Research paper

A longitudinal study on a place-based school-university partnership: Listening to the voices of in-service teachers

Hongming Ma[*], Monica Green

Institute of Education, Arts and Community, Federation University Australia, Melbourne, Australia

ABSTRACT

This paper reports on a longitudinal place-based study by two Australian teacher educators investigating their three-year science-based school-university partnership. The study examined key benefits, challenges, and tensions within the partnership. Data collection was drawn from focus group interviews with in-service teachers across each partnership year. While findings portray the partnership as a catalyst for increased science learning opportunities for school students, teaching opportunities for pre-service teachers, and new in-service teacher roles and responsibilities, the study highlights the evolving nature of partnership development, including the need for continuous negotiation of labor division and stakeholder expectations.

© 2023 The Authors. Published by Elsevier Ltd. This is an open access article under the CC BY license (http://creativecommons.org/licenses/by/4.0/).

1. Introduction

There are growing international concerns among science teacher educators about pre-service teachers' (PSTs') lack of preparedness, confidence, and reluctance to teach science in school settings (Appleton, 2003; Buss, 2010). Although formal teacher education practicum offers opportunities for PSTs to put theory into practice in general, PSTs' authentic engagement with science teaching in elementary schools is fragmented, largely due to the lack of consistent presentation of science in the school curriculum, as well as the lack of self-efficacy of in-service teachers as mentors (Kenny, 2012). On this note, building informed school-university partnerships with the specific purpose of promoting authentic science teaching experiences is touted as a potential solution to improved learning outcomes for PSTs (Jones et al., 2016; Kenny et al., 2018). As evidenced within the scholarly literature, school-university partnerships are not uncommon, especially in Australia where they have a distinctive history (Campbell et al., 2018; Jones et al., 2016). To this end, school-university partnerships have become increasingly recognized as a vital ingredient for strengthening teacher education reform, and for expanding teacher

educator and in-service teacher roles (Burton & Greher, 2010; Kruger et al., 2009). While much of the scholarly literature identifies the benefits a partnership can offer stakeholders (see Burroughs et al., 2020; Smith & Trexler, 2006), it also features overarching challenges and tensions associated with building a partnership (Goodnough, 2004; Martin et al., 2011). Additionally, even though school-university partnerships are viewed as valuable, there is limited research that considers the different developmental stages of a partnership, including understanding the evolving nature of partnership development.

This paper presents findings from a longitudinal study across a three-year school-university partnership (2016–2018) in rural Victoria, Australia. The partnership was established as part of a renewal process in a science education course within a Bachelor of Education (elementary) program and included the following stakeholders: in-service teachers and their elementary-aged students from Haysville Elementary School (pseudonym), as well as two teacher educators and their PSTs. The aim of the study was to capture in-service teacher perspectives about partnership processes and outcomes, and determine how such perspectives reflect the establishment, maintenance, and extension of the school-university partnership in focus. Specifically, the study highlighted in this paper extends earlier research that explored the benefits of another partnership in its first year using a participatory action research methodology (Green & Ma, 2018), followed by a reflexive

* Corresponding author.
E-mail addresses: Hongming.ma@federation.edu.au (H. Ma), Monica.green@federation.edu.au (M. Green).

self-study focusing on authors' perspectives within the same partnership (Ma & Green, 2019). Building on this body of research, this paper belongs to a research agenda that examines school-university partnerships and science teacher education through the lens of a place-based pedagogy (Ma & Green, 2021a; 2021b), as elaborated in the Theoretical Framework section of the paper.

2. Literature review

2.1. The nature and scope of school-university partnerships

Despite universities and schools having an enduring partnership history, particularly in Australia where partnerships are common (Green et al., 2020; Kruger et al., 2009; Petersen & Treagust, 2014), many have been driven by an entrenched hierarchical, non-reciprocal agenda that privileges university needs (Walsh & Backe, 2013). These 'one-way' partnership approaches originally emerged in teacher education to support practicum placement where PSTs gain practical teaching experience in schools (Mockler, 2013). However, the disruption of conventional university-privileged agendas brought with it a more contemporary approach to school-university partnerships that favored equal or mutual partnerships through uniting key stakeholders via shared vision, mutuality, and cohesive collaboration (Kruger et al., 2009). Such partnerships are often informed by relationship-building endeavors by partners and include genuine collegiality and collaborative intention (Burroughs et al., 2020; Chandler & Barron, 2021) that impact sustained benefits amongst stakeholders, outcomes, and partnership longevity (Smith & Trexler, 2006). As such, partnership frameworks are known for disrupting conventional teacher education practice which commonly operates in isolation from schools and the broader community (the social and physical environments in which schools are located) (Broadbent & Brady, 2013), enabling new structures that span the boundaries of school and university, while supporting partners to adopt new practices and roles (Johnston et al., 2002). When constructed this way, partnerships have substantial capacity to initiate 'new learning relationships' by valuing the diverse contributions of partnership stakeholders and supporting them to form committed relationships (Burroughs et al., 2020).

Further to these considerations are broader international concerns about the inherent limitations, competing problems and issues associated with partnerships (Bartholomewa & Haymore Sandholtz, 2009; Begun et al., 2010; Martin et al., 2011). More than two decades ago these challenges were identified in a comprehensive literature review that identified issues pertaining to the division of labor amongst partnership stakeholders, organizational and communication challenges, as well as the impact of differing school and university cultures (Smedley, 2001). Other stumbling blocks that continue to stymy school-university partnership relations include a lack of strategies that foster collaboration and shared understanding of stakeholder roles (Goodnough, 2004).

While some scholarly literature explores many of these important and compelling dimensions, they seldom examine the issues through a place-based theoretical lens. As Campbell et al. (2020, p. 7) argue, the interconnectedness of place and people is important for understanding "how we live and how we find (and produce) meaning as individuals and communities". To this end, we contend that as teacher educators and researchers, including that of our school-based colleagues, our educational work is layered with scales involving a nuanced interplay with the place we find ourselves located within (as discussed further in the 'Theoretical framework' section).

2.2. Science, partnerships, and in-service teacher perspectives

Building on the above considerations, school-university partnerships have played an important role in addressing the limited opportunity PSTs have in observing the teaching of science, and to practice it themselves during a practicum placement (Jones et al., 2016; Kenny, 2012). Similarly, these opportunities signify the impact of in-service teacher mentoring, which can significantly influence a student teacher's science experience (Weiland & Akerson, 2013). These issues were examined in a research project involving five Australian universities that focused on the cogent and unique practices underpinning an established and successful school-based science teacher education program called STEPS [Science Teacher Education Partnerships with Schools] (Jones et al., 2016; Kenny et al., 2014), which is specific to both elementary science teacher education and the preparation of PSTs to teach elementary science through partnerships. The research references the broader international concerns about elementary teachers' lack of confidence to teach science (Jones et al., 2016; Kenny et al., 2014), which was addressed through an interpretive framework that enabled strong, valuable, and effective partnerships that capitalized on the mutual but diverse strengths universities and schools bring.

Amidst the paucity of literature about in-service teacher partnership perspectives, Kruger et al.'s (2009) report highlights several concerns for in-service teacher partnership involvement. This includes the time it takes to build trust, reciprocity, and relationship in establishing the partnership in the initial instance, time availability to mentor PSTs and being taken away from their daily teaching responsibilities. We note the incongruence of this latter point given the vital role student learning plays in any school-university partnership (Broadbent & Brady, 2013; Burroughs et al., 2020; Green & Ma, 2018). A longitudinal Australian study that investigated how pre-service and in-service teachers worked together in an elementary science partnership across 23 schools and over 70 teachers (Kenny, 2012) used questionnaires pre and post pre-service school-based teaching to determine in-service teacher partnership expectations and feedback. The study cited teacher concerns regarding the need for PSTs to be better prepared, to better consider the learning needs of students and to spend more time in the classroom getting to know the children they would be teaching. They also referred to how teachers' science content knowledge and valuing science increased after observing PSTs' ideas and classroom practice. Similarly, teachers appreciated the opportunity to observe their students' science learning, noticing increased enthusiasm and engagement for the different science activities they participated in, including the subsequent and positive ways they remembered the learning experience. Further, teachers welcomed the additional support and resources PSTs provided, including small group learning opportunities for students via diverse science activities (Green & Ma, 2018).

Building on Kenny's (2012) research with in-service teachers, as well as focusing on the feedback and improvement on yearly iterations, the present study was framed by the overarching research question: How do in-service teachers perceive the impact of a three-year science-informed school-university partnership? The study explored three sub-questions:

- How do in-service teachers perceive the impact of the partnership on science curriculum in the school over the three years?
- How do in-service teachers perceive the opportunities and challenges brought to the school through the partnership over the three years?

- How do in-service teachers perceive the impact of the partnership on pre-service teachers' professional learning over the three years?

2.3. Theoretical framework: working within a cultural contact zone - a place pedagogy

This study stems from the broader project, 'Science Outside the Traditional Classroom', and draws on Margaret Somerville's place pedagogy framework (2010), which investigates the interrelatedness of people and places. The framework is composed of three key elements - storyline, embodiment, and cultural contact zone, as illustrated below:

- our relationship to place is constituted in stories and other representations,
- place learning is embodied and local, and
- deep place learning occurs within a contact zone of multiple contested stories (p.326).

According to Somerville, place is a productive pedagogical framework because it creates a way of thinking about the materiality of place and its "grounded physical reality" (2010, p. 330). Based on the premise we are all embedded in local places wherever we exist, Somerville argues that places are not necessarily physical, bounded or stable, but rather constructed through relational and temporal activities, a process Massey (2005) describes as a 'throwntogetherness' that generates unfolding and overlapping events and stories in place. On this note, Somerville argues that a place-based pedagogy framework encourages educators to engage with local community (e.g., people and places beyond the school environment) to become part of the ongoing story of local places (2010). Additionally, others have argued that place transcends any subject discipline such as environmental education (Renshaw & Tooth, 2018) or outdoor recreation (Wattchow & Brown, 2011), suggesting it is more concerned with 'negotiated and unfinished stories' that take into consideration the ontologies of place that encompass ideas of contestation, relationships, and culture (Somerville, 2010).

Throughout the wider project, we understood the study context as belonging to a particular cultural contact zone, where school and university cultures meet, interact, and are continuously negotiated. The process of building a partnership with the local school was an ongoing cultural practice through which new stories about the place (and its people) were formed. In this regard, we view all stakeholders as story makers responsible for shaping the places where teaching and learning interactions occurred and who in turn, are shaped by these places. This theoretical understanding underpins the design of the wider project and all data analysis.

3. Background: contextualizing the study

The partnership featured in this paper stems from our academic work as teacher educators in a regional university that favors transformative collaborations and mutually constructed partnerships with the wider community. In initiating the partnership, we approached Haysville Elementary School, which was geographically close to our university (a 10-min drive), and already serving as a placement school for PSTs and graduate employer. The main study site has a population of approximately 1500 people who live in the town or on surrounding farms and hamlets, and is made up of professionals, farmers, young families, and those seeking alternative lifestyles. The school's small class sizes are a defining and appealing characteristic of the school. Due to its increasing

popularity over the past five-six years, mostly due to a student influx from nearby regional townships, the school has a steady enrolment of over 220 children. Significantly, the school is renowned for its tightknit teaching teams and progressive teaching/learning approaches, which draws on Carol Dweck's (2012) 'growth mindset' learning culture that encourages students to stretch their existing learning abilities by embracing challenges and persisting in the face of setbacks. The school is frequently visited by external teachers (urban and regional) seeking to emulate its successful teaching practices. Another defining feature is the school's commitment to staff coaching from more senior staff.

In our initial conversation with the school principal, who became the 'partnership lynchpin' (Kruger et al., 2009), as part of the coordinated support, we shared key findings (impact) from our earlier regional partnership collaborations. These included: better developed science curriculum, increased science literacy through outdoor learning, enhanced pedagogical benefits for in-service teachers, and improved school/university relations (Green & Ma, 2018). In this new science partnership, we sought the opportunity for in-service teachers to mentor PSTs in the delivery of science lessons that would support their students' learning. The establishment of the partnership coincided with the new appointment of the school's science coordinator tasked with revitalizing science curriculum and pedagogy across the wider school. In keeping with earlier partnership outcomes, we highlighted our broader observations about PST preparedness to teach science in elementary schools, better professional engagement through in-service teacher mentoring and coaching, and overall improved school-wide science literacy as a consequence of PST science lessons. Such outcomes underpinned the success of our earlier school-university partnership that mutually supported school and university needs.

3.1. Partnership timeline

The first year of the partnership (2016) involved building new rapport between the teacher educators and the school staff and included an outdoor 'Science Day' whereby PSTs taught rotational science topics and lessons (identified by them) across the school. The second year (2017) drew on in-service teacher and teacher educator insights from 2016 to determine next steps. Rather than repeating the dedicated science day, PSTs worked with students over a sequential three-week period delivering 1-h sessions each week on a sequential science theme (identified by the teachers). At the completion of the three teaching sessions, in-service teachers provided feedback on PSTs' teaching, which included a focus on the school's teaching and learning culture (e.g., thinking and growth mindset as described earlier in the paper). Reflecting on the 2016/2017 iterations, and in preparation for the 2018 iteration, teachers and teacher educators agreed on the need for an introductory session emphasizing the school's learning culture, thereby giving PSTs an explicit message about the need for rigor and challenge in their science lessons.

Table 1 (below) highlights key features maintained across the three years, as well as changes made across the three years.

4. The method

An interpretive longitudinal case study framework was adopted to better understand: How do in-service teachers perceive the impact of a three-year science-informed school-university partnership? Semi-structured focus group interviews were employed as the main data collection method. In-service teacher viewpoints, including their thoughts, values and meanings about their involvement in the partnership became important methodological considerations (Denzin & Lincoln, 2003). Given the demanding and

Table 1
Key partnership features and changes.

	Key Partnership Features Consistent across the Three Years	Different Key Partnership Features across the Three Years	
Course design	• PSTs worked in groups of three or four. Each group planned and delivered a science lesson to groups of elementary students from the partner school. • Lesson topics were based on the Victorian Curriculum Science.	2016	• Each PST group developed and delivered a 30-mins rotational science lesson. • Eight lesson rotations in total. • Lesson topics were chosen by the PSTs according to personal preference.
		2017	• Each PST group developed and delivered a series of lessons (45 min each) over three weeks. • Lesson topics were chosen by the school according to the school's curriculum plan.
		2018	• Each PST group developed and delivered a series of lessons (1 h each) over three weeks. • Lesson topics were chosen by the school according to the school's curriculum plan
Location of PST teaching	• At the partner school (indoors and outdoors)	2016	• Lessons occurred in the school ground such as the formal play areas, vegetable garden, forested and open grass areas near oval, and sandpit.
		2017	• In classroom setting with at least one lesson being delivered outside of the classroom in the school ground.
		2018	• The same as 2017.
Teacher educator roles	• Introduced science teaching method (pedagogy and curriculum, including a place-based framework for science teaching). • Provided initial feedback to PSTs' lesson plans. • Provided on-site support to PSTs during their teaching. • Liaised with the school.		• Teacher educators' roles remained the same across the three years.
PST responsibilities	• Visited the school early in the semester (reconnaissance day) to become familiar with the environment. • Developed lesson plans. • Taught the lessons to small groups of students in the partner school.	2016 2017 2018	• Developed and delivered rotational lessons. • Developed and delivered consecutive lessons based on 5E Model. • The same as 2017.
In-service teacher involvement	• Arranged the school students into groups of six or seven. • Provided feedback to PSTs' lesson draft. • Provided on-site support to PSTs during their teaching. • Supervised school students during the teaching. • Gave a feedback presentation at the end of the semester to PSTs.	2016 2017 2018	• Two in-service teachers provided feedback to all PSTs' whole lesson drafts before the teaching day. • All classroom teachers involved in the partnership provided feedback to PSTs' lesson drafts. • Introduced the school culture at the end of the semester. • PSTs' lesson overviews were provided to in-service teachers. However, no in-service teacher written feedback was required. In-service teachers were encouraged to provide oral comments. • Introduced the school culture early in the semester when the PSTs first visited the school.

increasingly complex nature of teachers' work (Comber & Nixon, 2009), the focus groups were designed to capture in-service teachers' opinions in expedient ways by bringing them together once (for up to 60 min), rather than multiple times, and were framed by the teachers' perspectives about their involvement in the respective 2016–2018 partnerships. This method aimed to obtain data from a purposely selected group of individuals in order to gauge in-service teachers ongoing perceptions of the partnership, which informed subsequent partnership design in the following years. Tracking teachers' perspectives over the three years generated an important opportunity to explore a "string of concrete and inter-related events" (Flyvbjerg, 2011, p. 301) that informed all aspects of the study.

4.1. Data collection

All classroom teachers whose students participated in the science lessons were invited to join the focus group. The acting principal who coordinated the partnership was also invited. Due to the availability of teachers at the time of each year's group interview, the participant numbers varied as per the following breakdown: 2016 (three teachers), 2017 (four teachers), and 2018 (five teachers). In total, six teachers took part in the interviews. Among them, two teachers (the acting principal - Ms. C, and the science coordinator - Ms. E) participated in all three interviews; one teacher (Ms. A) was involved in the 2016 and 2017 interviews; one teacher (Mr. W) attended in 2017 and 2018; two (Ms. B and Ms. F) only joined in 2018.

One key consideration of teacher-based focus groups is their potential to provoke power hierarchies and dynamics. In acknowledging the inevitability of such power imbalances across social relationships (e.g., between researchers and the participants, and among the teacher participants) we recognize the data collection process is not always power-neutral. In response to such considerations, we conducted the focus group interviews in the school library, ensuring all participants had the opportunity to speak. In this way, the interview data roughly reflected participants' daily social experiences (Ayrton, 2019). Importantly, the partner school, teachers and principals work in a unique situation whereby they regularly coach each other, plan curriculum together and develop group-based innovative pedagogies. Based on these practices, teachers, regardless of their role and seniority, are encouraged and accustomed to sharing ideas and critiquing practice. To that end, we believe the school's unique teaching culture created a solid foundation for the focus group conversations.

The study was granted ethical approval by our university's Human Research Ethics Committee and the Victorian Department of Education. Participation was voluntary. All focus groups were held onsite in the school library at a time negotiated between the researchers and the participants (e.g., lunch time or after school).

Across each yearly cycle, in-service teachers were asked to respond to the following:

(a) Describe the science learning experience of your students with PSTs.

(b) Describe opportunities/challenges observed in relation to the partnership.

(c) Describe observations of PST designing and delivering science lessons.

(d) Explain if/how the pre-service science lessons were followed up in your classroom.

(e) Compare partnership outcomes from each year (relevant to teachers involved in more than one year).

As part of the case study, in-service teachers' written feedback to PSTs' lesson drafts, overall feedback to PSTs' teaching, and presentations of school culture were also collected. The presented findings in this study however were drawn from the focus group interviews, while the written documents were used as a source of triangulation.

4.2. Data analysis

The focus group interviews were recorded and transcribed for analysis. A thematic method (Braun & Clarke, 2006) was adopted in the data analysis process and open coding was used initially to identify primary patterns (Charmaz, 2006). The initial codes were categorized to identify themes in relation to the sub-research questions. The coded extracts were further reviewed by both researchers together with the in-service teachers' written feedback and presentation of school culture, to determine how they could support the identified themes. The practice of coding and searching for themes was guided by the place-based theoretical framework, in which information on the school's physical and social environments was carefully recorded. As such, stories and comments reflecting the interaction and negotiation of school and university cultures were identified. The findings represent an ongoing story of how all stakeholders - as story makers - are shaping and shaped by practice within this cultural contact zone.

The analysis process followed the phases suggested by Braun and Clarke (2006) which involves data familiarization, generating initial codes, searching for themes, reviewing themes, defining and naming themes, and producing the report. Although presented as linear, this process was iterative in that the researchers went backwards and forwards during the analysis process to compare codes and themes to pursue the most pertinent patterns. The original data were examined by the two researchers separately, then codes and themes were compared and further discussed through peer debriefing. Evidence was evaluated constantly throughout this process. Tentative themes were either modified or disregarded if they had insufficient extracts of data to support them. Some initial themes were split up to form new themes. Only themes agreed by both researchers were reported. In our report, we provided thick descriptions about the research context and background of the participants so that the readers could evaluate which context the research findings might be applicable.

5. Findings

The findings are presented under three main themes that correlate to the earlier mentioned sub-research questions. Under each theme, we attempt to 'tell' a chronological story. The purpose of presenting findings this way is to identify changes overtime and to fully understand the patterns and implications of a longitudinal study. Although the findings have been informed by individual teachers, their voices have also been represented collectively, mainly because the examples presented by teachers were typically expressed by several teachers, or in other words, expressed by one teacher, and agreed by others.

Theme 1: The evolution of partnership structure.

The integration of science teaching from being an 'add-on' to becoming an essential part of the school curriculum, representing the evolution of partnership structure over three years.

Theme 2: Opportunities and tensions.

New opportunities were consistently acknowledged in terms of enriched student learning and in-service teacher professional development, while tensions gradually eased as the challenge of the in-service teacher workload was addressed across the three years.

Theme 3: In-service teachers' observation of PSTs' professional learning.

The increased chances of professional learning of PSTs observed by in-service teachers as a result of the shift of lesson organizational structure over the three years.

Theme 1: The evolution of partnership structure.

5.1. Partnership year one (2016)

Overall, the three-year partnership has seen a gradual integration of PSTs' science teaching into the school's curriculum. In this first year, PSTs were required to design a science lesson via a personally selected science topic and organized like a mini science fair. This structure was suggested by the teacher educators (authors) based on their previous partnership experience with another local school. In 2016, the school did not have an overarching science curriculum, but was working towards developing this gap through a newly created science coordinator role within the school. Hence the proposed partnership was viewed as timely by the school.

The possibilities of developing the school's science curriculum were discussed in the focus group as highlighted below. One teacher suggested PSTs could deliver science in strands and covered over a couple of weeks, while another referred to the new Victorian Curriculum that could frame PSTs' teaching within the school's science curriculum.

> We're also having next year based on the new Victorian Curriculum. We've kind of mapped out a bit of a science continuum from P-6 to get our heads around having a viable curriculum and making sure that the kids are having access to all parts of science, not the same teacher each year just teaching one part of science. (Ms. E, 2016)

Another teacher suggested PSTs do a series of science lessons based on the school's curriculum as a preferred pedagogical approach.

> I think in terms of us benefitting as well as them [PSTs] I like what J said about just sharing that curriculum document and that makes it really clear for us and really clear for them what the focus is going to be or what it needs to be. And then if it's going to be chemical science for that time that they're coming in, well then let's try and have their lessons focus around chemical science. That way it fits with what we're doing curriculum-wise and, they get the benefit of exploring that area of the curriculum too, maybe in a bit more depth and get that practical experience as well as the theoretical experience at uni. (Ms. A, 2016)

5.2. Partnership year two (2017)

As previously highlighted, in 2017 PSTs' teaching was restructured as a series of lessons over three weeks, and unlike 2016, the science topic was determined by in-service teachers

according to curriculum (school) requirements. This modification was regarded as a positive dimension of the partnership in its second year, as evidenced by the following comment:

> I liked that it was specific on what curriculum area we wanted them to teach, not just science in general, but it was actually a part that we needed to have covered anyway, so I like that we were able to give them a particular part of science to focus on. (Mr. W, 2017)

Other comparisons between year one and year two of the partnership underlined the importance of having a balance between providing an exciting experience and making learning more meaningful for students.

> Last year's [2016 iteration] had a certain element of excitement because it was a day and the whole school [involved] … so there was an element of excitement of going and doing a lot of different things, but the learning wasn't as deep. I felt that this time [2017] they got to build on their learning and their understanding, and they had that excitement of seeing what would happen in the next session because there was something that they were building on or watching grow. (Ms. E, 2017)

Despite the PSTs' 2017 lesson plans being explicitly linked to the school's science curriculum (e.g., the new Victorian Curriculum), the focus group discussion revealed that in-service teachers did not follow up (as expected) post PSTs' teaching. This was partly because of how the school curriculum was mapped out, and partly because of the overall activity plan of the school, as demonstrated in the excerpts below:

> We didn't follow up a whole heap and that's because the curriculum that was covered there wasn't a whole more for us to actually do. … There wasn't much more new stuff that we actually had to teach; it was more just reflecting [on what had been taught by PSTs]. (Ms. A, 2017)

> I think the timing given when the science lessons were and then we had camp. It was like a break in our term, the camp then changed our focus a little bit from the science. (Mr. W, 2017)

5.3. Partnership year three (2018)

In this third and final year of the partnership, the in-service teachers and teacher educators chose to retain much of the teaching and learning structures implemented within the previous (second) year. Additionally, the teachers had developed a more informed understanding of what was possible within the partnership, including building on what they were already doing. Most agreed the PSTs' teaching could become an effective dimension of the school's science curriculum. As one teacher suggested:

> I think they [PSTs] fit in really well with what we were doing with our [science] theme. It wasn't just something added on [as in year one of the partnership]. I felt like it was continuing into what we're doing. (Ms. C, 2018)

Another teacher recognized that PSTs' teaching had become a meaningful part of their students' prior knowledge, which they suggested, enabled the in-service teachers to build on and go deeper in the same topic post PSTs' teaching:

> Because they [the school students] had that prior knowledge and that experience [with PSTs], … instead of us saying, 'This is

plastic, this is rubber, this is aluminum.' they already had that knowledge. So, it was kind of like, let's dive more into the deeper learning. And they vividly remembered it because, it was hands on, it was interesting, it was something − someone different teaching them, it wasn't us. (Ms. F, 2018)

Compared with the second year (2017), in-service teachers reported a more positive integration of PSTs' teaching. Consequently, both students and the teachers were able to build on PSTs' teaching and delve deeper into the selected curriculum area.

Theme 2: Opportunities and tensions.

5.4. Partnership year one (2016)

The first focus group emphasized the benefits of a one-day science forum. For example, in-service teachers were inspired to teach more science-related topics, realizing that the image of elementary school science could be different from that of high school science. They indicated that science teaching could be organized using the local environment, existing resources, and simple materials.

> I think it's benefitted me because it's actually sparked my desire to teach science. I don't think it's something that we probably do well here as a collective consistently. But from that day I think I've actually been researching what I can do and how I can just not do it in the classroom but actually use our environment. (Ms. A, 2016)

> It doesn't need to look like science at high school and I think what stops a lot of teachers in elementary school teaching science at all is they've got that last memory of it. (Ms. E, 2016)

The benefit to school students was also acknowledged, mainly in terms of providing an opportunity for students to learn with different people in different environments, undertake hands-on activities, and experience a variety of science topics.

> I know my kids. They loved the hands-on experience. … it was something different for them that they hadn't done before and that everyone would have a go at and it was in a different environment with different people so they loved that experience. (Ms. A, 2016)

> There was a good spread that sort of covered different areas of science which has opened up a bit of understanding and some questions from some of the kids too. And I thought they were really enthusiastic about it and the feedback from the students was pretty good. (Ms. C, 2016)

All classroom teachers were involved in supervising school students on the day, observing PSTs' teaching and providing on-the-spot feedback to PSTs in between each rotation. In-service teachers acknowledged the importance of undertaking these roles and saw them as opportunities to work with PSTs and make good use of their expertise:

> I think our role is to jump in and give the feedback on the day, that's the point of need for those PST students so our role is not just to stand back and let them go ahead and then do the feedback at the end. It is on the day and we see the benefits from doing it on the day. (Ms. E, 2016)

Observed challenges within the partnership were also noticed by in-service teachers. By way of example, some teachers expressed

concerns regarding the extra workload related to examining PSTs' lesson drafts by two people. Subsequent alternatives were suggested:

> I think that if we all shared the load, we're not having to plan for that lesson so the least we could do would be to read it and give feedback; otherwise, we'd usually be planning for that time. (Ms. A, 2016)

In-service teachers also suggested that the expectations on feedback be further clarified:

> When we teach our kids to give feedback and things like they've got to be given in relation to a success criterion. So, if they [PSTs] had a success criterion and we've got to be thinking about, 'are they meeting these … with their science lesson?' Just a bit more directed. (Ms. E, 2016)

5.5. Partnership year two (2017)

In the second year, future opportunities were again discussed, adding to what had been identified in the first year. In-service teachers particularly mentioned their own professional development by observing teaching science in a different way and reflecting on their own teaching.

> Professionally I think it was good for us to reflect on our practices and give feedback based on that. It's one of those things you don't realize how much you know until you see someone else just starting out. … Also, I got some great ideas from the PST with the way they went about different things and warm up games and things like that I thought was cool, so as much as I'm more experienced by more experience of years, I still learned from them as well. (Ms. F, 2017)

In-service teachers also acknowledged the benefits of having small groups to school students' learning.

> I do think the small groups and having more adults was great because some of the little learning wouldn't have been as targeted if it was just me and the whole grade. (Ms. A, 2017)

Although the workload of providing feedback to PSTs' lesson drafts was shared among more teachers in the second year, the issue of teachers being overloaded was again raised. Part of the issue was a result of this expectation not being sufficiently communicated.

> Mr. W (2017): I think that J and G spent a long-time giving feedback on their lessons to begin with, I don't know if that's realistic to do again next year, I don't think it is. So that will need to be addressed for next year.

> Teacher educator (one of the authors): Yeah, we realized that, and our initial purpose was not for you to actually go through every word. We should have communicated that aspect clearer. You only need to look at the activities and make sure that they are suitable and if there's any safety issue or need risk management and things like that.

There were also further discussions on what would be the best way of providing comments on the PSTs lesson drafts. It was finally decided that instead of sending the whole lesson plan documents, it would be more efficient and realistic for PSTs to provide a one-page overview for their lesson to in-service teachers with key

information including learning intentions, activities, and teaching materials.

5.6. Partnership year three (2018)

In the third year, changes to the partnership occurred mainly in terms of reduced workload for teachers on lesson-plan feedback, and a reduced ratio of PSTs to school students. In-service teachers observed that this time, the small groups were organized in a more effective way.

> One thing that I really noticed was that they [PSTs] have the ability to do things that we just can't do with 25 kids and one teacher. So I think it really engaged the kids because it was such a small group to be able to teach them. … The three sessions that they got to be in that small group and really get right into the nitty gritty, instead of just sitting there and watching. They were really a part of doing the learning, not have the learning done to them. (Ms. E, 2018)

The in-service teachers also appreciated how PSTs had their lesson drafts reviewed initially by teacher educators and how they were provided with lesson overviews. These 'quality control' measures seemed to provide a much-improved result.

> I know we talked about the lesson plans and all the feedback [last year]. And it was great for us to get those lessons and have a look and kind of know what was going on. The lessons were really high quality. … I think this year it really worked. It certainly was a benefit to us the whole thing. There was nothing that was like, putting us out. (Mr. W, 2018).

Theme 3: In-service teachers' observation of PSTs' professional learning.

A key understanding of a school-university partnership is to harness in-service teacher expertise in mentoring PSTs. As the university cohorts differed across the three-year partnership we were unable to trace individual PST groups' professional development. Findings presented under this third theme reflect what the partnership enabled PSTs to develop based on in-service teachers' observations, including possible differences due to changed lesson delivery structures.

5.7. Partnership year one (2016)

In the first year, the in-service teachers provided some on-the-spot feedback to PSTs for them to make quick adjustments between two rotations on the same day. Some in-service teachers noticed this enabled PSTs to 'reflect in action' and improve their practice:

> I think that's a good point that over the course of the day, looking at a couple of groups and giving them feedback after each sort of mini session they had, you could see the things that they changed and the improvements they made which was good. I think probably that our students towards the end of the day were seeing the benefits of that practice of running that same lesson two or three or four times.(Ms. A, 2016)

Further, in-service teachers noticed that the structure of the rotation allowed PSTs to run the same lesson several times during the day, which enabled them to observe and learn from each other, to gradually gain confidence, and develop a more solid understanding of the lesson's aim.

They probably improved as they went on. … A couple of groups over the course of the day, …those couple that were kind of at the start had no idea and the ones just running it all had caught onto what they could possibly be doing to chip in. I think some of the groups by the end of the day were more a team than possibly what they were at the start. I think maybe that's just with experience and confidence and knowing what to do … and understanding how the lesson ran. (Ms. C, 2016)

While the structure of the rotation made it possible for the PSTs to reflect in action, it was in-service teachers' expertise that drove the process forward, offering immediate and strong support to PSTs.

Because when we were working outside, and it was really windy and the flour was going everywhere. They [PSTs] were in panic-town and they didn't know what to do. But I just said, "It's okay, it happens". Then we worked together as to what we're going to do. I think one of the biggest things that they took away was that it doesn't always have to be 100% in front of the kids. As long as you reflect on it next time then you can improve it. (Ms. A, 2016))

5.8. Partnership year two (2017)

In the second year, in-service teachers acknowledged the three-week sequential lesson structure allowed more time for PSTs to get to know their students, reflect on action, take on feedback, and make improvements:

This time they actually had more time to go away and reflect and actually take on the feedback and then for next week incorporating that in their lesson. Rather than, 'the next groups coming in two minutes. Here's your feedback and then quickly'. I think that was good having the sequence of lessons this time. … And they got to know the students that they were working with, so there was something ongoing, they could do something that took time, that needed time, the weeks between for growing was good. (Ms. E, 2017)

In-service teachers suggested that some PSTs' teaching did not sufficiently challenge students. To remedy this issue the teachers suggested talking about this consideration at the beginning of the partnership rather than at the end:

They hadn't quite hit the mark and challenged the kids enough. … If we did the presentation that we did at the end, at the start, we'd have lots of questions and interest about it. … I think they would've got it a bit more and they could've even gone away and done some of their own research about what we were talking about, and I think that would've added to the quality of the tasks. (Mr. W, 2017)

As a result of the discussion, it was decided that in 2018 (the third year of partnership), in-service teacher would introduce school culture and lesson-plan expectations when PSTs initially visited the school.

Further to this consideration, lesson duration was also identified as an aspect for change, allowing PSTs to deepen the content, ask for student feedback and pack up. It would also provide enough time for students to complete their hands-on activities. As a result of the discussion, it was decided that in the following year each lesson duration would be extended from 45 min to 1 h.

I think some of them just had to quickly pack up, but it would've been good too if the lesson finishes a bit early and they've got five or ten minutes they can actually ask those discussion questions. I think an hour would be good. … Particularly if there's three in a group, so they can swap over, they're not under pressure for a whole hour to keep it going if there's three of them. … I reckon they could add more depth to their lessons, I think a few of them would've gone a bit deeper. … It also allows time for the kids to finish whatever product they're putting together. (Ms. A, 2017)

5.9. Partnership year three (2018)

In-service teachers acknowledged that in this particular year the quality of the lessons were higher: most PST groups had improved lesson preparation and levels of challenge.

Like last year with the three/fours, I think we noticed in the first week a lot of the tasks were a bit low level. Whereas this year I think the tasks were more on point. … They sort of hit the nail on the head generally with the challenge and the ability of the kids. (Ms. C, 2018)

Some in-service teachers mentioned that PSTs were able to get a better understanding of the students, and adjust their teaching (e.g., age-appropriate use of language) from in-service teacher feedback over the three weeks:

At the start in the first week, the language that they [PSTs] were using, a lot of the kids didn't know big words that they'd never heard of. And they [PSTs] just expected them to know it. And even the way that they [PSTs] were talking to them, it sounded they were talking to an adult rather than a five-year-old. … But then as soon as they got that feedback then they were able to adjust how they talk to them and actually explained the word in detail. (Ms. B, 2018)

6. Discussion and implications

In addressing the quality and limitations of conventional teacher education, which often occurs in isolation from schools and broader community (Broadbent & Brady, 2013), Jones et al. (2016) highlight the enabling importance of school-university partnerships. As discussed, the main purpose of developing the school-university partnership in this study was to engage with a local school community (including its teachers, students and its physical/social environments), embed in-service teachers into that environment (Somerville, 2010), and subsequently unite the collective might of all stakeholders. Such a coordinated support was integrated into all key aspects of the partnership practice, including redefining in-service teachers' role, and negotiating and developing collective intention. The following discussion about the study's findings focuses on similarities identified within existing studies and includes new partnership insights as gained from a longitudinal perspective.

6.1. Enculturating pre-service teachers via redefining in-service teachers' role

This study resonates with findings from existing studies whilst simultaneously generating new insights into PSTs' and in-service teachers' professional learning within a partnership. A key finding of this longitudinal study was in-service teachers' observations of PST's increased confidence. This outcome aligns with PSTs' self-reports and reflections about their own growth and

development in the latter stages of the wider project (Ma & Green, 2021a; 2021b). It also runs parallel with existing research that signifies the role of school-university partnership in providing an authentic practice context for PSTs in response to the concerns about their lack of confidence to teach science, and to observe and practice science teaching during normal placement (Jones et al., 2016; Kenny et al., 2014). In addition to experiencing authentic teaching and learning beyond a conventional practicum, this science-informed place-based partnership placed PSTs in a 'cultural contact zone' (Somerville, 2010). Despite the increasingly globalized and standardized ('one size fits all') curriculum frameworks that inform what schools and universities teach, the cultural, social and geographical determinants and contexts of those settings suggest they are uniquely different (White & Reid, 2008). These ideas are highlighted in research that identifies the significance and influence of 'context', particularly in relation to where PSTs begin their teaching preparation (Azano & Stewart, 2015; Lee, 2018).

In relation to this, in-service teachers played a critical role in introducing PSTs to the school's unique teaching/learning culture. The previously mentioned themes are indicative of how significant in-service teachers mentoring roles were within the partnership, which often required them to depart from conventional practicum responsibilities. This included in-service teachers refining their teaching structure and seeking improvements, mapping science teaching within the wider school curriculum, providing initial feedback on PSTs' lesson drafts, on-the-spot comments on PSTs' practice during their teaching, and summative feedback on their overall performance post teaching. In parallel to normal practicum conventions, classroom teachers also provided immediate support when PSTs were challenged by unexpected incidents during their teaching. These newly created roles are compatible with research findings that draw attention to how school-university partnership frameworks can extend and improve in-service teacher mentoring roles (Burton & Greher, 2010; Kruger et al., 2009; Walsh & Backe, 2013; Weiland & Akerson, 2013).

As highlighted previously in the paper, the school's teaching/learning culture was a formative dimension of teachers' and students' daily practice. An explicit introduction to school culture for PSTs was suggested by in-service teachers via the focus group in the second year of the partnership, a consideration not previously included in PSTs school briefings. Subsequently, in the third year, teachers and the principal highlighted the school's teaching/learning culture to the PSTs on their initial school visit, which enabled clear and early negotiations between two very different stakeholder cultures (e.g., school and university), which is an underlying principle of a place pedagogy framework (Somerville, 2010). The focus on school culture, including the newly created in-service teacher roles, enabled the enculturation of PSTs (Lee, 2018), setting a solid foundation for PSTs to better understand their students, school expectations, and develop aligning pedagogical repertoires.

6.2. The evolving nature of developing collaborative intention

It has been widely argued that a partnership with shared vision and collaborative intention is more sustainable, compared with conventional university-privileged partnerships (Kruger et al., 2009; Walsh & Backe, 2013). The underlying partnership in this study endeavored to benefit all stakeholders and was informed by co-constructive processes. Findings show that in-service teachers appreciated the way PSTs' teaching was embedded into the school's boarder science curriculum. In accordance with other research findings (e.g., Green & Ma, 2018; Kenny, 2012), in-service teachers also reported how they were inspired by observing PSTs' teaching, which generated subsequent reflection on their own practice. They

also acknowledged PSTs contribution in motivating and engaging elementary school students through a variety of 'hands-on' activities that advanced individual learning in small groups. Further, they valued the opportunities the partnership offered to student learning which they would not have achieved without the additional support and resources provided by the PSTs. It is important to note the teaching arrangements were not simply suggested by university teacher educators based on the needs for PSTs, rather, the in-service teachers were involved in shaping a 'reciprocal agenda' (Walsh & Backe, 2013) by evaluating lesson plan objectives, promoting learner engagement, and establishing small groups to maximize learning. Collectively, these positive outcomes demonstrated the value of trust, mutuality, and reciprocity among all stakeholders (Burroughs et al., 2020). Additionally, partners agreed on the need for greater efforts to establish a shared common language (Burroughs et al., 2020) that would support communication and assist with brokering school-university division commonly encountered in cross-institutional partnerships.

Developing collective intention within a school-university partnership takes time. By paying attention to the emerging opportunities and challenges, negotiating responsibilities, and trialing solutions, the study offered an opportunity to focus on the evolving nature of the partnership, as per the presented findings (in chronological order) under each theme. A closer look at the overarching partnership storyline shows how the partnership experienced a process from establishing agendas, to trialing ideas, addressing challenges, and reaching agreeable solutions. The reshaping and integration of science into the broader school curriculum is a worthy example. PSTs' teaching evolved from an 'one-off' science day to sequential lessons embedded into the school's science curriculum with strategically informed improvements each year. In-service teachers realized the potential of having PSTs teach science across the whole school in the first year, and similarly, saw the benefits of linking PSTs' teaching to the school's science curriculum in the second year. Despite these achievements however, in-service teachers seemed initially unprepared to follow up with the PSTs science lessons. However, the third year brought a more genuine incorporation of PSTs' teaching into in-service teachers' practice when they built on their students' prior science knowledge (as developed by PSTs).

Another example worthy of exploration is related to identifying challenges and working toward a solution during each iteration (year). The overall division of labor within the partnership, as identified in other partnership studies (e.g., Kruger et al., 2009; Smedley, 2001) emerged as problematic. Unlike formal practicum whereby a mentor teacher is allocated and paid for their extra work, there is no formal arrangement at the respective institutional levels to cover the extra workload on which partnership projects rely. We concur with researchers who argue how school-university partnerships will flounder if they generate additional work for teachers, which stands to impact their primary interests and responsibilities (Kruger et al., 2009). Findings from this study exemplify how this issue was raised at the end of the partnership in the first year, followed by solutions and their implementation in the second year, as well as stakeholder expectations clarified at the end of the second year. These decisions and insights ensured the third year of the partnership had more feasible and informed arrangements in place.

Taking these considerations into account, it is essential to acknowledge the evolving nature of building successful partnerships. Given that any partnership is unique, including its context, specific challenges and tensions, it is important to establish regular feedback and reflection mechanisms through which matters, expectations and solutions can be genuinely identified. In this light, allocating generous time to engage in honest, consistent, and

ongoing negotiations across stakeholders appears to be a key consideration.

The evolving nature of partnership development enables both teacher educators and in-service teacher colleagues to continue to construct opportunities for PSTs to build new relations within a rural school community, (just one example of the emerging benefits of an ongoing partnership, where practice can be improved in iterative ways). When working as liaisons, teacher educators need to take into consideration PSTs' needs, university requirements, and partner school's expectations. The nuanced context, that is, the specificities of place, including social, environmental and cultural dimensions, can have profound effects on understanding and working with the layered context in which the partnership operates. In this sense, building and maintaining partnerships are part of cultural practice, whereby teacher educators work as cultural brokers. In this regard, the 'cultural contact zone' aligns with the concept of 'third spaces' defined by Zeichner (2010) as spaces "where academic and practitioner knowledge and knowledge that exists in communities come together in new, less hierarchical ways in the service of teacher learning" (p. 89). These implications resonate with what Martin et al. (2011) argue, that facilitating development of the potential collective third space offers more transformative structures that enrich and support the implementation of teacher education programs.

7. Conclusion

The study presented in this paper illustrates how partnership frameworks can effectively disrupt conventional teacher education practice that operates in isolation from schools and the broader community (Broadbent & Brady, 2013). In the words of Somerville (2010), we view the featured partnership as a 'negotiated and unfinished story' that presented new and sustained opportunities to focus on learning for all stakeholders in ongoing ways (Kruger et al., 2009). Furthermore, the partnership brought to light how in-service teacher stakeholders can expand their roles and responsibilities over time (Burton & Greher, 2010).

Discussion of the findings confirmed the benefits of this school-university partnership, affirming how new partnership relationships can be built and sustained. As we have found in our broader school-university partnership work, each school has established cultures that need to be identified and negotiated early in the partnership. Working collegially and reciprocally, maintaining regular and clear communication, making good use of stakeholder expertise, and seeking stakeholder agenda are all key ingredients to a sustainable partnership. The findings over three years highlight a range of enabling partnership practices, including the significance of establishing initial trust building, identifying potential opportunities and challenges, clarifying mutual expectations, brainstorming possible strategies and solutions, reflecting, and evaluating for future iterations.

It takes time for any partnership to mature, and this requires long term commitment, engagement and continuous and transparent examination of mutual agendas. Such expectations, based on our experience, are time consuming, which is a key challenge identified throughout the scholarly literature. Having a more systematic agenda in place at the institutional level, that is, one that recognizes the considerable time and effort required for building long-term partnerships is one potential solution. Other partnership vulnerabilities include recognizing that in many cases, partnerships rely on the effort of 'inspired individuals' (Kruger et al., 2009). As such, a change of career direction or motivation of individuals may determine partnership consistency and longevity. To this end, genuine support mechanisms at institutional levels, including

increased professional resources could overcome some of the limitations identified here. Given the diverse needs of all partnership stakeholders, there is scope for continued research that examines effective partnership approaches and strategies.

Building on these considerations, further research might address issues such as: "What might a more systematic agenda to support partnership development look like?" "How could genuine support mechanisms, such as administration and financial assistance, be established at institutional levels?" "How can such mechanisms encourage and sustain effective school-university partnerships?" A genuine institutional support system could also offer a solution to another (currently underexamined) research direction which is to document and trace the growth of PST capacity to teach science within a school-university partnership model. We welcome ongoing research in this space, and hope this longitudinal study adds to national and global school-university partnership discourse and practice.

Data availability

The data that has been used is confidential.

References

Appleton, K. (2003). How do beginning primary school teachers cope with science? Toward an understanding of science teaching practice. *Research in Science Education, 33*, 1–25.

Ayrton, R. (2019). The micro-dynamics of power and performance in focus group: An example from discussions on national identity with the south Sudanese diaspora in the UK. *Qualitative Research, 19*(3), 323–339. https://doi.org/10.1177/1468794118757102

Azano, A., & Stewart, T. (2015). Exploring place and practicing justice: Preparing pre-service teachers for success in rural schools. *Journal of Research in Rural Education, 30*(9), 1–12.

Bartholomewa, S., & Haymore Sandholtz, J. (2009). Competing views of teaching in a school–university partnership. *Teaching and Teacher Education, 25*, 155–165.

Begun, A. L., Berger, L. K., Otto-Salaj, L. L., & Rose, S. J. (2010). Developing effective social work university – community research collaborations. *Social Work, 55*(1), 54–62.

Braun, V., & Clarke, V. (2006). Using thematic analysis in psychology. *Qualitative Research in Psychology, 3*(2), 77–101. https://doi.org/10.1191/1478088706qp063oa

Broadbent, C., & Brady, J. (2013). Leading change in teacher education in Australia through school-university partnerships. *European Journal of Social & Behavioural Sciences, 4*(4), 687–703.

Burroughs, G., Lewis, A., Battey, D., Curran, M., Hyland, N. E., & Ryan, S. (2020). From mediated fieldwork to Co-constructed partnerships: A framework for guiding and reflecting on P-12 school–university partnerships. *Journal of Teacher Education, 71*(1), 122–134.

Burton, S., & Greher, G. (2010). School-university partnerships: What do we know and why do they matter? *Arts Education Policy Review, 109*(1), 13–24.

Buss, R. (2010). Efficacy for teaching primary science and mathematics compared to other content. *School Science & Mathematics, 110*(6), 290–297.

Campbell, C., Chittleborough, G., Gilbert, A., Hobbs, L., Jones, M., Kenny, J., & Redman, C. (2018). Models of school-based practice: Partnerships in practice. In L. Hobbs, C. Campbell, & M. Jones (Eds.), *School-based partnerships in teacher education* (pp. 39–57). Springer.

Campbell, A., Duffy, M., & Edmondson, B. (2020). Regional contexts and regional research. In A. Campbell, M. Duffy, & B. Edmondson (Eds.), *Located research: Regional places, transitions and challenges* (pp. 5–10). Palgrave-MacMillan.

Chandler, P. T., & Barron, L. (2021). Transforming teacher education through effective partnerships. In P. T. Chandler, & L. Barron (Eds.), *Rethinking school-university partnerships* (pp. 9–24). Information Age Publishing.

Charmaz, K. (2006). *Constructing grounded theory: A practical guide through qualitative analysis*. Sage.

Comber, B., & Nixon, H. (2009). Teachers' work and pedagogy in an era of accountability. *Discourse: Studies in the Cultural Politics of Education, 30*(3), 333–345.

Denzin, N., & Lincoln, Y. (2003). *The landscape of qualitative research*. Sage.

Dweck, C. (2012). *Mindset: How you can fulfil your potential*. Constable & Robinson.

Flyvbjerg, B. (2011). Case study. In N. Denzin, & Y. Lincoln (Eds.), *The sage handbook of qualitative research* (pp. 301–317). Sage.

Goodnough, K. (2004). Fostering collaboration in a school district-University partnership: The teachers researching inquiry-based science project. *Teaching Education, 13*(3), 319–330.

Green, M., & Ma, H. (2018). Transforming teacher education science through an Australian university-school partnership. In M. Reardon, & J. Leonard (Eds.),

Making a positive impact in rural places: Change agency in the context of school-university-community collaboration in education (pp. 285–309). Charlotte, USA: Information Age Publishing.

Green, C. A., Tindall-Ford, S. K., & Eady, M. J. (2020). School-university partnerships in Australia: A systematic literature review. *Asia-Pacific Journal of Teacher Education, 48*(4), 403–435. https://doi.org/10.1080/1359866X.2019.1651822

Johnston, B., Wetherill, K., High, H., & Greenebaum, H. (2002). Teacher socialization: Opportunities for school-university partnerships to improve professional cultures. *High School Journal, 85*(4), 23–39.

Jones, M., Hobbs, L., Kenny, J., Campbell, C., Chittleborough, G., Gilbert, A., Sandra, H., & Redman, C. (2016). Successful university-school partnerships: An interpretive framework to inform partnership practice. *Teaching and Teacher Education, 60*, 108–120. https://doi.org/10.1016/j.tate.2016.08.006

Kenny, J. (2012). University-school partnerships: Pre-service and in-service teachers working together to teach primary science. *Australian Journal of Teacher Education, 37*(3). Article 6.

Kenny, J., Hobbs, L., Herbert, S., Chittleborough, G., Campbell, C., Jones, M., Gilbert, A., & Redman, C. (2014). Science teacher education partnerships with schools (STEPS): Partnerships in science teacher education. *Australian Journal of Teacher Education, 39*(12), 43–65. https://doi.org/10.14221/ajte.2014v39n12.4

Kenny, J., Jones, M., & Speldewinde, C. (2018). Theory and practice: The context of partnerships in teacher education. In L. Hobbs, C. Campbell, & M. Jones (Eds.), *School-based partnerships in teacher education* (pp. 3–19). Springer.

Kruger, T., Davies, A. C., Eckersley, B., Newell, F., & Cherednichenko, B. (2009). *Effective and sustainable school-university partnerships: Beyond determined efforts of inspired individuals.* Teaching Australia – Australian Institute for Teaching and School Leadership.

Lee, R. (2018). Breaking down barriers and building bridges: Transformative practices in community- and school-based urban teacher preparation. *Journal of Teacher Education, 69*(2), 118–126.

Ma, H., & Green, M. (2019). From northern China to Hazelwood wetlands: Navigating place and identity through science education. In S. Plowright, M. Green, & N. F. Johnson (Eds.), *Educational researchers and the regional university: Agents of regional-global transformation (pp173-190).* London: Springer.

Ma, H., & Green, M. (2021a). Learning to teach in place: Transforming pre-service teacher perceptions of science teaching through place pedagogies. *Australian Journal of Teacher Education, 46*(7). https://doi.org/10.14221/ajte.2021v46n7.3

Ma, H., & Green, M. (2021b). The affordance of place in developing place-responsive science teaching pedagogy: Reflections from pre-service teachers. *Journal of Science Teacher Education, 32*(8), 890–910. https://doi.org/10.1080/1046560X.2021.1898139

Martin, S., Snow, J. L., Franklin, T., & Cheryl, A. (2011). Navigating the terrain of third space: Tensions with/in relationships in school-university partnerships. *American Association of Colleges for Teacher Education, 62*(3), 299–311.

Massey, D. (2005). *For space.* Sage.

Mockler, N. (2013). The slippery slope to efficiency? An Australian perspective on school/university partnerships for teacher professional learning. *Cambridge Journal of Education, 43*(3), 273–289.

Petersen, J., & Treagust, D. (2014). School and university partnerships: The role of teacher education institutions and primary schools in the development of preservice teachers' science teaching efficacy. *Australian Journal of Teacher Education, 39*(9), 152–167.

Renshaw, P., & Tooth, R. (2018). Diverse place-responsive pedagogies: Historical, professional and theoretical threads. In P. Renshaw, & R. Tooth (Eds.), *Diverse pedagogies of place: Educating students in and for local and global environments* (pp. 1–21). Routledge.

Smedley, L. (2001). Impediments to partnership: A literature review of school-university links. *Teachers and Teaching: Theory and Practice, 7*(2), 189–209.

Smith, H., & Trexler, C. (2006). A school-university partnership model: Providing stakeholders with benefits to enhance science literacy. *Action in Teacher Education, 27*(4), 23–34.

Somerville, M. (2010). A place pedagogy for 'global contemporaneity. *Educational Philosophy and Theory, 43*(3), 326–344.

Walsh, M., & Backe, S. (2013). School–university partnerships: Reflections and opportunities. *Peabody Journal of Education, 88*(5), 594–607.

Wattchow, B., & Brown, M. (2011). *A pedagogy of place: Outdoor education for a changing world.* Monash University Publishing.

Weiland, I., & Akerson, L. (2013). Toward understanding the nature of a partnership between an elementary classroom teacher and an informal science educator. *Journal of Science Teacher Education, 24*, 1333–1355.

White, S., & Reid, J. (2008). Placing teachers? Sustaining rural schooling through place-consciousness in teacher education. *Journal of Research in Rural Education, 23*(7), 1–11.

Zeichner, K. (2010). Rethinking the connections between campus courses and field experiences in college- and university-based teacher education. *Journal of Teacher Education, 61*(1–2), 89–99.