback indicated that both students and their supervisors were dissatisfied with the key aspects of the placement. Inefficient communication meant HCO staff were often unaware that students would be arriving and they were not clear about their supervisory roles when working alongside students. University staff also identified the need to review the pedagogical underpinnings of the professional experience placement programme. This HCO was invited to be a part of a project with the university to improve the experiences of the students and their supervisors in practice.

The leader of professional experience placement at the university, and co-author of this chapter, approached a member of the STEPS project, because she felt that the STEPS Interpretive Framework (Jones et al. 2016) offered a process and some tools which might assist in this task. After initial discussion, a research project was formed. Thus, the project had two key intended outcomes, firstly to review the nature of the existing partnership between the university and the HCO in order to improve the student learning outcomes, and secondly, to explore applicability of the Interpretive Framework to develop partnerships in the health sector.

The HCO was invited and agreed to participate in the joint collaborative project with the university. As this was an existing partnership which had been in place for many years, initially, the Growing University–School Partnerships (GUSPs) from the Interpretive Framework guided the initial review to ascertain what was working well and what was needed to be improved. It also provided some key questions and planning tools for the project team to work with once a commitment to action had been agreed. The representations of partnership practice (RPP) component of the Interpretive Framework was of particular interest to the staff within the Faculty of Health, and this was used to question nature of the existing partnership with the HCO. It was concluded by all partners that the existing engagement was "Connective" in nature, meaning, that while the professional experience placement provided valuable learning opportunities that served the needs of both parties, it was opportunistic and tended to be short term in nature, in that the focus was on placement each year, with little consideration of whether the learning experiences were meeting the needs of all stakeholders. In addition, it was agreed that communication between the stakeholders was lacking.

Subsequently, the planning documentation from the Interpretive Framework was used to clarify the goals of the project and guide the review and implementation process. Over several meetings with key stakeholders from the university and the HCO, a multi-phased implementation plan was mapped. This led to an inclusive and

comprehensive preliminary cross-sectoral consultation with the key stakeholders: university staff, students, HCO management and HCO staff, from which emerged a common desire to improve the professional experience placement programme and in particular the communication between all stakeholders. Additionally, it was agreed there was a need to improve the educational outcomes and the structure of the placement for students. Part of the problem, as reported during the consultations, involved the way in which some students were placed at the HCO. There seemed to be limited communication between the parties, with students often arriving unannounced at the HCO with no clear understanding of the expectations by either the HCO staff or the students during the placement.

Again, using the RPP, the university and the HCO agreed to work towards a partnership that is more *Generative* in nature. They wanted to create opportunities for mutual professional learning, and they recognised the need for collaborative planning. They acknowledged the need for an ongoing commitment to developing and supporting the student learning; and to regularly evaluate how the experience from the perspective of all stakeholders to ensure it is meeting its intended outcomes.

In the start-up phase of the project, and prior to the next round of placements, online surveys were sent to HCO staff and the students to ascertain their expectations about the upcoming placement. During the placement, a workshop was conducted for the HCO staff to discuss fundamental aspects of student placement such as the intended nature and quality of student learning, the requirements of successful partnership arrangements, with a focus on reciprocity, mutual understanding and collaboration.

Following completion of the project the students were also invited to participate in an online survey related to their placement experiences at the conclusion of their placement experience. The university staff reported that the Interpretive Framework enabled university and HCO staff to make explicit the nature and intent of the partnership, and to overtly discuss the notion of reciprocity associated with student placement activity. It helped them to highlight and make explicit the purpose and rationale for learning from the perspective of all stakeholders and to develop a plan for engaging students and staff of the university and the placement agency in a dialogue about the learning experience.

The Interpretive Framework encouraged a collaborative dialogue between university and HCO staff and provided a safe space where they could provide feedback about the notion of partnership, could offer suggestions for improvement and develop a depth of understanding of the expectations of students, their colleagues and staff from the broader university.

In regard to the second key goal of the project, exploring the applicability of the STEPS Interpretive Framework to the health sector, this project has demonstrated its usefulness as a tool for exploring an existing partnership between a university and a HCO. The framework enabled university and HCO staff to make explicit the nature and intent of the partnership, and to overtly discuss the notion of reciprocity associated with student placements.

Following completion of the project the relationship between the HCO and the Faculty of Health at the university in this case study has strengthened. Additional university staff have been employed to act as conduits between the two organisations,

with students moving seamlessly between the HCO and the university. The Interpretive Framework, more specifically, the RPP and the GUSP, were used to re-invigorate an existing partnership with a key HCO. In particular:

- The Interpretive Framework helped to highlight and make explicit the purpose and rationale for learning from the perspective of all stakeholders and to develop a plan for engaging students and staff of the university and the placement agency in a dialogue about the learning experience.
- The Interpretive Framework encouraged a collaborative dialogue between university and HCO staff and provided a safe space where HCO staff could provide feedback about the notion of partnership, could offer suggestions for improvement and develop a depth of understanding of the expectations of students, their colleagues and staff from the broader university.
- Additionally, the use of the Interpretive Framework provided context for academic staff and assisted them to re-orientate their reasons for engagement with industry partners.
- In particular, however, it provided a pedagogically sound and transferrable framework for success that legitimized the sometimes unacknowledged interactions between industry partners and education providers. More significantly, the learning from this project has been used to re-invigorate the overall approach to building stronger relationships with other HCOs.

The university staff running the professional experience programme in the Faculty of Health found the Interpretive Framework to be highly adaptable to their situation. The methodology was followed as it was presented in the documentation. The only changes necessary were to replace specific words in the documentation referring to "schools" and "science" with words more appropriate to their context such a "Health Care Organisation" and "Nursing".

15.3 Case Study 2: Medical-Legal Partnerships

This case study concerns a project to establish two medical-legal partnerships (MLPs) in the Barwon Region of Victoria, Australia, in September 2014. The case study explores how the Steps Interpretive Framework (Jones et al. 2016) was applied by the project team to assist in the establishment of the MLPs. The rationale for MLPs is to provide legal support and services to those who are disadvantaged both through living with mental illness and through the more limited access to legal services that is typical of regional and rural life. Ready access to legal practitioners has been shown to reduce psychological stress by enabling timely to resolution of issues like tenancy, fines, custodial orders, which can weigh upon an individual with mental health concerns and exacerbate the deterioration of one's mental health (Ryan et al. 2012). This form of support had been shown to significantly impact in a positive way upon the health of those disadvantaged people. The concomitant outcome of potential

reductions in overall costs to the public health system was also a consideration (Noble 2012; Noone 2012).

When one considers social determinants of health such as work environment, legal concerns and housing, and how psychological stress can impede upon these, it is clear that social disadvantage can lead to increased stress. Lifestyle choices such as unhealthy dietary patterns and smoking leading to heart disease and cancer are impacted upon by stress. Therefore, cooperation between legal and mental health service provision is highly beneficial to individuals with mental health concerns.

A mobile MLP (Kisely et al. 2010) works with individuals diagnosed with mental health problems who are registered for the mobile service and when domestic incidents occur, partners in the MLP attend the home or wherever the patient might be located. MLP partners initially work collaboratively to support the individual to deal with the immediate problem but then maintain an ongoing relationship to prevent further incidences. By taking the partnership to the individual, rather than the individual needing to go to the service, which can be extremely uncomfortable for individuals dealing with mental health issues, the MLP aids in reducing incidences of issues such as the perpetration of violence, which in turn leads to legal action. Collaboration between mental health service providers and legal support networks therefore circumvents incidents caused by the confluence of mental health and legal problems.

Not only are there benefits to those with mental health issues. Professionals working in the mental health sector gain improved identification and support procedures for their clients with legal needs. In one example, the discontinuance of a government benefit led a team consisting of clinicians, a psychiatrist and care coordinators, specialising in helping mental illness patients to approach an MLP. The MLP lawyer took up the matter, acted as the representative and came up with a solution to overcome this issue leading to the reinstatement of the benefit or alternative means of funding being accessed. The care team was noted as saying that "this was a problem that could only have been addressed by a medical-legal partnership". Through collaboration, an acceptable approach informed by medicine and law was found to address an issue at a systems level which then benefitted the mental health patient (Chaudary 2014).

With the support of small philanthropic grant an action research project was set-up to establish two MLPs in two parts of the Barwon Region—one in a large regional city and the other in a smaller, more remote rural town. The purpose of the MLPS was to enhance access to justice systems and services for rural and regional Australians with mental health issues. Undertaking this project was particularly timely given that the Australian Government's National Disability Insurance Scheme (NDIS) was being piloted in the Barwon Region at the same time, and this presented an opportunity to put explore the potential of the joint advocacy approach to inform the future roll-out of the NDIS (https://www.ndis.gov.au/index.html). The National Disability Insurance Scheme (NDIS) is a fund set-up by the Australian Government and is being rolled out across Australia since July 2016. It is intended to link carers, people with a disability and support service to develop and fund a care plan suited to the needs of each individual with a significant and permanent disability.

The most suitable potential legal partners for the project were identified as Community Legal Centres (CLCs), because they are used to working unconventionally within the boundaries of conventional legal practice and typically think broadly about their clients' needs. Indeed, when the project team met with the staff of the CLCs they quickly declared their own need to find new and better ways of connecting with clients who are unlikely to present themselves on their doorstep. When potential partners in the mental health sector were approached, we had expected that they would protest that their heavy work demands in dealing with clients would prevent them from participating in the project. The mental health providers, however, immediately understood the potential benefits of the MLP concept for their work and agreed to participate. They recognised that the mental health of their clients is constantly compromised by the lack of timely legal help, and that as mental health professionals, they are not in a position to identify, let alone begin to address, the legal needs of their clients. As one mental health worker told us "We tend to see everything from a therapeutic perspective".

They saw benefits in having a lawyer on hand as opposed to just having someone to refer to. Many of their clients, even once a legal problem had been identified, and an accessible, affordable referral found, might just not get around to going. The openness, indeed enthusiasm, displayed by both the legal and the mental health providers was a critical element in establishing the project.

The success of the MLP required clients to come to the service. It is important to note that the people using the MLP lead lives crowded with daily concerns due to their mental illness, often exacerbated by poverty or discrimination. The mental health workers suggested that the MLP should be set-up in a way that made it as easy as possible for people to talk to a lawyer once a possible legal problem had been identified. Based on their advice, the project team decided to focus on existing centre-based programmes that were reasonably well attended and to maintain as informal an atmosphere as possible where participants would be able to chat easily. Ultimately, the MLP took the form of a weekly community lunch for people with mental illness at a service provider that happened to be located a few doors from the legal service. The legal service agreed to send one of its lawyers to the mental health service community lunch as often as possible—and at least once a month. They would just "blend in" at first, using the time to get to know and be known by some of the clients as well as to form a few links with some of the staff.

The visits would be informal and relaxed on the outside, but many important programme goals and aims and processes would be ticking away beneath the surface. The conversations with clients would be geared to building relationships and trust, and to noticing any early indicators of possible legal problems that might be bubbling away in their lives. The conversations with staff would enable the lawyers to build awareness of the clients' legal problems and a sense of the needs of staff to be able to understand and identify legal problems. The interactions between the lawyers and the mental health staff in the MLP's would enable cross-fertilisation. The interactions would help both professional groups to build a sense of the overall shared space of the mental health and legal advocacy sectors and identify systemic issues, and how do they might be able to work on them together?

The biggest risk to the functioning of the MLP was considered to be when the lawyers and mental health workers return to their traditionally siloed workplaces. The challenge for the MLP model is how to maintain momentum. It is early stages, so the outcomes of the project, at the time of writing this chapter, have not been formally analysed. What we wish to describe, however, is how the STEPS IF was used to guide the process of establishing the MLP.

The connection of the STEPS Interpretive Framework was not coincidental as one of the authors of this chapter worked across both the STEPS and the MLP project. The development of both projects occurred concurrently which allowed for comparison although STEPS was well underway when the MLP project began. It soon became apparent that as both projects were concerned with establishing partnerships that the Interpretive Framework could well be applicable to this project. The two parts of the Interpretive Framework which informed the MLP project were growing university–school partnerships (GUSP) (Chap. 6) and Representations of Partnership Practices (RPP) (Chap. 5). The GUSP provided guidance for the partners to initiate, implement and evaluate the MLP project. The RPP allowed consideration of elements such as: why was the MLP was initiated; the forms of institutions needed to involve in establishing the MLP; what type of partnership this would represent; and how the small amount of theoretical material available on MLPs would assist us build an MLP in the Australian context. To develop this further, consideration was given to specific elements of the GUSP and the RPP. We consider here in simple language, the STEPS Interpretive Framework document and then apply underlying principles of the GUSP and RPP to the MLP and the action research practices applied to draw together two partners, partners who have less in common than the context in which schools and universities partner to nurture PSTs.

While the acronym "GUSP" is aimed towards schools and universities, the five components of the GUSP have applicability in the context of establishing an MLP.

- *Need and rationale*: Considering partner needs and reason for involvement formed an important base from which we began to contact both medical and legal providers. The CLC had indicated they needed to rethink how they connected with this section of their client base and they saw the MLP as an innovative way to address a segment of their client base that they were not effectively servicing. The MLP provided a way to establish a mutually beneficial partnership. Likewise, the mental health provider saw a need to address a shortfall in supporting their clients. On occasions, staff at the mental health provider were asked questions of a legal nature by clients. Without the necessary qualifications, by establishing the partnership, the needs of the client could be satisfied during the implementation phase of the partnership.
- *Institutional and unit demands*: Both partners faced constraints in partnership organisation. Constraints such as when the legal provider should be on-site, how to initially resource the partnership when no funding was available and also to address practical issues such as ensuring office space so that confidential discussions between clients and the lawyer could take place.

- *Relationships*: Defining the type of partnership and the roles of the partners needed to be considered and the commitment of each partner in the MLP. Highly important was the building of trust in three ways as the client, lawyer and mental health worker all needed to build trust in creating a working relationship.
- *Nature and quality of learning*: While in an education setting, the nature and quality of the PST learning is the main focus, the MLP provides a range of learning opportunities for both the lawyer who may not have been exposed to working closely with mental health workers and for the mental health worker in learning how to identify opportunities when their clients have a legal need and should be referred to a lawyer.
- *Commitment to action*: Partners in an MLP needed to carefully consider how the ongoing relationship could be maintained and how ongoing contact occurs. This mirrors what occurs in a school–university partnership. During initiation, all partners in the MLP would become involved in negotiation that constructs the mechanics of the partnership, again, much like that which occurs in the School–University Partnership.

The GUSP provided us with a framework to understand the critical components in the initiation phase of the MLP and helped us, as the researchers, to be more cognisant of the steps required in bringing together two parties to form a successful partnership.

The *Representation of Partnership Practices* (RPP) provided a critical framework for our research to consider where our partnership would sit within the typology of practices described as connective, generative and transformative. We needed to consider whether we wanted this to be a short-term arrangement, one whereby we simply undertook our research and the MLP would stop. As the wish of the project team was to establish a partnership that would become ongoing and self-supporting, the sort of partnership that was desired was clearly generative possibly, hopefully developing into a transformative partnership in time as the mutual benefits of the MLP became apparent. Thus, the evaluation of the outcomes of the project would be critical to inform its development and also, as there was no ongoing funding for this partnership, to determine how it could become sustainable financially. Having obtained a commitment to action through the GUSP, the RPP structure allowed us to design the MLP as a generative partnership by considering the four RPP components.

- *Purposes*: Previous research, predominantly from the USA, indicated that the benefits of the MLP were wide ranging. Viewing the MLP as a partnership with both generative and transformative elements, there was the opportunity for the MLP to encourage professional learning for both lawyer and mental health worker and to meet client needs that both had acknowledged they were at the time poorly equipped to address. This would have been active learning as opportunities would have arisen on-site and with the potential to be addressed immediately. Historically, the opportunity for both MLP partners to learn and grow had been documented.
- *Institutional practices*: The generative nature of the MLP meant that the visits by the lawyer to the mental health provider would be catered to times when the clients were most likely to be at on-site at the mental health provider. Planning, a vital

component of a generative partnership, was critical to the success of establishing the partnership and the activities that allowed for both partners to integrate their services.
- *Nature of partnership*: The success of a generative school-partnership is to ownership of the planning involved in the partnership structure. In the MLP, both parties to the partnership took an active role in shaping the interactions between the lawyer into the mental health service, especially in the early stages. It was especially important, for example, that ample staff from the mental health provider would be available to support the lawyer's initial visits to the healthcare provider.
- *Linking theory to practice*: The researchers were the key drivers of the theoretical understandings critical to the success of an MLP, and we were able to demonstrate the theoretical perspectives to partners. For the practitioners, however, this was the least applicable component of the RPP to the MLP. However, the theoretical underpinnings of the MLP are important if the approach is to gain credibility with funding bodies, and it is hoped that this project will contribute to developing a more cogent theory of MLPs that will inform future practice, especially within the Australian Context.

As the project is not completed at the time of writing, this chapter is intended to consider the adaptability of the STEPS Interpretive Framework to initiate and guide a partnership project outside of the university sector. The case study demonstrates that the Interpretive Framework was used successfully to:

- to inform the initiation of a partnership model that was in its early stages of development for the Australian context and the establishment of mutual goals.
- guide the coming together of the partners and their discussion around the nature of the desired partnership.
- guide the planning and consideration of issues around the sustainability of the project.
- identify the need for a deeper understanding of the theoretical underpinnings of the MLPs in an Australian context.

15.4 Conclusion

These two case studies have demonstrated that the Interpretive Framework is adaptable to learning contexts other than schools. The Interpretive Framework initially arose from a teacher education context and to help provide authentic learning opportunities for teachers of science. It was designed to provide opportunities for preservice teachers to work in classrooms with students so they could apply the ideas learned at university to real situations and reflect on the experience and learn and grow as professional teachers. It also addressed notions of reciprocity and mutual benefits for the participant stakeholders.

The generalizability of Interpretive Framework tools and methodology possibly stems from the universality of the themes it was designed to address: the long standing

the theory–practice divide; and the nature of the co-operative partnerships between stakeholders needed to ensure authentic learning takes place. The literature indicates these themes may be evident in learning situations in a range of professional contexts other than teaching.

These case studies suggest the key elements of the Interpretive Framework can, with minor adjustments, be readily adapted to support learning partnerships in other contexts and professions that the language in the documentation can readily be adapted to suit different contexts. For example, the Growing University–School Partnerships (GUSPs) could be changed to a more generic term such as Growing Learning Partnerships (GLPs) and the inclusion of more context-specific terminology.

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Chapter 16
Visionary Practice

Linda Hobbs and John Kenny

Abstract This chapter draws on the insights in previous chapters to present two visions for the use of partnerships in teacher education and the applicability of our STEPS Interpretive Framework as a language to inform and describe partnership work, and to show how education-focused partnerships can be set up to work most effectively in a range of other contexts. A discussion follows of how this framework contributes to the literature on partnerships follows as do some suggestions for limitations of their use.

Keywords Partnership model · Interpretive Framework
Educational and non-educational contexts · Limitations

16.1 Introduction

In this book, we have presented the STEPS Interpretive Framework that was developed from an analysis of five models of school-based approaches to primary science teacher education. The STEPS Project was established to examine partnerships emerging in the context of teacher education to enable pre-service teachers (PSTs) to gain authentic experiences of teaching science. The five universities involved had independently integrated school-based approaches with their university primary science teaching. Chapters 4–9 presented data from this research project that led to the development of the various components of the Interpretive Framework, which was subsequently validated with other science teacher educators across Australia and internationally and refined further.

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The Interpretive Framework distinguishes three different types of partnerships, Connective, Generative and Transformative, based on the level of mutual engagement between the partner organisations (Chap. 5). That the development of the Interpretive Framework was based on universal notions partnerships to providing of authentic learning situations to link theory and practice led the project team to speculate on how useful it might be in other contexts. In Part 3 of this book, we reported on how the Interpretive Framework was applied to other teacher education contexts (Chaps. 9–14), and to other learning partnership contexts outside of teacher education (Chap. 15). These chapters illustrate the flexibility of the model and show how others might use the Interpretive Framework to support their partnership work.

In this chapter, we draw these ideas together and summarise how the Interpretive Framework can add value to universities and/or other organisations wishing to develop partnerships oriented to authentic learning. Its value stems from the guidance for stakeholders to clarify the level of engagement within the partnership; to make key decisions about the desired pedagogical outcomes; to identify the mutual benefits; to guide the planning process; and determine the resources necessary to achieve the desired outcomes.

This chapter is visionary in two ways. We propose that (1) the *use of partnerships* within educational contexts is value-adding, addressing questions such as what counts as partnerships in teacher education and education more broadly; and how partnerships can be positioned and actioned to successfully link theory to practice; and (2) the STEPS Interpretive Framework can be used as a *partnership model* and is applicable in education and non-education-based contexts, recognising that, while arising out of the science education context, the model has applications beyond science to other areas of education. This applicability has been demonstrated through the case studies in Part 3. However, the model requires reinterpretation if it is to be a generic model suitable for others to develop context-specific language. Questions regarding "What is transferrable?" and "What needs reinterpretation?" are explored. Application of the partnership model requires a reassessment of the language, intentions and relative usefulness of the different parts of the model. In addition, the applicability of the partnership model beyond educational contexts is considered.

16.2 Vision 1: Using Partnerships in Education

As described in Chap. 2, the partnerships in the STEPS Project arose in response to systemic problems in science education a general lack of commitment by practicing teachers to teach science in a dedicated way in schools, a tendency for formal practicum to provide few experiences of teaching science and a tendency for PSTs to come to their initial teacher education with a history of negative science experiences and attitudes. One of the primary motivations for involvement in a partnership during initial teacher education is the opportunity for pre-service teachers (PSTs) to gain authentic experiences of teaching a unit of science to children.

With much of the science teaching embedded in authentic classroom experiences, the teacher educators were able to be present at the schools during the teaching period and evaluate the success of their own science education programs as well as observe the ways in which classrooms and schools are evolving over time. One of the primary motivations for involvement in a partnership during initial teacher education is the opportunity for PSTs to gain authentic experiences of teaching a unit of science to children. PSTs need a successful and authentic experience of teaching science to children to not only enhance their knowledge and capability in teaching science but also to build their confidence. PSTs are presented with an opportunity to apply and practice the theory learned in the university setting in a timely and often concurrent manner where the teacher educator supports PSTs to bring theory into their teaching practice. This concurrent theory–practice learning is not always possible when the formal practicum or professional teaching experience sits before or after curriculum units, or even once teachers have entered the profession. It enables the teacher educator to address issues with PSTs and assist them to reflect on their teaching practice.

In considering the broader application of the Interpretive Framework, three other examples from teacher education were described in Part C of this book. These examples illustrate how different groups are using the Interpretive Framework to support partnerships to establish and maintain high-quality educational outcomes within three teacher education contexts: a long-standing relationships around program development schools in the UK (Chap. 10); formal practicum arrangements where negotiation of partnerships involved high-level leadership at the school and university levels (Chap. 11); and formal practicum involving a consortium of key players in Catholic education (Chap. 12). Each of these chapters describes partnerships that are rigorously negotiated and seriously embedded into the institutional structures. The partnerships arrangement in each of these was crucial to the developing strong commitment to designing models of practicum that were responsive to the needs within the sector.

One of the lessons from the STEPS Project was the need for responsiveness to changing circumstances within any given partnership arrangement. For example, for each partner, practicalities such as staff changes or changes in the leadership can lead a partner organisation to reconsider its strategic priorities at any time. Similarly, changes to education policy or funding arrangements for schools or universities may affect a given partnership. Thus, partnerships are dynamic in nature and the relationships that sustain them must be developed and maintained over time as discussed in detail in Chap. 1.

16.2.1 Policy Influences in Initial Teacher Education

As outlined in Chap. 1, the Teacher Education Ministerial Advisory Group (TEMAG 2014) report recommended that all primary PSTs should acquire “at least one subject specialisation, prioritising science, mathematics or a language” (p. 22).

In 2017, AITSL published Program Standard 4.4, which provides further guidance for the inclusion of primary specialisations, as a requirement of accreditation of all initial teacher education programs in Australia. This has direct implications for "the structure and/or content of many initial teacher education programs" (p. 3). As distinct from secondary teachers, the aim is not to produce primary teaching graduates who teach in only one curriculum area. They are to still be generalist primary teachers, but with a deeper focus in their particular specialisation. Primary specialisations are described as "clearly defined pathways into and/or within a program" (p.1), with a focus on subject/curriculum areas that are in demand, and where PSTs will be required "to demonstrate expert content knowledge, pedagogical content knowledge and highly effective classroom teaching in their area of specialisation" (p. 1). As demonstrated in the STEPS Project, authentic school-based learning experiences for PSTs during primary initial teacher education programs would provide these deep learning opportunities. The Interpretive Framework can inform the redesign and implementation of initial teacher education programs to incorporate specialisations.

This has direct parallels with the STEPS Project, and because it was derived using universal notions of partnership and authentic learning linking theory to practice, as described above, there is no reason why this notion of a school-based component to provide authentic teaching experiences for PSTs cannot be applied more broadly, for example, to other specialist curriculum areas in teacher education such as Arts, Technology, Languages, Mathematics, Music, History. It also presents a specific opportunity, outside of the normal practicum, for PSTs to demonstrate their ability to meet the higher end Australian Institute for Teaching and School Leadership (AITSL) standards (AITSL 2015) within a chosen specialisation.

The above work also illustrates how the Interpretive Framework can guide the required process of consultation with education and accreditation bodies to rethink how practicum components of ITE programs can be more effectively integrated with the university learning and to address the long-standing criticisms outlined in Chap. 1.

These policy drivers ensure the teacher educational landscape is constantly changing, and partnerships need to be responsive. In the next section, we illustrate the evolving nature of partnerships by giving an update on the status and structure of two school-based models from the STEPS Project: Deakin University and University of Tasmania (UTAS).

16.2.2 Update: Deakin University Science Program

In 2016, as part of reaccreditation of the Bachelor of Education at Deakin, the science unit in which the school-based model is placed was moved from third year to final trimester fourth year. During fourth year, students are firmly focused on preparing applications for jobs and teacher registration. Three elements were embedded into the science unit where teachers from the partner schools could interact more with the PSTs so as to increase engagement with the profession and improve teacher readiness. Firstly, PSTs "interview" the classroom teacher in their first week at the

school to ascertain information about the students (such as particular behavioural issues or learning needs) and the content to be taught (such as how to link with the school's teaching plans). Secondly, in the last couple of weeks, the PSTs report their learning to the classroom teacher through "reflection circles" and engage in professional discussion about how their teaching shows evidence of them achieving the graduate professional teacher standards (AITSL 2015). Thirdly, a "Celebration day" was introduced where the children showcase their learning to each other or other people in the school, supported by the PSTs.

Each of these elements is negotiated at the school level by the teacher educator such that each element might play out quite differently at each school. For example, PSTs at one school might report only to their classroom teacher, whereas at another school, the PSTs might report to all of the other PSTs or to all of the teachers. The Celebration day can involve children from just the year level involved in the partnership, parents or children from other year levels, and it might run as an expo of artefacts, role-plays, songs or videos.

These new elements add an extra layer of complexity to the program that can sometimes be difficult to manage (e.g. the teachers may not be available for the reflection circles or the initial teacher interview); however, the effectiveness of these elements can be improved by remaining flexible and working positively with school teachers and leaders to find creative solutions when complications arise. The teacher educator and the unit chair or campus coordinators are responsible for negotiating the various arrangements, most of which can happen during the three-hour school workshop, so additional time for such arrangements is relatively minimal, an important point when considering how to resource these types of initiatives.

The continued involvement of the schools illustrates the value placed on their involvement in the "Deakin science" program and that the expectations placed on the teachers are not too onerous in most circumstances. The STEPS Interpretive Framework, in particular, the GUSP, has been valuable in reconsidering the aims and rationale for the Deakin science program, and in planning the learning outcomes for the PSTs. We will use the Partnership Negotiation Tool (PNT) to evaluate the changes to ensure that they are meeting the varying needs of the partners involved. We believe that involving the schools more helps us move towards a more transformative partnership, although we believe that it is important for us to maintain some distance from the schools' aims as we need to allow our students to focus explicitly on teaching science using the 5Es and "representations" as the key informing theories; we have found that it can be problematic if schools have too much input into what and how science is taught. We believe that a generative partnership is therefore suitable for meeting the needs of our students.

16.2.3 University of Tasmania Partnership Proposal

Like other universities in Australia, UTAS has to respond to changes in policy driven by notions of work-readiness and the quality agenda. This is reflected in a broader

Table 16.1 Proposed pilot projects to use the Interpretive Framework to redesign ITE at UTAS to better integrate university learning with authentic practice

B.Ed (Primary) *Focus*	Type of partnership	M.Ed (Secondary) *Focus*
Year 1 & Year 2 *Connecting with teaching and school*	Connective	Year 1 *Connecting with teaching and schools*
Year 3 *Engaging with the profession*	Generative or transformative	Year 2 *Engaging with the profession and building your identity as a teacher*
Year 4 *Building your identify as a teacher (specialisations)*		

push across the university to include work-integrated learning (WIL) approaches and more employer engagement as a key curriculum priority across all disciplines. Clearly, also an organisational perspective is needed to address resourcing questions such as workload impacts and resourcing questions associated with WIL as discussed in Chap. 1.

Given these policy drivers, it is timely to consider what this might look like within the Faculty of Education and how the Interpretive Framework might inform better integration of university learning with the practicum and the inclusion of specialisations within the primary ITE program.

The proposal below illustrates how the Interpretive Framework could help to guide the conversations between Faculty leaders, the Education Department in Tasmania and other providers and leadership within the university. Table 16.1 draws on the Representations of Partnership Practices (RPPs) from the Interpretive Framework to suggest how the two existing ITE programs offered in the Faculty might be redesigned to accommodate the external and internal policy drivers outlined above.

In essence, each year of the ITE programs adopts a specific learning focus which has implications for the required level of partnership engagement to achieve the learning outcomes. In the early stages of the ITE programs, the learning focus is on helping PSTs to connect with schools and teaching, but, in the latter stages, the focus shifts to helping the PSTs build their professional identity and transform themselves into professional "classroom-ready" teachers.

Under the current arrangements, schools are largely involved on a Connective basis. The greater clarity of learning focus as PSTs progress through the course would guide conversations between the university and the Department of Education, and other providers, to identify the level at which each school is prepared to be involved in the PE program. Some schools would chose to continue with a Connective involvement, by providing PSTs in the early stages of their teacher education program to become familiar with schools and teaching. This would enable PSTs to gain a realistic experience of life in schools and engage with teachers as colleagues. This

is an important aspect of beginning teachers developing a more realistic view of teaching as a profession and deciding if it is what they want to do.

Other schools may be identified as willing to be involved in partnerships at the Generative and Transformative levels of engagement, largely to support those PSTs in the later stages of their course. The schools could provide access for PSTs to develop subject specialisations or provide internship approaches with the practicum experiences integrated with the university program in the final year and to help them to meet the AITSL graduate teacher standards and transition into the profession.

With sufficient schools identified at the various levels of engagement, it would enable a more concentrated effort delivering on PL for mentor teachers in the generative and transformative schools. Over time, schools may change their level of involvement, but this again would be part of the ongoing conversations.

Schools that decide to engage in the PE program at a Transformative level would commitment to working collaboratively with the university lecturers and the PSTs to develop the professional identity of each individual and build their professional competence and ability to meet the requirements of the graduate teaching standards.

The Interpretive Framework would be central to driving this process of clarifying the project and establishing a commitment to action. It would also provide a significant research opportunity for the Faculty to take a lead in researching and evaluating the design of effective teaching education and provide guidance to staff involved in leading and organising on how to develop and maintain the partnerships that underpin WIL programs. The planning materials in STEPS Interpretive Framework could be of great assistance in clarifying the educational issues and guiding universities to ask the right questions to ensure the programs are set up to succeed in terms of the educational outcomes and the resources needed to achieve them.

16.3 Vision 2: A Partnership Model for Education and Non-education-Based Contexts

The growing push for work-ready graduates and the rising emphasis on work-integrated learning (WIL) is also documented as a longer-term trend in universities. The indications are that the STEPS Interpretive Framework provides a framework in which these educationally based partnerships can be negotiated in a range of disciplines, as discussed below.

While recognising that the STEPS arose out of the science education context, the case studies in Part 3 of this book demonstrated that the model has applications beyond science education to other educational and non-educational contexts. This showed that the Interpretive Framework is transferrable, but it begs the question about what changes need to be made to make it more generalisable and what specific aspects of it need to be changed or reinterpreted to suit different contexts?

Our research indicates that the Interpretive Framework could be used to guide the formation or evaluation of partnerships in a range of other contexts. It was relatively easily adapted with minor adjustments to the questions and language used in the

original documentation to make it them more suitable to the specific setting, the desired educational outcomes and the inclusion of more context-specific language. As a sustainable methodology, to establish and support educational partnerships, the Interpretive Framework needs also to support the stakeholders and decision-makers to adapt to ongoing policy and social changes.

In Chap. 12, Cooper, Cowie and Campbell found that there needed to be initiation and negotiation with "stakeholders at different levels and with different responsibilities within the system that was the partnership". In particular, high-level discussions were needed to get the partnership practices and learning opportunities embedded into the university structures.

In Chap. 13, Hobbs, Cripps Clark and Plant identified that greater time and energy needed to be given to introducing the professional development program to principals associated with the Skilling the Bay Project, prior to the formal negotiation and initiation phase as identified in the GUSP and as supported by the Partnership Negotiation Tool. The Deakin consultant was seen as a crucial element in the program, assisting leaders to establish joint working parties, consider the nature of the learning desired and the process steps and resources necessary to get there. This supports the importance of the notion of "boundary spanners" to work actively across the interface of the organisational partners to maintain communication and as suggested by Peach et al. (2011).

In Chap. 15, it was applied to improve learning partnerships in two case studies in health education. In the first, there were existing problems with the clinical experience training aspects of nurse and medical staff. The university firstly used the STEPS Interpretive Framework to evaluate the nature of the situation and identify where the problems may be occurring. Many of the problems reported were associated with linking theory from university to practice, but there was little coherence between the learning opportunities within a busy health education environment, with mass student intake, and what was happening at university. The need to pass large numbers through the crowded healthcare organisations (HCOs) was reminiscent of the situation in schools where PSTs are often placed in schools with little connection to their university studies (Chap. 2). Through the RPP, the Interpretive Framework allowed the health educators to identify their partnership as connective, but to also aim towards creating a more generative form of partnership. The Interpretive Framework planning documents provided a framework to envisage the type of generative learning situation they desired, and the tools suggested an approach to establish and develop a more productive partnership to bring this about.

In the second case study involved the development of two medical–legal partnerships (MLPs) to support people with mental health issues to deal with legal issues. The Interpretive Framework was used to guide the establishment of the MLPs and helped to identify the need for more research into how they work in an Australian context.

16.3.1 Learning Partnerships for Universities

In Chap. 1, it is noted that there is widespread criticism of university graduates and calls for more "work-ready" graduates. Work-integrated learning (WIL) is generally seen as inherently valuable by all stakeholders. While WIL has been a long-standing and highly valued component of many university professional courses, mass education has resulted in difficulties placing students and a growing disconnect between the university learning and the industry placement experience.

Agencies like Teacher Education Quality Standards Agency (TEQSA) have expressed concerns that WIL can also be poorly organised and ad hoc, such as in mass placement programs, leading to poor educational outcomes and little time for genuine reflection on practice. To minimise this risk, TEQSA has outlined standards that universities are expected to meet in the delivery of their programs. Students need guidance and support to get the most out of these programs, and the participating partners also need to have their own needs met.

The resource and educational demands of integrating work- and university-based learning experiences can be very valuable, but depend on functional partnerships to work effectively.

Looking more broadly at how the STEPS Interpretive Framework can be applied within universities, it is clear that partnership work is essential to achieving the goals and imperatives of universities; however, not all universities have a clearly articulated partnership framework that encompasses the range of partnerships opportunities available.

Broadly speaking, most universities engage in the following: Australian and international academic partnerships that provide pathways to enrolments; research and consultancy that situate the university within the nexus between industry, government and the professions; community engagement activities as service to the community through provision of services (such as training) and products (illustrated in Chap. 13 as professional development for schools); researcher development for theoretical and applied research where industry perspectives are essential for informing the generation of new theoretical perspectives, new theoretical perspectives influencing industry practices; and embedding industry experiences for students through WIL schemes (as discussed above) where partnerships between workplaces, academics and students are designed to meet the needs of both the employers and students.

Drawing on the language of the Principles of Partnership Practice (detailed in Chap. 4) and the GUSP (Chap. 6), a modified set of practice principles can be generated to inform this broader partnership work between universities and industry. Table 16.2 identifies five principles that underpin university-industry partnerships: commitments of university and industry partners; theory–practice links, which should be inherent and embedded within partnership; description of the learning and research that might be achieved; the roles of each partner; and how reflection and evaluation processes might be embedded so as to inform the vibrancy of the partnership.

These principles can be part of a framework used for establishing, maintaining and evaluating university–industry partnerships. As stated, this focus on industry

Table 16.2 Practice principles and guiding questions for university–industry links

Principle	Guiding questions
Commitments Partnerships are established because of a commitment to improve or achieve quality university and industry practice, and their ability to enhance the quality of university student learning outcomes	What are the commitments being demonstrated through the partnership? How is commitment to quality built into the partnership arrangement?
Theory–practice links Partnerships allow for authentic engagement between the university and industry through providing links between practice and theory	What do university and industry partners potentially gain from this authentic engagement?
Learning or research environment Partnership arrangements must take account of the specific learning requirements of the university and the professional and/or industries involved	How will the partnership assist the university and partner organisations to establish a learning/research environment that meets the professional and industrial requirements?
Roles for supporting practice The roles that university and industry stakeholders play in supporting practice, and one another, should be clear and relevant for the purpose of the partnership	What are the role expectations for providing support to all members of the partnership?
Reflection on practice Learning requires critical reflection on practice	How is critical reflection built into the partnership arrangement?

is topical given the focus on "work-readiness" and "employability" direction of university goals in the current era (ACEN 2015; Oliver 2015).

Education appears to be becoming a means to prepare people for the world of work, with a general shift away from the view that education can serve a greater good that transcends the specific requirements of the workplace. There needs to be concerted efforts to ensure that this latter perspective is not lost. Partnerships between universities and industry therefore need to be developed while keeping in mind the deep learning that can be achieved through this theory–practice nexus, recognising that university engagement with industry and the community can lead to reciprocity that is meaningful exchange of ideas and practices that have mutual benefits. Careful integration and articulation of the learning or beneficial outcomes are essential; this focus on learning outcomes is critical in the work we have been doing with our partner schools and is illustrated in Chap. 3.

16.4 Using the Interpretive Framework—New Insights and Limitations

The STEPS Interpretive Framework provides a language for people moving into or wanting to articulate their partnership. The GUSP "Nature and Quality of Learning" component (Chap. 6) demands careful articulation of what each partner stands to benefit from the partnership, whether the partnership is Connective, Generative or Transformative (Chap. 5). School-based approaches to science teacher education have clear potential for identity work (Sveningsson and Alvesson 2003) and improving teacher self-efficacy and confidence, improved praxis, and increased capacity to work within and develop relationships, as was shown in Chap. 8. Chapter 11 shows how the language of the GUSP can be applied to monitoring and evaluation of other university–school partnerships. In Chap. 13, the nature and quality of the learning section of the GUSP was adjusted so that each school could direct the focus of what learning they hoped to gain from participation in the teacher professional development program.

Chapter 15 suggests that some changes to the language of the Interpretive Framework might be appropriate to better match the context. For example, the GUSP might be more aptly called Generating Learning Partnerships (GLPs) to reflect the possibility of supporting partnerships in a broader learning contexts beyond teacher education.

The RPP (Chap. 5) and GUSP (Chap. 6) are important contributions to the literature relating to partnership work. Kruger et al.'s (2009) work comes close, although the RPP gives credence to connective partnerships that is those intended for short-term gain and perhaps one-sided impact. We believe it is still useful to label these as partnerships. The other point of difference is that we do not see the typology as hierarchical; all partnership types have value as long as they are purposeful and meeting a need, as illustrated in the proposal for change at the University of Tasmania. There can be a tendency, for example, to aim for transformative partnerships when establishing a school-based model in teacher education; however, the resources and relationships needed are intensive and often a generative partnership may be appropriate to meet the needs of the university and school.

The growth model (Chap. 9) provides a framework for considering the variables that can give a measure of the effects of the partnerships and is particularly relevant for partnerships where there are strong learning outcomes for particular members, e.g. the PSTs in our school-based models. Where these types of partnerships are transformative in design, then learning outcomes for teachers might also be articulated and examined. For example, if the focus of learning is on inquiry questions that are conceptualised and examined by PSTs and classroom teachers together, then there could be additional learning outcomes for teachers or school, such as degree of teacher change in practice or new curriculum initiatives in the school. These professional learning opportunities would be explicitly written into the partnership agreement and could be examined through other variables.

A limitation of the RPP is that the language used. It can be confusing for some whether it refers to the partnership model overall, or to the possible impact on individual people within the partnership. For example, in one of the UTAS Generative school-based science partnerships, learning was intended for all involved, including teaching staff, but the emphasise was on change in practice and identity for the PST. There was no significant expectation that the partner school would change. However, a teacher participating in this program was quite transformed by seeing effective science teaching and was prompted to change their practice and structures within the school. In another school, involved in the early years of the RMIT school-based program, introduced a science specialist into the timetable after seeing the enormous effect that a sustained science program can have on student engagement and learning. While the effect of this change might be considered transformative for the school, but it actually reduced the involvement of all the other teachers in teaching science at their year level because the science program ran only during the specialist classes and the teachers were effectively removed from the partnership. The classroom teachers were removed from the partnership. This example illustrates that use of the RPP needs to clearly articulate whether the language is being used to describe the overall intended nature of the program and its anticiapted effects for those involved. In the above example, while the school program was transformed by the inclusion of a specialist, the intended science PL for the generalist classroom teachers was inadvertently reduced.

The Partnership Negotiation, Monitoring and Evaluation Tools (PNT, PMT and PET) are particularly relevant for supporting partnership work. As has been discussed, they are written specifically for university–school partnerships associated with science teacher education, so the specific language or questions may need to be modified to suit a different context, but the general headings are particularly transferable. They enable careful planning and thoughtful exchange of ideas that respects each partners' roles in the partnership. As mentioned by the authors of Chap. 12, they can be modified to be used at all levels of the organisation. According to the authors of Chap. 13, they can be used as a mediating tool for the partnership that provided a "road map and schedule for the journey". In turn, the tool was modified as the needs of the partnership and focus of the learning changed. They state that "the relational nature of the tool enabled it to be adapted to both the individual schools' needs and to the program as it developed".

16.5 Conclusion

Our first vision arising from this book is that school-based approaches are a way of meeting the needs of both the profession and university initial teacher education as long as the relative knowledge and skills of each are respected. As part of our analysis of the current trends in school-based approaches in initial teacher education around Australia, evidence emerged from other science educators of attempts to run similar programs, but these relied on the dedication of individuals, who took on

large workloads and often the programs lacked full integration with the institutional supports and resources (Kenny et al. 2015). Despite these challenges, the five models presented here, and others around Australia, have perpetuated, at different levels of embeddedness, but they are sustained because the partners believe in what they can achieve.

Partnerships offer a way forward, at all levels. While partnerships in education are not new, doing them well so that there are ongoing benefits for all can be challenging. We are in a state of change where there are greater demands on universities to engage more seriously with the professions. This nexus between the profession and university education is necessary to ensure teacher preparation is informed by both theory and practice. It is in this nexus that practice is no longer situated solely in schools, nor is theory situated only at university. Reciprocity means both contribute something meaningful to the interaction.

The third space and boundary spanning metaphors are useful for conceptualising these approaches, as mentioned in Chaps. 1 and 15. This space exists at the boundaries between the university and the external organisations, be they school or industry. While the specific needs and expectations of different organisations may differ, there is a common need for this boundary spanning work. This is how successful partnerships can be established and maintained, and university is central to driving this agenda if the partnerships are to lead to effective learning. Who stands to learn is critical to establish early on. Careful articulation of the outcomes of the partnership is needed, and boundary spanners can be well supported by the STEPS Interpretive Framework, especially the GUSP and the Partnership Tools.

Clarity about the nature and quality of learning is crucial to ensuring growth and sustainability of the partnership. Decisions need to be made about the degree to which the partnership practice is embedded within the core business of each partner, that is, whether the partnership is to be connective, generative or transformative. The enablers of growth (Chap. 8) ensure that this articulation occurs when the partnership is negotiated, maintained, renegotiated and evaluated. The principles of partnership practice are important also at all stages as they can be used to establish rules of engagement. The nature of the learning and relationship elements is likely to change depending on the changing needs and how well the original design matches the needs of each.

The second vision is that the STEPS Interpretive Framework be utilised as a partnership model to support educational and non-educational partnerships. Some translation is needed to ensure that this is possible. Certainly, within universities, there is much scope for translating elements of the model to support the recent push to have strong links between university and industry, as demonstrated through WIL. A partnership framework that situates the university as essential for education beyond the immediate technical requirements of industry would focus on the reciprocal benefits that each partner plays in achieving high-quality learning outcomes for the university students, as well as having outcomes for industry beyond just adequate preparation of the next generation of potential employees. In addition, the Interpretive Framework is worthwhile outside of universities and schools, as

was demonstrated in Chap. 15 where the RPP is used to articulate the partnership elements of a medical–legal partnership.

The STEPS Interpretive Framework provides language for articulating the nature of the partnerships and the intended learning, reminders for what is needed for strong partnerships, such as risk-taking and trust, reciprocity and mutuality, recognition of respective goals, respect, adaptability and responsiveness to changing needs, and diverse representation of the types of partnerships possible, that is connective, generative or transformative. The framework also ensures that stages of initiation and negotiation, monitoring and evaluation are embedded within partnership discussions, arrangements and documentation, such as through memoranda of understanding.

As a project, STEPS enabled us to put our respective science education programs under the microscope. What emerged from our analysis, and reflection on what we did, was a deeper understanding of why it works. Each of us has been influenced by the successes and challenges. The STEPS Interpretive Framework gives us the language, and a process, to articulate what how to establish, maintain and evaluate our partnerships and to justify the resources that might be needed. The tools of the Interpretive Framework were very useful for us, and, in Part 3 we demonstrated their applicability to other contexts, so we feel confident that they will be useful for others.

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